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REMEDIAL INVESTIGATION SUPPLEMENT

Martin Marietta Reduction Facility
The Dalles, Oregon

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GERAGHTY & MILLER, INC.

REMEDIAL INVESTIGATION SUPPLEMENT

MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

JULY 1988

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Section One

REMEDIAL INVESTIGATION SUPPLEMENT

MARTIN MARIETTA REDUCTION FACILITY THE DALLES, OREGON

1.0 INTRODUCTION

The Final Remedial Investigation Report for the Martin Marietta Reduction Facility (MMRF), The Dalles, Oregon was submitted to USEPA on March 11, 1988. Subsequent to the completion of planned Remedial Investigation (RI) field activities in August 1987, several unresolved issues were identified which required further data collection and/or evaluation. The results of these additional activities are encompassed in this document.

Further data collection activities and/or analysis of data focused on the following:

- Determine the limits of perched water at the site and the areal extent impacted perched water.
- Collect additional samples of Chenoweth Creek surface water and sediments and analysis at reduced detection limits in light of potential water quality concerns.
- Collect addition samples from monitoring wells MWR-9A and MWR-9B to evaluate if elevated constituent concentrations detected previously are an artifact of well construction.
- Revise on-site wind rose and compare wind data collected between June 1987 to December 1987 with wind data presented in the Final RI Report and data used in the Risk Assessment.
- Document assumptions used to model ground-water flow and contaminant transport in the B-aquifer and incorporate constituent concentrations from MWR-8B and MWR-9B in calculations of the mass of the source.
- Present analytical data collected from basement sumps in various buildings at the site.

- Compare monthly water level data collected between August 1987 to May 1988 with water elevation data and potentiometric maps presented in the Final RI Report.

In addition to the presentation of data collection activities and/or analysis, there are several errata items which address questions not fully considered in the Final RI Report and/or present information which may further clarify statements in the RI. The errata include:

- Detailed topographic map of the site and the surrounding area.
- Comprehensive table with well construction details and well construction logs missing for the Final RI Report.
- Discussions on total and EP Toxicity analyses of arsenic in landfill leachate samples.
- Reevaluation of iron cyanide speciation analyses and its impact on the interpretation of free cyanide analyses at the site.

Each chapter of this supplement is self contained. Appendix A presents all analytical data collected during the RI with validation qualifiers. Appendix B is a detailed discussion of the fate of cyanide species at the MMRF with applicable calculations. The supporting documentation for the validation and classification of analyses completed during Spring 1988 are included in Appendix C. All Spring 1988 laboratory analyses including split sample analyses are included in Appendix D.

Section Two

2.0 EM GEOPHYSICAL SURVEY

As identified during the RI, there is a potential for perched water to collect in areas of the site where fill is located over impermeable bedrock. In addition, perched water in the Old Cathode Waste Area (OCWA) has been found to contain high concentrations of dissolved constituents (thus, good electrical conductors)--a favorable shallow electromagnetic geophysical mapping target. An electromagnetic (EM) geophysical survey was used to identify the extent and location of perched water at the site and to delineate zones of perched water containing dissolved constituents. Test pits were excavated in conjunction with the survey to collect field confirmation samples of perched water for analysis. The geophysical survey was completed as outlined in the Work Plan submitted by Geraghty & Miller to USEPA Region X on January 29, 1988, on behalf of Martin Marietta. The data collection phase of the EM survey was completed in February 1988.

The areas at the MMRF site that were included in the geophysical survey are:

- Old Cathode Waste Area (OCWA)
- Bath Recovery Pad (BRP)
- Cathode Wash Area (CWA)
- North Fill Area (NFA)
- South Fill Area (SFA)

The geophysical data were affected by electrical noise from cultural features, but provided valuable information regarding the areal extent of perched water and perched water containing elevated concentrations of dissolved constituents (Figure 1). The following sections describe the theory and the results of the EM survey completed at the MMRF.

2.1. ELECTROMAGNETIC THEORY

A ground conductivity meter was used to perform the EM survey at the MMRF. The instrument transmits an electromagnetic signal into the ground and measures the secondary magnetic field that is generated in response to the ground, heterogeneities in the subsurface, and/or objects nearby (metal debris, power lines, buildings, etc.). The instrument utilizes the inductive method of

electrical exploration; the signal is both introduced into the ground and detected by the receiving antenna by inductive coupling. This electromagnetic method also measures eddy currents which are induced in the earth by a time varying magnetic field. Usually the term inductive method is applied when the receiver is in the "near field" or induction zone of the transmitter. The primary or source fields used in this type of EM survey are typically generated by passing an alternating current through coils. The receiver coil is also electrostatically shielded to eliminate capacitive coupling between coil and ground, and coil and operator.

2.1.1. ELECTROLYTIC CONDUCTION

Electric conductivity may be propagated in rocks and minerals in three ways: electronic (ohmic), electrolytic (ionic), and dielectric conduction. Ohmic conduction is current flow in materials containing free electrons such as metals. Dielectric conduction takes place in poor conductors or insulators which have very few free carriers or none at all. Electrolytic conduction is the propagation of current by ionic conduction (molecules having an excess or deficiency of electrons). In ionic conduction, the resistivity varies with the mobility, concentration and degree of dissociation of the ions; the latter depends on the dielectric constant of the solvent. Ionic current flow is slow compared to ohmic conduction and the movement represents an actual transport of material, usually resulting in chemical transformation.

Because most rocks are poor conductors, their resistivities are extremely large and their conductivities extremely small. However, rocks are usually porous and, in the subsurface, their pores are filled with fluids, generally water. Conductivity is defined as the ability of a material to conduct electrical current. Ionic solutions, even in soil and rock, tend to be good conductors. As a result, fluid-filled porous rocks are electrolytic or ionic conductors.

The effective resistivity of these rocks is similar to a cylindrical solid of length L and cross-section A, having resistance R between the end faces. The effective electrical resistivity, rho, in this case is given by the following equation:

$$rho = RA/L$$

The following table highlights the effect of water content on the bulk resistivity and conductivity of basalt. Conductivity is the

reciprocal of resistivity, with resistivity units in ohm-meters and conductivity units in mhos per meter.

Rock	% H_2O	Rho	Conductivity
Basalt	95	4×10^4	2.5×10^{-4}
Basalt	49	9×10^5	1.1×10^{-5}
Basalt	26	3×10^7	3.3×10^{-7}
Basalt	0	1.3×10^8	7.7×10^{-8}

The information in the above table is taken from Applied Geophysics by Telford, Geldart, Sheriff, and Keys (Cambridge University Press, 1981, pp 445,455,521-522).

2.1.2. GEOPHYSICAL FIELD EQUIPMENT: THE GEONICS EM-31

A Geonics EM-31 Ground Conductivity Meter and digital data logger were used to complete the EM survey at the MMRF. The Geonics EM-31 Ground Conductivity Meter is manufactured by Geonics Limited of Canada. The instrument consists of two horizontal coplaner loops, one acting as a transmitter and the other as a receiver, separated by a rigid boom. A 9.9 kHz signal in the transmitter coil induces circular eddy currents in the ground which in turn produce a secondary magnetic field. The receiver intercepts this secondary field and the instrument measures the ground conductivity by comparing the strength of the secondary field to that of the primary. The EM-31 has an intercoil spacing of 3.7 meters which yields an effective depth of exploration of about 6 meters (19.68 feet). The instrument can also be operated on its side which reduces the effective depth of exploration to approximately 3 meters (9.84 feet). These configurations are referred to as the vertical (deeper penetration) and horizontal (shallower penetration).

The Geonics EM-31 responds to electrical conductivity contrasts in subsurface materials and is useful for locating buried drums, tanks, pipes, and other conductors by virtue of their contrasting

electrical properties. The conductivity meter is also useful for mapping variations in the soil itself and dissolved ground-water constituents can often be effectively delineated. Cultural features are any features that can affect electrical geophysical data. Common cultural features include: power lines, fences, railroad tracks, underground metal pipes, underground pipelines with cathodic protection, buried telephone cables, etc.

The conductivity data were digitally recorded in the field using a portable data logger. The digital recorder has options for entering line numbers, station increments, notes at each station (e.g. noise due to power lines), and the capability to gather data for an entire day. This device provides an efficient RS-232 computer data interface that allows the data to be directly downloaded to a personal computer (PC). During the MMRF survey, utilizing the digital recorder significantly decreased data processing time and aided in the decision making process of where to locate the test pits.

2.2. FIELD ACTIVITIES

Field activities were initiated at the MMRF on February 3, 1988 and completed on February 12, 1988. A site tour was conducted to evaluate the areas where the geophysical survey was to be completed prior to initiating the survey. The locations of the EM survey at the site, as well as the locations of test pits completed, are shown in Figure 1.

2.2.1. GEOPHYSICAL FIELD SURVEY

The Geonics EM-31 arrived at the site on February 2, 1988, and was field tested on the morning of February 3. The instrument was determined to be completely functional and new batteries were installed prior to starting the survey. In a clearing away from power lines near the Martin Marietta office, an area was marked and used as a calibration checkpoint prior to data collection each day for the entire period of the survey.

The OCWA was assumed to be the "worst case" with respect to interference from the cultural features; therefore, bearings for the entire survey was chosen according to the layout of cultural features in this particular area. The line orientation was chosen to intersect as many cultural features as possible at right angles to minimize the noise and effects on the electromagnetic data by these features. The line orientation in all areas was North 40°

East. All lines were laid out using a Brunton pocket transit (compass) and 200 foot (ft) tape for accuracy. The location of the areas surveyed and individual survey lines are shown in Figure 1.

Electromagnetic geophysical data were collected over the OCWA first in order to correlate the data with test pit results from the previous summer. On February 4, data were collected and transferred to the on-site micro computer (PC) from only Line 50 in the OCWA to ensure that the instrument and data logger were working properly. The remaining survey lines and station were then laid out in the study areas and data collected. All data were downloaded to the PC at the end of each day or more often as needed. Initial data collected at the site were interpreted in the field to determine locations for test pits and areas where additional data should be collected. Additional data were collected as necessary.

2.2.2. CONFIRMATION TEST PITS

Thirteen test pits were completed to corroborate the survey results and the initial interpretation of the EM survey. Water samples were collected and submitted for analysis from all pits which contained sufficient water to allow sample collection; water samples were collected and analyzed from Test Pits 1, 2, 3, 5, 10 and 11. The remainder of the pits were dry or contained small amounts of water as noted in Table 1. All test pits were dug to what appeared to be the top of the bedrock surface (as far as the backhoe could dig). The depths listed in Table 1 are to the bottom of the pit if it was a dry hole or to the top of the water in the pit if water was present.

Leachate in the OCWA is characteristically coffee-colored with an electrical conductance in the range of 10,000 to 60,000 μmhos/cm. Coffee-colored water was only encountered in Test Pit 3, located near the landfill sump in the Old Cathode Waste Pile area; however, the electrical conductance was only 3,120 μmhos/cm. Water samples with relatively high electrical conductance (the same order of magnitude as Test Pit 3) were measured in Test Pits 2, 10 and 11.

2.2.2.1. Sample Collection

Water samples were collected from test pits utilizing a Teflon bailer suspended from Teflon coated wire and monofilament line. Sampling equipment was decontaminated between samples by USEPA approved methodology; a soap scrub and distilled water rinse,

followed by 10% nitric acid, isopropyl alcohol and distilled water rinse. Decontaminated sampling equipment was dried with Kimwipes and wrapped in plastic between sample locations. Samples were placed into appropriately labeled bottles and immediately stored in ice chests until they could be transferred to the locked refrigerator in the field office.

In accordance with the Quality Assurance Project Plan (QAPP), quality assurance (QA) samples were collected at a frequency of 1 per 20 samples; QA samples included field blanks, replicate samples, trip blanks and sampler rinsate blanks. Split samples were collected at a frequency of 1 per 10 samples. Sample collection, sulfide and oxidized screen testing of cyanide samples, and careful record keeping and chain-of-custody procedures outlined in the QAPP were also strictly adhered to.

2.2.2.2. Analytical Program

Samples were analyzed for pH and electrical conductance in the field. Samples were submitted for laboratory analysis of free cyanide, total cyanide, fluoride, sulfate, arsenic and sodium. Total sodium is an important parameter because as the concentration of sodium in the water increases, the solution becomes more electrolytic (conductive). Table 1 summarizes all field data regarding the test pits; Table 2 presents the laboratory results for test pit water samples.

The analytical data were validated and classified in accordance with the USEPA Sample Management Office (SMO) procedures described in detail in Appendix D of the Final RI Report. The data set was independently evaluated and the majority of data was rated as acceptable and classified as Level B; these data can be used quantitatively. The only exception was low matrix spike recovery for free cyanide analyses which resulted in these values being flagged with J; these data should be used qualitatively. Sporadic quality control problems are noted in the validation report; however, no other laboratory quality control difficulties resulted in samples bias. The results of the data validation are included in Section 5.0 and Appendix C. The original laboratory reports are included in Appendix D.

2.3. RESULTS OF THE EM SURVEY

The results of the EM surveys and the test pits for the individual areas of the MMRF investigated are discussed below. The results of the survey for each area are presented in Figures 2 through 21. The relative difference in electrical resistivity (density of contours) between the areas surveyed is the significant feature used in evaluating subsurface conditions. The contoured data presented in Figure 2 through 21 are in units of μmhos/m.

2.3.1. OLD CATHODE WASTE AREA

The Old Cathode Waste Area is located adjacent to the aluminum reduction facility and the on-site landfill. There is metal debris on the ground on the northeast portion of the area (salvage area) and various underground pipes and fences are located in the area. The geophysical survey appeared to be useful in delineating areas of dissolved constituents, in spite of the cultural noise present in the area. The results of the EM survey are presented in Figures 2-5. Test Pits 3, 4 and 9 were completed in this area.

The conductivity data from the OCWA showed a marked difference between the vertical dipole (deeper readings) and the horizontal dipole (shallower readings) measurements. In the upper left hand corner of the diagrams on both the vertical and the horizontal plots there is an area of elevated conductivity. The elevated conductivity is related in part to the presence of leachate that is being generated by the landfill located north of this area. Test Pit 3 was excavated in this area at Line 60/Station 7 to a depth of 6.5 ft. The water sample from this pit had an electrical conductance of 3120 μmhos/cm and a total sodium concentration of 810,000 μg/L. Free and total cyanide were detected at 33 mg/L (J) and 190 mg/L, respectively, and fluoride at 288 mg/L.

Other prominent features in the OCWA vertical plot are the two "bulls-eye" highs located at 450,300 (Note: Locations are identified as 450 ft on horizontal axis and 300 ft on vertical axis on both vertical and horizontal dipole figures) and at 75,150. The first anomaly is located near two large coke piles at the site. Test Pit 4 was excavated nearby at Line 30/Station 24 and was dry at a depth of 8.5 ft. The second bulls-eye was located next to a former test pit that had been excavated the previous summer in which high conductivity perched water was identified; therefore, a new test pit was not excavated at this time. There is also an anomaly located in the horizontal data at 325,500 which is attributed to the stacks of metal debris in this area.

An additional test pit that was excavated in an area of low conductivity measurements where no water or water with dissolved constituents was expected to be encountered. This pit was to serve as "ground truth" to correlate the results of the EM survey. Test Pit 9 was located at Line 50/Station 12 and was 6 ft deep. The pit was wet, but did not yield sufficient water to sample.

On the Old Cathode Waste Area plots, where X = 0 on the figures, the Station number = 0. Also, where Y = 0 on the figures, the Line number = -30. The following is a list of the stations where data were gathered. The irregularity of the stations and lines is a result of the various boundaries and buildings that were encountered.

Line	70	had Stations	7-15	measured
Line	60	had Stations	4-18	measured
Line	50	had Stations	1-21	measured
Line	40	had Stations	2-21	measured
Line	30	had Stations	2-26	measured
Line	20	had Stations	2-19	measured
Line	10	had Stations	2-12	measured
Line	0	had Stations	1-11	measured
Line	-10	had Stations	0-10	measured
Line	-20	had Stations	0-8	measured
Line	-30	had Stations	2-7	measured

2.3.2. BATH RECOVERY PAD

The Bath Recovery Pad (BRP) area is bounded on the north by a fence and the landfill ditch and on the south by the road that runs along the reduction facility. The BRP is a reinforced concrete pad with walls on three sides, approximately 3 ft high. There are piles of aluminum slag on the western portion of the pad and coke on the eastern part of the pad. EM survey data for the BRP are presented in Figures 6-9. Test Pits 1 and 2 were completed in this area.

The concrete is believed to contain metal rebar for support; measurements gathered near the pad appeared to be adversely affected (see lower left corner of Figure 8). The vertical data showed an anomaly at 75,50 that was interpreted as an area of perched water. Test Pit 1 was excavated on Line -60/Station 41 at this anomaly. Water was encountered in Test Pit 1 at a depth of 7.5 ft with an electrical conductance of 625 μmhos/cm. Laboratory analysis of this water revealed a total sodium concentration of

91,500 µg/L. Free and total cyanide and fluoride concentrations for this sample were 0.028 mg/L (J), 18 mg/L, and 34 mg/L, respectively.

Test Pit 2 was located at Line -20/Station 47, because of high conductivity readings in the area (location 200,250, Figure 8). Water encountered in the pit at 6.5 ft had an electrical conductance of 2400 µmhos/cm and a total sodium concentration of 215,000 µg/L. Free and total cyanide and fluoride concentrations for this sample were 3.6 mg/L (J), 26 mg/L, and 11 mg/L, respectively.

The upper left corner of Figure 6 (horizontal data) shows an anomalous semi-linear bunching of contour lines that corresponds to a fence that was crossed by the survey lines. A test pit was not excavated in this area.

On the Bath Recovery Pad plots, where X = 0 on the figures, the Station number = 38. Also, where Y = 0 on the figures, the Line number = -70. The following is a list of the stations where data were gathered. The irregularity of the stations and lines are a result of the various boundaries and fences that were encountered.

Line	-20	had Stations	43-50	measured
Line	-30	had Stations	40-45	measured
Line	-40	had Stations	39-44	measured
Line	-50	had Stations	38-43	measured
Line	-60	had Stations	39-50	measured
Line	-70	had Stations	38-48	measured

2.3.3. CATHODE WASH AREA

Cathodes (pots) are rinsed off in the Cathode Wash Area (CWA) located southeast of the hard pitch building. There is a concrete pad over the southern portion of the area with some associated underground pipes (water, etc.). A concrete wash/catch basin is located in the southern-most part of the area. EM survey data for the CWA are presented in Figures 10-13. Test Pit 7 was completed in this area.

Data for both vertical and horizontal dipoles exhibits a fair amount of variability in the CWA. This variability is attributed to a fence that crosses the survey lines, underground piping in the concrete pad area, a fence that parallels River Road, and nearby power lines east of River Road. Test Pit 7 was excavated over the conductivity high located at Line 0/Station 29. The test pit was

excavated to a depth of 8.5 ft. The excavation was wet but did not yield sufficient water to sample. Another pit had been excavated in the summer of 1987 just east of Test Pit 7 and it also had also been dry.

On the Cathode Wash Area plots, where X = 0 on the figures, the Station number = 21. Also, where Y = 0 on the figures, the Line number = -10. The following is a list of the stations where data were gathered. The irregularity of the stations and lines is a result of the various boundaries and buildings that were encountered.

Line	20	had Stations	24-28	measured
Line	10	had Stations	26-31	measured
Line	0	had Stations	21-34	measured
Line	-10	had Stations	24-36	measured

2.3.4. NORTH FILL AREA

There is an extensive area of fill located east of River Road. The fill area contains basalt rubble from excavation (blasting) of the reduction facility foundation and drainage systems. The rubble is of various sizes ranging up to large boulders. A thin cover of soil exists in some areas. There is an abrupt drop off at the eastern edge of the fill which defines the Port Authority property boundary. The North Fill Area (NFA) is the area north of the stream that bisects the fill area (Figure 1). The results of the EM survey for the NFA are presented in Figures 14-17. Test Pits 6, 8, 12 and 13 were completed in this area.

The vertical geophysical data had more pronounced high conductivity anomalies than the horizontal data. However, the horizontal data do closely track the vertical data. Test Pits 6 and 8 were completed in areas of high conductivity anomalies. Test Pit 6 was completed at Line 180/Station 50. This pit was excavated to a depth of 5 ft when dry bedrock was encountered. Test Pit 8 was completed at Line 200/Station 48. Bedrock was encountered at a depth of 8.5 ft and was also dry.

Two additional test pits (12 and 13) were completed in low conductivity areas in the NFA to verify that conductive perched water was not being overlooked by the geophysical survey. Test Pit 12 was located at Line 170/Station 40 and was excavated to a depth of 7 ft. Test Pit 12 was dry. Test Pit 13 was located at

Line 140/Station 48 and was excavated to 3 ft before dry bedrock was encountered.

The high conductivity anomalies in the NFA did not yield any high or low conductivity water in the test pits that were excavated. Although the source of the conductivity anomalies is not known, major anomalies do not appear to be a result of high conductivity perched water zones.

On the North Fill Area, where X = 0 on the figures, the Station number = 40. Also, where Y = 0 on the figures, the Line number = 140. The following is a list of the stations where data were gathered. The irregularity of the stations and lines is a result of the various boundaries and power lines that were encountered.

Line	220	had Stations	50-56	measured
Line	210	had Stations	46-56	measured
Line	200	had Stations	43-57	measured
Line	190	had Stations	42-56	measured
Line	180	had Stations	41-54	measured
Line	170	had Stations	40-52	measured
Line	160	had Stations	42-52	measured
Line	150	had Stations	46-50	measured
Line	140	had Stations	47-50	measured

2.3.5. SOUTH FILL AREA

The South Fill Area (SFA) is located on the south side of the stream that cuts across fill area east of River Road. Several power lines parallel the east side of River Road; data collection at the lower station numbers near River Road was hampered by the electrical noise from the power lines. No geophysical data were collected under the power lines where Test Pit 11 was excavated. The EM survey data for the SFA are presented in Figures 18-21. Test Pits 5, 10 and 11 were excavated in this area.

The horizontal data has an overall tighter bunching of contours as opposed to the vertical data. Test Pit 5 was located at Line 140/Station 94; an area of moderate conductivity where perched water might be expected, although water with elevated levels of dissolved constituents was not anticipated. The pit was excavated to 7 ft and water samples collected. The water samples had an electrical conductance of 310 μmhos/cm and total sodium concentration of 15,000 μg/L. Free and total cyanide and fluoride

concentrations for this samples were 0.48 mg/L (J), 1.2 mg/L, and 0.52 mg/L, respectively.

The location of Test Pit 10 was selected to investigate an anomaly present in both the horizontal data and the vertical data (25,300). Test Pit 10 was excavated to 6.5 ft. The water sample had an electrical conductance of 2320 µmhos/cm and a total sodium concentration of 620,000 µg/L. Free and total cyanide and fluoride concentrations for the pit water samples were 0.13 mg/L (J), 24 mg/L, and 73 mg/L, respectively.

Test Pit 11 was located adjacent to River Road under the power lines and has no line or station designation. Test Pit 11 was excavated to a depth of 5.5 ft. Water samples had an electrical conductance of 3350 µmhos/cm and a total sodium concentration of 949,000 µg/L. Free and total cyanide and fluoride concentrations for the pit samples were 0.30 mg/L (J), 27 mg/L, and 78 mg/L, respectively.

On the South Fill Area plots, where X = 0 on the figures, the Station number = 84. Also, where Y = 0 on the figures, the Line number = 50. The following is a list of the stations where data were gathered. The irregularity of the stations and lines is a result of the various boundaries and power lines that were encountered.

Line	170	had Stations	91-95	measured
Line	160	had Stations	87-97	measured
Line	150	had Stations	86-99	measured
Line	140	had Stations	86-101	measured
Line	130	had Stations	85-105	measured
Line	120	had Stations	84-104	measured
Line	110	had Stations	85-105	measured
Line	100	had Stations	92-106	measured
Line	90	had Stations	98-107	measured
Line	80	had Stations	102-109	measured
Line	70	had Stations	103-111	measured
Line	60	had Stations	106-113	measured
Line	50	had Stations	109-115	measured

2.4. DISCUSSION AND LIMITATIONS OF SURVEY DATA

The close proximity to the plant and various sources of cultural noise affected the geophysical data collected at the MMRF. Noise problems did inhibit using all of the data collected, as some of

it was obviously noise contaminated. This was evident in the field because the analog meter on the EM-31 would oscillate with no specific period in noisy areas. These areas were noted on the data recorder and affected data points were removed from the final data set. Signal saturation occurred in a number of areas and some data had to be removed from the data set to avoid inaccurate interpretation.

Another significant problem was the presence of metal debris around the site. Due to the high amounts of voltage that passed through some of this metal during the aluminum reduction process, strong magnetic remanence was present. This was observed in the field by the fluctuations of the compass needle near these metal objects.

As mentioned previously, some of the anomalies can not be adequately explained based on the data collected (e.g. the anomalies in the NFA). It is not known at this time whether or not these anomalies are due to geologic features or electrical noise. Specific anomalies were field checked with test pits. Large amounts of basalt rubble were observed in these test pits. It is possible that due to the low conductivity of basalt, the EM-31 signal was penetrating deeper and the anomalies are a result of deeper features. Induced electrical signals may have traveled farther (experience less signal loss) in a high resistivity medium like basalt where the materials act as resistors. Electrical signals lose strength as they encounter conductive (high conductivity or low resistivity) materials, as the signal is conducted away through the material.

2.5. CONCLUSIONS

The geophysical survey successfully identified areas with perched water and areas where the perched water contained elevated levels of dissolved constituents (OCWA, portions of the SFA and the BRP, and Test Pit 11). The test pits proved to be useful ground truth in verifying the geophysical results. Laboratory analysis of water samples collected from the test pit were useful in quantifying the survey results. The geophysical data were affected by electrical noise from the aluminum reduction facility, power lines, metal debris, and other cultural features, but still provide valuable information regarding the areal extent of perched water and perched water containing elevated concentrations of dissolved constituents. The approximate limits of the perched water are illustrated in Figure 1.

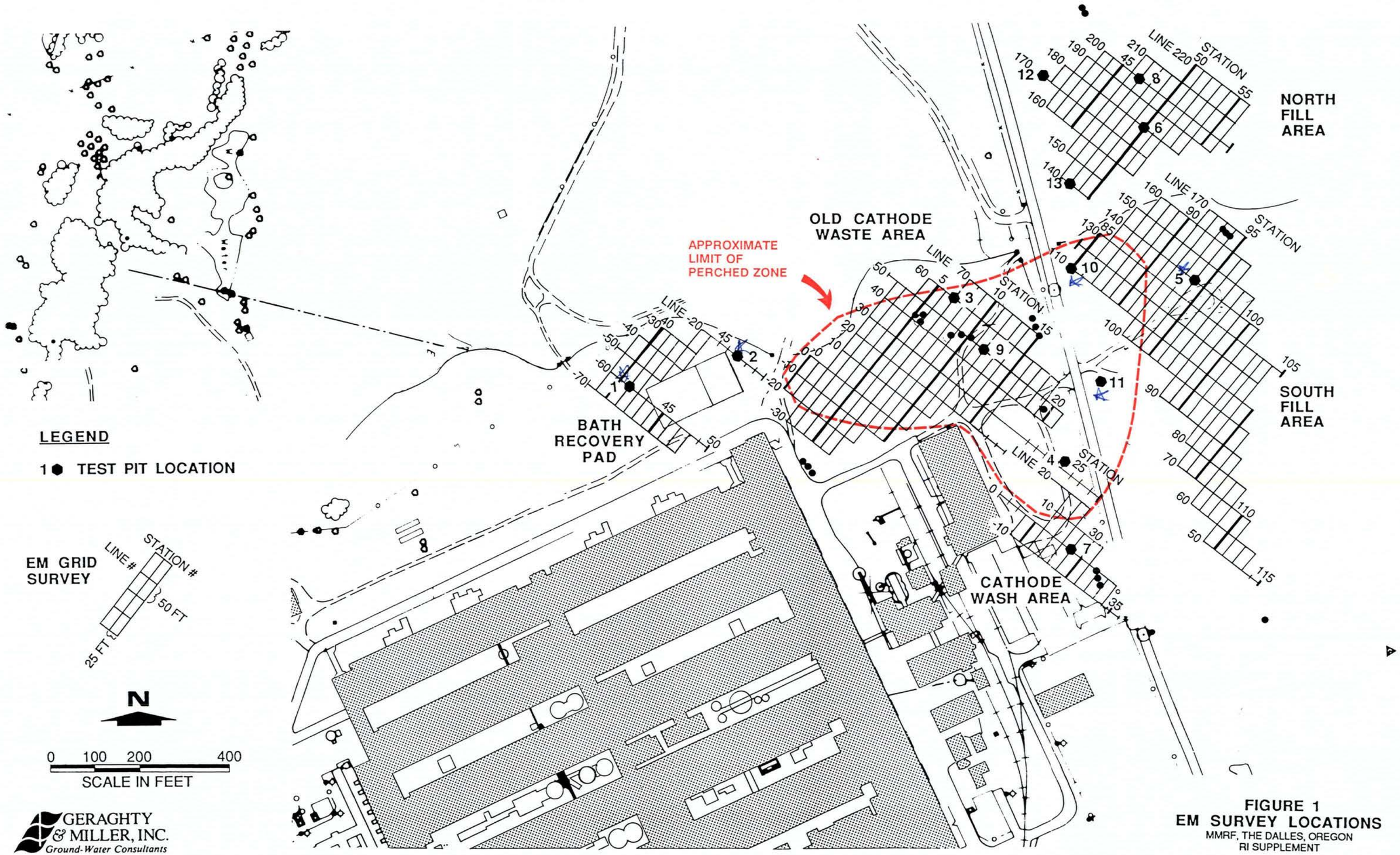

FIGURE 1
EM SURVEY LOCATIONS
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

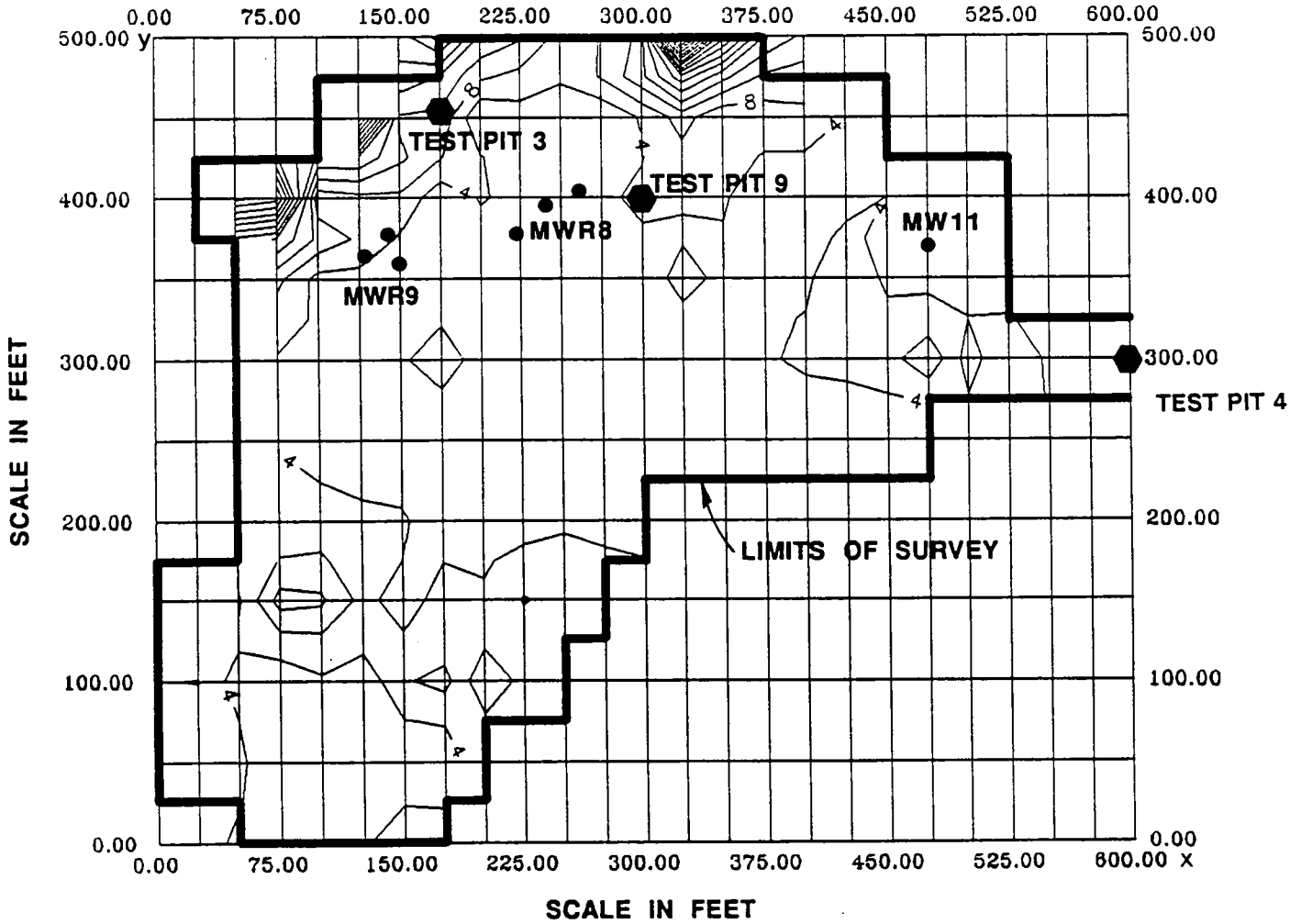

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FIGURE 2
OLD CATHODE WASTE AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

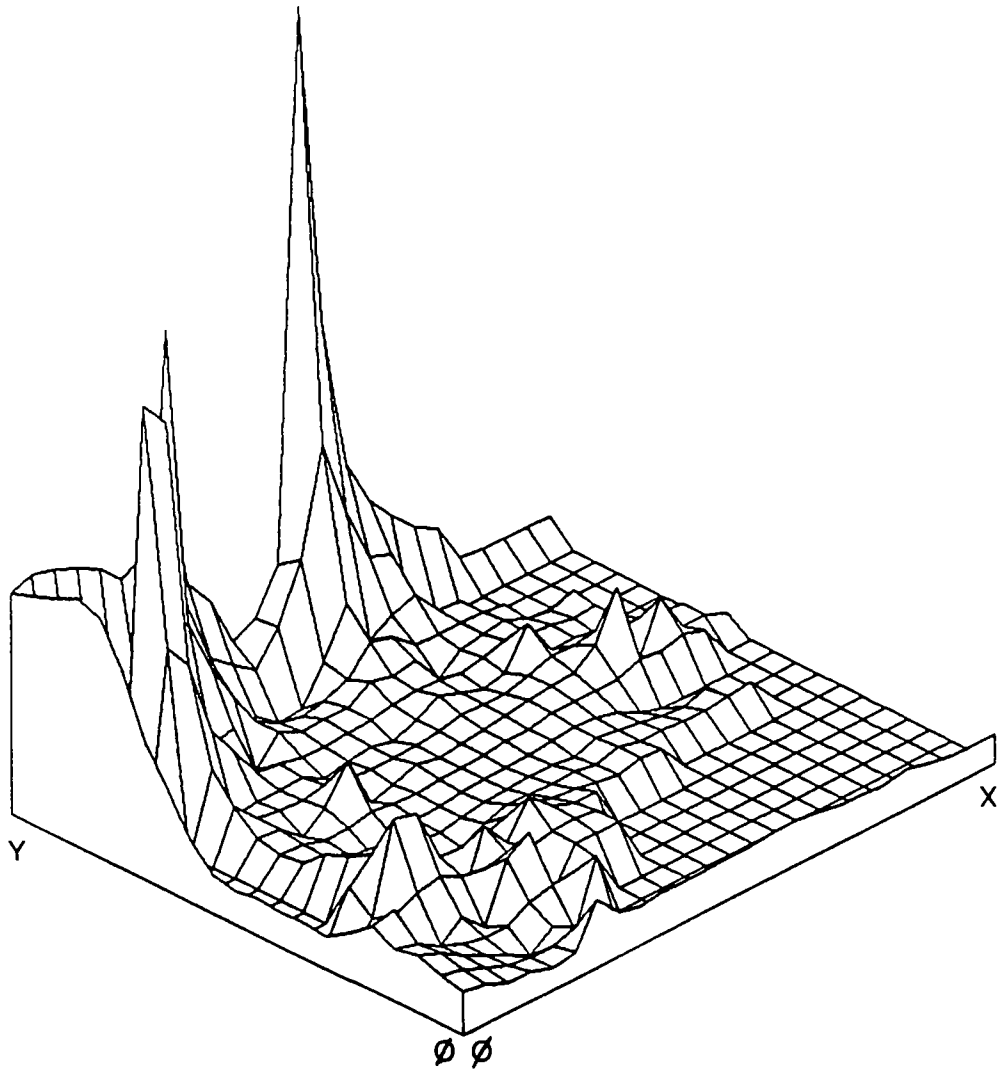

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FIGURE 3
OLD CATHODE WASTE AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

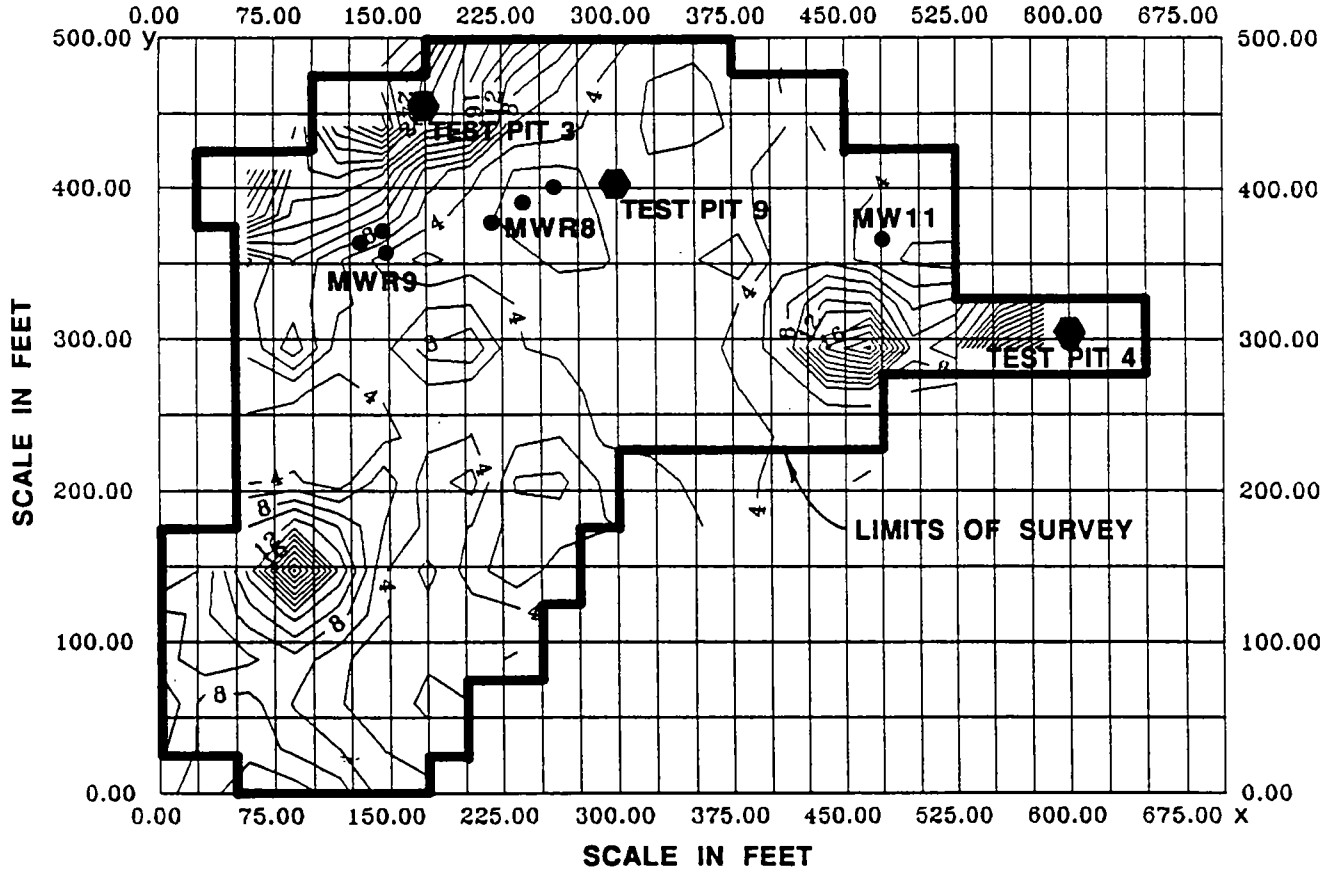

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FIGURE 4
OLD CATHODE WASTE AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

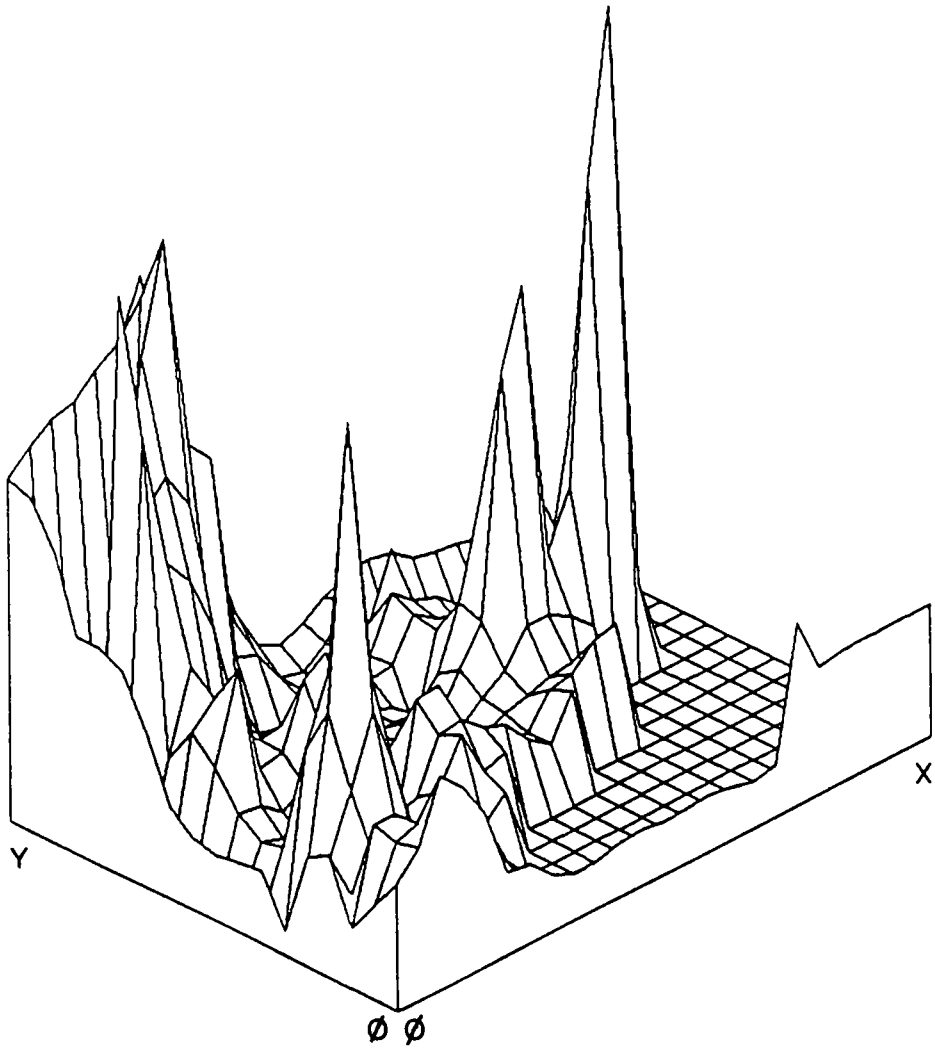

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FIGURE 5
OLD CATHODE WASTE AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

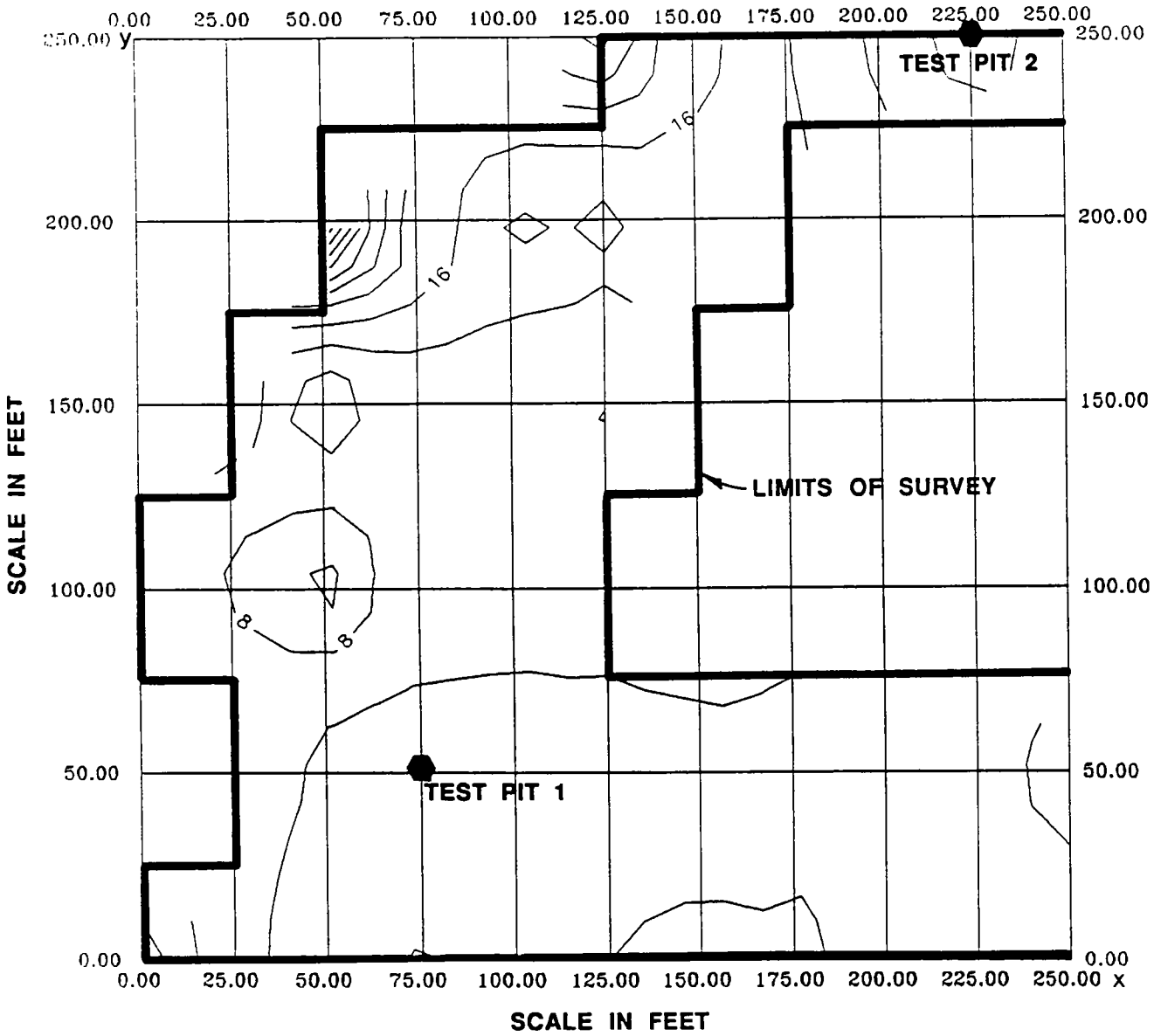

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FIGURE 6
BATH RECOVERY PAD
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

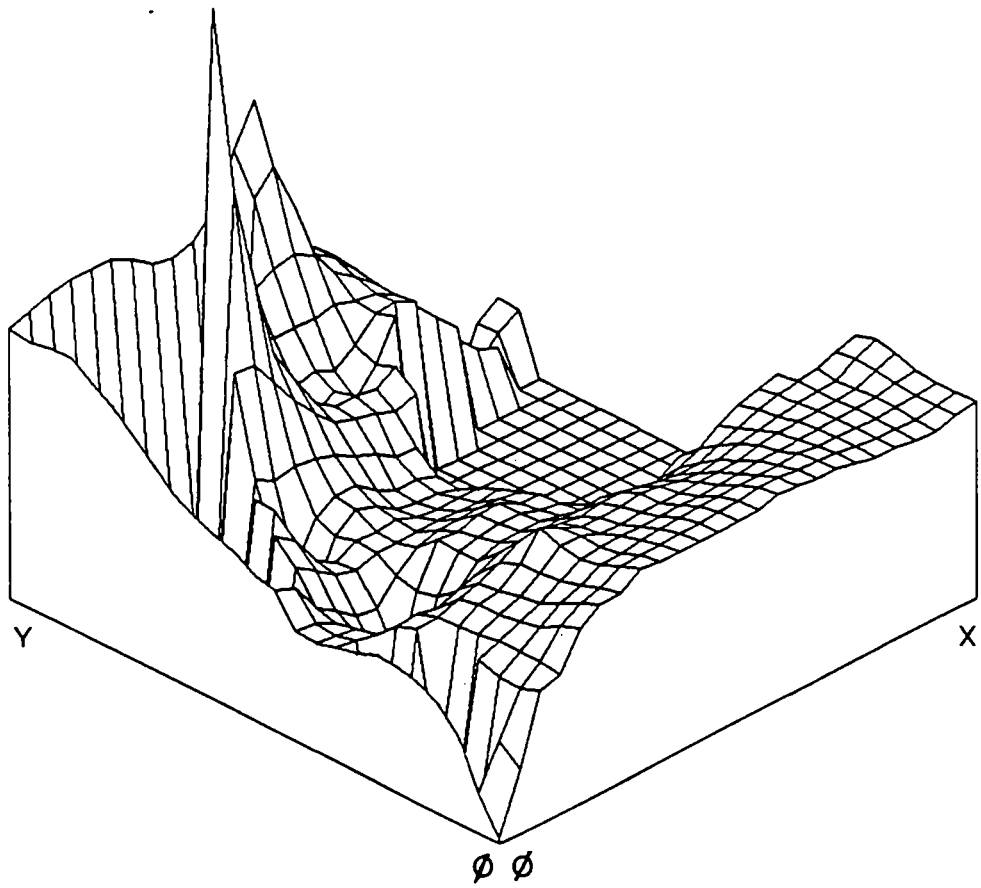

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FIGURE 7
BATH RECOVERY PAD
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

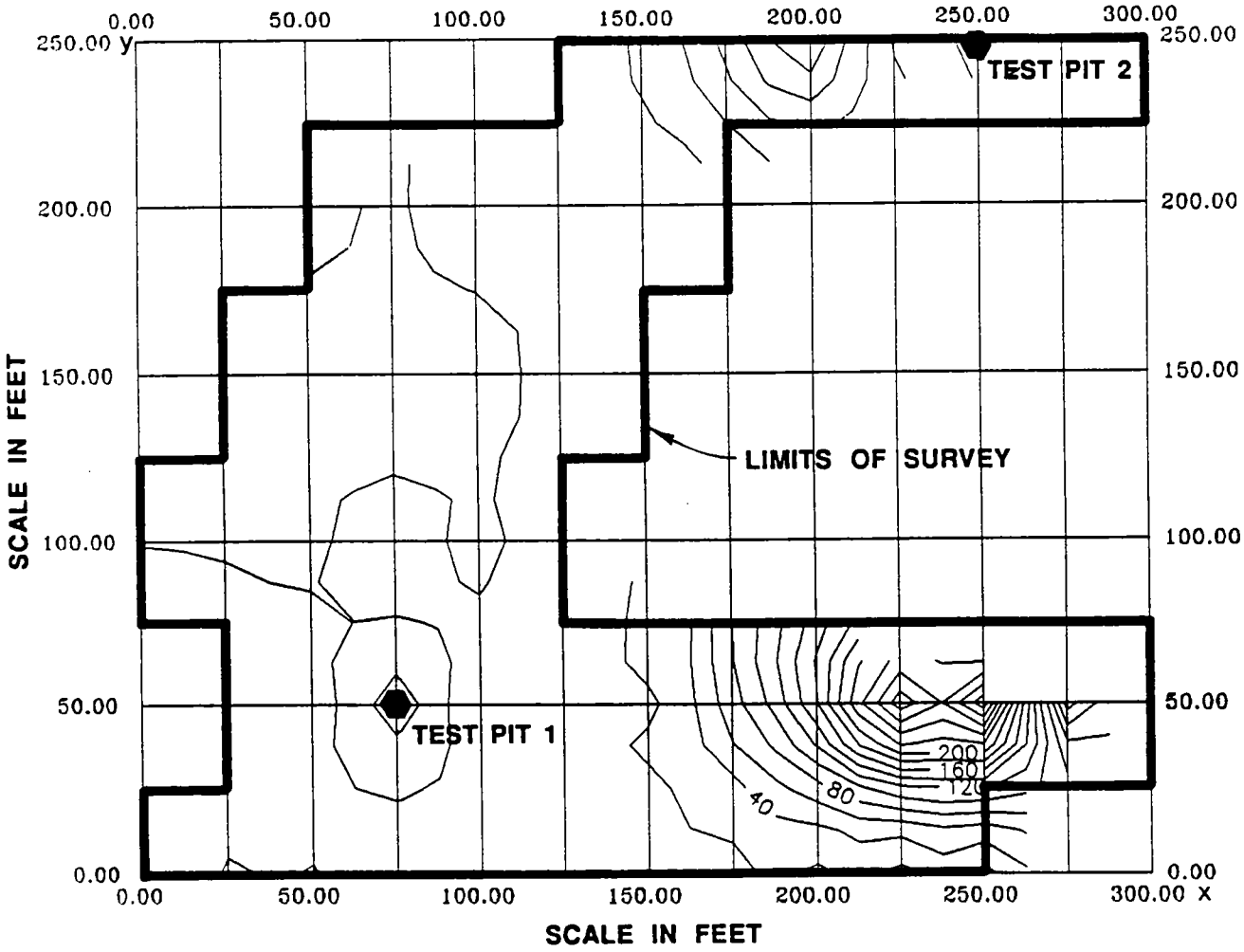

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FIGURE 8
BATH RECOVERY PAD
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

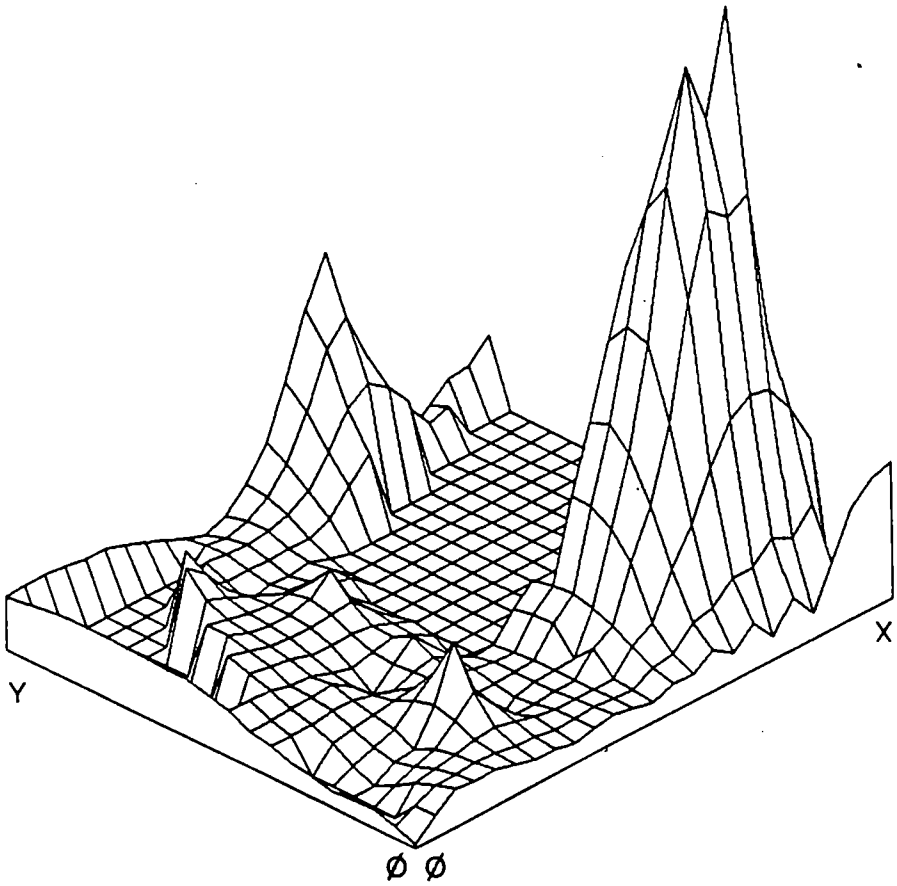

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FIGURE 9
BATH RECOVERY PAD
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

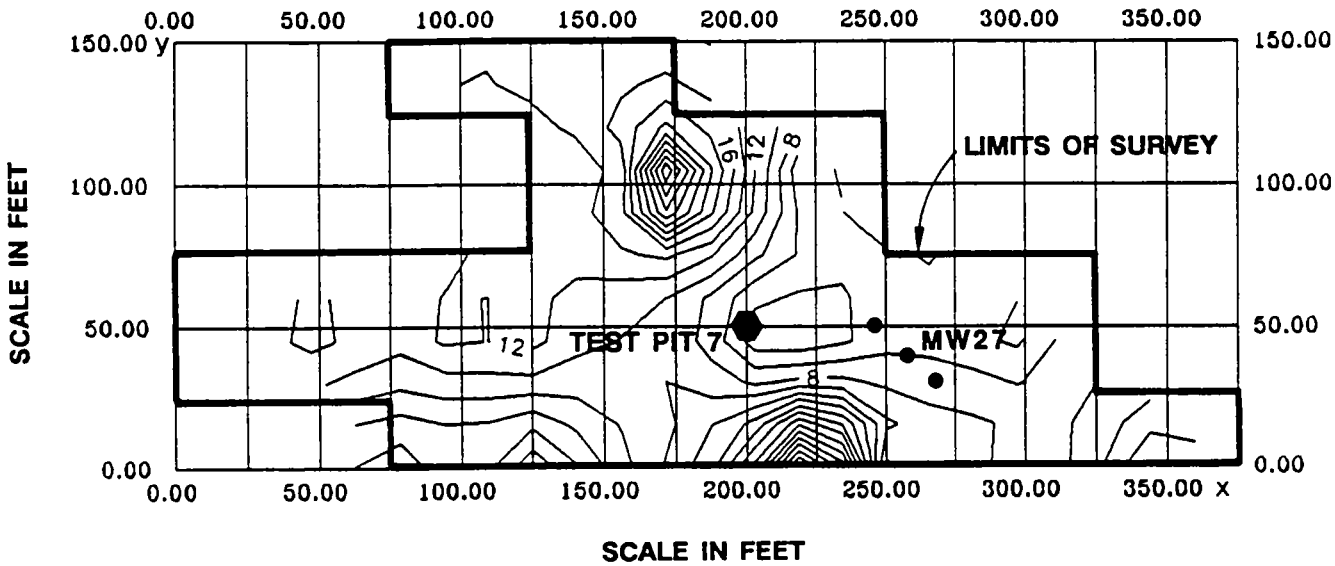

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FIGURE 10
CATHODE WASH AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

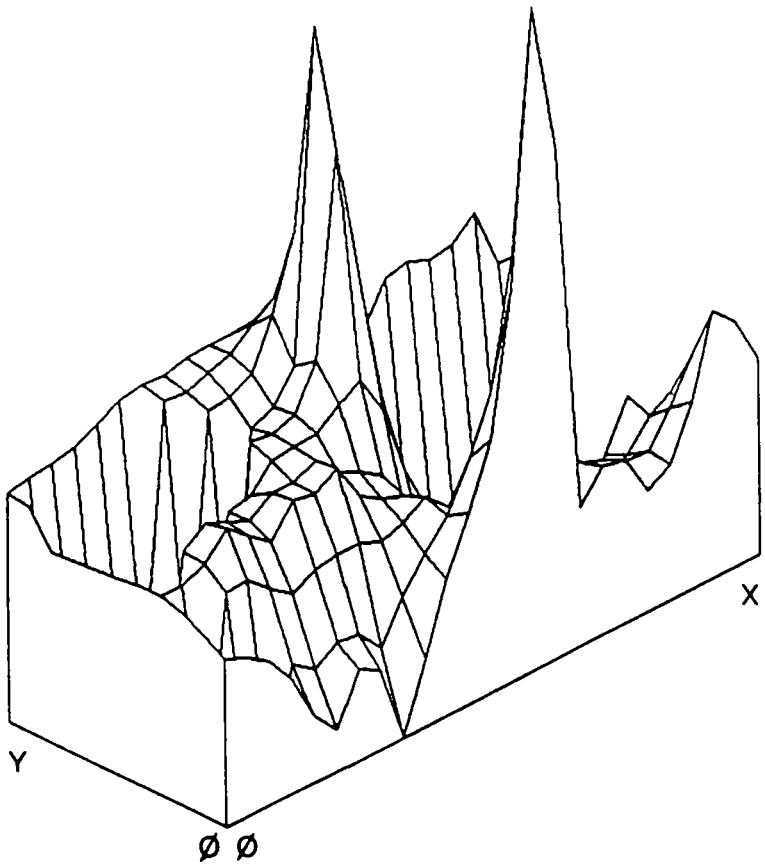

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FIGURE 11
CATHODE WASH AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

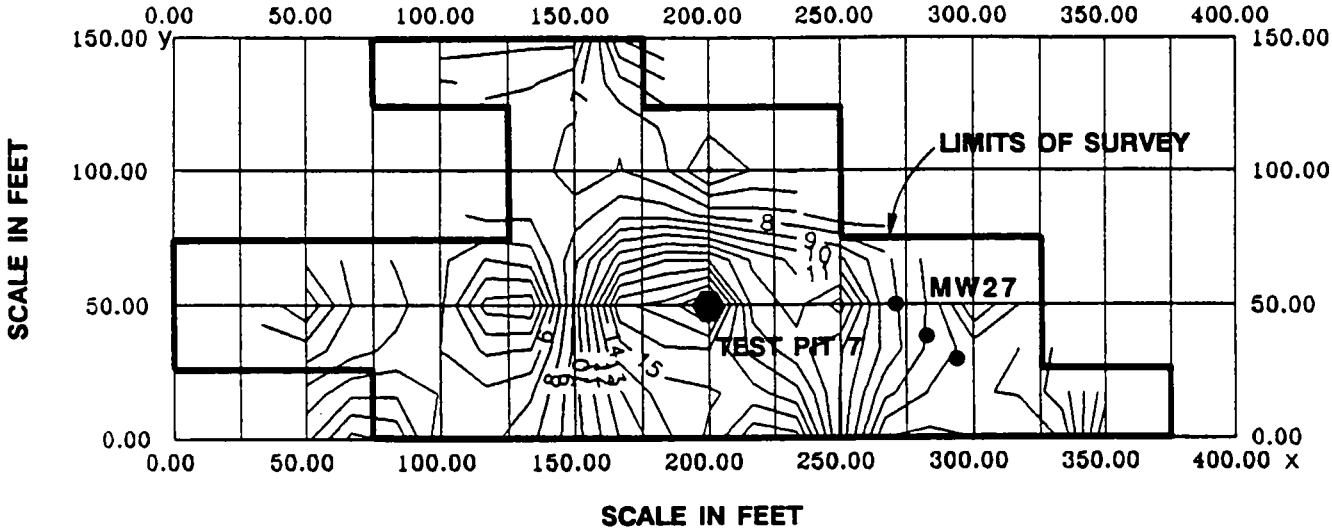

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FIGURE 12
CATHODE WASH AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

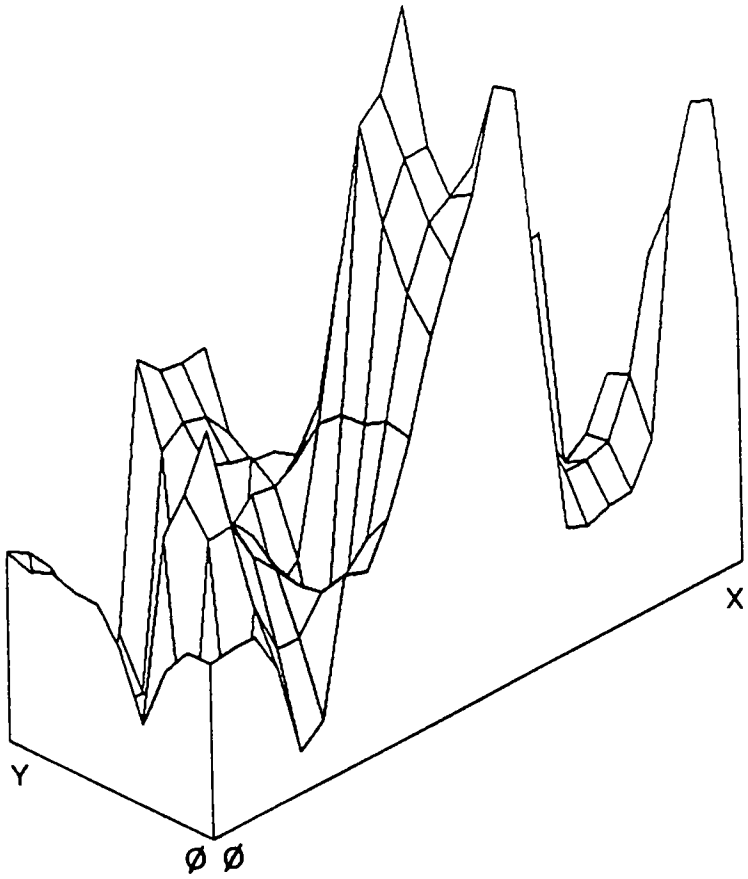

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FIGURE 13
CATHODE WASH AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

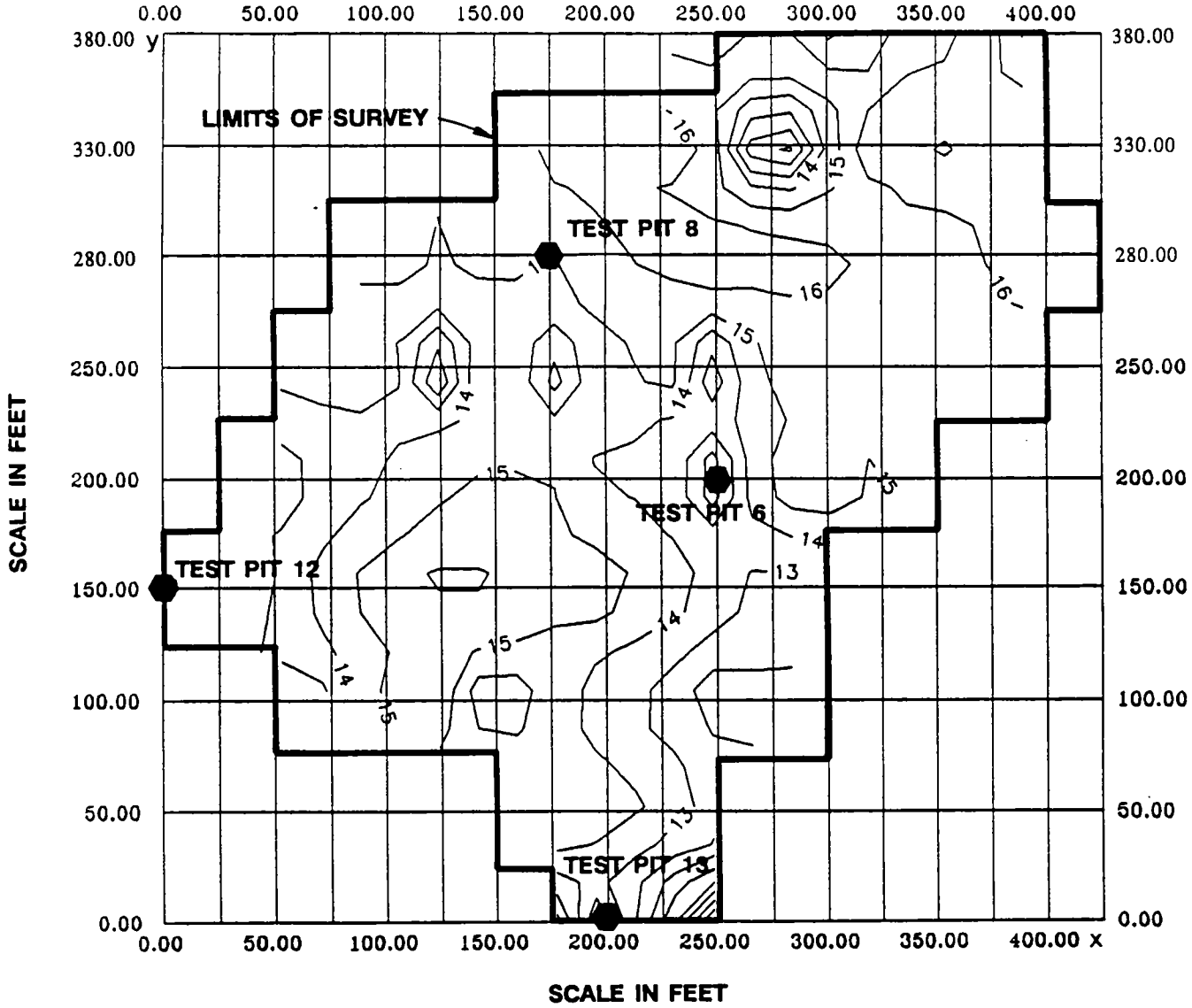

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FIGURE 14
NORTH FILL AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

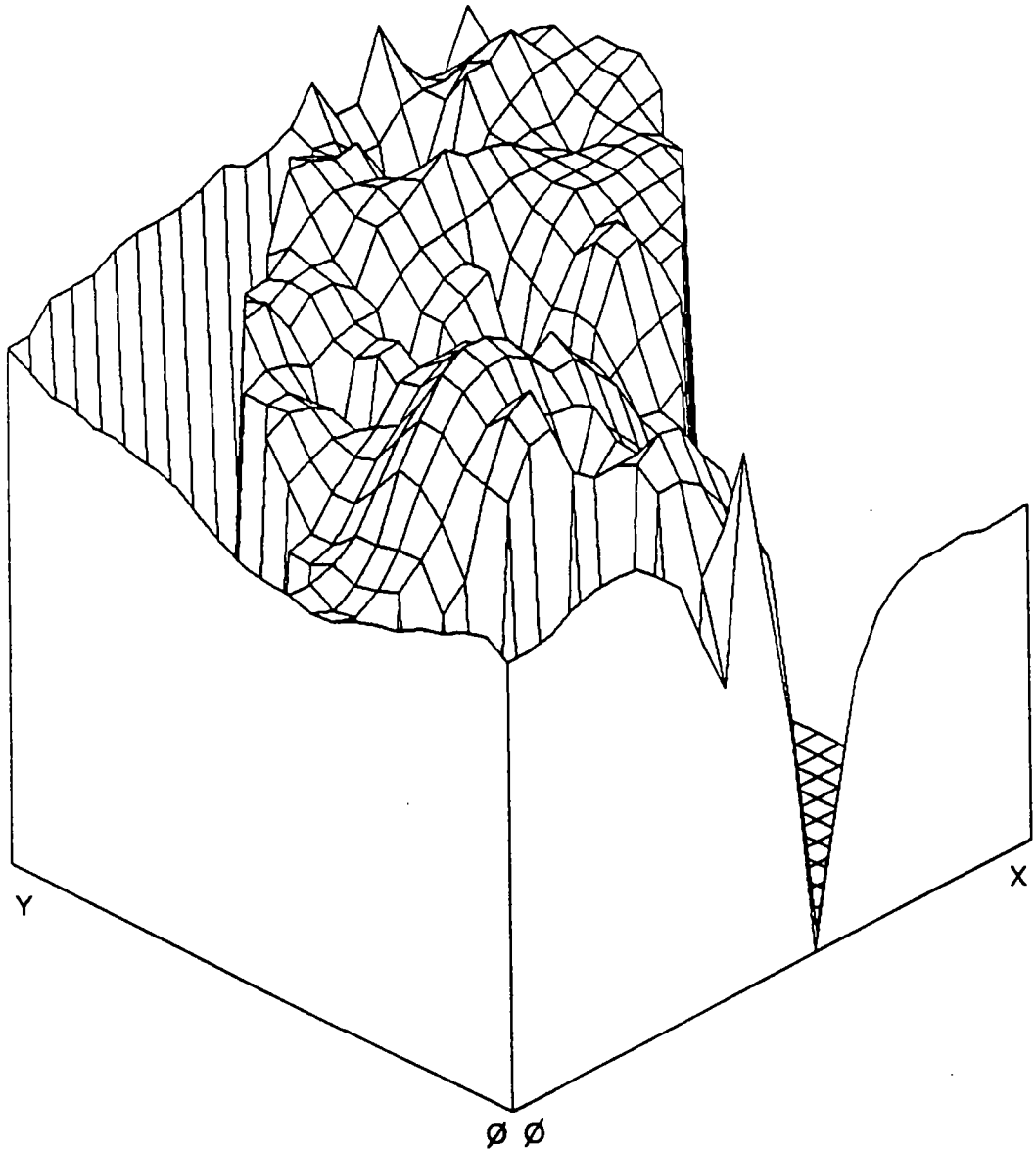

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FIGURE 15
NORTH FILL AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

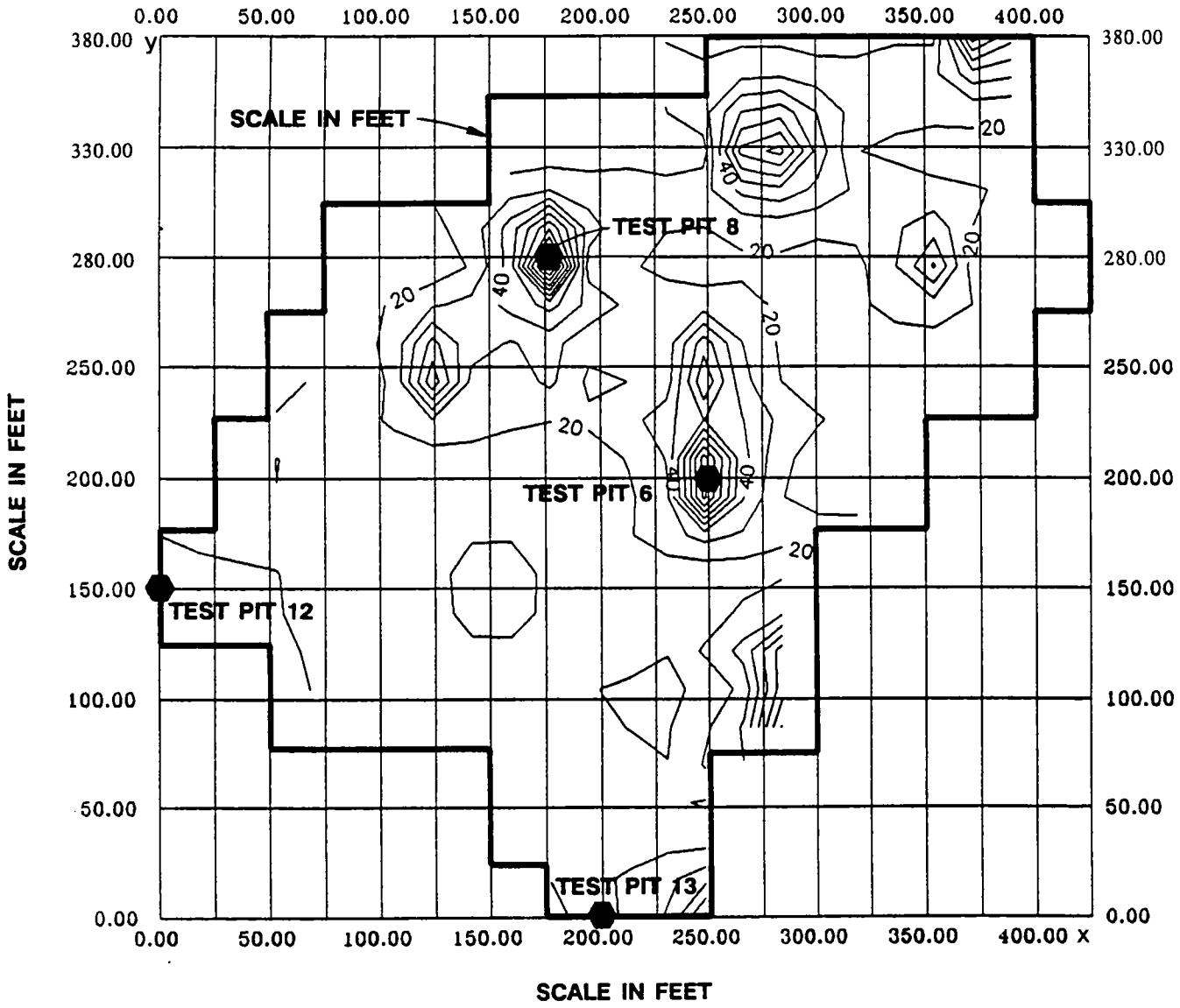

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FIGURE 16
NORTH FILL AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

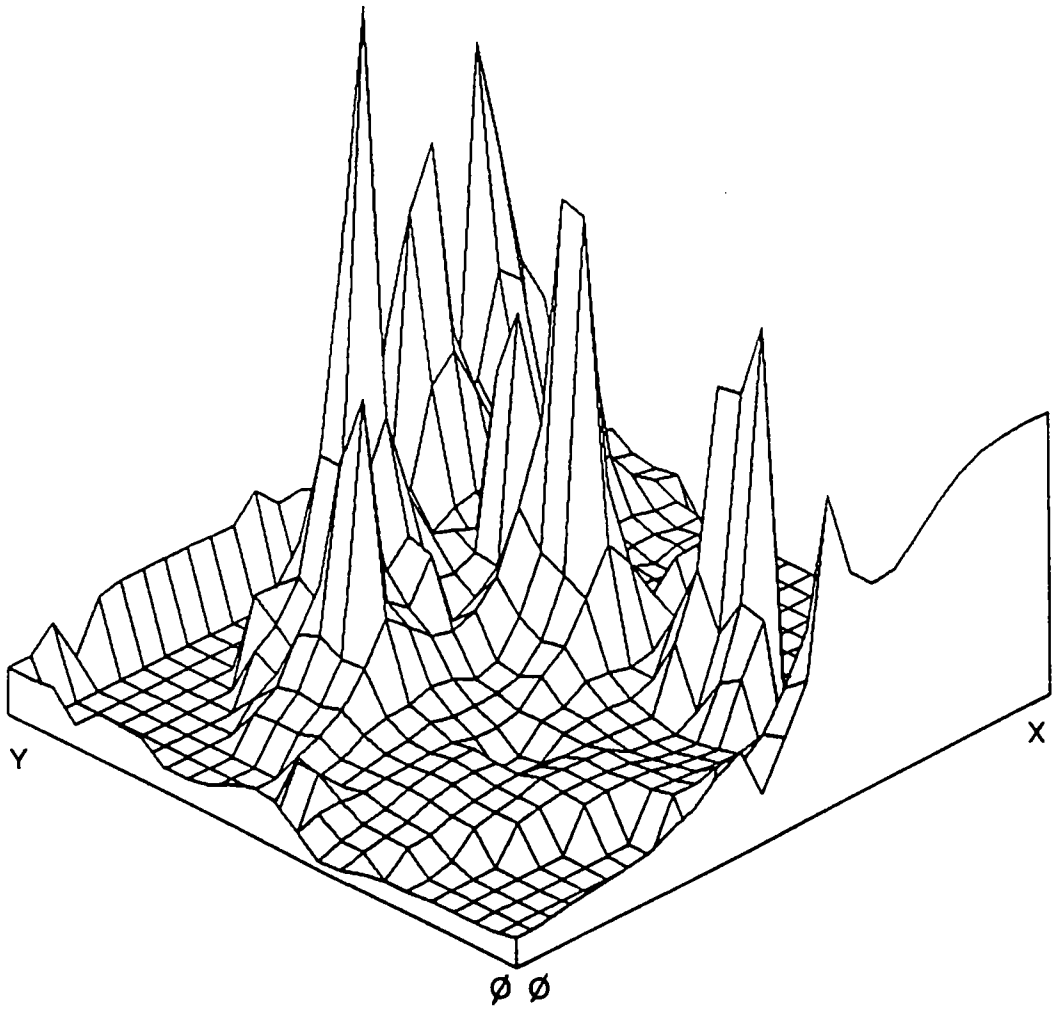

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FIGURE 17
NORTH FILL AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

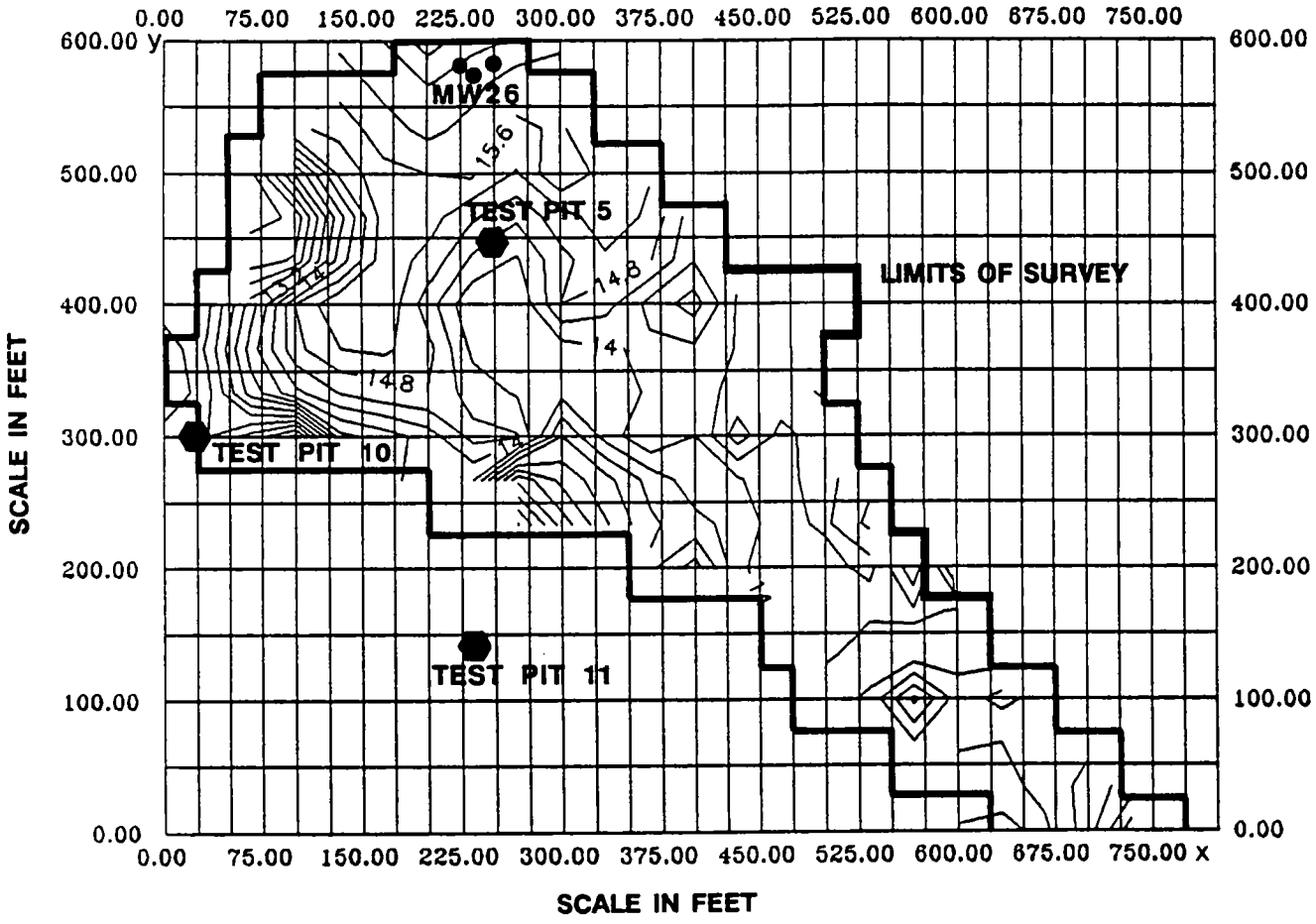

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FIGURE 18
SOUTH FILL AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

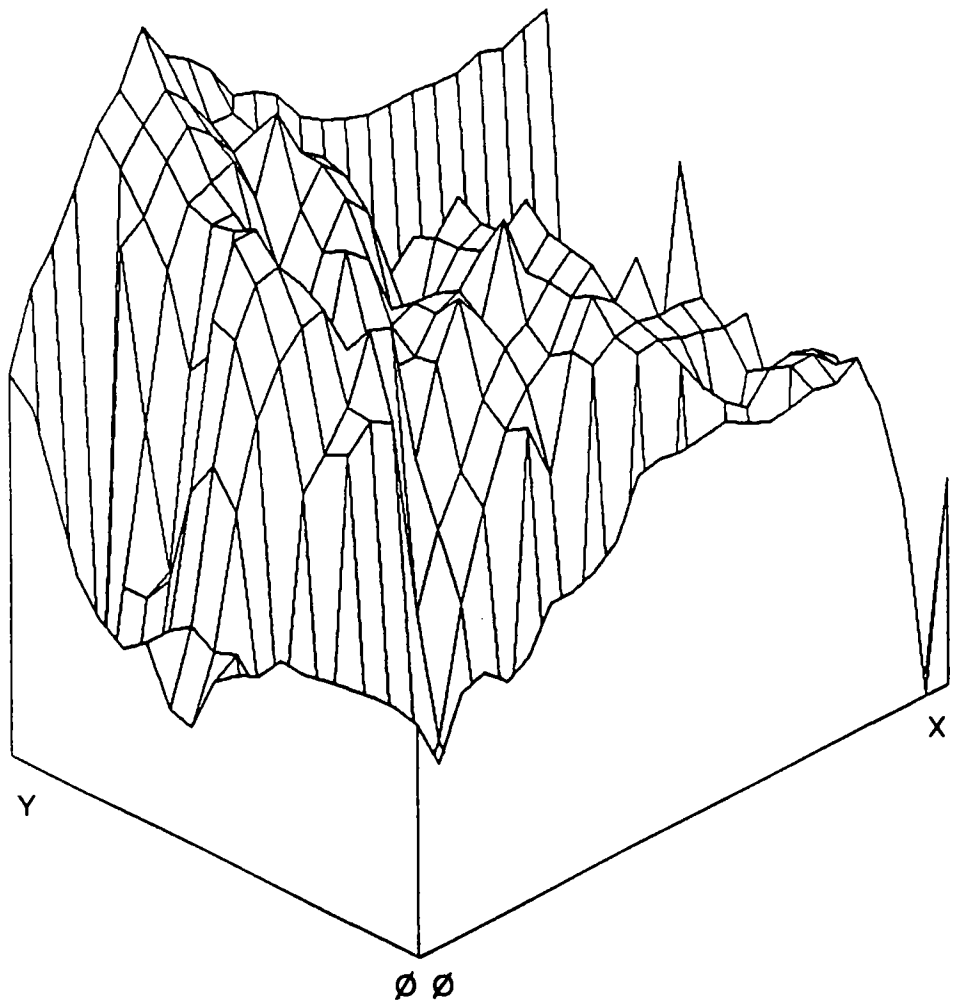

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FIGURE 19
SOUTH FILL AREA
HORIZONTAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

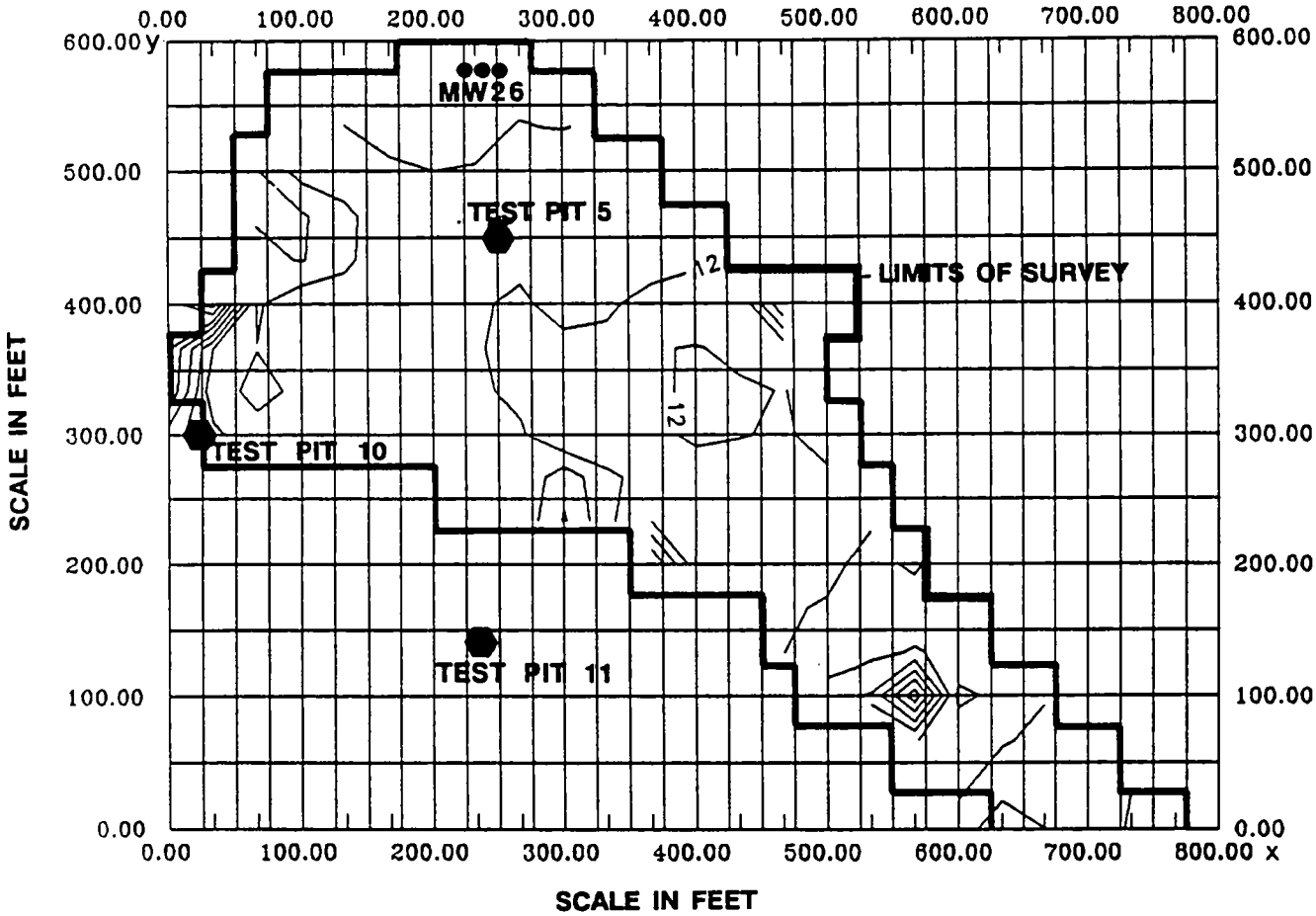

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FIGURE 20
SOUTH FILL AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

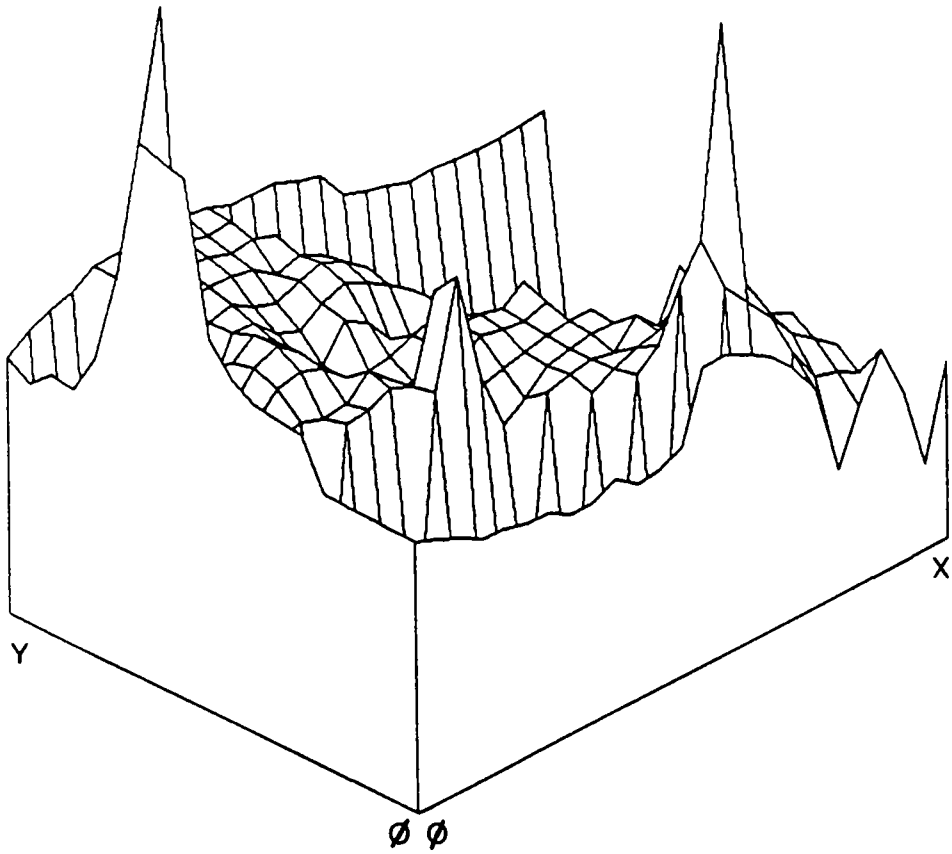

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FIGURE 21
SOUTH FILL AREA
VERTICAL DIPOLE EM SURVEY
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

TABLE 1

EM SURVEY TEST PITS
LOCATIONS AND FIELD PARAMETERS
FEBRUARY 10-11, 1988
MMRF, THE DALLES
RI SUPPLEMENT

TEST PIT	STATION NUMBER	LINE NUMBER	AREA LOCATED	EC*	pH	APPROX DEPTH
1	41	-60	BRP	625	7.7	7.5
2	47	-20	BRP	2400	8.3	6.5
3	7	60	OCWA	3120	9.1	6.5
4	24	30	OCWA	Dry	–	8.5
5	94	140	SFA	310	6.7	7.0
6	50	180	NFA	Dry	–	5.0
7	29	0	CWA	Wet	–	8.5
8	48	200	NFA	Dry	–	8.5
9	12	50	OCWA	Wet	–	6.0
10	85	110	SFA	2320	8.9	6.5
11	–	–	SFA	3350	8.9	5.5
12	40	170	NFA	Dry	–	7.0
13	48	140	NFA	Dry	–	3.0

Notes:

EC - Electrical conductance; units in μmhos/cm
Depth - feet below land surface
Wet - not sufficient water in pit to sample
Dry - no water in pit

020DAL3:RISUPP.TBL

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TABLE 2--EM TEST PITS SAMPLING ANALYTICAL RESULTS

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE (MG/L)	TOTAL CYANIDE (MG/L)	FLUORIDE (BY ISE) (MG/L)	TOTAL ARSENIC (UG/L)	TOTAL SODIUM (UG/L)	SULFATE (TURBIDIMETRIC) (MG/L)
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	0.028 J	18	34	3.0 U	91500	30
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	3.6 J	26	11	[3.9]	215000	490
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	33 J	190	288	51	810000	131
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	0.48 J	1.2	0.52	9.9	15000	47
RRTPW-110G	880212-0 5	PIT 10	WATER	11-Feb-88	16-Feb-88	0.13 J	24	73	480	620000	78
RRTPW-111G	880212-0 6	PIT 11	WATER	11-Feb-88	16-Feb-88	0.30 J	27	78	568	949000	116
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	[0.0045] J	0.0026 U	[0.057]	[3.2]	1000	[1.1]
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	0.36 J	1.2	0.39	[15] J(1)	16000	42
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	[0.0073] J	0.0026 U	[0.05]	3.0 U	[628]	1.0 U
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	0.0026 UJ	0.0026 U	0.048 U	[3.6]	[558]	1.0 U

NOTES:
U - ANALYTE WAS ANALYZED FOR BUT NOT DETECTED ABOVE THE INSTRUMENT DETECTION LIMIT (IDL)
[ ]- RESULTS GREATER THAN IDL, BUT LESS THAN THE QUANTITATION LIMIT; VALUE IS ESTIMATED
J - ESTIMATED VALUE
(1)- SAMPLE DILUTED 3x DUE TO MATRIX INTERFERENCE, THUS 15 UG/L IS BELOW THE ADJUSTED QUANTITION LIMIT AND IS REPORTED WITH "J" FOOTNOTE

MMRFDATA:EMPITS.WK1

Section Three

3.0 CHENOWETH CREEK SAMPLING

The potential exists for Chenoweth Creek to be a receptor of chemical constituents as a result of both surface-water and ground-water in-flow from the alluvial aquifer. Detection limits for cyanide and fluoride analyses of Chenoweth Creek surface-water samples collected during the RI were not sufficiently low to allow for comparison with applicable EPA ambient water quality criteria, salmon avoidance behavior criteria, and health advisories. Therefore, six sample locations between the Interstate bridge and the mouth of Chenoweth Creek were selected by a representative of the Fish & Wildlife Service (Figure 22). Surface water and sediments were sampled on February 4 and March 7, 1988, during and shortly after the spring spawning period.

Double sample volumes were collected and analyzed to achieve the required quantitation limits. The analytical data were reviewed by ICF-Clements as an extension of the RI Risk Assessment. No impact has been demonstrated on Chenoweth Creek sediment or surface water from any potential discharge from MMRF, and detected levels were all below available aquatic life criteria.

3.1. FIELD ACTIVITIES

Field activities were completed on February 4, 1988 and March 7, 1988. Six sampling locations were selected by Tim Unterwegner, Oregon Department of Fish & Wildlife during the February sampling event as most representative of possible fish spawning areas. Mr. Unterwegner was not available during the March sampling event. However, the locations were flagged and photographed to ensure that the same locations were sampled. The sampling locations were located at approximately equal intervals along the creek between the Interstate bridge and the mouth of Chenoweth Creek. Figure 22 illustrates the sampling locations.

3.1.1. SAMPLE COLLECTION TECHNIQUE

All samples were collected from the near shore by directly filling the sample bottles. The order in which sample locations were sampled was from the downstream-most point upstream to ensure that any bottom sediments disturbed by wading would not affect the subsequent samples collected.

Field measurements for pH, electrical conductance, temperature and dissolved oxygen were taken at each sampling location. Measurements were taken directly in the creek, downstream of the sampling location. Surface water sample bottles were immersed to fill and the covers closed underwater. A Pyrex™ measuring cup and stainless steel spoon were used to scoop the sediments. The sediments were then transferred into the sample bottles. The measuring cups and stainless steel spoons were decontaminated between sampling location in accordance with procedures defined in the QAPP. Samples were placed in ice chests and transferred to a locked refrigerator in accordance with chain-of-custody protocol.

3.1.2. ANALYTICAL PROGRAM

Surface water samples were analyzed for free and total cyanide, fluoride, sulfate, total arsenic and total sodium; four liters of sample were collected at each sample location. Sediment samples were analyzed for free and total cyanide and fluoride. One liter of sediment was collected at each location.

Quality assurance samples included one trip blank, one field blank, one sample rinsate blank and one split sample with associated trip blank for each sample matrix. Sulfide and oxidizer screen tests were completed for each water matrix sample collected for cyanide analysis prior to preservation (except trip blanks which were not opened).

3.2. ANALYTICAL RESULTS

Results of the chemical analyses are presented in Table 3. The analytical data were validated and classified in accordance with the USEPA Sample Management Office (SMO) procedures described in detail in Appendix D of the Final RI Report. The data set was independently evaluated and all of the data were rated as acceptable and classified as Level B; these data can be used quantitatively. The results of the data validation are included in Section 5.0 and Appendix C. The original laboratory reports are included in Appendix D.

Three locations along the creek were sampled upstream of the potential influence of the MMRF site (locations 4, 5 and 6) and downstream of the site to the Columbia River (locations 1, 2 and 3). Analytical results for these samples were evaluated to determine if upstream and downstream results were significantly

different, and to determine if detected values exceed levels which may adversely impact aquatic life.

3.2.1. SURFACE WATER RESULTS

Sampling results for both sampling periods were very similar; sodium and sulfate levels being slightly higher during the March sampling. As shown in Table 4, neither free nor total cyanide were detected in either upstream or downstream samples at a detection limit of 0.0026 mg/L. This detection limit is well below the aquatic life ambient water quality criteria (AWQC) of 0.005 mg/L. Fluoride levels were very similar in both upstream and downstream samples, and detected values (ranging from 0.084 to 0.15 mg/L) were less than the value of 0.2 mg/L associated with salmon avoidance behavior.

Arsenic was detected at low concentrations close to the detection limit of 3 μg/L in both upstream and downstream samples. Both sets of sampling results showed upstream and downstream sulfate and sodium levels to be very similar, with concentrations being higher generally during the second sampling period. No aquatic life AWQC values are available for arsenic, sodium, or sulfate.

Based on the above results, no impact has been demonstrated on Chenoweth Creek surface water from any potential discharge from the MMRF, and detected levels were all below available aquatic life criteria.

3.2.2. SEDIMENT RESULTS

As shown in Table 4, free cyanide was not detected (maximum detection limit of 0.037 mg/kg) in either upstream or downstream sediment samples. Total cyanide was detected only once, at a concentration of 0.59 mg/kg in upstream sample CCSDG-5R taken in February, but was not detected (detection limit of 0.037 mg/kg) in any samples collected downstream of the MMRF site. Fluoride results for upstream and downstream samples were generally equal. Sediment samples were not analyzed for arsenic, sodium, or sulfate.

3.3. CONCLUSIONS

Based on the two sets of analyses presented above, no impact on Chenoweth Creek surface water or sediments from any potential discharge (via surface runoff or ground water discharge) from the

MMRF has been demonstrated. In addition, although no monitoring wells are present in the alluvial aquifer adjacent to Chenoweth Creek, the spring sampling of surface water and sediments indicates that significant sources of fluoride or cyanide are not present in the alluvial aquifer.

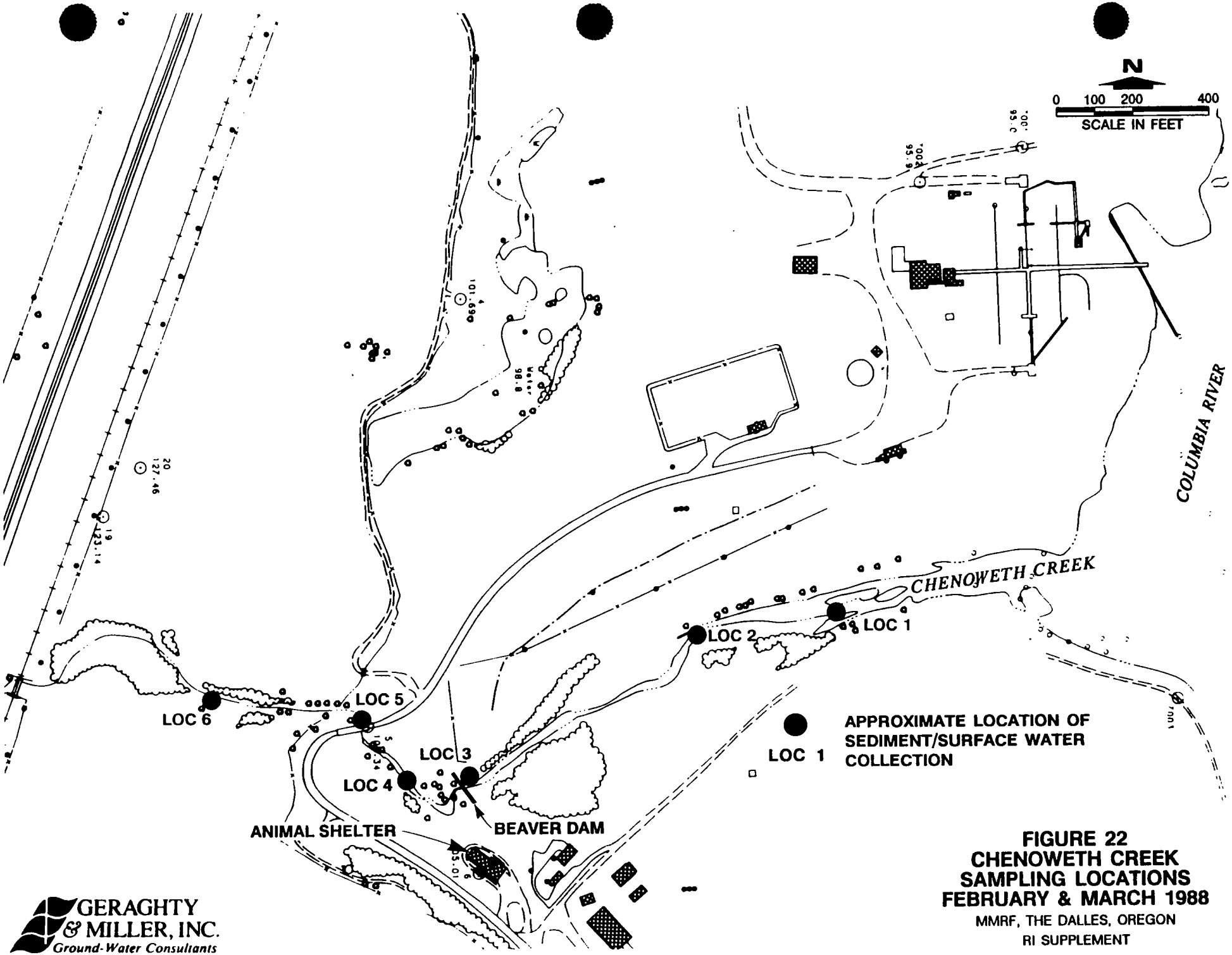

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FIGURE 22
CHENOWETH CREEK SAMPLING LOCATIONS
FEBRUARY & MARCH 1988
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

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TABLE 3--CHENOWETH CREEK SAMPLING ANALYTICAL RESULTS

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)	PERCENT SOLIDS
SURFACE WATER - FEBRUARY						MG/L	MG/L	MG/L	UG/L	UG/L	MG/L	
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.084]	3.0 U	5960	7.4	NA
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.13]	3.0 U	5600	6.9	NA
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.12]	[3.6]	5940	7.4	NA
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.11]	3.0 U	5850	7.4	NA
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.10]	3.0 U	5550	6.7	NA
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0039 U	[0.10]	3.0 U	6160	6.5	NA
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	0.048 U	3.0 U	1440	1.0 U	NA
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.093]	3.0 U	5720	7.2	NA
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	0.0026 U	0.0026 U	0.048 U	3.0 U	289 U	1.0 U	NA
SEDIMENTS - FEBRUARY						MG/KG	MG/KG	MG/KG				
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	0.033 U	0.033 U	[1.2]	NR	NR	NR	80
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	0.037 U	0.037 U	2.4	NR	NR	NR	70
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	0.036 U	0.036 U	[1.4]	NR	NR	NR	73
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	0.035 U	0.035 U	[0.96]	NR	NR	NR	74
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	0.030 U	0.59	[0.97]	NR	NR	NR	86
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	0.035 U	0.035 U	[1.6]	NR	NR	NR	74
CCSDG-7R	880208-048	FIELD BLANK	WATER*	04-Feb-88	06-Feb-88	0.026 U	0.0026 U	0.048 U	NR	NR	NR	NA
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	0.031 U	0.031 U	[1.2]	NR	NR	NR	85
CCSDG-9R	880208-049	SAMP RINSATE	WATER*	04-Feb-88	06-Feb-88	0.026 U	0.0026 U	0.048 U	NR	NR	NR	NA
TRIP BLK 6	880208-054	TRIP BLANK	WATER*	29-Jan-88	06-Feb-88	0.026 U	0.0026 U	0.048 U	NR	NR	1.0 U	NA
SURFACE WATER - MARCH						MG/L	MG/L	MG/L	UG/L	UG/L	MG/L	
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.12]	[3.6]	7900	6.7	NA
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.13]	[3.1]	7630	6.7	NA
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.13]	[3.4]	7920	9.2	NA

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TABLE 3--CHENOWETH CREEK SAMPLING ANALYTICAL RESULTS

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)	PERCENT SOLIDS
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.12]	3.0 U	7740	9.7	NA
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	0.15	[4.2]	8120	10.0	NA
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.13]	[3.9]	8270	9.4	NA
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.1]	[3.6]	7720	7.7	NA
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	0.048 U	3.0 U	[211]	1.0 U	NA
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	0.0026 U	0.0026 U	0.048 U	3.0 U	[309]	1.0 U	NA
SEDIMENTS - MARCH						MG/KG	MG/KG	MG/KG				
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	0.035 U	0.035 U	[1.5]	NR	NR	NR	74
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	0.038 U	0.038 U	[1.2]	NR	NR	NR	69
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	0.033 U	0.033 U	[1.1]	NR	NR	NR	79
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	0.032 U	0.032 U	[1.5]	NR	NR	NR	82
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	0.033 U	0.033 U	[1]	NR	NR	NR	78
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	0.030 U	0.030 U	[0.77]	NR	NR	NR	86
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	0.032 U	0.032 U	[0.82]	NR	NR	NR	81
CCSDG-8R2	880309-028	FIELD BLANK	WATER*	07-Mar-88	09-Mar-88	0.026 U	0.026 U	0.048 U	NR	NR	NR	NA
CCSDG-9R2	880309-029	SAMP RINSATE	WATER*	07-Mar-88	09-Mar-88	0.026 U	0.026 U	0.048 U	NR	NR	NR	NA
TRIP BLK 5	880309-030	TRIP BLANK	WATER*	29-Jan-88	09-Mar-88	0.026 U	[0.027]	NR	NR	NR	NR	NA
TRIP BLK 6	880309-031	TRIP BLANK	WATER*	03-Mar-88	09-Mar-88	NR	0.64	NR	NR	NR	NR	NA
TRIP BLK 4	880309-032	TRIP BLANK	WATER*	03-Mar-88	09-Mar-88	NR	NR	[1.3]	NR	NR	NR	NA

NOTES:
U - ANALYTE WAS ANALYZED FOR BUT NOT DETECTED ABOVE THE INSTRUMENT DETECTION LIMIT (IDL)
[ ]- VALUE IN BRACKETS GREATER THAN IDL, BUT LESS THAN THE QUANTITATION LIMIT; VALUE IS ESTIMATED
* - AQUEOUS BLANK RECALCULATED AS SOIL
NR - ANALYSIS NOT REQUESTED
NA - ANALYSIS NOT APPLICABLE

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TABLE 4

CHENOWETH CREEK DATA ANALYSIS
MMRF, THE DALLES
RI SUPPLEMENT

Chemical	Range of Upstream[c] Concentrations		Range of Downstream[d] Concentrations		Maximum Blank Concentrations	Units
Surface Water:	March 7	February 4	March 7	February 4		
Arsenic	<3.0-4.2	<3	3.1-3.6	<3-3.6	<3	ug/L
Sodium	7740-8270	5850-6160	7630-7920	5600-5960	1440	ug/L
Free Cyanide[a]	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	mg/L
Total Cyanide	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	mg/L
Fluoride[a]	0.12-0.15	[0.093]-0.11	0.12-0.13	0.084-0.13	<0.048	mg/L
Sulfate	9.4-10.0	6.5-7.4	6.7-9.2	6.9-7.4	<1	mg/L
Sediments[b]:						
Free Cyanide	<0.03	<0.030	<0.038	<0.037	—	mg/kg
Total Cyanide	<0.03	<0.035-0.59	<0.038	<0.037	—	mg/kg
Fluoride	0.77-1.5	0.96-1.6	1.1-1.5	1.2-2.4	—	mg/kg

— = not applicable
[a] Aquatic life ambient water quality criteria for free cyanide and fluoride are 0.005 mg/L and 0.200 mg/L, respectively.
[b] Sediment samples were not analyzed for arsenic, sodium, and sulfate.
[c] Sample Locations 4-6
[d] Samples Locations 1-3

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Section Four

4.0 GROUND-WATER SAMPLING

Ground-water samples collected in August 1987 indicated elevated concentrations of cyanide and fluoride in monitoring wells MWR-9A and MWR-9B which were thought to be an artifact of well construction. To verify this hypothesis and in order to evaluate the current of condition of selected wells throughout the site, additional ground-water sampling was completed between April 19 and April 27, 1988 at the MMRF. Twenty-two (22) wells and three test pit sumps were sampled during this period. Monitoring well locations are illustrated in Figure 23.

Although samples were collected for analysis of fluoride, sulfate, total arsenic, total sodium, total cyanide and free cyanide, quality control problems were encountered in the laboratory associated with the free and total cyanide analyses. These problems made it necessary to resample all 22 wells and three test pits. The resampling was completed between May 31 and June 4, 1988; only samples for free and total cyanide were collected and analyzed. All analytical data were validated and classified. The result of the analyses are presented in Table 5. Results of the cyanide analyses performed in April were found to be unusable and are not included in the data summary table.

4.1. FIELD PROCEDURES

Static water levels were taken on all on-site wells (including wells not sampled) prior to initiating sampling activities. The measurements were performed using a Slope Indicator Company Model 51453 Water Level Indicator (accurate to 0.01 ft).

Prior to sampling, the wells were purged by evacuating a minimum of four casing volumes. If the well went dry prior to evacuating four casing volumes the well was left to recover until a sufficient volume of water entered the casing. Wells were evacuated using either a 1075 ml Galtek Teflon bailer, a pneumatic Hydrostar™ pump, or an electric submersible pump. Evacuated volumes were measured using 5 gal buckets or a flow meter. The three test pits were evacuated utilizing a sump pump.

Evacuated water from the wells in the Old Cathode Waste Pile/Salvage Area (MW-8 and MW-9) were discharged to the NPDES

discharge point. The remaining B-aquifer and off-site wells were discharged to the ground. Evacuated water from the remaining S-aquifer and A-aquifer wells were contained in a trailer-mounted tank and subsequently discharged and treated at the RCRA Pad Sump.

After evacuation of the well a ground-water sample was collected directly into the sample containers. In the bailed wells and test pits the water sample was transferred directly from the bailer to the sample container. Ground-water samples taken from wells with submersible and Hydrostar™ pumps were taken from discharge spigots. Sample bottles were stored in iced coolers until they could be transferred properly by chain-of-custody to the locked on-site refrigerator. Specific conductance, pH, and temperature of the ground water were measured at the time the samples were taken from each well.

All non-dedicated equipment was decontaminated before use and between wells as necessary. The standard decontamination process consisted of a soap and water wash, deionized (DI) water rinse, nitric acid (HNO_3) rinse, DI rinse, isopropanol rinse, and double DI rinse. The interior of the sump pump used to evacuate ground water from the test pits was decontaminated by rinsing with water, washing with soap and water, and pumping clear water through the system; the exterior was decontaminated following standard protocol.

It was noted while measuring water levels that many of the dedicated bailers had dirt on the bottom and that some were being stored in the annulus between the well casing and the protective casing. Therefore, all dedicated bailers were decontaminated prior to use during the April program. Dedicated bailers were then properly stored in the well casing suspended by a teflon-coated wire from the well cap.

4.1.1. ANALYTICAL PROGRAM

Ground-water monitoring wells and test pits were sampled for total and free cyanide (CN), total arsenic (As) and sodium (Na), fluoride and sulfate. Samples were collected in containers provided by Versar Laboratories as follows:

April

Total Cyanide	1 1-Liter plastic bottle
Free Cyanide	1 1-Liter plastic bottle
Sulfate & Fluoride	1 1-Liter plastic bottle
Total Metals (Arsenic & Sodium)	1 1-Liter plastic bottle

June

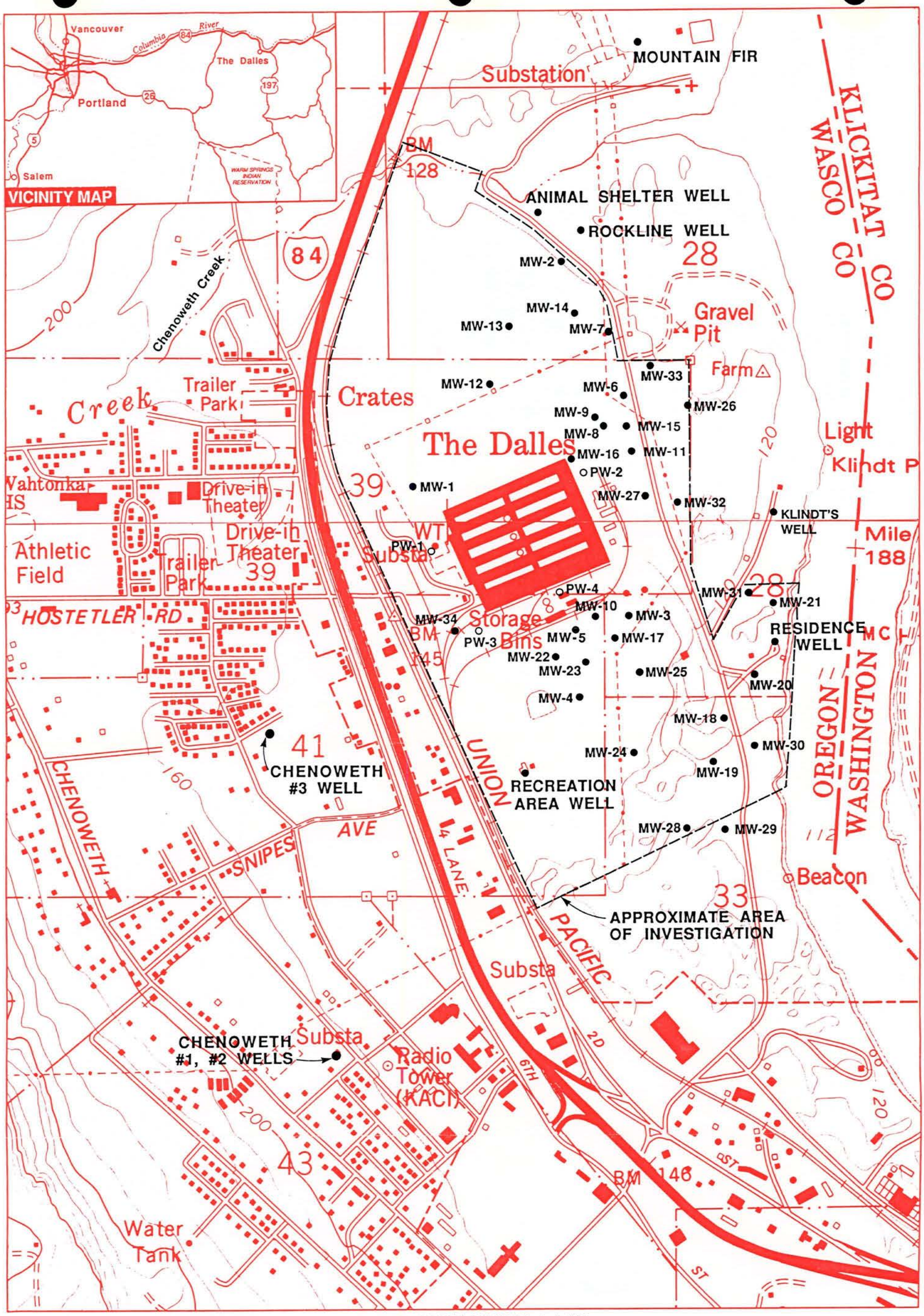
Total Cyanide	2 1-Liter plastic bottle
Free Cyanide	2 1-Liter plastic bottle

For each sampling round, quality assurance samples were collected at a frequency of 1 per 20; two field blanks, two sampler rinsate blanks (only one in June), four trip blanks, and two field replicates. Split samples were collected at a frequency of 1 per 10; three split samples were collected. In accordance with the QAPP sulfide and oxidizer screen tests were completed for each water matrix sample collected for cyanide analysis prior to preservation. Careful record keeping and chain-of-custody procedures were also strictly adhered to.

4.2. ANALYTICAL RESULTS

The analytical data for ground-water samples collected in Spring 1988 were validated and classified in accordance with the USEPA Sample Management Office (SMO) procedures described in detail in Appendix D of the Final RI Report. The results of the Spring 1988 data validation are included in Section 5.0 and Appendix C. The original laboratory reports are included in Appendix D. As mentioned previously, laboratory problems were encountered during the free and total cyanide analyses of samples collected in April. Laboratory quality control samples were outside acceptable limits for matrix spike recovery and laboratory control samples. All of the free and total cyanide analyses for samples collected in April were flagged R, unusable, and are not included in any further discussions; only free and total cyanide samples recollected in June are included in the data summary table.

The results of the April and June ground-water analyses are presented in Table 5. The data set was independently evaluated and all of the data, with the exception of free and total cyanide analyses for April, were rated as acceptable and classified as



SOURCE: USGS 7.5 Minute Topographic Map THE DALLES NORTH, OREG.-WASH Quadrangle, 1974 and THE DALLES SOUTH, OREG.-WASH Quadrangle, 1977

N

0 500 1000 2000

SCALE IN FEET

OREGON

GERAGHTY & MILLER, INC.
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FIGURE 23
MONITORING WELL LOCATIONS
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

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TABLE 5--GROUND-WATER SAMPLING ANALYTICAL RESULTS

			JUNE 1988				APRIL 1988					
WELL NUMBER	DESCRIPTION	MATRIX	LAB ID	DATE COLLECTED	FREE CYANIDE (MG/L)	TOTAL CYANIDE (MG/L)	LAB ID	DATE COLLECTED	FLUORIDE (BY ISE) (MG/L)	TOTAL ARSENIC (UG/L)	TOTAL SODIUM (UG/L)	SULFATE (TURBIDIMETRIC) (MG/L)
MWR-2B		WATER	880606-018	03-Jun-88	0.051	0.21	880426-001	23-Apr-88	0.84	3.0 U	46700	82
MW-5S		WATER	880606-023	03-Jun-88	0.3	18	880425-009	21-Apr-88	28	3.0 U	547000	85
MW-7B		WATER	880606-010	02-Jun-88	0.075	1.0	880422-002	20-Apr-88	0.48	3.0 U	24700	85
MW-8S		WATER	880606-007	02-Jun-88	0.15	8.2	880421-015	19-Apr-88	0.68	3.0 U	57500	152
MWR-8A		WATER	880606-011	02-Jun-88	0.064	1.1	880422-008	20-Apr-88	0.67	3.0 U	35200	86
MWR-8B		WATER	880606-012	02-Jun-88	0.048	0.50	880422-005	20-Apr-88	0.71	3.0 U	17200	38
REP1	REP OF MW-8B	WATER	880606-001	02-Jun-88	0.042	0.53	880422-004	20-Apr-88	0.60	3.0 U	17100	47
MW-9S		WATER	880606-006	02-Jun-88	0.043	0.8	880421-016	20-Apr-88	1.5	3.0 U	48500	25
MWR-9A		WATER	880606-005	02-Jun-88	0.065	3.4	880422-001	20-Apr-88	5.8	3.0 U	73800	57
MW-9B		WATER	880606-002	02-Jun-88	0.063	3.0	880422-006	20-Apr-88	9.7	[4.7]	109000	53
MW-14B		WATER	880606-009	02-Jun-88	0.11	0.72	880422-003	20-Apr-88	0.56	3.0 U	20600	64
MW-17S		WATER	880606-017	03-Jun-88	0.022	0.39	880425-008	21-Apr-88	0.51	3.0 U	28300	76
MW-18S		WATER	880606-019	04-Jun-88	[0.0058]	0.040	880426-002	23-Apr-88	3.7	3.0 U	+244000	+1480
MW-19S		WATER	880606-008	03-Jun-88	0.01	0.034	880426-005	22-Apr-88	4.2	3.0 U	168000	3.9
MW-21S		WATER	880606-021	03-Jun-88	0.015	0.022	880426-006	22-Apr-88	5.3	3.0 U	224000	1680
REP2	REP OF MW-21S	WATER	880606-022	03-Jun-88	0.012	0.039	880426-007	22-Apr-88	5.4	3.0 U	230000	1550
MW-29S		WATER	880606-004	03-Jun-88	0.0026 U	[0.0068]	880426-008	22-Apr-88	2.3	3.0 U	61900	844
MW-33B		WATER	880603-002	01-Jun-88	0.10	2.2	880426-003	22-Apr-88	0.28	3.0 U	19100	191
MW-34B		WATER	880603-003	01-Jun-88	[0.0037]	0.012	880425-011	22-Apr-88	0.73	3.0 U	33100	12
CHENOWETH #1		WATER	880603-006	01-Jun-88	0.0026 U	0.0026 U	880420-027	19-Apr-88	0.96	3.0 U	45300	48
CHENOWETH #2		WATER	--	--	NA	NA	880420-028	19-Apr-88	0.98	[4.5]	49400	47
CHENOWETH #3		WATER	880603-007	01-Jun-88	0.0026 U	0.0026 U	880429-005	27-Apr-88	0.84	3.0 U	41100	34
ANIMAL SHELTER		WATER	880603-005	01-Jun-88	[0.0045]	0.023	880420-029	19-Apr-88	0.25	[3.3]	5080	14
RESIDENCE WELL		WATER	880603-001	01-Jun-88	[0.0085]	0.017	880429-004	27-Apr-88	4.2	3.0 U	172000	987
SA-D	TEST PIT SUMP	WATER	880606-013	04-Jun-88	0.50	76	880429-007	27-Apr-88	288	123	2090000	571
OCWP-B	TEST PIT SUMP	WATER	880606-014	04-Jun-88	0.65	260	880429-008	27-Apr-88	513	610	7400000	1430
OCWP-D	TEST PIT SUMP	WATER	880606-015	04-Jun-88	0.39	106	880429-009	27-Apr-88	1300	<860	6290000	863
MW-5FB	FIELD BLANK	WATER	880606-024	03-Jun-88	0.0026 U	0.0026 U	880425-010	21-Apr-88	0.18	3.0 U	[269]	1.0 U
MWR-9FB	FIELD BLANK	WATER	880606-003	02-Jun-88	0.0026 U	0.0026 U	880422-007	20-Apr-88	0.22	3.0 U	[209]	[1.3]
MW9-SR2	SAMPLER RINSATE	WATER	--	--	NA	NA	880421-014	19-Apr-88	0.048 U	3.0 U	534	[1.0]
OCWP-SR1	SAMPLER RINSATE	WATER	880606-016	04-Jun-88	0.012	[0.0038]	880429-010	27-Apr-88	0.048 U	[4.3]	1380	1.0 U
TRIP BLANK #1		WATER	880603-004	27-May-88	0.0026 U	0.0026 U	880420-030	15-Apr-88	0.048 U	3.0 U	[166]	1.0 U
TRIP BLANK #2		WATER	--	--	NA	NA	880426-004	15-Apr-88	[0.050]	3.0 U	17 U	1.0 U
TRIP BLANK #1		WATER	880606-020	31-May-88	0.0026 U	[0.0034]	880429-006	20-Apr-88	0.048 U	3.0 U	[280]	[1.0]

NOTES: U = RESULTS LESS THAN INSTRUMENT DETECTION LIMIT (IDL)
[ ] = RESULTS GREATER THAN IDL, BUT LESS THAN QUANTITATION LIMIT
NA = NOT ANALYZED, NOT COLLECTED

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Level B; these data can be used quantitatively. The results of the data validation are included in Appendix C and the original laboratory reports are included in Appendix D.

4.3. CONCLUSIONS

The results of the ground-water analyses were generally comparable to analyses completed in August 1987. The more significant changes in constituent concentrations are presented below:

	Fluoride		Free Cyanide		Total Cyanide	
	1987	1988	1987	1988	1987	1988
MW-8S	1.0 U	0.68	0.136	0.15	7.01	8.2
MWR-8A	1.0	0.67	0.030 J	0.064	1.78	1.1
MWR-8B	2.9	0.71	0.062 J	0.048	1.22	0.50
MW-9S	1.9	1.5	0.060	0.043	16.70	0.8
MWR-9A	10	5.8	0.132	0.065	12.60	3.4
MWR-9B	20	9.7	0.057	0.063	10 J	3.0
MW-5S	57	28	0.215	0.30	34.10	18

Note: Units in mg/L

The concentrations of cyanide and fluoride in monitoring wells MWR-9A and MWR-9B have dropped considerably since the 1987 analyses which supports the hypothesis that these elevated concentrations may be an artifact of well construction and will likely continue to drop in the future.

Section Five

5.0 VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA

Analytical results for samples collected during Spring 1988 were validated and classified according to the USEPA Sample Management Office (SMO) procedures described in detail in Appendix D of the Final RI Report. Surface water, sediment, perched water, and ground water samples were collected at the Martin Marietta Reduction Facility, The Dalles, Oregon between January 29, 1988 to June 4, 1988.

Each data set was independently evaluated and the majority of data were rated as acceptable and classified as Level B; the data can be used quantitatively. Low matrix spike recovery for free cyanide analyses associated with the test pits resulted in these values being flagged with J. Laboratory problems were encountered during the analysis of free and total cyanide for ground-water and perched water samples collected during April 1988. These analyses were outside quality control limits (QC) and therefore unusable; all samples were recollected in June. No other laboratory quality control difficulties were noted which resulted in samples bias.

5.1. FIELD PROCEDURES

Samples collected during Spring 1988 were all collected in accordance with USEPA approved sample collection methods specified by reference in Section 6.0 of the Quality Assurance Project Plan (QAPP). The areas sampled included the following:

- Perched water samples were collected from test pits excavated in conjunction with a electromagnetic survey to investigate perched water at the site.
- Two rounds of surface water and sediment samples were collected from six sampling locations along Chenoweth Creek.
- Ground-water samples were collected from selected wells at the MMRF site.

Details of sampling procedures are outlined in the sections summarizing the respective field activities (Section 2.0, 3.0 and 4.0). Samples were analyzed by approved methods as specified in

the Methods of Analysis section of this document and summarized in the following table:

Parameters	Method	Preservative	Quantity/Bottle
Total Cyanide	Modified 335.2/CLP (7/85)	NaOH pH >12 Chilled 4° C	1 Liter Plastic
Free Cyanide	Std. Meth. 412 B,D,H	NaOH pH >12 Chilled 4° C	1 Liter Plastic
Fluoride	Water 300.0 Sludges/soils 340.2 + Leaching	Chilled 4° C	1 Liter Plastic
Sulfate	300.0	Chilled 4° C	(Same container as Fluoride)
Total Sodium	200.7/273.2	HNO_3 pH <2 Chilled 4° C	1 Liter Plastic
Total Arsenic	206.2	HNO_3 pH <2 Chilled 4° C	(Same container as Sodium)

Samples collected for cyanide analyses were screened in the field for sulfides and oxidizers prior to preservation. Samples collected for metals analyses were unfiltered.

In accordance with the QAPP, quality assurance (QA) samples were collected at a frequency of 1 per 20 samples; QA samples included field blanks, replicate samples, trip blanks and sampler rinsate blanks. Split samples were collected at a frequency of 1 per 10 samples. Sample collection, sulfide and oxidized screen testing of cyanide samples, and careful record keeping and chain-of-custody procedures outlined in the QAPP were also strictly adhered to.

5.2. LABORATORY REPORTS

Analytical results are presented in four laboratory reports by Versar, Inc. dated:

- March 30, 1988 -- Chenoweth Creek surface water and sediment samples (first round), and perched water samples from the EM Test Pits; collected January 29 to February 11, 1988.

- April 22, 1988 -- Chenoweth Creek surface water and sediment samples (second round); collected March 3 to 7, 1988.
- June 24, 1988 -- Ground-water samples (all parameters); collected April 19 to 27, 1988.
- July 1, 1988 -- Ground-water samples (resampling for free and total cyanide); collected June 1 to 4, 1988.

Versar, Inc., EMS Operations Environmental Chemistry Laboratory performed the work presented in this report according to the "Task Order for Laboratory Services No. 901-999-701" (Contract No. 87-ETMF-002 with Martin Marietta Corporation). Quality control (QC) protocols specified in Task Order were adhered to. The QC support data grouped with the appropriate validation summary sheets (e.g. laboratory blanks, matrix spikes) are included in Appendix C. The results of the analyses, laboratory report summary, and sample identification cross reference list are included as Appendix D of this document.

Split samples were sent to CompuChem Laboratories, Inc. in February and to Ecova in March, April and June. The split sample laboratory reports are included in there entirety in Appendix D. A table comparing results of the split analyses is included with the validation summary sheets (Appendix C).

5.3. VALIDATION PROCEDURES

The laboratory validation review is strictly an evaluation of the analytical performance of the laboratory without regard to the sample source, field procedures or records. Analytical data that were rated "acceptable" received no qualifier codes; or U qualifier codes; data that were rated "provisional" were flagged with qualifier codes J or UJ as required by the EPA Functional Guidelines; and, data rated "unacceptable" was flagged R. When QC parameters assigned to a batch of analyses did not meet acceptance criteria, the same qualifier was applied to the other samples analyzed within that batch as required by the validation guidelines. To facilitate the evaluation of surface water conditions to appropriate regulatory criteria, all values were reported between the Limit of Quantitation (LOQ) and the Instrument Detection Limit (IDL); these values are presented in brackets (e.g. [0.084] mg/L fluoride).

For this investigation, the explanation of the J, U and R qualifier codes (flags) are as follows:

J - The associated value is an estimated quantity because quality control criteria were not completely met.

U - The parameter was analyzed for but was not detected above the Instrument Detection Limit (IDL).

R - Quality control data indicates that the data are unusable (compound may or may not be present). Resampling is necessary for verification.

In order for the analytical data to be considered defensible and useful for quantitative purposes the field methods employed during the collection of the samples must also be reviewed. Field Data Packages were prepared for each group of samples collected and submitted for analysis. These data packages were further evaluated to provide an overall "use" classification for the validated data. The data classification summary check list is included with the validation summary support documentation (Appendix C) of the laboratory validation of this report.

The screening criteria for chemical data classifies the data into three "use" categories:

Unusable data	These data do not meet Level A criteria or are flagged with an R in the laboratory validation process.
Level A	These are data that meet the first level of screening criteria but not the second level (Level B). These data may or may not have been flagged with a J during data validation. These data may be used for qualitative purposes.
Level B	These are data that meet both sets of screening criteria (A and B) and have not been flagged with an R or J qualifier during data validation. These data may be used for quantitative purposes.

As a means of summarizing the results of the validation process, the data were rated as acceptable (no or U data qualifiers), provisional (flagged with J qualifier code) or unacceptable (flagged with R). A complete discussion of the validation and classification procedures and a listing of applicable references

is included in Appendix D of the Final Remedial Investigation Report for the MMRF, The Dalles, March 1988.

5.4. SUMMARY OF VALIDATION AND CLASSIFICATION

Excluding the cyanide analyses completed in April which were unusable and resampled, the majority of data were rated as acceptable and classified as Level B; these data can be used quantitatively. The only exception was low matrix spike recovery for free cyanide analyses associated with the test pits which resulted in these values being flagged with J; these data should be used qualitatively. Sporadic quality control problem are noted on the validation summary sheets (Appendix C); however, no other laboratory quality control difficulties resulted in samples bias.

Section Six

6.0 REVISED WIND ROSE

Wind is a predominant climatic factor in The Dalles. Wind roses are used to graphically display variations in wind velocity and direction distribution at a particular location over a selected period of time. Two wind roses were constructed and utilized during the RI. One wind rose was developed for use in conjunction with the RI Endangerment Assessment (presented as a histogram). This wind rose illustrated long-term trends in the general area observed in data collected over a thirteen-year period at The Dalles Airport, located approximately 2 miles southeast of the site (Final RI Report, Appendix B, Figure 1). A second wind rose was developed to illustrate site-specific wind conditions observed in wind velocity measurement taken at the on-site meteorological station during June and July, 1987 (Final RI Report, Figure 2.3).

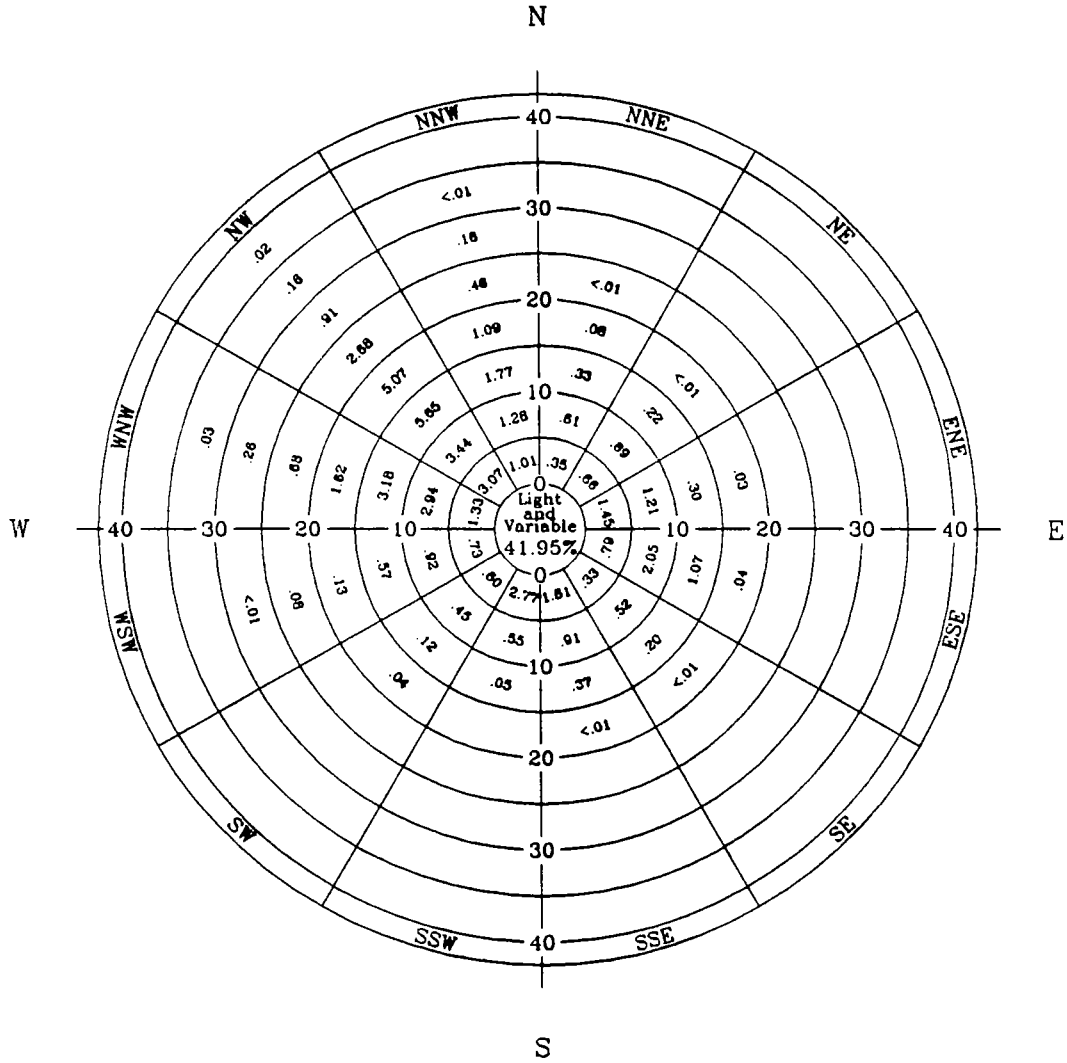
Because only two months of data were collected at the time on-site wind rose was prepared, there was a concern that seasonal variations were not adequately illustrated. Therefore, the on-site wind rose was subsequently revised to included additional wind velocity data collected from June 1987 to December 1987 (Figures 24 and 25).

The following table illustrates the predominate wind direction and velocities for the MMRF as documented in the three wind roses. The dominant wind direction is from the northwest(NW)/west-northwest (WNW) in all three wind roses.

Wind Speed/ Direction	June/ July	June/ December	Airport
All velocities			
- from NW	32.5%	21%	16%
- from WNW	16%	10.1%	16.5%
- from NNW	8.5%	6%	11%

Comparing the three, it is apparent that the original on-site wind rose (June/July 1988) was weighted towards higher velocity winds (greater than 10 mph), particularly from the NW. This is most likely a result of seasonal variations in wind velocity; winds are stronger in the hot summer months. However, all three wind roses illustrate basically the same wind circulation pattern--moderate to strong winds (10-35 mph), generally from the NW/WNW. In addition, the on-site wind data indicate that it is appropriate to utilize the more extensive wind database from The Dalles Airport in order to evaluate the site (see RI Risk Assessment).

Wind Speed/ Direction	June/ July	June/ December	Airport
Light & Variable	19.5%	42%	NA
10-20 mph All directions	37.5%	27%	29%
10-20 mph NW	19.8%	10.7%	8%
10-20 mph WNW	8.5%	4.8%	8%
10-20 mph NNW	5%	3%	5.5%
>20 mph All directions	11%	5.5%	9.5%
>20 mph NW	7%	4%	3%
>20 mph WNW	2.3%	>1%	5%
>20 mph NNW	1.3%	>1%	1.5%



Legend

.04 Percent Time, Between June 1987 and December 1987, That Wind Prevailed From Given Direction Within Specific Wind Speed Class.

40 Wind Speed Class Limits in MPH

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FIGURE 24
WIND ROSE FOR THE DALLES, OREGON
JUNE 1987 TO DECEMBER 1987
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

Wind Data THE DALLES, OREGON 6/87 through 12/87

minutes / % time

Direction → / Speed ↓	NNE 0-30	NE 30-60	ENE 60-90	ESE 90-120	SE 120-150	SSE 150-180	SSW 180-210	SW 210-240	WSW 240-270	WNW 270-300	NW 300-330	NNW 330-360	TOTALS Minutes	TOTALS %
0-5	830 / .35	1560 / .66	3440 / 1.45	1880 / .79	780 / .33	4300 / 1.81	6570 / 2.77	1420 / .60	1740 / .73	3170 / 1.33	7300 / 3.07	2390 / 1.01	35,380	14.89
5-10	1440 / .61	2110 / .89	2870 / 1.21	4880 / 2.05	1240 / .52	2150 / .91	1310 / .55	1060 / .45	2190 / .92	6980 / 2.94	8180 / 3.44	3030 / 1.28	37,440	15.76
10-15	780 / .33	520 / .22	710 / .30	2530 / 1.07	470 / .20	890 / .37	110 / .05	280 / .12	1360 / .57	7560 / 3.18	13,410 / 5.65	4200 / 1.77	32,820	13.83
15-20	180 / .08	10 / <.01	60 / .03	90 / .04	10 / <.01	10 / <.01		90 / .04	300 / .13	3880 / 1.62	12,040 / 5.07	2600 / 1.09	19,250	8.10
20-25	10 / <.01								190 / .08	1620 / .68	6360 / 2.68	1090 / .46	9270	3.90
25-30									20 / <.01	620 / .26	2150 / .91	430 / .18	3220	1.36
30-35										80 / .03	370 / .16	20 / <.01	470	0.20
35-40											40 / .02		40	0.02
Total Minutes	3240	4200	7080	9380	2500	7350	7990	2850	5800	23,890	49,850	13,760		
Total %	1.36	1.77	2.98	3.95	1.05	3.09	3.36	1.20	2.44	10.06	20.99	5.79		

LIGHT & VARIABLE

Minutes	%
99,650	41.95

GRAND TOTAL MINUTES

237,540

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FIGURE 25
WIND ROSE DATA FOR THE DALLES, OREGON
JUNE 1987 TO DECEMBER 1987
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

Section Seven

7.0 GROUND-WATER MODELING

A two-dimensional analytical solution of the advection-dispersion equation with exponential decaying source was used to model the transport of constituents in the B-aquifer at the MMRF (Cleary and Ungs, 1978). The B-aquifer is the uppermost aquifer used by the nearest downgradient receptor and an apparent viable source for further water supply development. It is believed that the most likely pathway for constituents to enter the B-aquifer is where the Chenoweth fault intersects both the alluvial aquifer and the B-aquifer (the modeled source area). Therefore, the "source" of contaminants modeled are those dissolved constituents which may have reached the B-aquifer via the Chenoweth Fault; these constituents may potentially be derived from several on-site areas, such as run-off from the landfill in the past.

Ground-water flow from several source areas identified in the RA for the site (e.g., the Scrubber Sludge Ponds) is not towards the Chenoweth Fault and it is unlikely that these constituents will move downwards to the B-aquifer. However, regardless of the source, the approach utilized would be conceptually the same. The constituents reaching the B-aquifer are what is being modeled, not specific potential source areas on the site surface.

The limitations of the analytical solution utilized and the assumptions used to model the site are more fully described in Section 4.7.3 of the Final RI Report. An analytical approach was chosen for use at the site because of the simplicity of the approach and because it offers an exact mathematical solution to a modeled scenario. Analytical solutions are limited as to their flexibility; a more flexible approach would be to utilize a numerical model to assess site conditions. However, a numerical model requires detailed information regarding areal heterogeneities as well as temporal variations in hydraulic conditions and water quality; sufficient data are not available for the site to produce a reliable numerical analysis. Therefore, an analytical approach is the method of choice for assessing future ground-water conditions. For example, because the analytical solution does not account for radial flow (pumping) or short term variations in ground-water conditions (water table fluctuations) boundary conditions are not critical; only the current water table/potentiometric surface is utilized in the calculations.

Contaminant transport modeling was used to evaluate ground-water movement in the B-aquifer and predict both the maximum and maximum average (over 70 years) concentrations of constituents at receptors located along the axis of the modeled plume, directly downgradient of the "source." The axis of the plume was assumed to extend from MW-2 near the fault to Chenoweth Irrigation Well #3 (the nearest potential receptor). Two points along this axis were evaluated; the MMRF site boundary and Chenoweth Irrigation Well #3.

The average concentration for the contaminant source area was obtained by averaging the values observed during the 1987 ground water sampling for wells MWR-2B, MWR-7B, MWR-8B, MWR-9B, MW-14B, MW-26B, and MW-33B. The results of the contaminant transport model are presented in Table 6. These results support the ground-water modeling section included in the RI through the use of an increased source area (MWR-8B and MWR-9B), modeling of parameter sensitivity (varying source decay period), and providing data related to the site boundary. The constituents observed in wells MWR-8B and MWR-9B are believed to be an artifact of well construction; however, data from these wells were included in order to provide a more conservative (worst case) scenario analysis of the B-aquifer.

7.1. MODELING PARAMETERS

The following parameter values assumptions were used:

Vx = 1.3 ft/day	(average linear velocity)
R = 1	(retardation)
a(L) = 100 ft/day	(longitudinal dispersivity)
a(T) = 60 ft/day	(transverse dispersivity)
D(L) = 130 ft^2/day	(longitudinal dispersion)
D(T) = 78 ft^2/day	(transverse dispersion)

The values utilized are conservative in so far as they imply no retardation, no vertical dispersivity, constituents do not degrade, and the zone of contamination completely penetrates the B-aquifer.

The parameter values utilized in the model were available from data generated during the RI with the exception of values for dispersivity. Values for dispersivity were generated for studies completed on the Columbia River Basalt Group in Washington and Idaho. Reported dispersivity values determined are as high as 4000 ft/day (EPRI, 1985) for large scale field tests. More conservative values were utilized in modeling the B-aquifer at the MMRF (100 ft/day for longitudinal dispersivity).

7.2. DIMENSIONS OF THE SOURCE AREA

The area where the Chenoweth fault intersects the B-aquifer is assumed to be the "source area" for constituents in the model. The dimensions of this area are:

W = 2000 ft	(width parallel to the trend of the fault)
L = 500 ft	(length perpendicular to trend of the fault; parallel to the direction of flow)
Z = 1 ft	(depth--arbitrary in 2D model)

7.3. MASS AT SOURCE

The mass in a source WxLxZ would be:

$$2000 \times 500 \times 1 = (1 \times 10^6) C_o$$

where C_o is the initial concentration assumed to be everywhere equal throughout the source volume.

The Cleary model "emits" the mass from a 2D plane with dimensions WxZ. If the source decay constant is given a half-life of HL = (.693)L/V (exponential decrease), then the total amount of mass emitted is $(1 \times 10^6) C_o$. By increasing L, we increase HL and increase the mass emitted.

For example:

L	HL (yrs)	Mass emitted
500	0.73	$(1 \times 10^6) C_o$
5000	7.3	$(10 \times 10^6) C_o$
10,900	16	$(21.8 \times 10^6) C_o$

The entire mass emitted will pass through any XZ plane downgradient of the source if given sufficient time. The longer the half-life, the greater the maximum concentration at the given plane and the more persistent the high concentrations. For example, at the

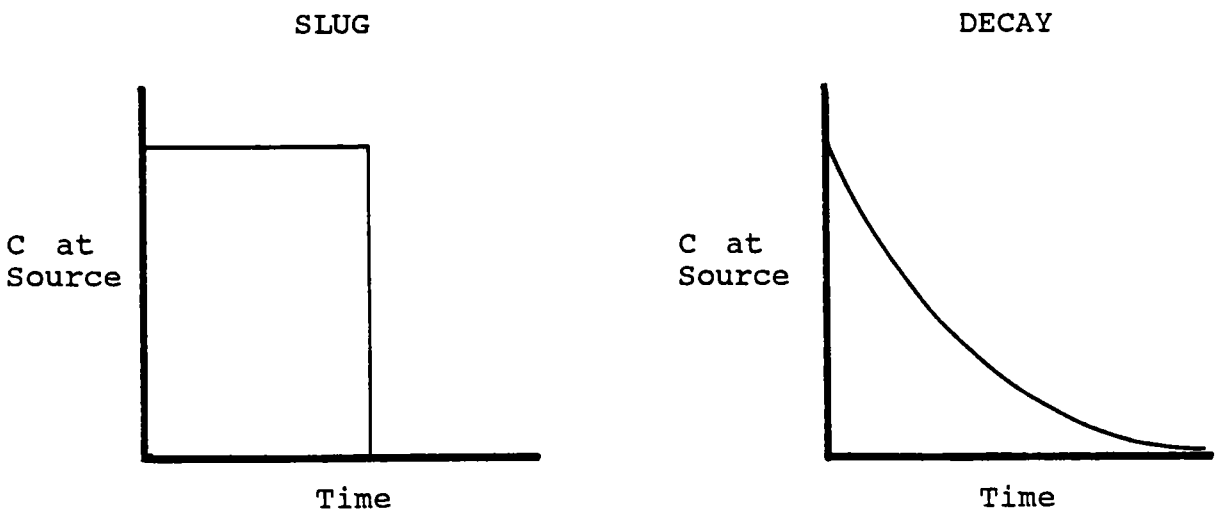
center of the plume 5280 ft downgradient of the source plane, we find:

HL (yrs)	Time(yrs) of Max. Conc.	Max C/C_o	C/C_o at t=20 yrs	C/C_o at t=50 yrs
0.73	11	.1443	.0023	negligible
7.3	16	.4867	.3451	.0204
16	16	.6298	.5391	.1472

7.4. APPROACH USED TO MODEL B-AQUIFER AT MMRF

A "slug" approach would consist of moving the mass from the source through the aquifer while allowing dispersion to fray its edges. The "decay" approach, adopted here, moves the mass out of the source area at an exponentially decaying rate. At initial time (t = 0) the concentration at the most downgradient portion of the source area is C_o. Rather than moving a slug with concentration C_o across this downgradient plane over a time equal to L/V (or 500/1.3=385 days) after which the concentration at the plume drops from $C=C_o$ to C=0, the plume emits mass at a gradually decreasing rate.

Concentration at Source



The decay function better describes how contaminants typically flush out of a source area. A third approach, a continuous source, was not deemed applicable to the site as source control measures are in place (i.e., control of landfill run-off and removal of the former cathode waste storage area).

7.5. CHOICE OF HALF-LIFE

The assumption is made that contaminants are not limited to the source volume in the B-aquifer (that is, there are more contaminants present in the pathway between the ground surface and the B-aquifer). In effect, for the reported results chosen for the source area were 21.8 times bigger than the volume 2000x500x1. This choice was NOT based on any analysis. It gave a convenient half-life of 16 years. However, it implies that in the "pipeline" feeding B Aquifer, there is 21.8 x the mass currently estimated to be in Aquifer B. The increased time for the mass to move through the pipeline is reflected in the longer half-life.

7.6. RESULTS

The modeling results are consistent with those presented in the Final RI Report. Under none of the modeled scenarios are criteria for free cyanide exceeded at the site boundary or the nearest downgradient receptor (Chenoweth Irrigation Well #3) in the B-aquifer. Under the most conservative approach modeled (longest decay period) the concentration of fluoride in the B-aquifer may exceed state standards by a nominal amount (2.9 mg/L vs 2.2 mg/L), but only for a discrete period of time; long term averages are well below the standard. Under all scenarios modeled, the actual concentrations of constituents observed in the Chenoweth Irrigation Well #3 are well below standards because of dilution from the DGWR.

Reference:

EPRI, 1985, "A Review of Field-Scale Physical Solute Transport Processes in Saturated and Unsaturated Porous Media" Report EA-4190, Proposal by TVA, Norris, TN.

MODELING ASSUMPTIONS

OUTPUT FROM CLEARY'S 2D ANALYTICAL SOLUTION OF ADVECTION-DISPERSION EQUATION WITH EXPONENTIALLY DECAYING SOURCE

SOURCE IS FAULT INTERSECTING AQUIFER "B". IT IS ASSUMED TO HAVE WIDTH=2000 FT
LENGTH (IN DIRECTION OF FLOW) = 500 FT IN B-AQUIFER
(L>500 IMPLIES CONTAMINANT IS BACKED UP IN SHALLOWER AQUIFERS)
"B" MASS = MASS OF CONSTITUENT AT SOURCE IN "B" AQUIFER
= CONCENTRATION (CO) * WIDTH (2000) * LENGTH (500)

HALF LIFE (H.L.) OF CONCENTRATION AT DOWNGRADIENT END OF SOURCE AREA.

RECEPTOR IS ASSUMED TO BE LOCATED ALONG AXIS OF CONTAMINANT PLUME
PLUME DIRECTLY DOWNGRADIENT OF SOURCE.

MMRF BOUNDARY RECEPTOR IS LOCATED WHERE LINE CONNECTING MW2 TO
CHENOWETH WELL #3 CROSSES PROPERTY BOUNDARY.

MODEL PARAMETERS

VX = 1.3 FT/DAY
LONGITUDINAL DISPERSIVITY = 100 FT/DAY
TRANSVERSE DISPERSIVITY = 60 FT/DAY
CONTAMINATION ZONE COMPLETELY PENETRATES THICKNESS OF "B" AQUIFER.
CONSTITUENTS DO NOT DEGRADE.
NO RETARDATION.
NO VERTICAL FLOW OR DISPERSIVITY.

SOURCE CONCENTRATIONS (DATA COLLECTED 8/87)

WELL ID	FREE CN	TOTAL Na	F	SO4
MW-26B	0.047	32.5	0.8	69
MW-2B	0.034	48.3	1.6	81
MW-14B	0.041	24.8	0.8	69
MW-7B	0.035	27.7	1.6	85
MW-33B	0.1	21.7	0.8	115
MW-8B	0.062	43.7	2.9	61
MW-9B	0.057	195	20	92
AVERAGE CONCENTRATION	0.054	56.2	4.1	82

NOTES: MW-8B AND MW-9B ADDED IN CALCULATION OF SOURCE CONCENTRATION.
ALL UNITS IN MG/L.

1) PREDICTED MAXIMUM CONTAMINATION
IN "B" AQUIFER AT CHENOWETH WELL #3

PARAMETERS USED	FREE CN	TOTAL Na	F	SO4	TIME FROM RELEASE
L=500FT H.L.=.73YR 1X "B" MASS	0.008	8.1	0.6	12	11 YRS
L=5000FT H.L.=7.3YR 10X "B" MASS	0.026	27.4	2.0	40	16 YRS
L=10900FT H.L.=16YR 21.8X "B" MASS	0.034	35.1	2.5	51	16 YRS

2) PREDICTED MAXIMUM AVERAGE 70-YR CONCENTRATION
IN "B" AQUIFER AT CHENOWETH WELL #3

PARAMETERS USED	FREE CN	TOTAL Na	F	SO4	TIME FROM RELEASE
L=500FT H.L.=.73YR 1X "B" MASS	0.001	0.7	0.0	1	1-70 YRS
L=5000FT H.L.=7.3YR 10X "B" MASS	0.006	6.5	0.5	9	8-76 YRS
L=10900FT H.L.=16YR 21.8X "B" MASS	0.013	13.5	1.0	20	8-76 YRS

3) PREDICTED MAXIMUM CONCENTRATION
IN "B" AQUIFER AT MMRF BOUNDARY

PARAMETERS USED	FREE CN	TOTAL Na	F	SO4	TIME FROM RELEASE
L=500FT H.L.=.73YR 1X "B" MASS	0.010	10.7	0.8	16	8 YRS
L=5000FT H.L.=7.3YR 10X "B" MASS	0.030	31.7	2.3	46	12 YRS
L=10900FT H.L.=16YR 21.8X "B" MASS	0.038	39.7	2.9	58	12 YRS

4) PREDICTED MAXIMUM AVERAGE 70-YEAR CONCENTRATION IN "B" AQUIFER AT MMRF BOUNDARY

PARAMETERS USED	FREE CN	TOTAL Na	F	SO4	TIME FROM RELEASE
L=500FT H.L.=.73YR 1X "B" MASS	0.001	0.7	0.1	1	1-70 YRS
L=5000FT H.L.=7.3YR 10X "B" MASS	0.007	7.2	0.5	10	4-72 YRS
L=10900FT H.L.=16YR 21.8X "B" MASS	0.014	15.0	1.1	22	8-76 YRS

THE ABOVE TABLES CAN BE MULTIPLIED BY A CONSTANT TO REFLECT THE MIXING OF CLEAN DGWR WATER WITH WATER FROM THE "B" AQUIFER FROM A WELL DRAWING FROM BOTH THE "B" AQUIFER FROM A WELL DRAWING FROM BOTH THE B-AQUIFER AND THE DGWR (E.G. CHENOWETH #3). IF THE WELL WATER IS ASSUMED TO BE 5 PARTS DGWR FOR 2 PARTS "B" AQUIFER, THE FACTOR IS 0.2857.

APPLYING THIS FACTOR TO THE RECEPTOR AT CHENOWETH WELL #3 FOR THE 70 YEAR MAXIMUM AVERAGE YIELDS:

PARAMETERS USED	FREE CN	TOTAL Na	F	SO4	TIME FROM RELEASE
L=500FT H.L.=.73YR 1X "B" MASS	0.000	0.2	0.0	0	1-70 YRS
L=5000FT H.L.=7.3YR 10X "B" MASS	0.002	1.9	0.1	3	8-76 YRS
L=10900FT H.L.=16YR 21.8X "B" MASS	0.004	3.9	0.3	6	8-76 YRS

Section Eight

8.0 BASEMENT SUMPS

There are sump pumps located in the basements of the cell lines, hard pitch building and the alumina unloading building of the MMRF (Figure 26). These sumps were installed during the construction of these buildings to remove water which collects in the space between the original excavation in the basalt and the basement foundation. The sump pumps operate intermittently; the pumps start up automatically if the sump fills with water. The volume of water pumped from the basements is dependent primarily on the amount of precipitation. Water samples were periodically collected and analyzed from the various sumps. These data are presented in Table 7.

8.1. CELL LINE SUMPS

There are 16 sump pumps located throughout the basement of the cell lines. These pumps are infrequently used to remove water from the fume trenches in the basement floor; only four of the pumps are used routinely. The basement floor is located approximately 8 ft below land surface (ft bls) and the trenches are approximately 2 ft deep. The water from the sumps is discharged to the NPDES discharge point.

In addition to the 16 sump pumps, there are six larger foundation pumps which are used to depress the water table below the facility. These pumps also discharge to the NPDES discharge point.

8.2. HARD PITCH BUILDING SUMP

The hard pitch building sump is located in the southwest corner of the building in the excavation for the bucket elevator. The basement floor is located approximately 40 ft bls and the sump pump is set approximately 2 ft below the floor. The sump has operated with variable regularity since the plant has been in operation; the pump typically operates more frequently during the wet winter period and less during the dry summers. The hard pitch building sump pump discharges to the discharge channel.

8.3. ALUMINA UNLOADING BUILDING SUMP

The sump in the alumina unloading building is located approximately 20 to 25 ft bls, approximately 1 ft below the basement floor. The water from this sump is pumped to the discharge channel.

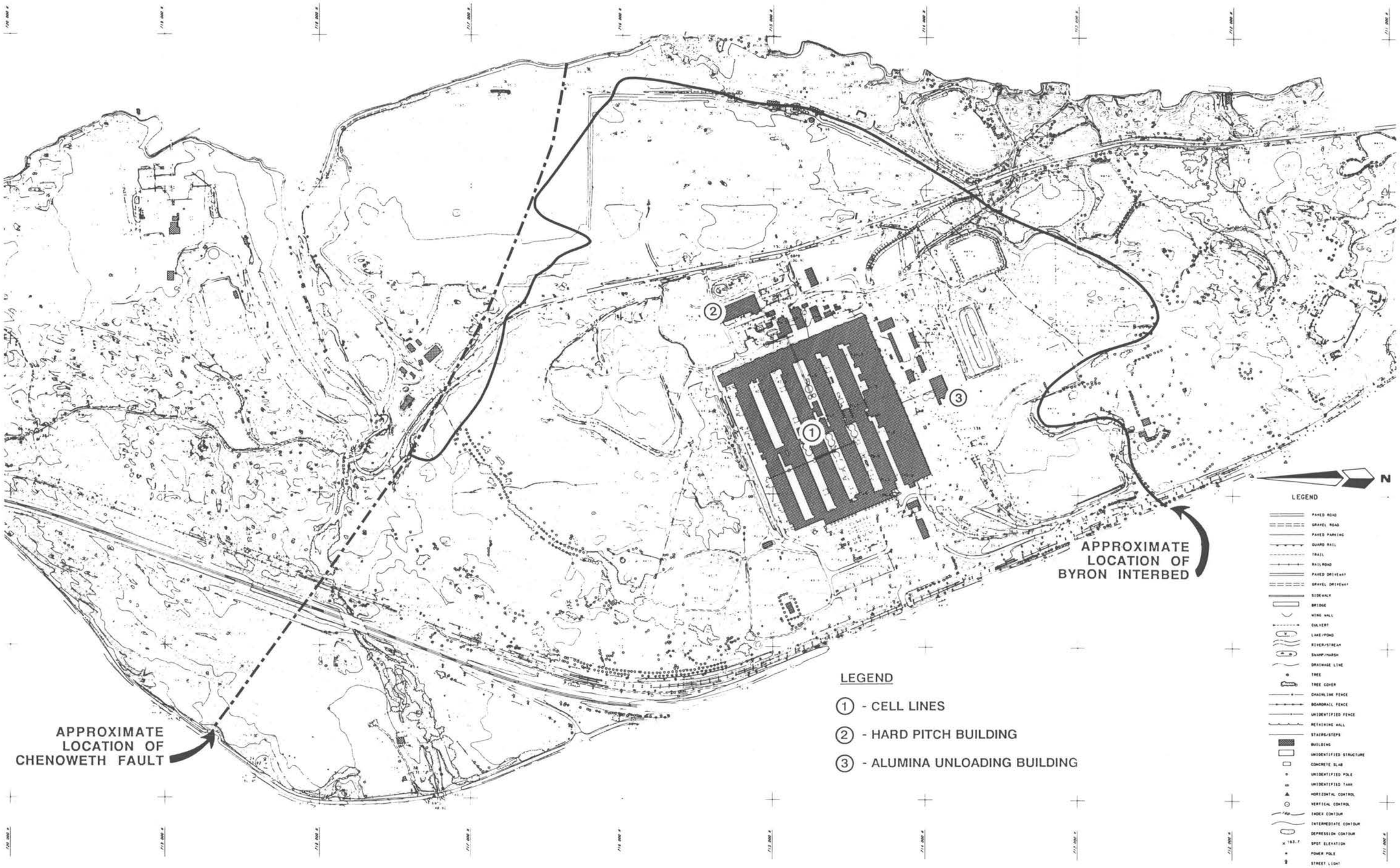


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FIGURE 26
TOPOGRAPHIC MAP AND SELECTED SITE FEATURES
MMRF, THE DALLES, OREGON
RI SUPPLEMENT

DATE	TOTAL CYANIDE (PPM)	FREE CYANIDE (PPM)	FLUORIDE (PPM)	pH (STANDARD UNITS)	FLOW (GPD)
BASEMENT "A" ROOM WEST					
10-Jun-83	0.022	0.033	2.5		
10-Oct-85	0.02	0.002	1.93		
BASEMENT "A" ROOM EAST					
05-Nov-83	0.024	0.035	4.8		
BASEMENT "B" ROOM WEST					
26-Aug-83	0.024	0.036	8.7		
05-Nov-83	0.014	0.015	12.8		
10-Oct-85	0.003	0.001	16.7		
24-Oct-85	0.003	0.000	14.0		
BASEMENT "C" ROOM EAST (COURTYARD)					
10-Oct-85	0.07	0.0025	1.03		
BASEMENT "D" ROOM EAST					
10-Oct-85	1.53	0.012	18.0		
24-Oct-85	0.36	0.0015	16.4		
HARD PITCH SUMP					
04-Dec-81	73.2	0.06			
19-Feb-82	314.0	0.10	330.0		
20-Aug-82	538.0	0.07	1020.0		
31-Aug-82	618.0	0.17	633.0		
19-Oct-82	234.0	0.28	278.0		
16-Nov-82	23.9	0.49	176.0		
27-Nov-82	85.3	0.13	199.0		
12-Jan-83	39.0	0.11	163.0		
03-Feb-83	44.7	0.056	233.0		
19-Feb-83	62.5	0.32	371.0		
09-Mar-83	212.0	0.34	825.0		
05-Apr-83	279.0	0.37	880.0		
29-Jun-83	306.0	0.22	587.0		
20-Jul-83	294.0	0.18	591.0		
30-Aug-83	200.0	0.18	681.0		
31-Oct-83	226.0	0.32	1280.0		
11-Nov-83	136.8	0.18	586.0		
30-Dec-83	90.9	0.11	554.0		
26-Jan-84	38.8	0.07	223.0		
28-Feb-84	182.0	0.31	897.0		
31-Mar-84	271.0	0.28	956.0		
19-Apr-84	352.0	0.26	913.0		
12-May-84	412.0	0.29	1250.0		
09-Jun-84	324.0	0.47	1190.0		
14-Jul-84	282.5	0.28	1110.0		
14-Aug-84	533.0		1570.0		
11-Sep-84	675.0	0.056	1670.0		
16-Oct-84	140.0	0.031	394.0		
11-Nov-84	120.0	0.075	424.0		
11-Jan-85	160.0	0.028	598.0	10.2	1200

DATE	TOTAL CYANIDE (PPM)	FREE CYANIDE (PPM)	FLUORIDE (PPM)	pH (STANDARD UNITS)	FLOW (GPD)	
14-Jan-85	180.0	0.022	625.0	10.3	600	
15-Jan-85	170.0	0.084	568.0	10.3	600	
16-Jan-85	180.0	0.016	660.0	10.2	600	
21-Jan-85	170.0	0.02	520.0	10.3	600	
22-Jan-85	110.0	0.018	371.0	10.3	600	
23-Jan-85	73.0	0.025	228.0	10.1	510	
24-Jan-85	80.0	0.022	281.0	10.0	580	
25-Jan-85	82.0	0.038	270.0	10.1	510	
28-Jan-85	54.0	0.033	173.0	10.1	450	
30-Jan-85	87.0	0.053	304.0	10.1	470	
31-Jan-85	85.0	0.037	294.0	10.1	440	
01-Feb-85	60.0	0.067	198.0	10.1	370	
04-Feb-85	53.0	0.068	187.0	10.0	260	
06-Feb-85	38.0	0.086	130.0	9.9	395	
07-Feb-85	46.0	0.11	171.0	10.1	720	
08-Feb-85	N.S.					
11-Feb-85	11.0	0.086	56.2	10.1	655	
13-Feb-85	110.0	0.065	528.0	10.3	6805	
14-Feb-85	74.0	0.068	396.0	10.4	9650	
15-Feb-85	90.0	0.059	455.0	10.3	7580	
19-Feb-85	71.0	0.14	433.0	10.3	7200	
20-Feb-85	94.0	0.046	434.0	10.2	4530	
25-Feb-85	76.0	0.70*	372.0	10.4	3640	*
26-Feb-85	93.0	0.088	336.0	10.1	2620	
27-Feb-85	130.0	0.18	509.0	10.3	2570	
28-Feb-85	110.0	0.34	476.0	10.3	1940	
01-Mar-85	120.0	0.95	621.0	10.3	2020	
04-Mar-85	140.0	0.09	560.0	10.3	1590	
05-Mar-85	180.0	0.062	644.0	10.4	1480	
06-Mar-85	--	--	--	--	1330	
07-Mar-85	180.0	0.021	491.0	10.3	1450	
14-Mar-85	190.0	0.21	751.0	10.3	930	
21-Mar-85	220.0	0.038	856.0	10.3	720	
28-Mar-85	190.0	0.15	836.0	9.6	1740	
04-Apr-85	130.0	0.041	672.0	10.4	1060	
11-Apr-85	220.0	0.59	722.0	10.3	680	
18-Apr-85	220.0	1.8	774.0	10.5	550	
25-Apr-85	250.0	2.0	769.0	10.3	470	
02-May-85	240.0	0.81	927.0	10.4	490	
09-May-85	218.0	1.23	906.0	10.4	330	
16-May-85	284.8	1.52	884.0	10.5	190	
23-May-85	268.3	4.11	953.0	10.4	330	
30-May-85	314.73	2.99	1110.0	10.4	510	
06-Jun-85	216.50	0.202	496.0	10.2	760	(1)
13-Jun-85	88.51	0.409	390.0	10.0	1965	
20-Jun-85	102.48	2.280	465.0	10.0	940	
27-Jun-85	133.73	0.505	476.0	10.1	710	
03-Jul-85	151.81	0.580	828.0	10.2	620	
12-Jul-85	185.20	0.830	678.0	10.1	460	
18-Jul-85	227.78	0.665	885.0	10.1	330	
25-Jul-85	260.40	1.645	1070.0	10.3	250	
01-Aug-85	262.65	0.710	1020.0	10.4	350	(2)
08-Aug-85	331.85	0.565	1270.0	10.5	325	
15-Aug-85	310.32	0.580	1240.0	10.4	280	
22-Aug-85	355.78	1.440	1200.0	10.4	220	
29-Aug-85	273.33	0.300	1160.0	10.3	130	
05-Sep-85	276.92	0.270	1100.0	10.3	160	
12-Sep-85	94.83	0.070	390.0	10.1	5030	(3)
19-Sep-85	98.90	0.295	295.0	9.8	1690	
27-Sep-85	119.14	0.305	450.0	10.0	1122	
03-Oct-85	124.0	0.17	501.0	10.1	545	
10-Oct-85	149.6	0.335	548.0	9.9	565	
17-Oct-85	175.3	0.29	598.0	9.9	490	

DATE	TOTAL CYANIDE (PPM)	FREE CYANIDE (PPM)	FLUORIDE (PPM)	pH (STANDARD UNITS)	FLOW (GPD)
24-Oct-85	202.9	0.175	832.0	10.4	1060 (4)
31-Oct-85	157.2	0.19	603.0	10.1	610
07-Nov-85	114.8	0.11	493.0	10.1	790 (5)
14-Nov-85	135.3	0.14	509.0	10.0	520
21-Nov-85	96.6	0.07	487.0	10.0	1560
27-Nov-85	49.2	0.07	150.0	9.6	1100
05-Dec-85	13.9	0.07	90.8	9.2	625
12-Dec-85	34.8	0.25	202.0	9.7	5570
19-Dec-85	50.4	0.11	274.0	9.7	1125
26-Dec-85	27.8	0.07	90.7	9.0	610
02-Jan-86	15.67	0.28	52.6	9.0	670
09-Jan-86	68.21	0.08	310.0	10.0	10270 (6)
16-Jan-86	33.70	0.20	208.0	9.7	17805 (7)
23-Jan-86	5.37	0.05	99.7	9.3	11840
30-Jan-86	17.08	0.45	148.0	9.7	11580
06-Feb-86	13.48	0.04	138.0	9.35	7340
13-Feb-86	36.62	0.26	242.0	9.5	5740
20-Feb-86	12.11	0.06	119.0	9.1	8135
27-Feb-86	10.04	0.12	101.0	9.1	7720
06-Mar-86	26.72	0.08	148.0	9.1	3590
13-Mar-86	27.01	0.93	178.0	9.6	4320
20-Mar-86	22.62	0.25	173.0	9.2	2950
27-Mar-86	25.44	0.19	142.0	9.5	2803
03-Apr-86	31.10	1.26	151.0	9.5	1330
10-Apr-86	30.95	0.34	188.0	9.7	930
17-Apr-86	44.60	2.90	164.0	9.6	680
23-Apr-86	43.23	1.03	149.0	9.7	540
01-May-86	52.27	0.36	186.0	9.6	460
08-May-86	86.80	0.53	299.0	9.8	690
15-May-86	99.12	1.14	363.0	10.2	460
22-May-86	118.44	0.79	325.0	10.2	380
29-May-86	78.77	2.15	216.0	10.1	230
05-Jun-86	75.00	0.73	149.0	9.9	170
12-Jun-86	34.94	2.71	98.3	9.7	160
19-Jun-86	147.30	1.08	447.0	10.1	220
26-Jun-86	103.84	0.42	325.0	10.0	150
03-Jul-86	71.20	0.919	239.0	9.9	133
10-Jul-86	66.54	1.76	210.0	9.8	70
17-Jul-86	81.27	2.37	138.0	9.7	80
24-Jul-86	52.61	0.60	103.0	9.6	70
31-Jul-86	56.3	3.86	254.0	10.0	70
07-Aug-86	63.02	1.55	270.0	10.0	70
14-Aug-86	64.71	0.79	88.9	9.5	75
21-Aug-86	96.35	0.69	164.0	9.8	80
28-Aug-86	77.04	0.40	549.0	10.1	70
04-Sep-86	89.50	0.55	522.0	10.1	75
11-Sep-86	90.14	1.07	67.9	9.3	70
18-Sep-86	22.74	0.54	61.5	9.2	80
25-Sep-86	102.34	0.49	308.0	9.8	380 (8)
02-Oct-86	191.81	0.58	856.0	10.1	390
09-Oct-86	190.00	0.70	862.0	10.1	140
16-Oct-86	133.00	0.56	634.0	10.0	150
23-Oct-86	180.00	0.45	888.0	10.1	140
30-Oct-86	167.00	0.19	899.0	10.2	420
07-Jan-87	9.15	0.112		9.4	
14-Jan-87	8.83	0.067		9.8	
21-Jan-87	8.64	0.065		9.9	
28-Jan-87	2.92	0.020		9.5	
04-Feb-87	6.59	0.022	104.0	9.8	5.4
11-Feb-87	6.33	0.126	151.0	9.9	2.3
18-Feb-87	11.80	0.072	105.0	9.6	2.8
26-Feb-87	13.20	0.273	153.0	9.7	1.5
04-Mar-87	12.00	0.401	112.0	9.7	1.2

DATE	TOTAL CYANIDE (PPM)	FREE CYANIDE (PPM)	FLUORIDE (PPM)	pH (STANDARD UNITS)	FLOW (GPD)
11-Mar-87	20.91	0.229	296.0	9.8	1.6
18-Mar-87	5.77	0.125	94.7	9.6	2.9
25-Mar-87	8.88	0.301	101.0	9.6	1.6
01-Apr-87	3.94	0.140	55.6	9.0	1.00
08-Apr-87	2.73	0.415	55.6	9.0	1.33
15-Apr-87	29.30	0.134	139.0	9.6	5.39
22-Apr-87	18.80	0.128	324.0	9.8	5.63
29-Apr-87	9.45	4.050	55.9	8.8	0.69
06-May-87	12.90	0.245	75.5	9.3	0.75
13-May-87	3.52	0.592	66.2	9.7	0.63
20-May-87	1.00	0.073	76.3	9.3	1.08
27-May-87	11.30	1.100	79.6	9.4	0.57
03-Jun-87	12.6	0.037	81.1	9.6	0.42
10-Jun-87	15.9	0.235	97.4	9.5	0.42
17-Jun-87	19.9	0.242	106	9.5	0.51
24-Jun-87	18.0	0.267	113	9.5	0.42
01-Jul-87	18.80	0.154	109	9.8	0.41
08-Jul-87	20.30	0.200	115	10.1	0.29
15-Jul-87	3.36	0.024	26	9.5	2.89
22-Jul-87	18.20	0.382	146	10.1	0.92
29-Jul-87	13.70	0.200	114	10.1	0.86
05-Aug-87	14.2	0.248	82	9.9	0.67
12-Aug-87	11.8	0.270	96	10.0	0.67
19-Aug-87	15.9	0.646	115	10.1	0.59
26-Aug-87	12.2	0.128	98	9.6	0.53
02-Sep-87	13.61	0.176	86	9.4	0.38
09-Sep-87	15.00	0.208	98	9.6	0.37
16-Sep-87	15.20	0.076	79	9.6	0.18
23-Sep-87	16.70	0.206	76	9.6	0.15
30-Sep-87	18.10	0.370	84	9.9	0.15
07-Oct-87	19.8	0.708	80	9.8	0.16
14-Oct-87	11.0	0.219	58	9.5	0.19
21-Oct-87	21.4	0.255	62	9.4	0.19
28-Oct-87	11.0	0.346	59	9.2	0.10
04-Nov-87	38.1	0.108	132	10.0	0.10
11-Nov-87	29.5	0.101	102	10.0	0.16
18-Nov-87	39.1	0.293	132	10.1	0.16
24-Nov-87	37.4	0.291	139	10.3	0.22
02-Dec-87	3.80	0.022	64	9.9	17.8
09-Dec-87	1.25	0.013	44	9.4	25.4
16-Dec-87	4.50	0.040	56	9.6	5.0
22-Dec-87	4.25	0.045	55	10.0	2.6
29-Dec-87	3.85	0.063	56	9.6	1.4
06-Jan-88	5.90	0.106	67	9.5	0.92
13-Jan-88	1.45	0.017	45	9.2	18.68
20-Jan-88	2.58	0.083	45	9.1	3.35
27-Jan-88	2.26	0.038	45	9.4	1.94
03-Feb-88	3.21	0.058	44	9.2	1.38
10-Feb-88	4.33	0.088	46	9.3	1.05
17-Feb-88	4.95	0.035	47	11.1	0.84
24-Feb-88	2.15	0.025	47	9.2	0.61
02-Mar-88	6.65	0.275	48	9.2	0.55
09-Mar-88	6.45	0.242	50	9.3	0.50
16-Mar-88	7.85	0.408	49	9.3	0.40
23-Mar-88	14.00	0.197	86	9.7	0.35
30-Mar-88	5.80	0.085	68	9.7	0.68
06-Apr-88	4.50	0.160	62	9.6	0.73
13-Apr-88	6.20	0.034	56	9.5	0.51
20-Apr-88	4.30	0.0415	50	9.2	5.31
27-Apr-88	5.15	0.028	60	9.4	0.71
04-May-88	6.10	0.256	60	9.4	1.26
11-May-88	6.50	0.130	52	9.2	0.90
18-May-88	5.25	0.116	41	8.9	0.53

DATE	TOTAL CYANIDE (PPM)	FREE CYANIDE (PPM)	FLUORIDE (PPM)	pH (STANDARD UNITS)	FLOW (GPD)	
25-May-88	1.95	0.034	40	9.0	0.40	
08-Jun-88	7.950	0.142	65	9.3	0.67	
15-Jun-88	6.400	0.095	46	9.0	0.47	
22-Jun-88	6.800	0.0975	39	8.9	0.33	
29-Jun-88	7.750	0.201	36	8.8	0.26	
ALUMINA UNLOADING BUILDING SUMP						
21-Mar-85	0.150	0.002	--	--		
28-Mar-85	0.098	0.015	--	--		
03-Apr-85	0.120	0.003	--	--		
11-Apr-85	0.120	0.043	--	--		
18-Apr-85	0.071	0.009	--	--		
25-Apr-85	0.190	0.028	--	--		
02-May-85	0.240	0.025	--	--		
09-May-85	0.180	0.030	--	--		
16-May-85	0.196	0.066	--	--		
23-May-85	0.191	0.073	--	--		
06-Jun-85	0.401	0.027	--	--		(9)
13-Jun-85	0.519	0.039	--	--		
20-Jun-85	0.694	0.162	--	--		
27-Jun-85	0.831	0.013	--	--		
03-Jul-85	0.831	0.058	--	--		
12-Jul-85	0.080	0.020	--	--		
18-Jul-85	0.890	0.040	--	--		
25-Jul-85	0.960	0.230	7.5	7.1		
01-Aug-85	1.650	0.025	6.9	6.9		(10)
08-Aug-85	0.770	0.048	7.9	7.0		
15-Aug-85	0.870	0.030	7.6	7.0		
22-Aug-85	0.890	0.045	7.3	7.2		
29-Aug-85	0.930	0.110	6.8	7.1		
05-Sep-85	0.940	0.012	7.2	7.0		
12-Sep-85	1.420	0.002	10.5	6.9		(11)
19-Sep-85	1.020	0.005	11.9	7.0		
27-Sep-85	1.140	0.055	9.2	7.1		
03-Oct-85	0.930	0.002	10.5	7.4		
10-Oct-85	1.030	0.009	8.0	6.95		
17-Oct-85	1.10	0.002	8.3	7.0		
24-Oct-85	0.87	0.007	7.5	6.9		
31-Oct-85	1.30	0.015	8.75	7.0		
07-Nov-85	0.96	0.002	7.4	8.2		
14-Nov-85	0.77	0.004	8.3	7.5		
21-Nov-85	1.12	0.002	8.7	8.4		
27-Nov-85	1.27	0.006	13.0	7.1		
05-Dec-85	1.13	0.01	14.3	7.4		
12-Dec-85	0.70	0.017	10.6	7.0		
19-Dec-85	0.77	0.01	10.7	7.0		
26-Dec-85	0.83	0.004	10.8	6.9		
02-Jan-86	0.77	0.03	9.3	7.1		
09-Jan-86	0.32	0.01	11.0	7.45		
16-Jan-86	0.82	0.01	10.6	7.8		
23-Jan-86	0.63	0.02	18.2	7.2		
30-Jan-86	0.54	0.03	16.1	7.4		
06-Feb-86	0.55	0.01	22.5	7.1		
13-Feb-86	0.49	0.01	16.1	7.05		
20-Feb-86	0.26	0.01	19.2	7.0		
27-Feb-86	0.35	0.01	18.0	7.3		
06-Mar-86	0.52	0.01	16.3	7.0		
13-Mar-86	0.53	0.08	14.2	7.0		
20-Mar-86	0.43	0.02	12.7	7.0		
27-Mar-86	0.49	0.01	11.7	7.3		
03-Apr-86	0.59	0.04	11.3	7.0		
10-Apr-86	0.68	0.01	10.5	7.2		

DATE	TOTAL CYANIDE (PPM)	FREE CYANIDE (PPM)	FLUORIDE (PPM)	pH (STANDARD UNITS)	FLOW (GPD)	
17-Apr-86	0.83	0.13	10.8	7.5		
23-Apr-86	0.93	0.02	9.5	7.3		
01-May-86	0.85	0.05	8.6	7.7		
08-May-86	0.77	0.01	8.4	7.6		
15-May-86	0.10	0.01	7.9	7.6		
22-May-86	0.79	0.012	7.5	7.6		
29-May-86	0.82	0.019	7.3	7.7		
05-Jun-86	0.84	0.22	7.3	7.6		
12-Jun-86	0.88	0.03	7.3	7.6		
19-Jun-86	0.89	0.12	7.1	7.65		
26-Jun-86	0.87	0.24	6.5	7.9		
03-Jul-86	0.918	0.130	7.9	7.9		
10-Jul-86	0.85	0.02	8.3	8.1		
17-Jul-86	0.95	0.08	7.0	7.6		
24-Jul-86	0.95	0.01	16.0	8.8		
31-Jul-86	0.99	0.22	7.1	7.6		
07-Aug-86	1.07	0.14	6.7	7.6		
14-Aug-86	1.02	0.18	6.7	7.6		
21-Aug-86	1.09	0.03	6.9	7.6		
28-Aug-86	1.06	0.003	6.7	7.6		
04-Sep-86	1.06	0.02	6.5	7.6		
11-Sep-86	1.09	0.085	6.8	7.6		
18-Sep-86	1.53	0.10	6.6	7.7		
26-Sep-86	0.95	0.03	6.4	7.6		(8)
02-Oct-86	0.86	0.01	6.9	7.6		
09-Oct-86	0.92	0.007	6.9	7.6		
16-Oct-86	1.35	0.011	7.0	7.6		
23-Oct-86	1.12	0.008	7.2	7.6		
30-Oct-86	0.77	0.005	7.2	7.5		
05-Nov-86	0.83	0.002	7.1	7.4		
12-Nov-86	0.85	0.005	7.6	7.7		
19-Nov-86	1.28	0.114	7.0	7.7		
25-Nov-86	1.26	0.009	8.5	7.8		
03-Dec-86			9.7	7.7		
10-Dec-86			9.3	7.8		
17-Dec-86			8.8	7.7		
23-Dec-86			9.3	7.6		

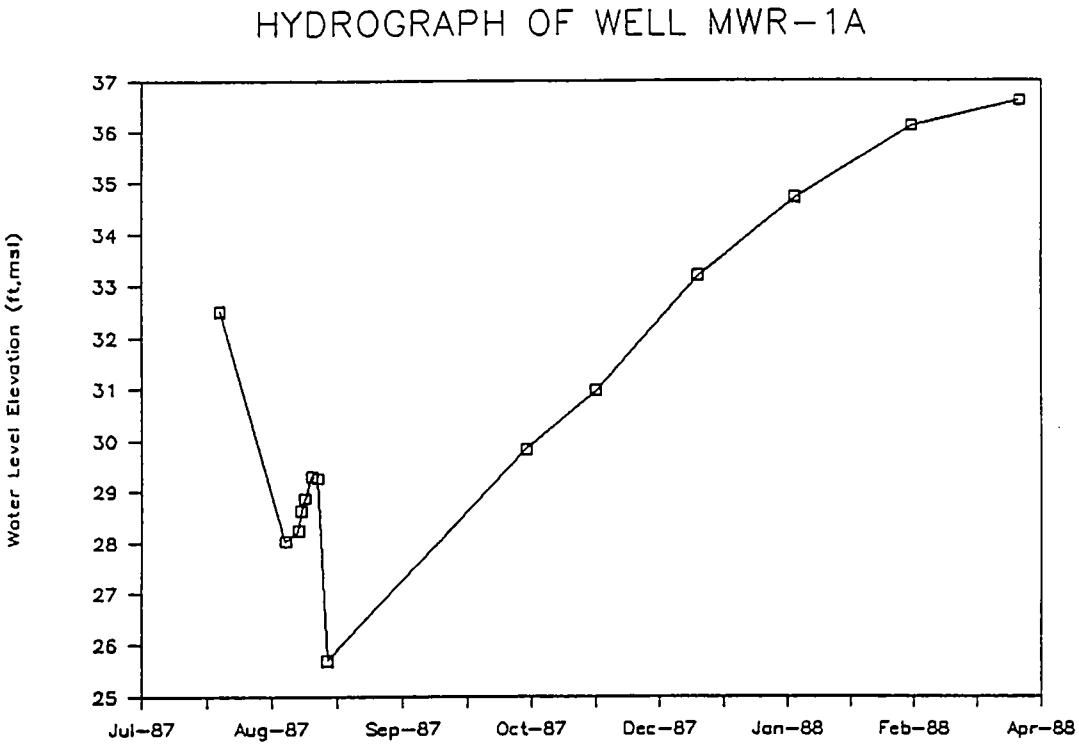
NOTES: GPD = GALLONS PER DAY
* MAY HAVE BEEN ERROR IN FREE CN SETUP PREPARATION
(1) .65" RAIN
(2) .20" RAIN
(3) 1.35" RAIN 9/9
(4) .38" RAIN ON 10/22, 23, 24
(5) .01" RAIN
(6) RAPID SNOW MELT
(7) RAPID SNOW MELT AND RAIN
(8) NORTHWEST ALUMINUM
(9) .65" RAIN
(10) .20" RAIN
(11) 1.35" RAIN ON 9/9-9/10

MMRFDATA:SUMPDATA.WK1

Section Nine

9.0 GROUND-WATER ELEVATION MEASUREMENTS

Potentiometric surface maps were prepared for the S-, A- and B-aquifer and are included in the Final RI Report (Figures 4.8, 4.9 and 4.10). These maps were prepared from water level data obtained in August 1987. In order to evaluate potential seasonal variations in ground-water flow, ground-water elevation measurements have been recorded on a monthly bases since August 1987. For each month water levels were collected, potentiometric maps were prepared for each aquifer. Although the actual water level elevations (depth to water) changed markedly over the time period evaluated, 20 ft in some cases, the direction of ground-water flow remained comparable. Hydrographs have been prepared which illustrate the water level changes (Figure 27) and the water-level measurements are presented in Table 8.


HYDROGRAPH OF WELL MWR-1A
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

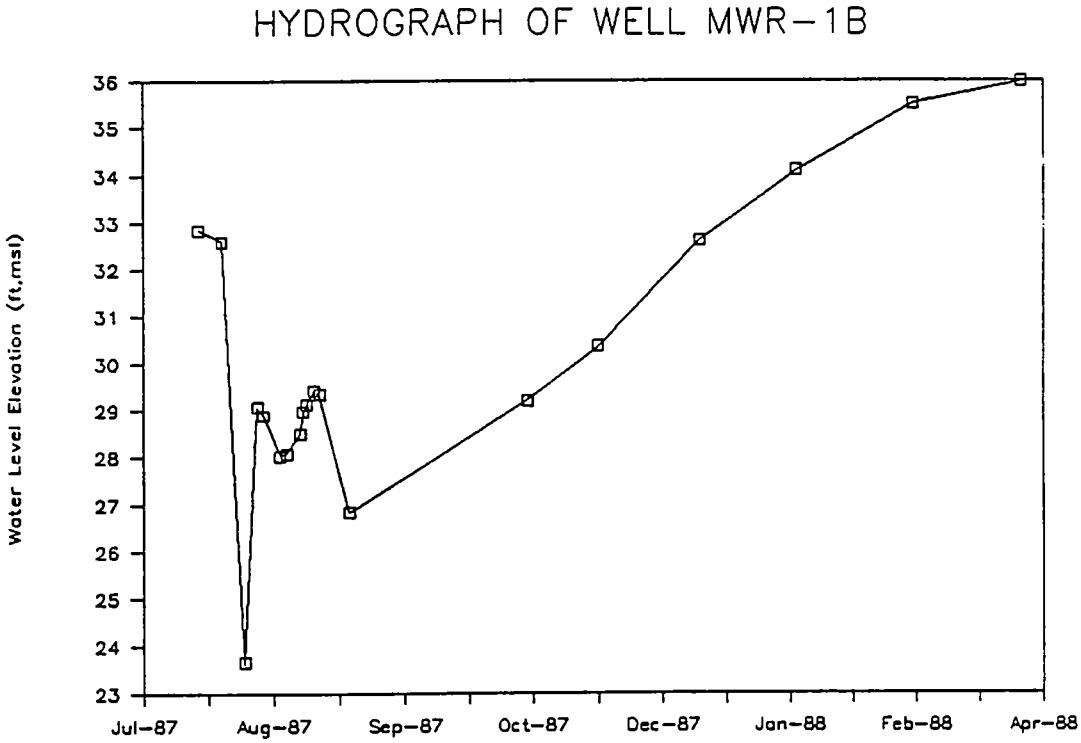
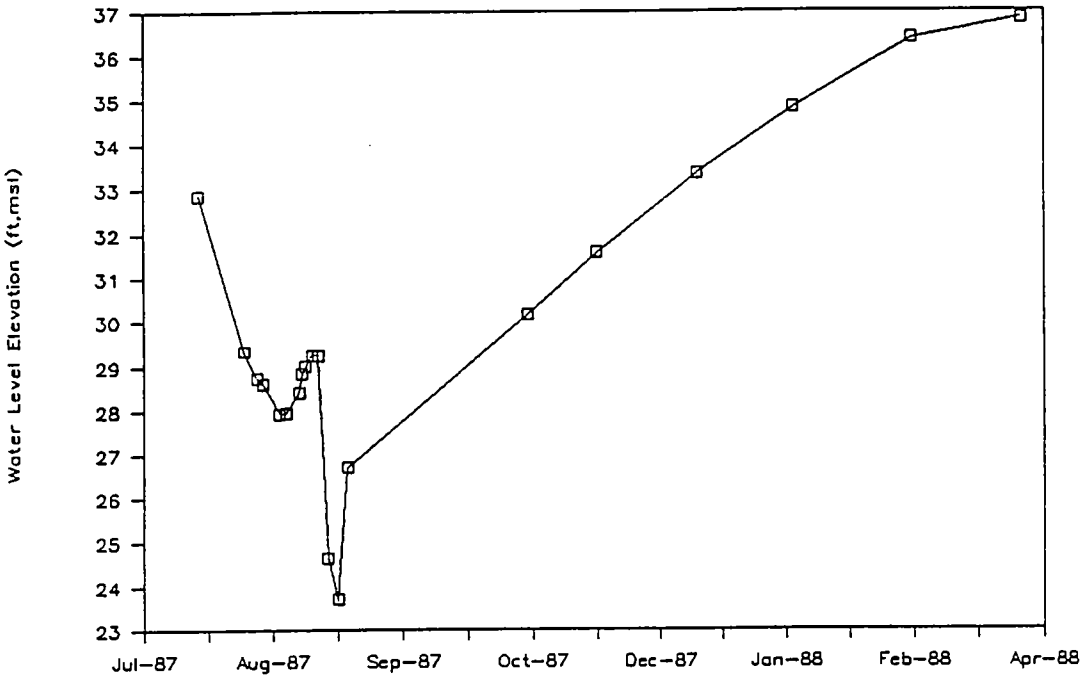

HYDROGRAPH OF WELL MWR-1B
Water Level Elevation (ft,msl)
36
35
34
33
32
31
30
29
28
27
26
25
24
23
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

HYDROGRAPH OF WELL MWR-2A



HYDROGRAPH OF WELL MW-2S

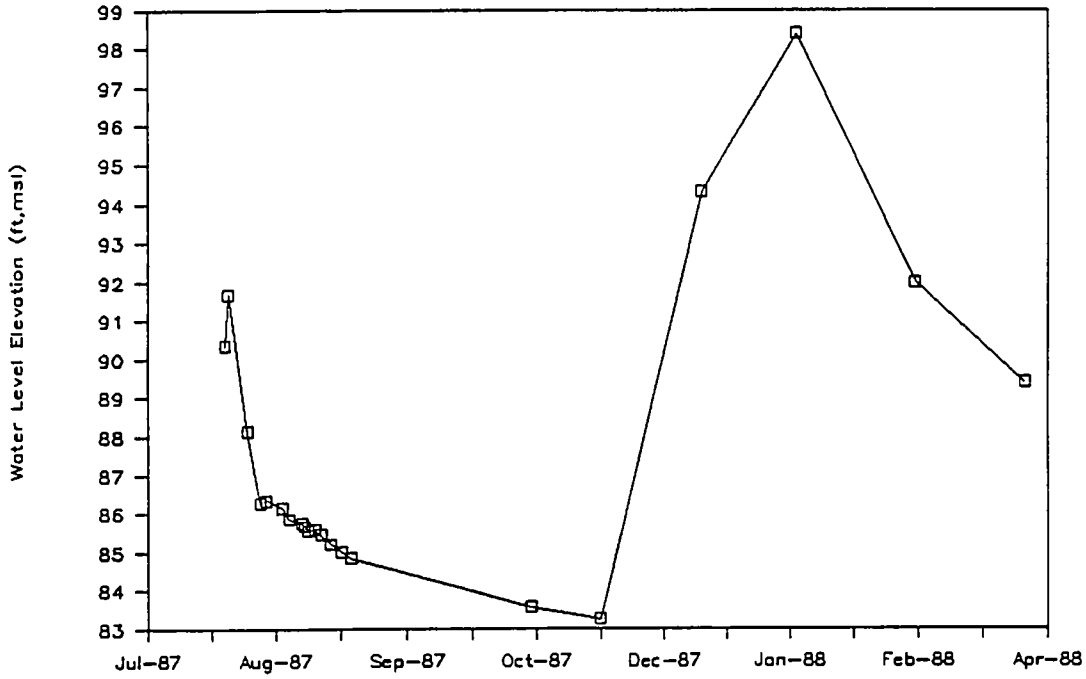
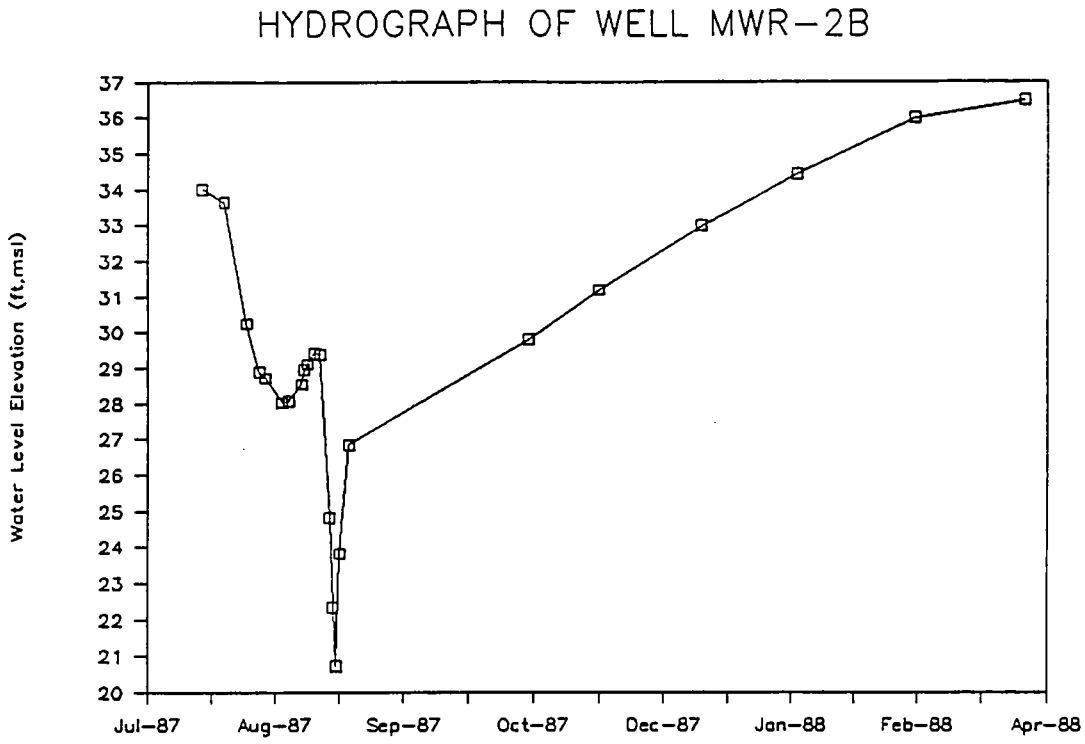


FIGURE 27


HYDROGRAPH OF WELL MWR-2B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

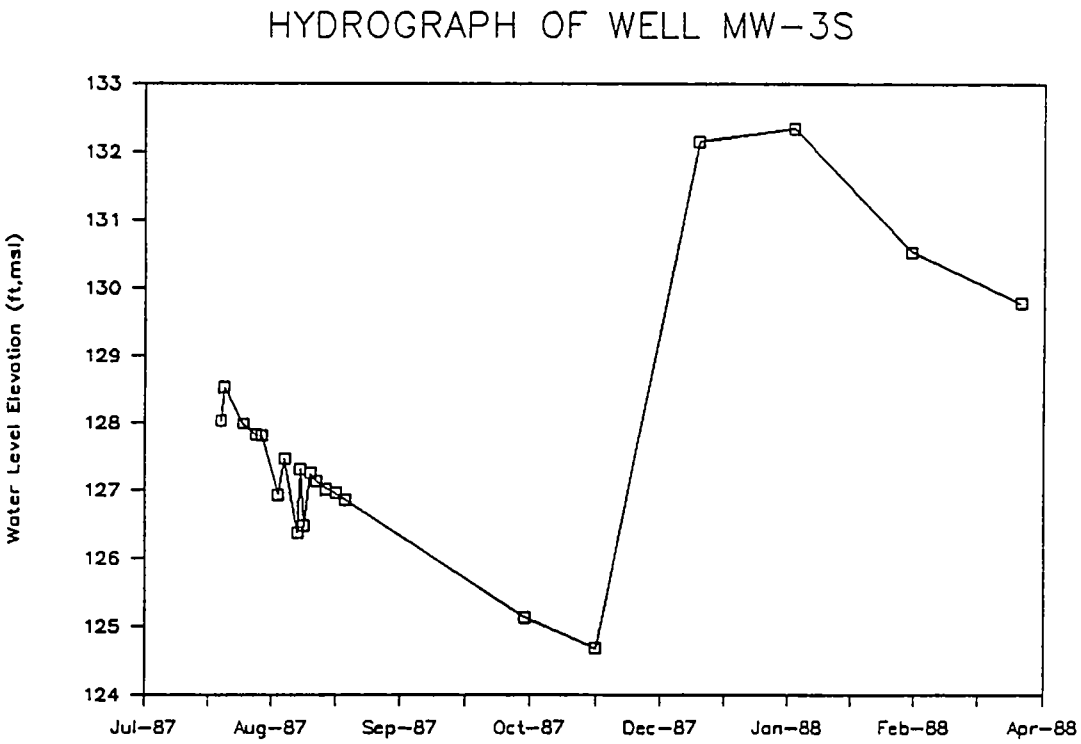
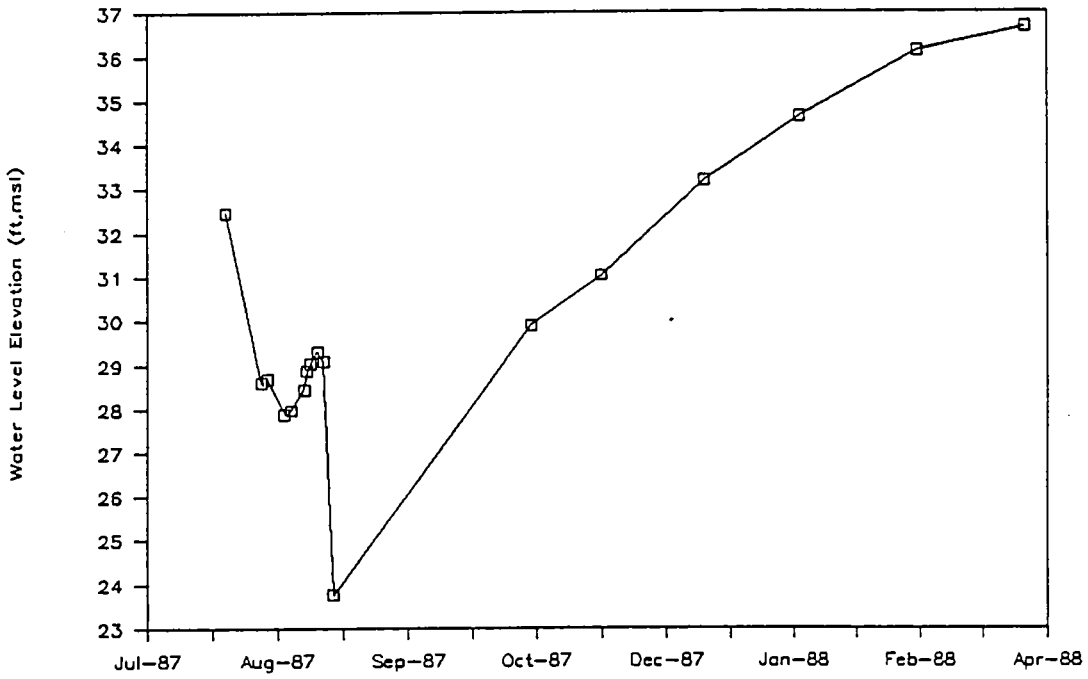

HYDROGRAPH OF WELL MW-3S
Water Level Elevation (ft,msl)
133
132
131
130
129
128
127
126
125
124
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

HYDROGRAPH OF WELL MWR-3A



HYDROGRAPH OF WELL MWR-3B

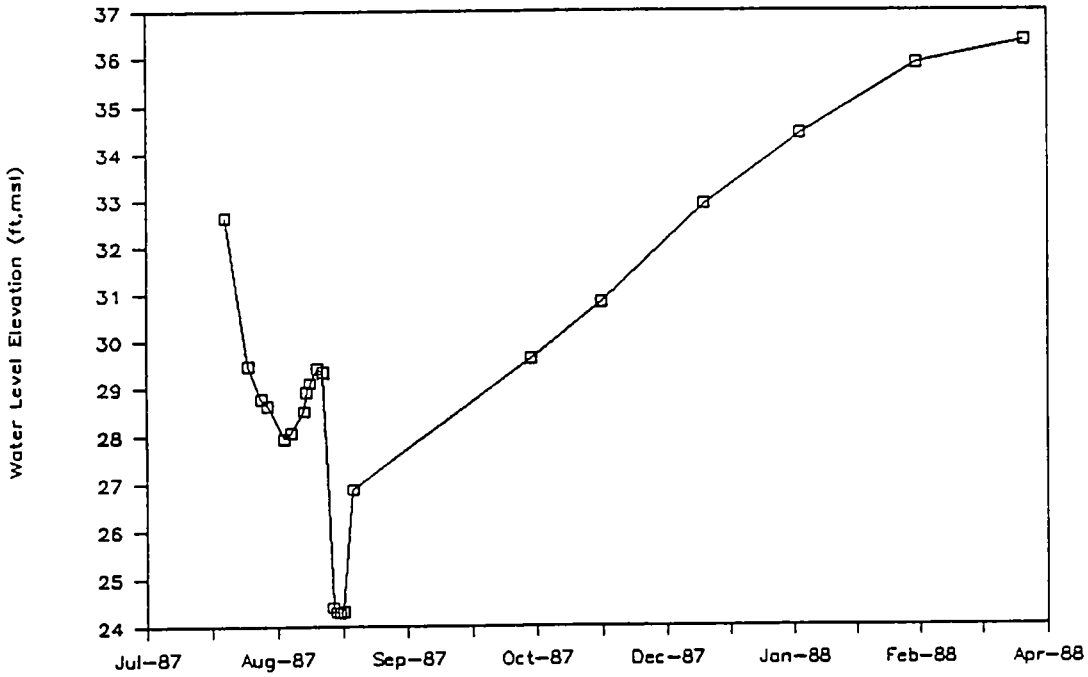
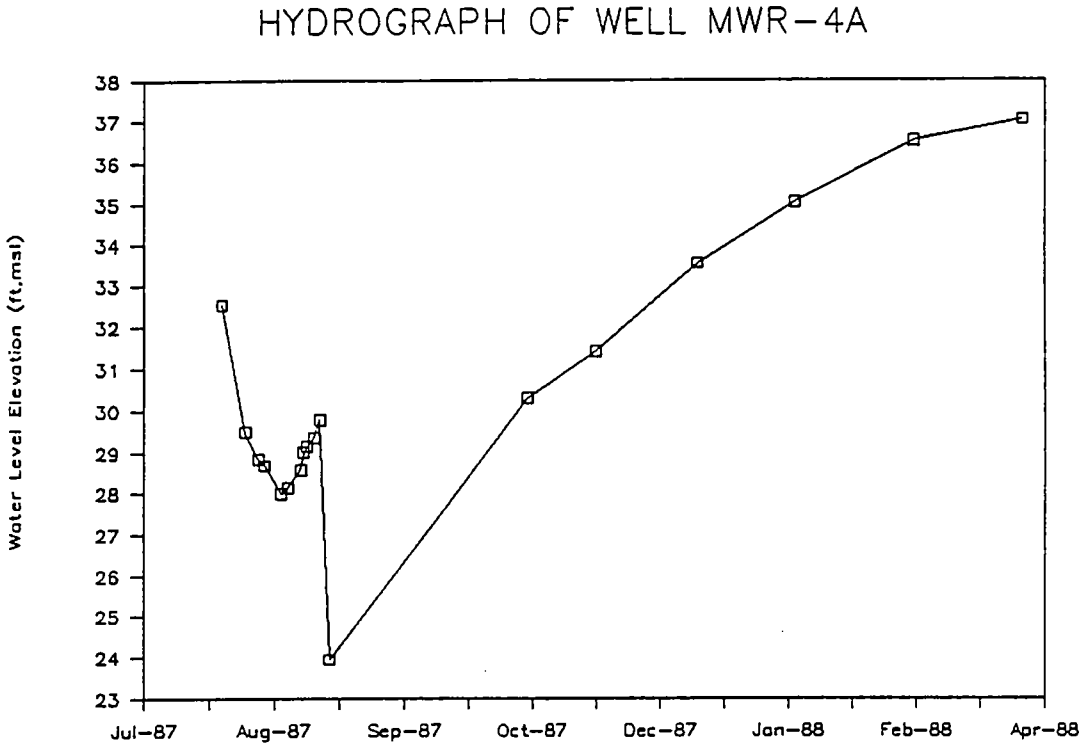


FIGURE 27


HYDROGRAPH OF WELL MWR-4A
Water Level Elevation (ft,msl)
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

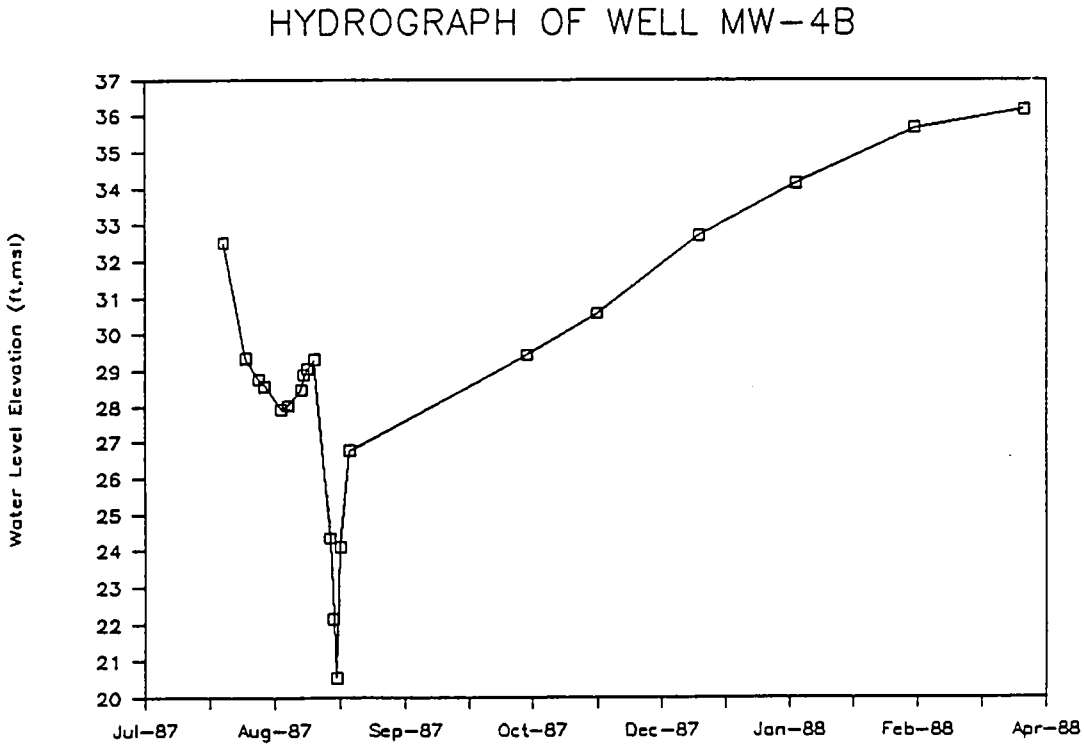
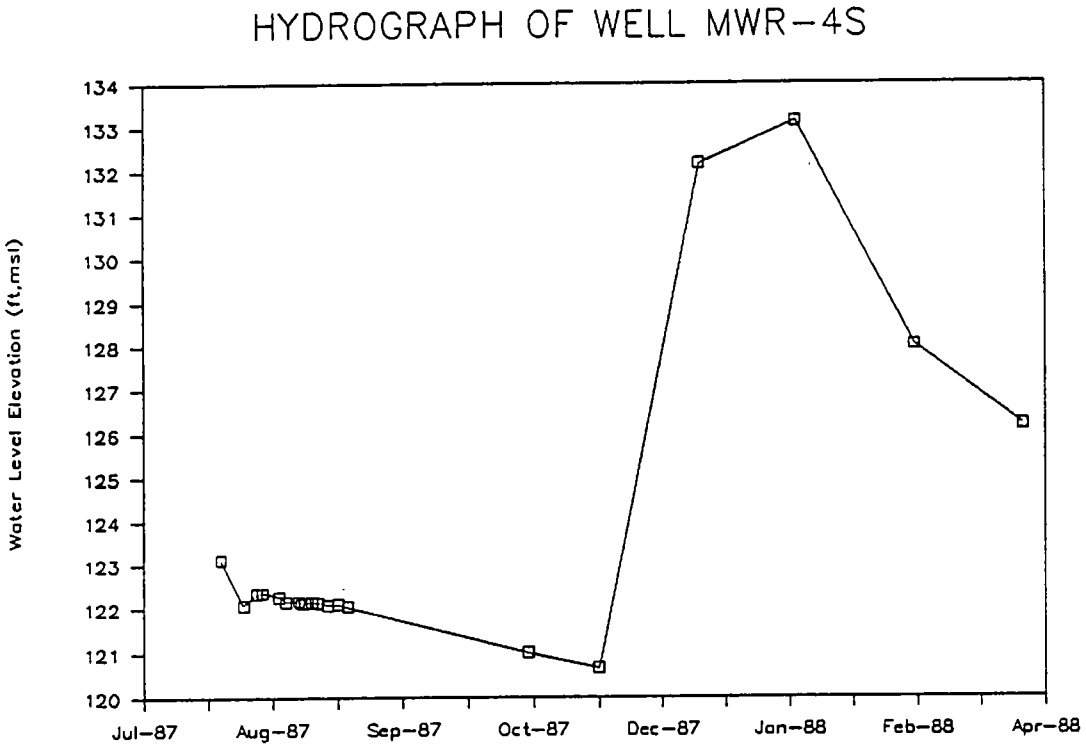

HYDROGRAPH OF WELL MW-4B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MWR-4S
Water Level Elevation (ft,msl)
134
133
132
131
130
129
128
127
126
125
124
123
122
121
120
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

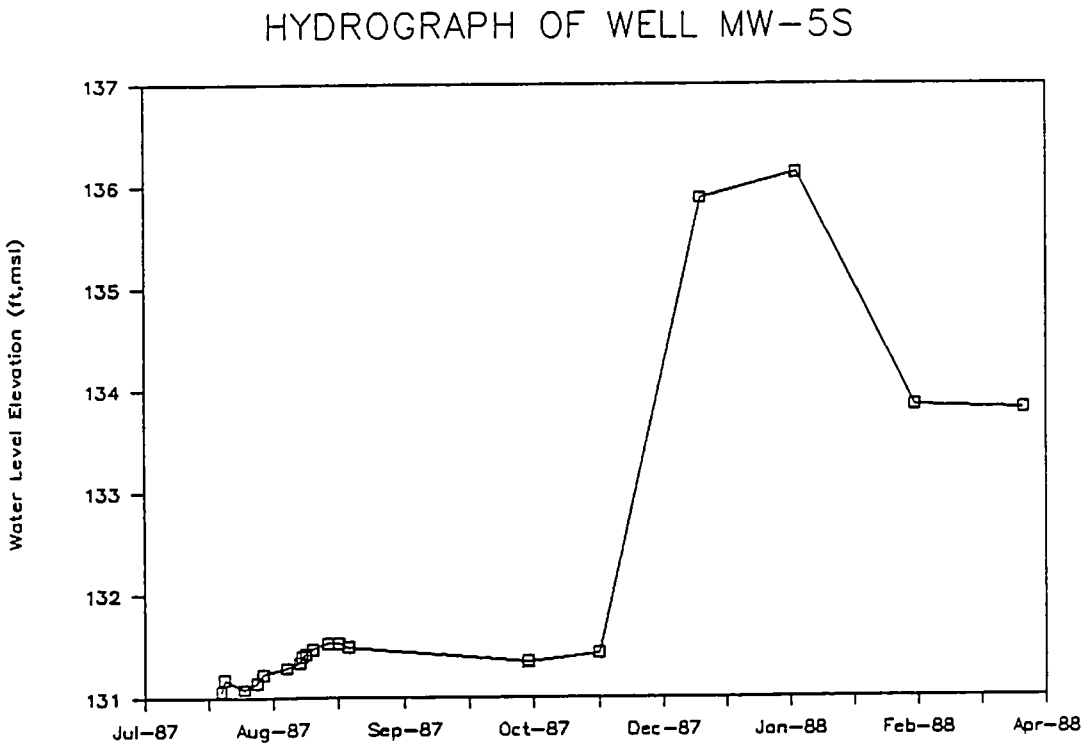
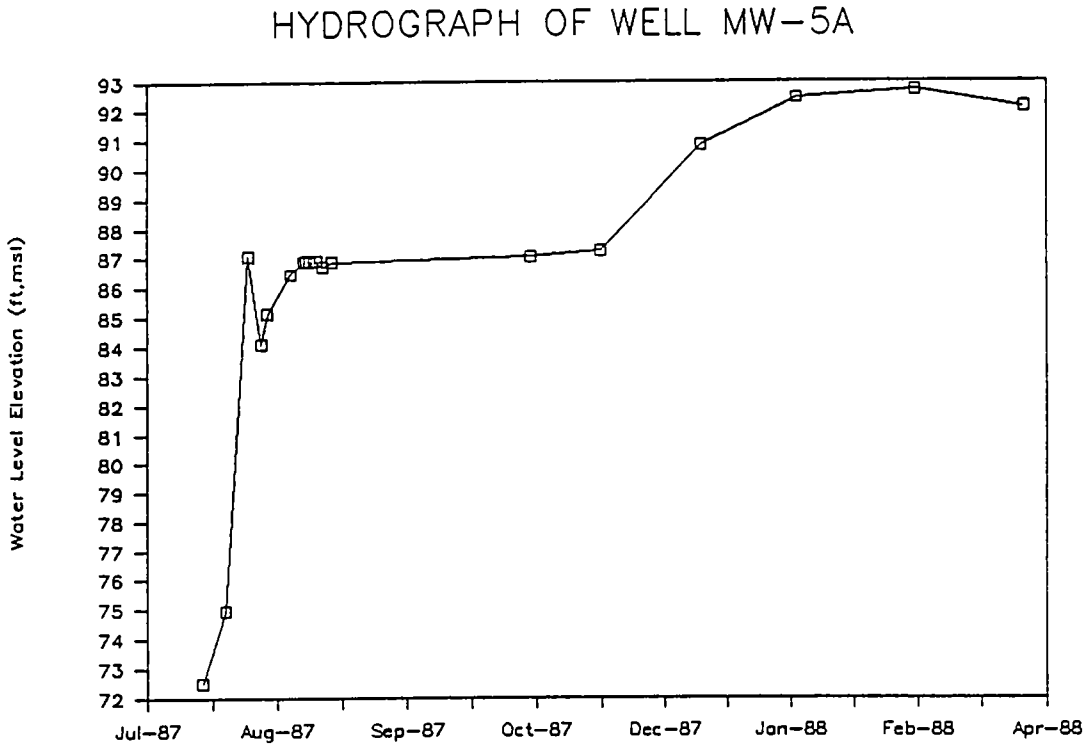

HYDROGRAPH OF WELL MW-5S
Water Level Elevation (ft,msl)
137
136
135
134
133
132
131
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-5A
Water Level Elevation (ft,msl)
93
92
91
90
89
88
87
86
85
84
83
82
81
80
79
78
77
76
75
74
73
72
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

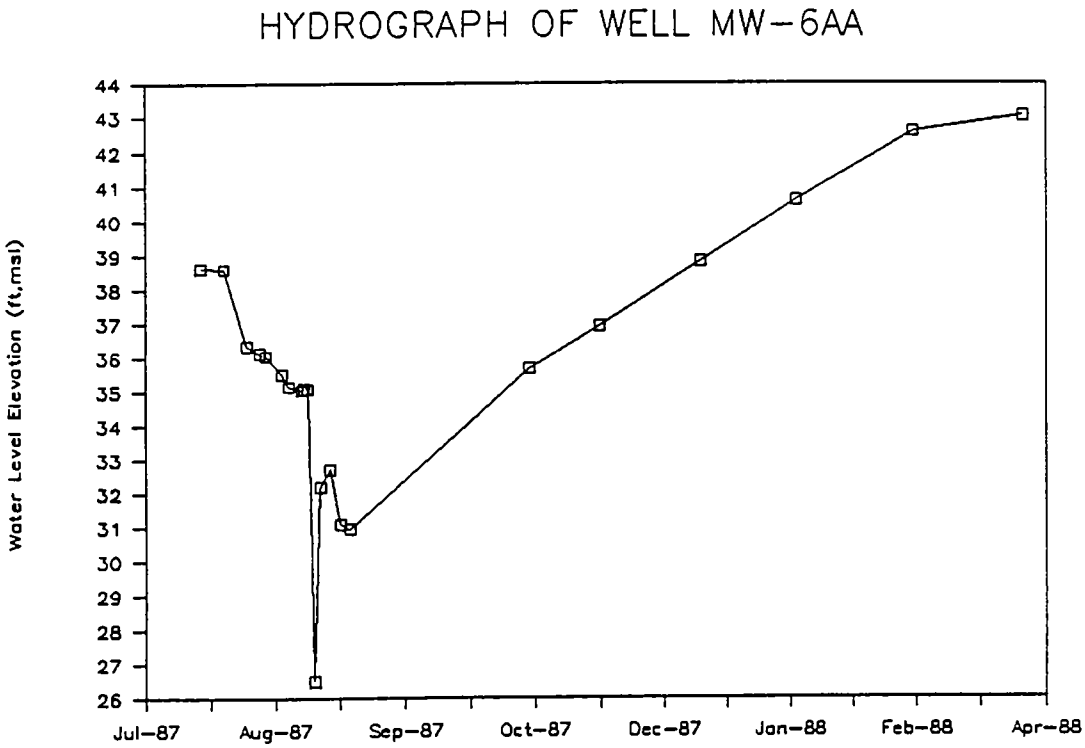
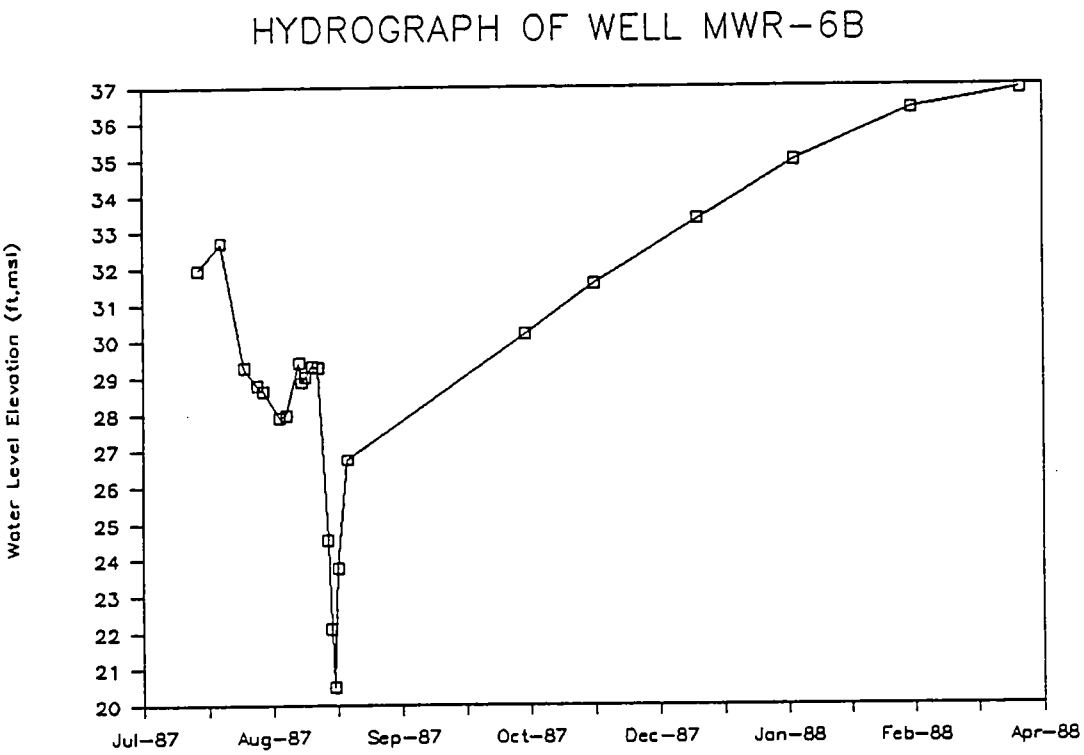

HYDROGRAPH OF WELL MW-6AA
Water Level Elevation (ft,msl)
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MWR-6B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
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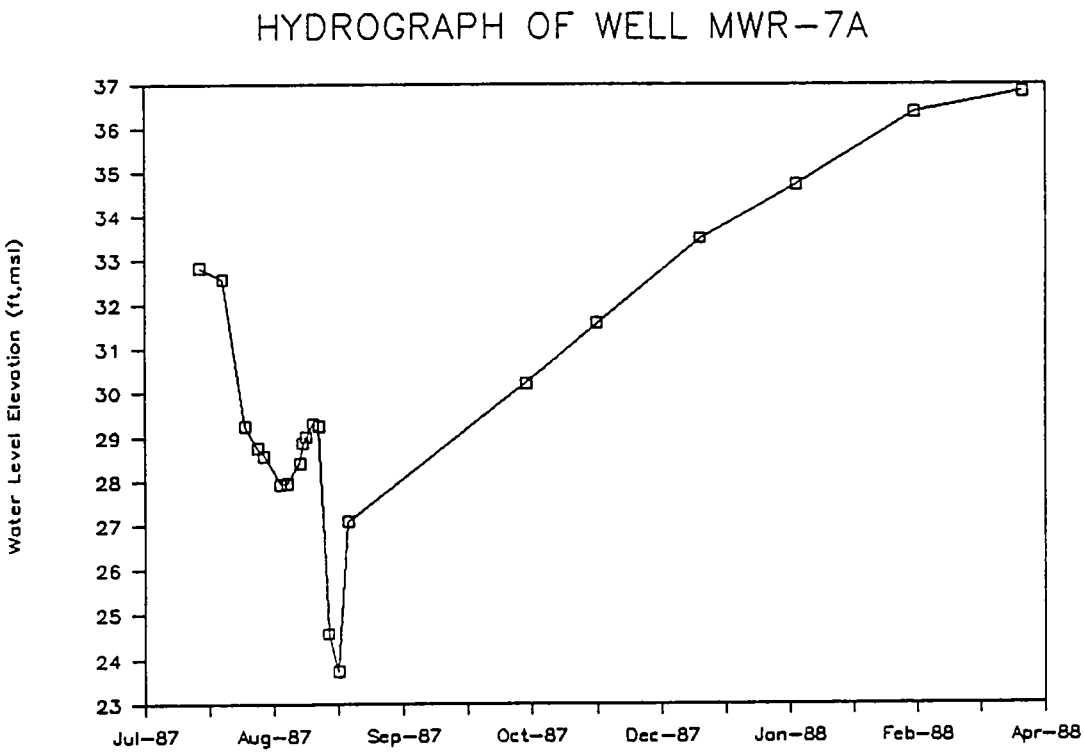
23
22
21
20
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88


HYDROGRAPH OF WELL MWR-7A
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
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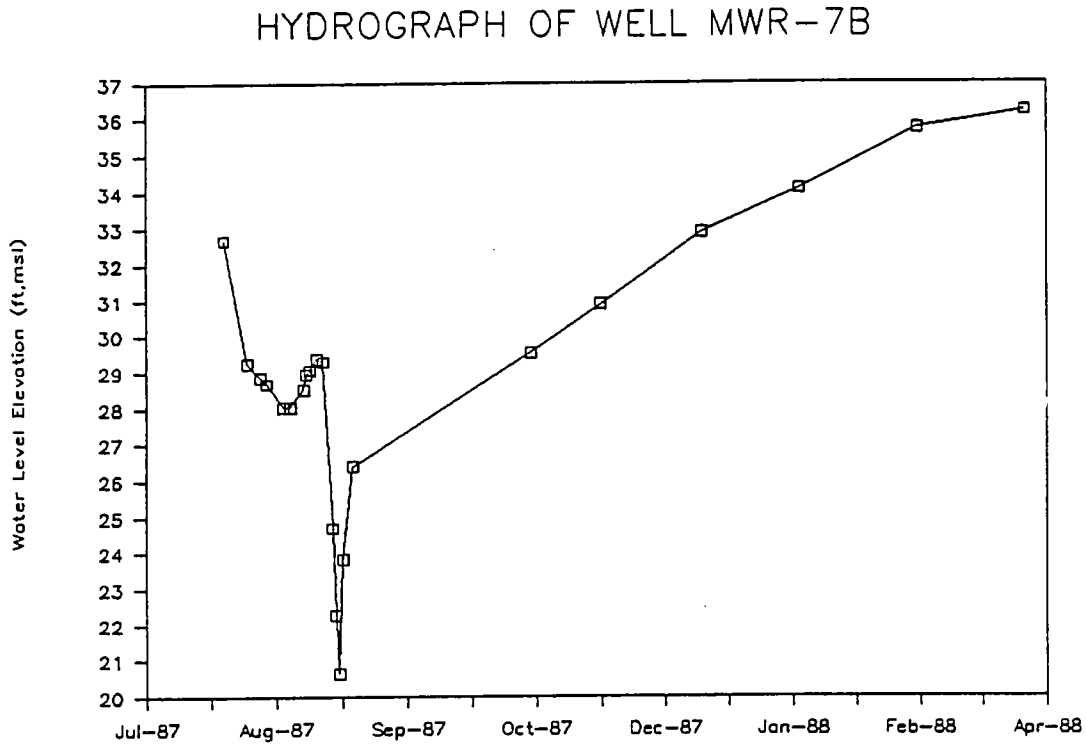
23
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MWR-7B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

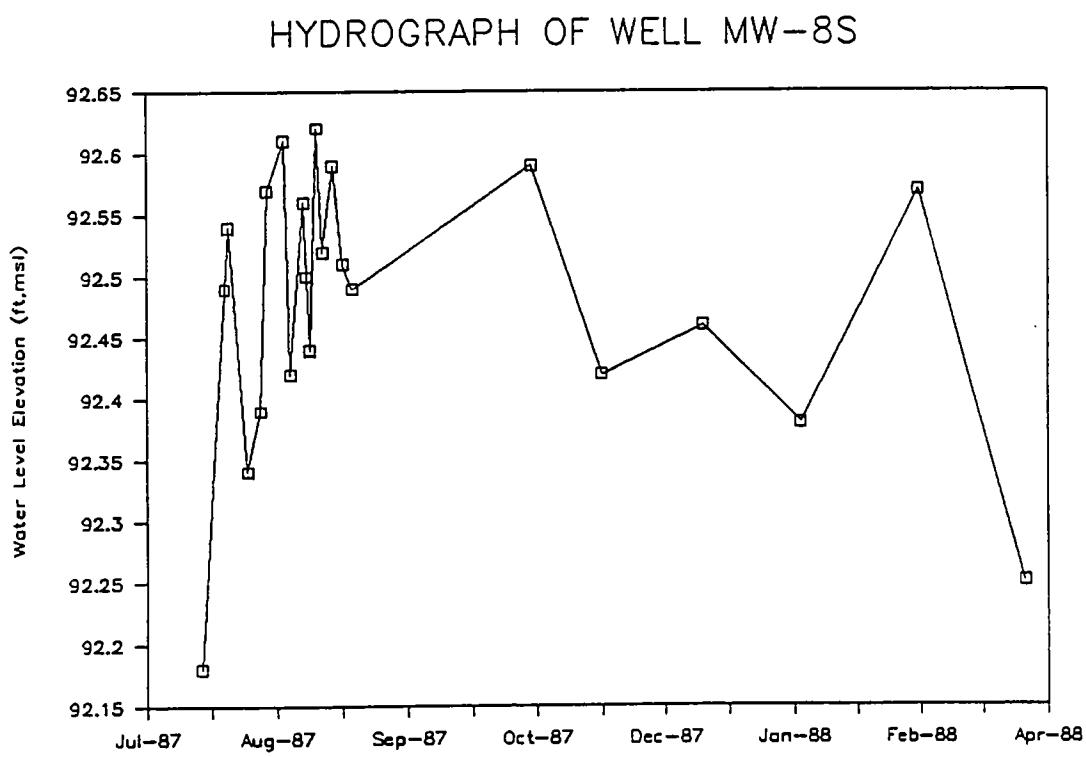
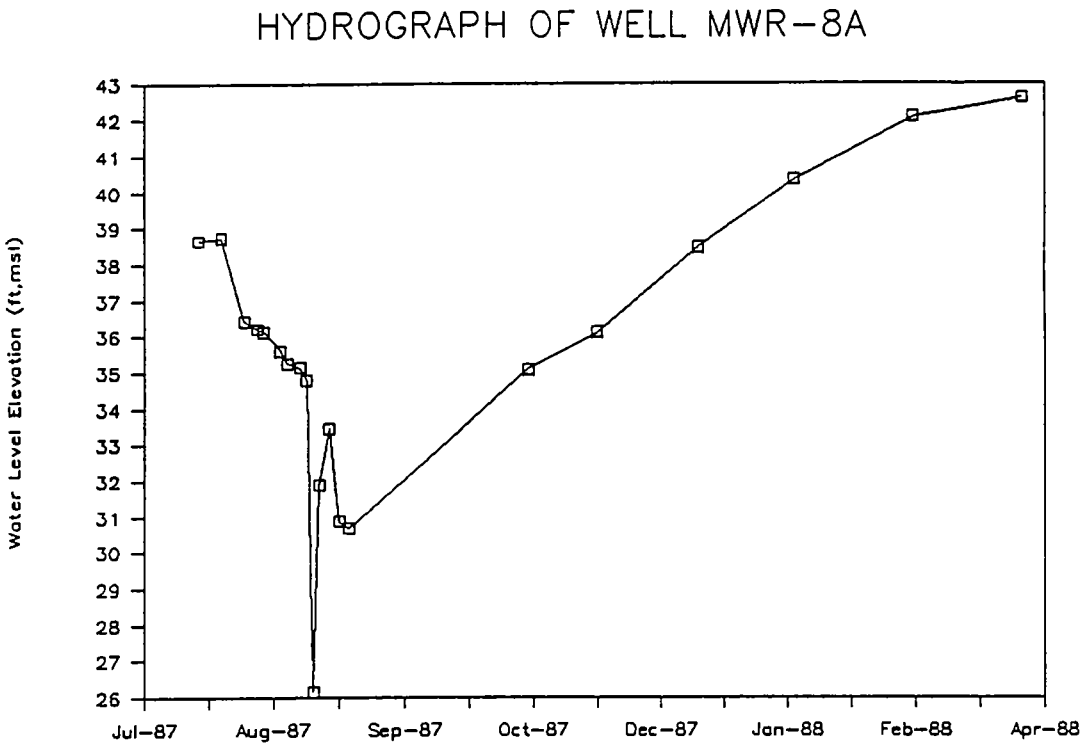

HYDROGRAPH OF WELL MW-8S
Water Level Elevation (ft,msl)
92.65
92.6
92.55
92.5
92.45
92.4
92.35
92.3
92.25
92.2
92.15
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MWR-8A
Water Level Elevation (ft,msl)
43
42
41
40
39
38
37
36
35
34
33
32
31
30
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28
27
26
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

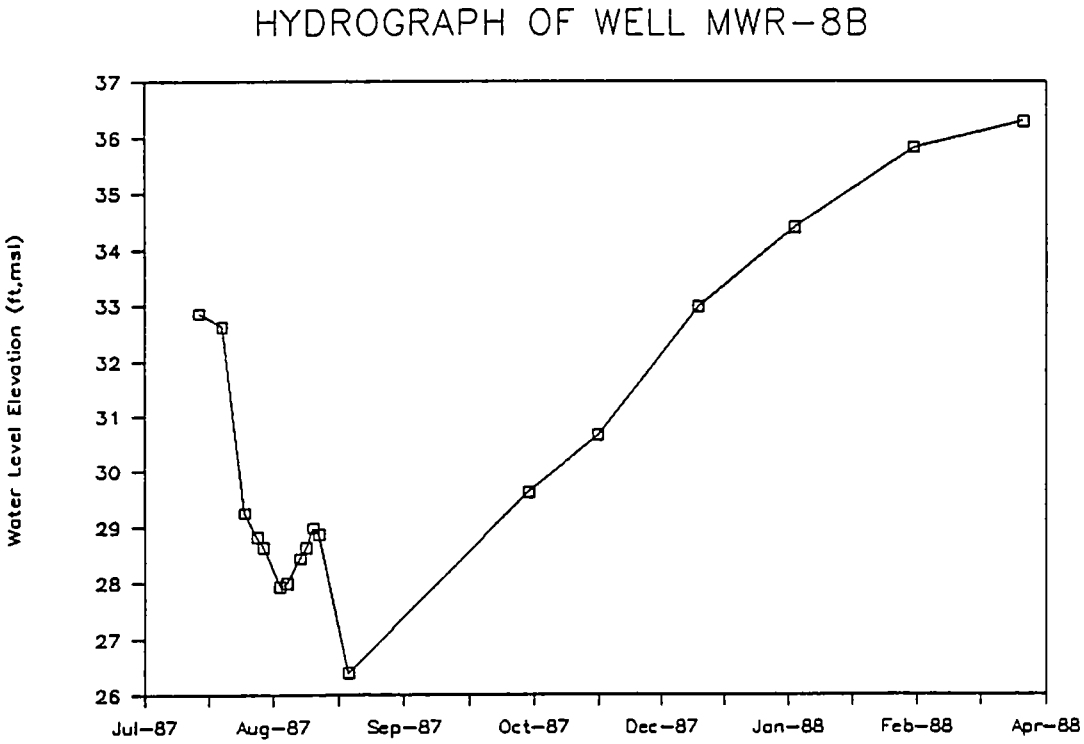
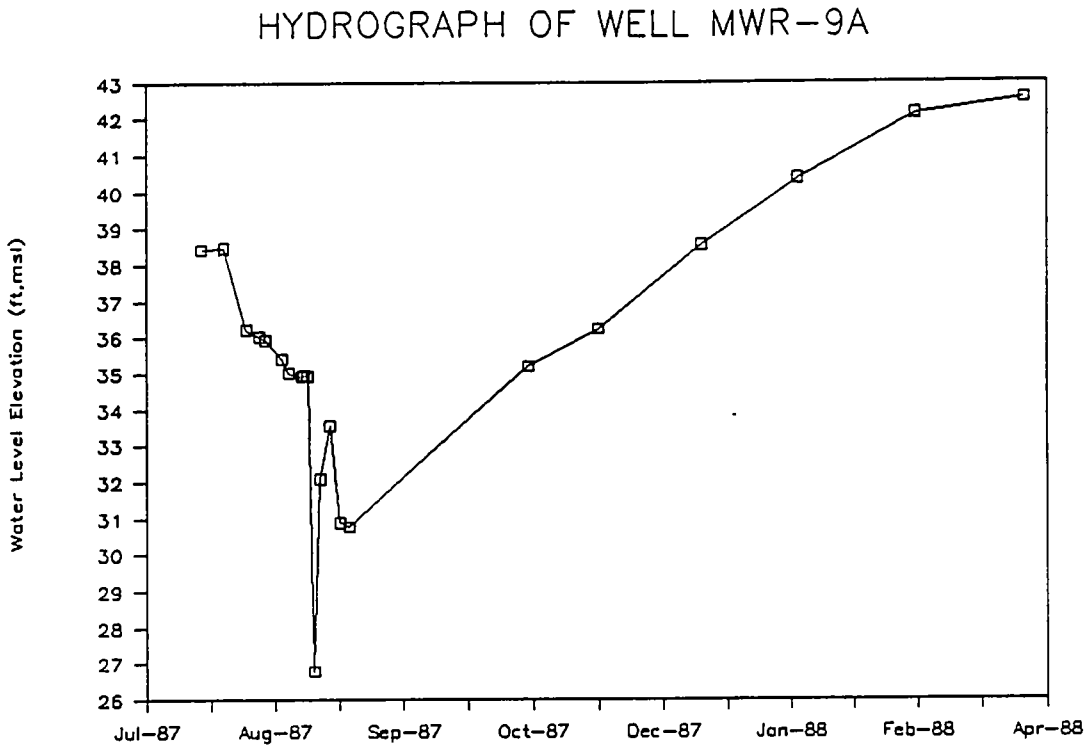

HYDROGRAPH OF WELL MWR-8B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MWR-9A
Water Level Elevation (ft,msl)
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

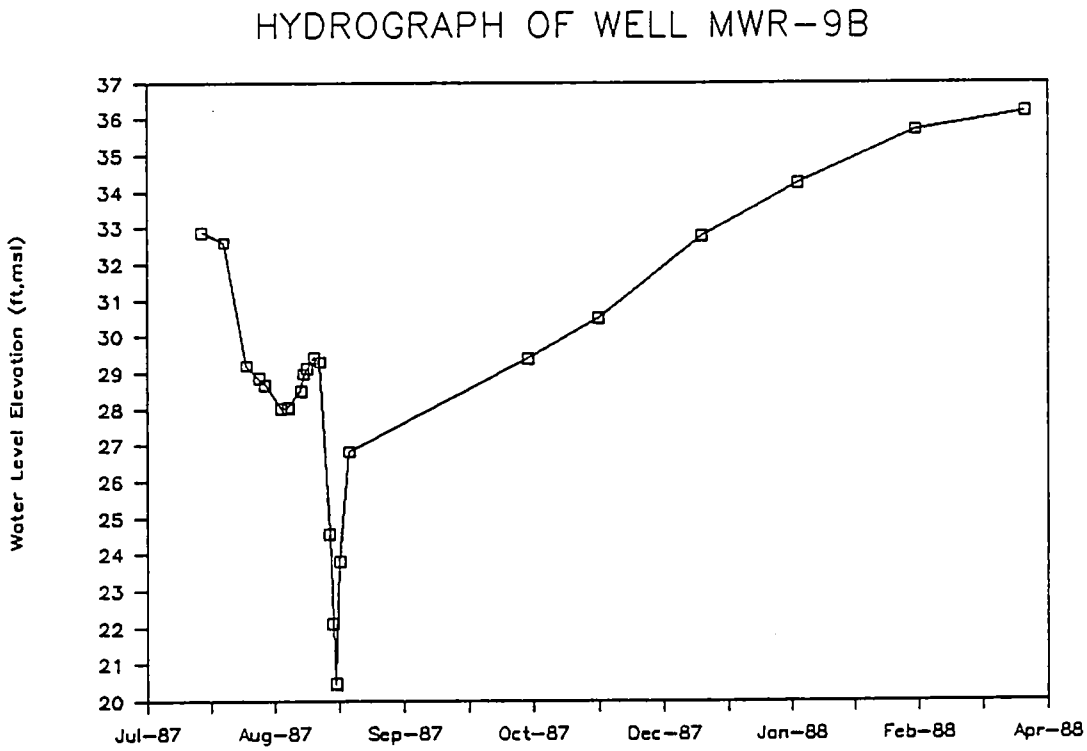
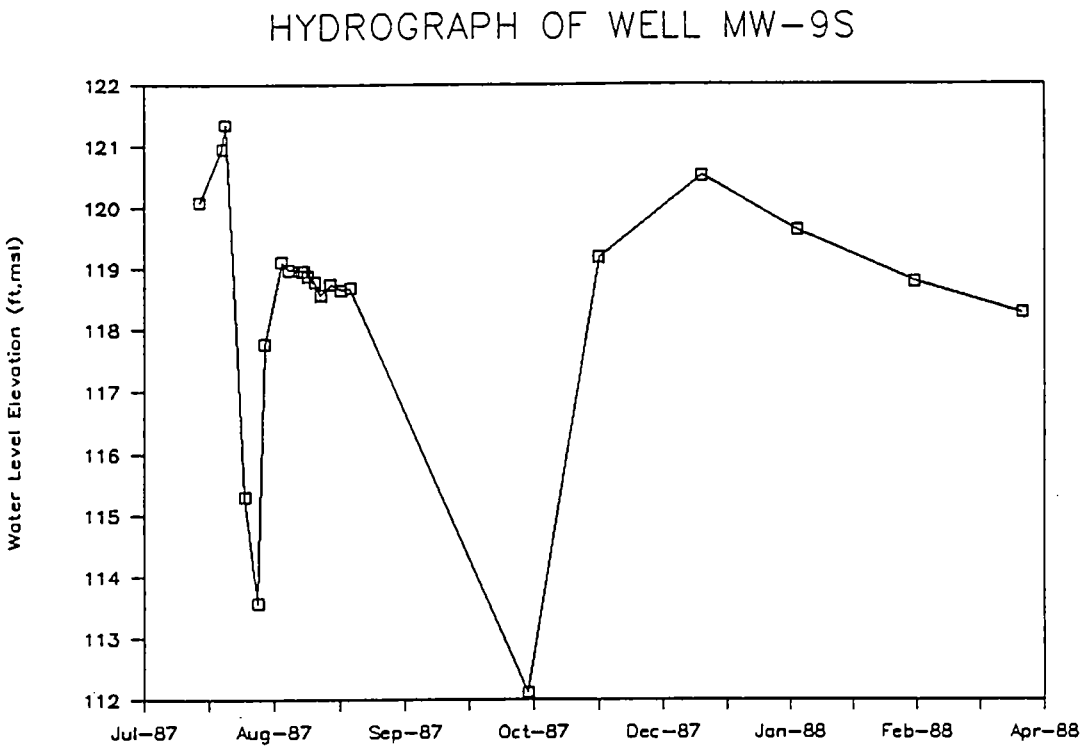

HYDROGRAPH OF WELL MWR-9B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-9S
Water Level Elevation (ft,msl)
122
121
120
119
118
117
116
115
114
113
112
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

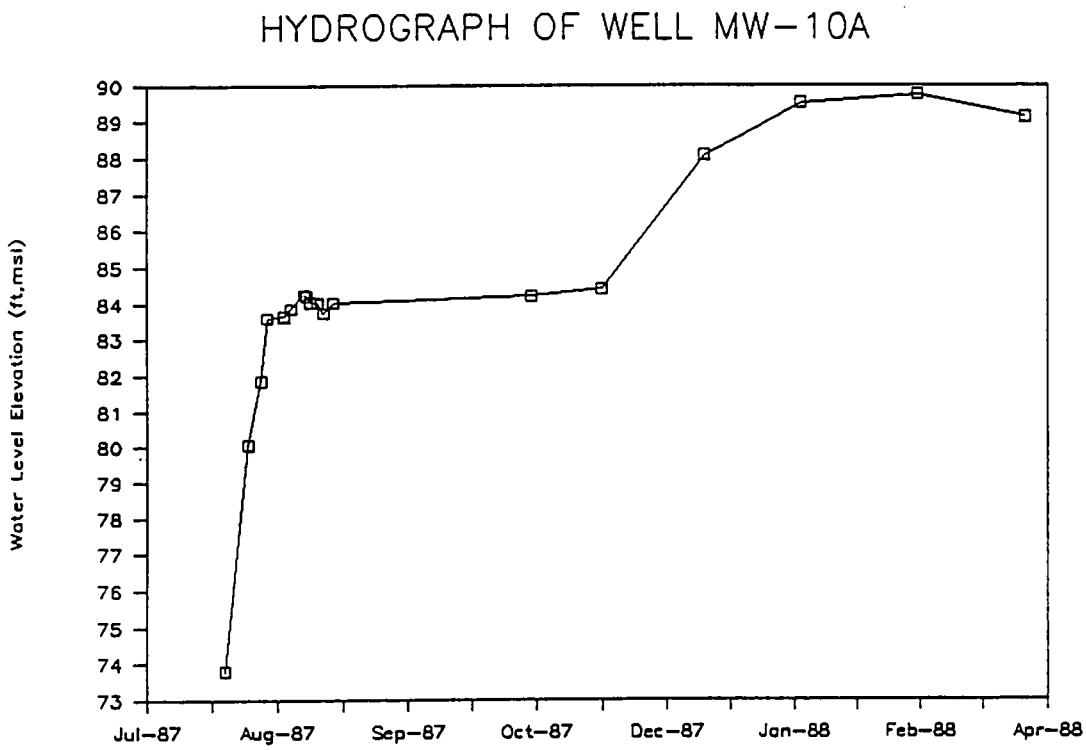
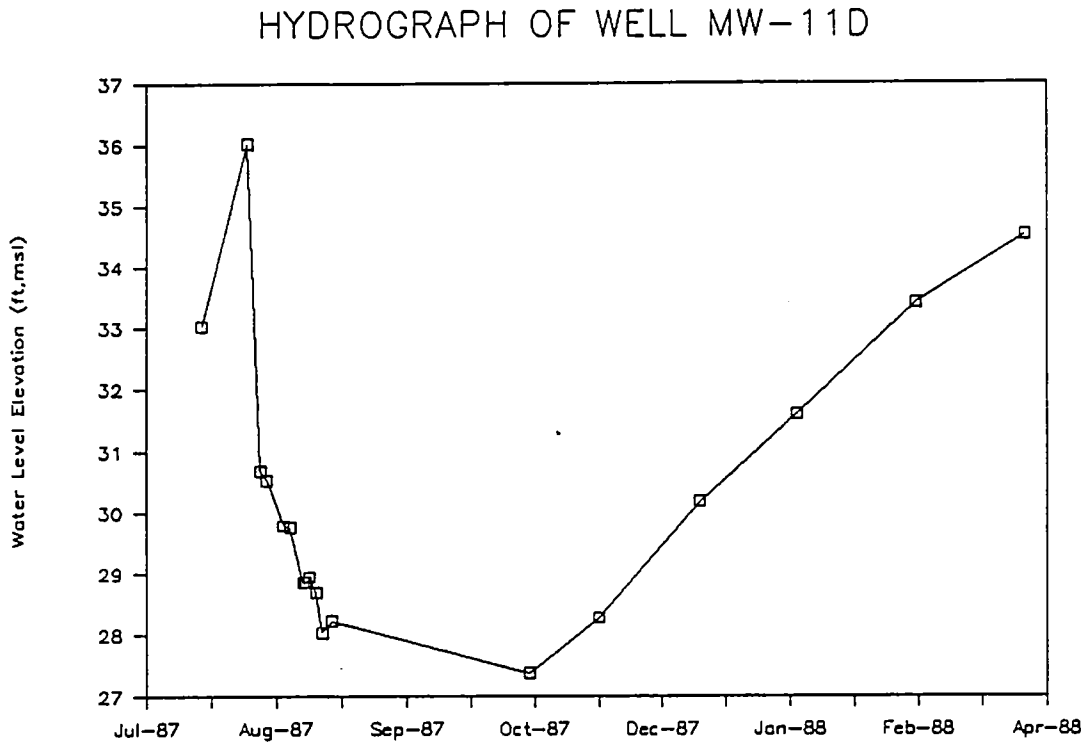

HYDROGRAPH OF WELL MW-10A
Water Level Elevation (ft,msl)
90
89
88
87
86
85
84
83
82
81
80
79
78
77
76
75
74
73
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-11D
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

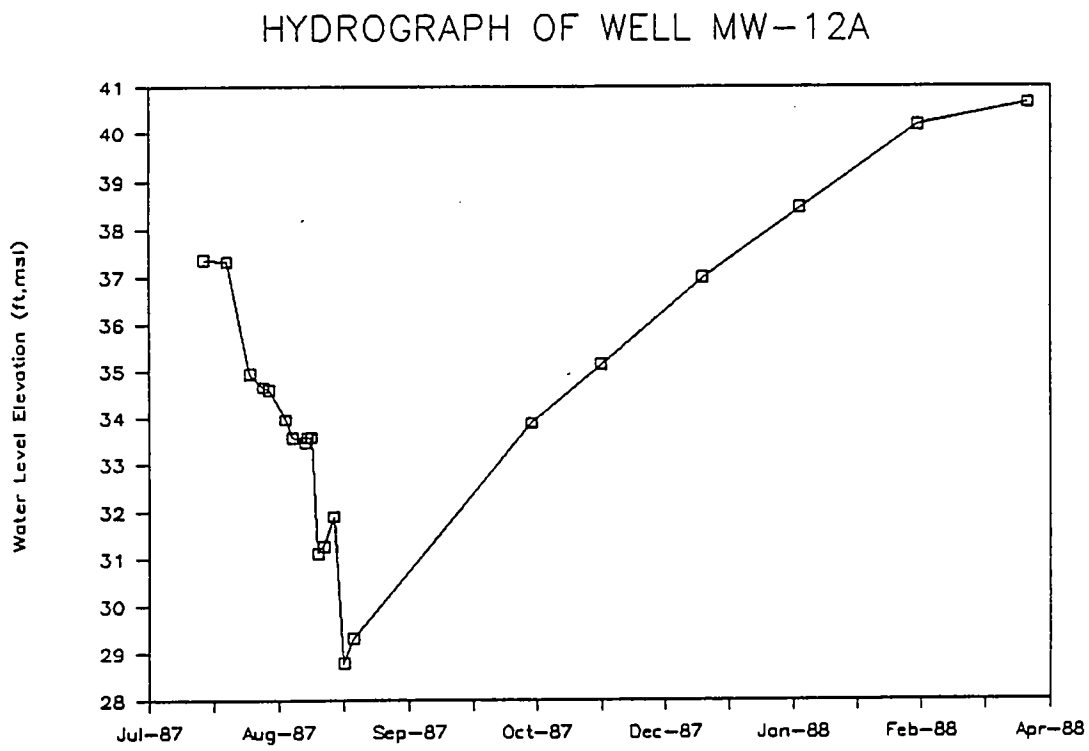
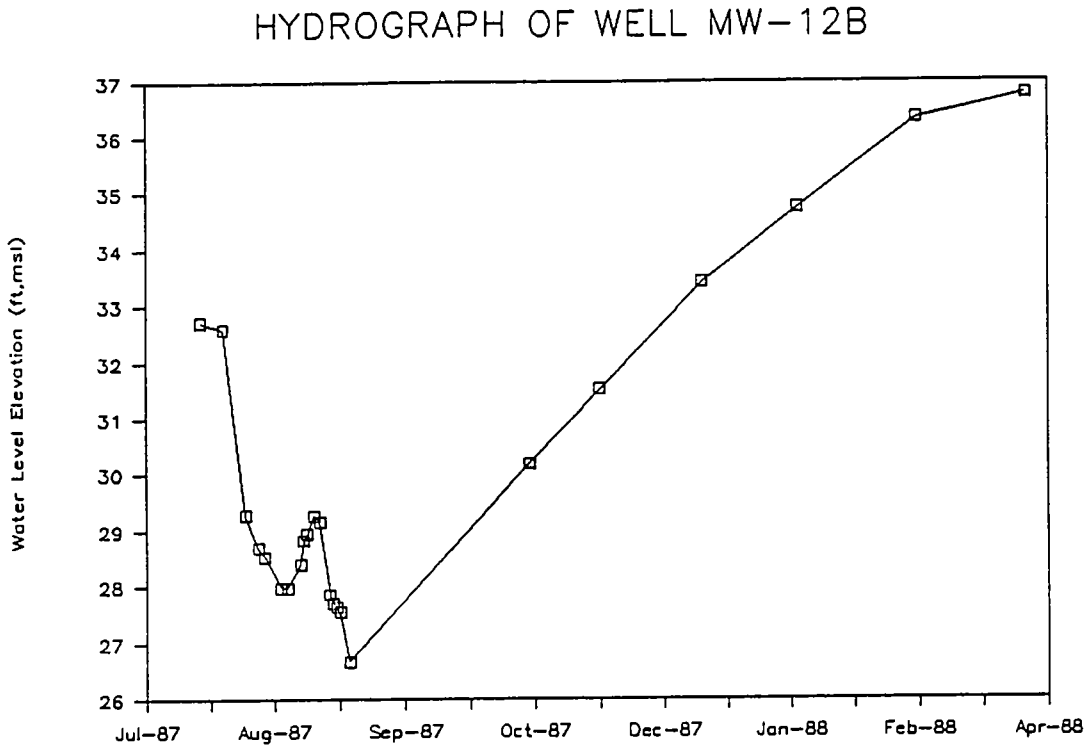

HYDROGRAPH OF WELL MW-12A
Water Level Elevation (ft,msl)
41
40
39
38
37
36
35
34
33
32
31
30
29
28
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-12B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

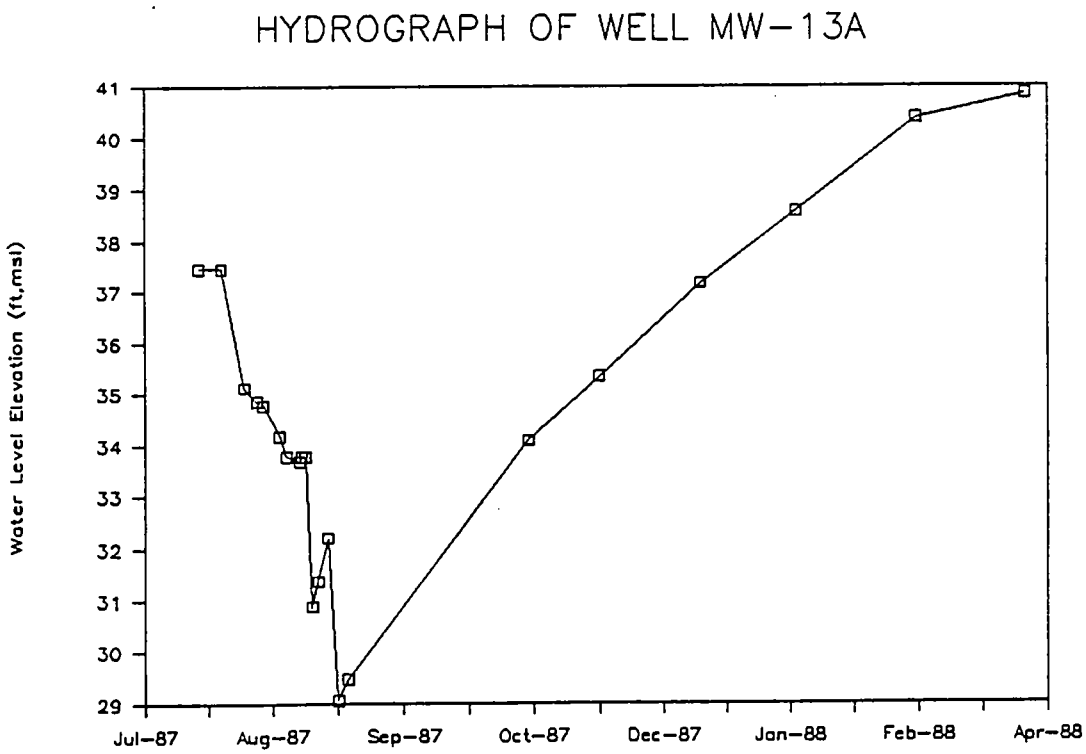
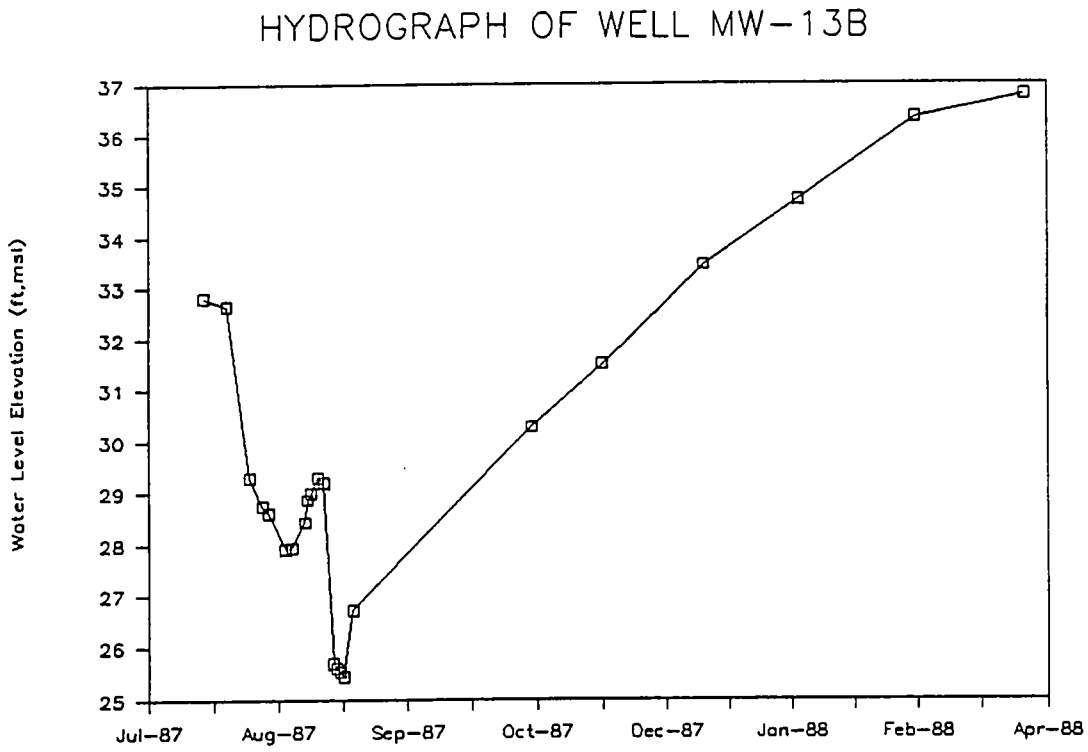

HYDROGRAPH OF WELL MW-13A
Water Level Elevation (ft,msl)
41
40
39
38
37
36
35
34
33
32
31
30
29
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-13B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

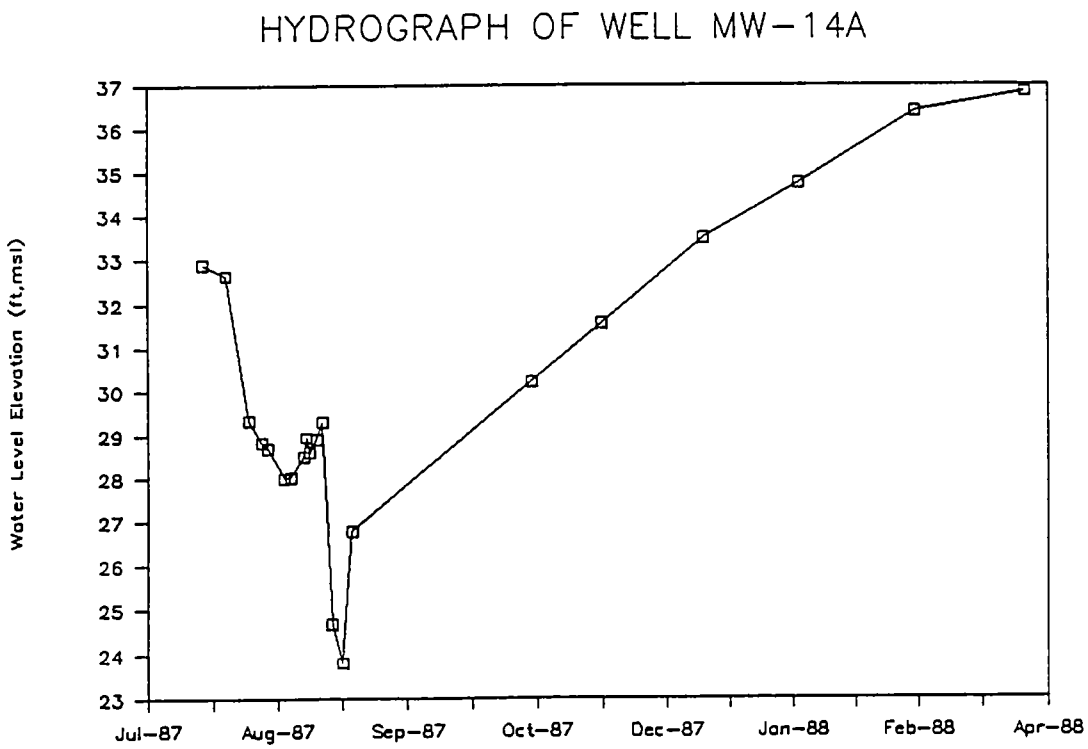
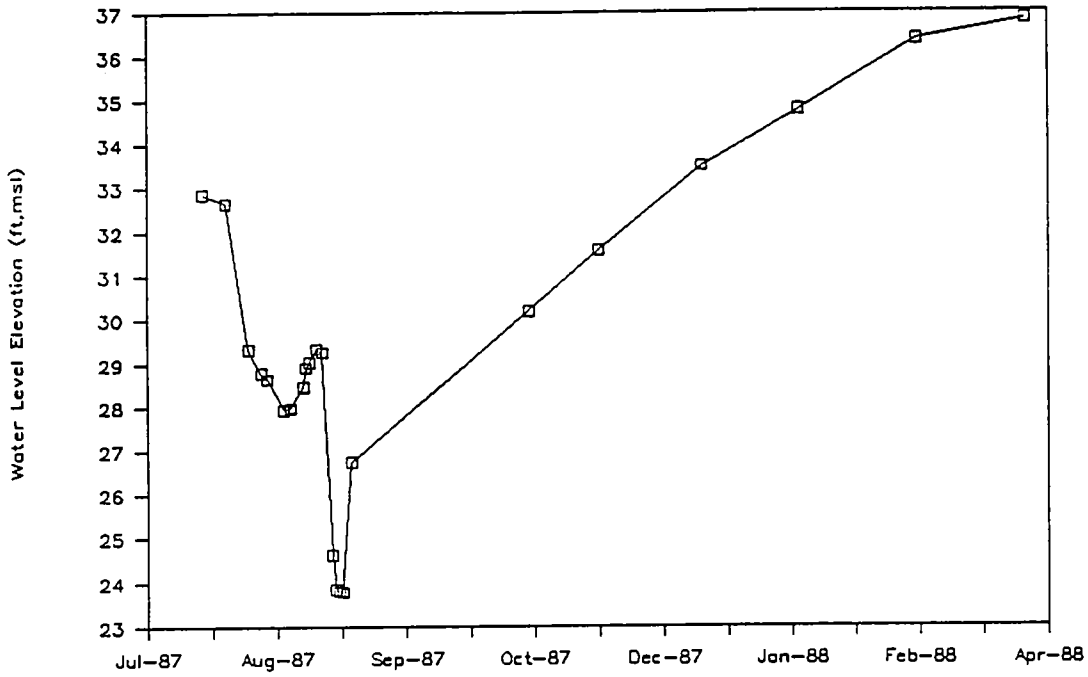

HYDROGRAPH OF WELL MW-14A
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

HYDROGRAPH OF WELL MW-14B



HYDROGRAPH OF WELL MW-15S

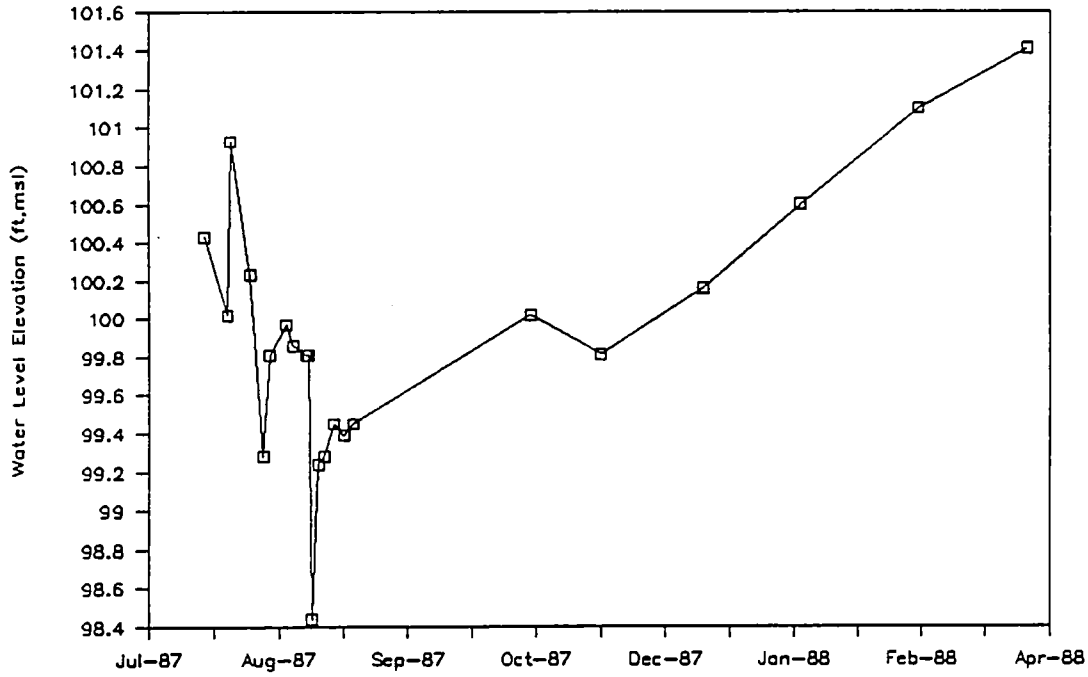
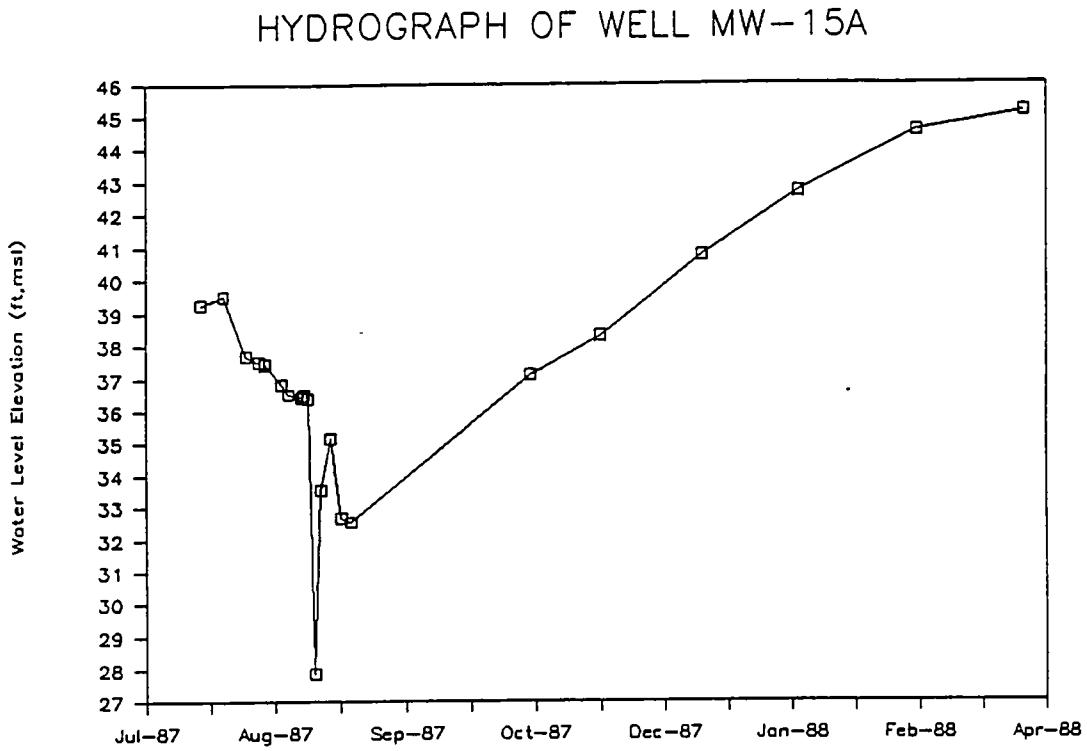


FIGURE 27


HYDROGRAPH OF WELL MW-15A
Water Level Elevation (ft,msl)
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

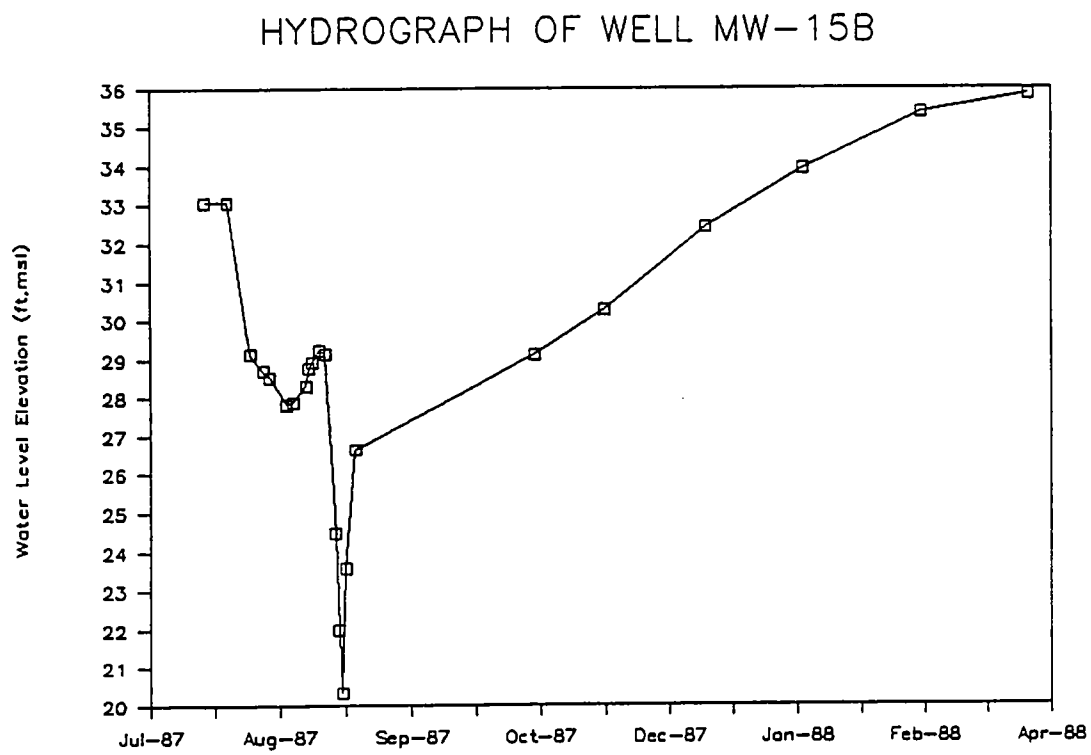
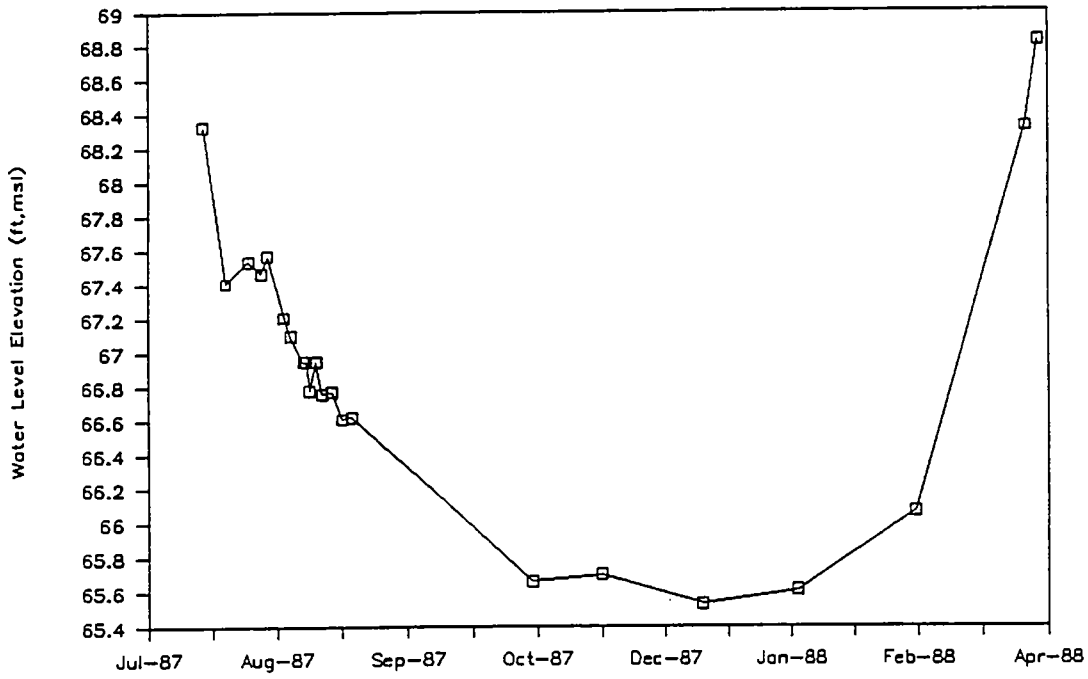

HYDROGRAPH OF WELL MW-15B
Water Level Elevation (ft,msl)
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

HYDROGRAPH OF WELL MW-16A



HYDROGRAPH OF WELL MW-16B

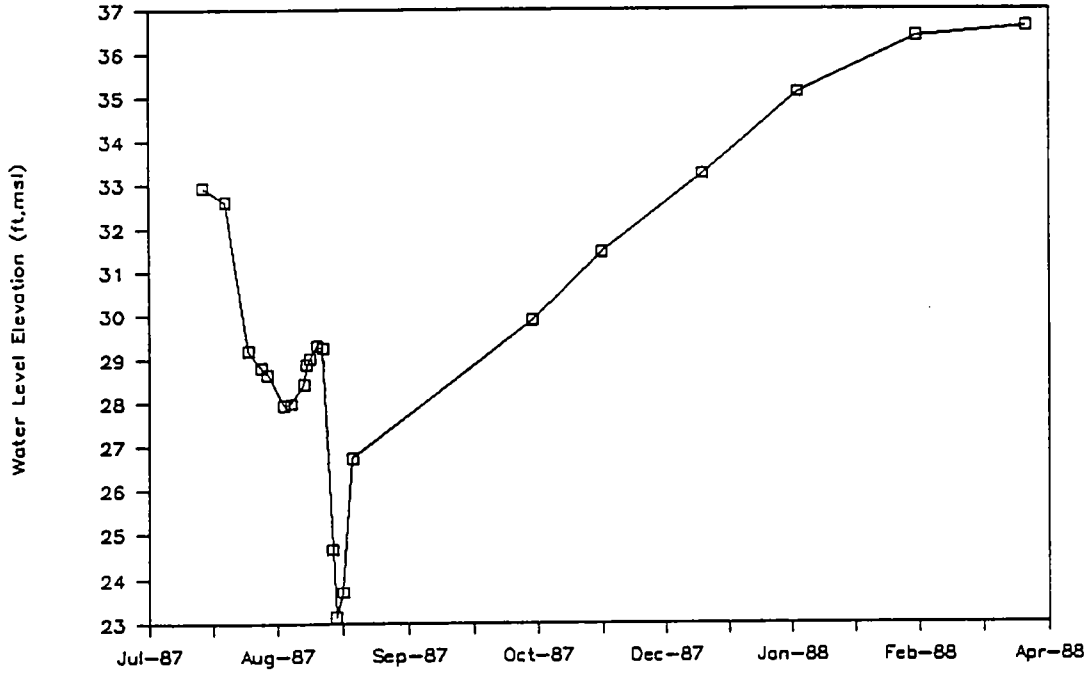
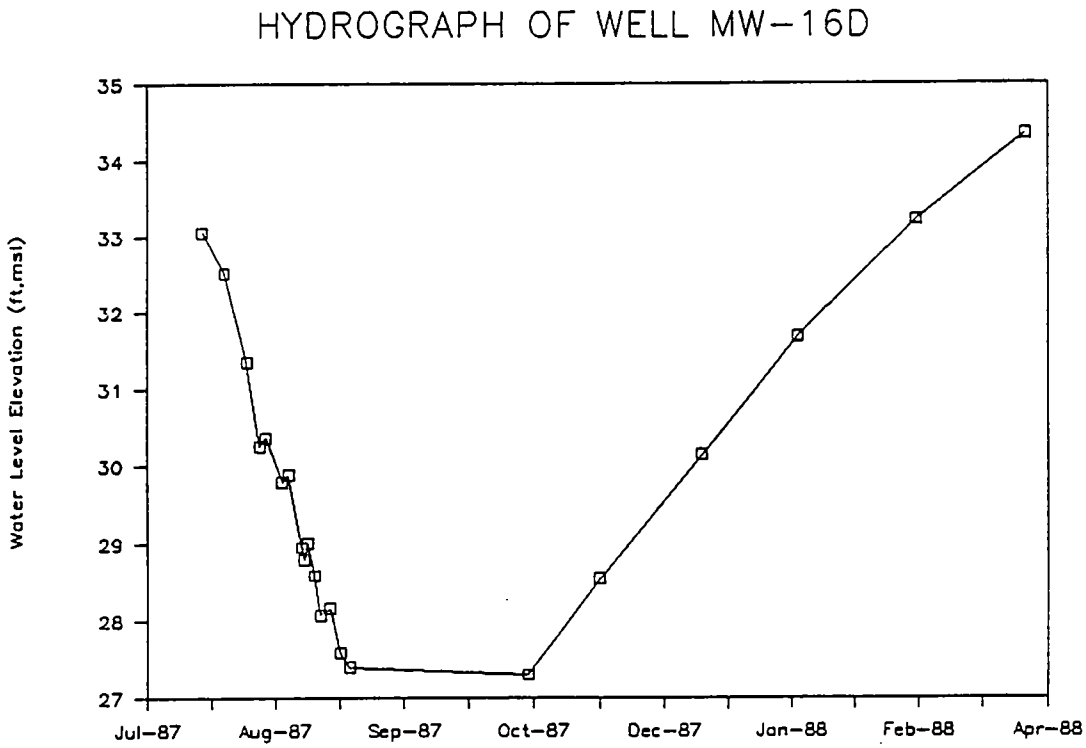


FIGURE 27


HYDROGRAPH OF WELL MW-16D
Water Level Elevation (ft,msl)
35
34
33
32
31
30
29
28
27
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

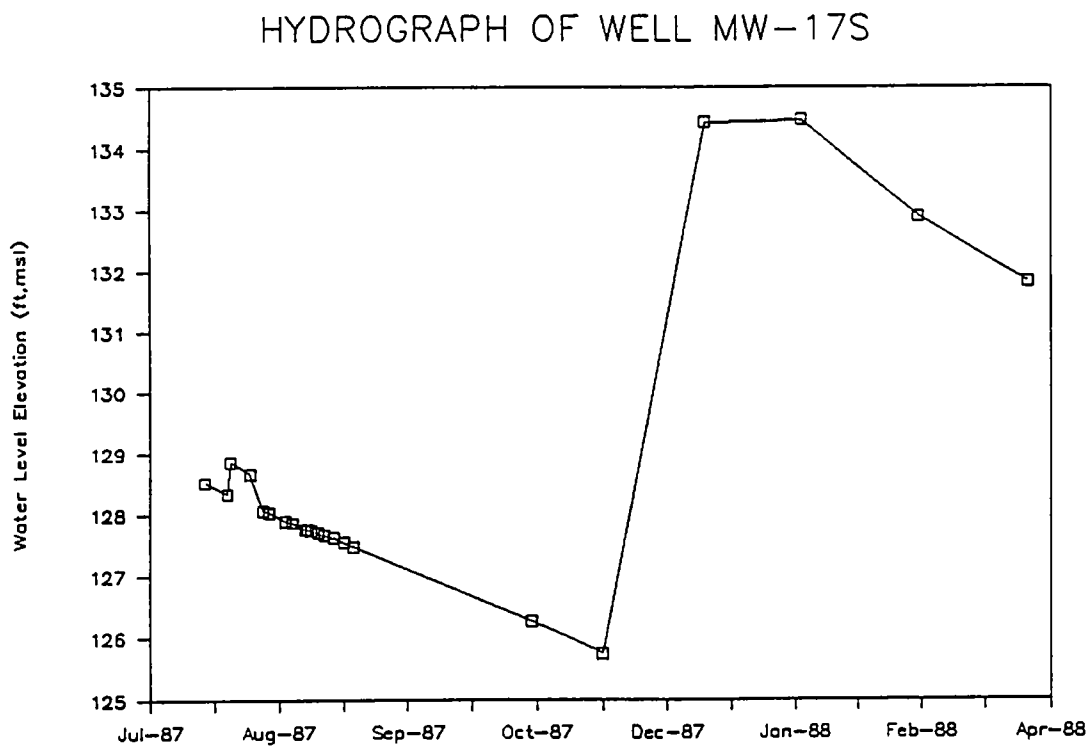
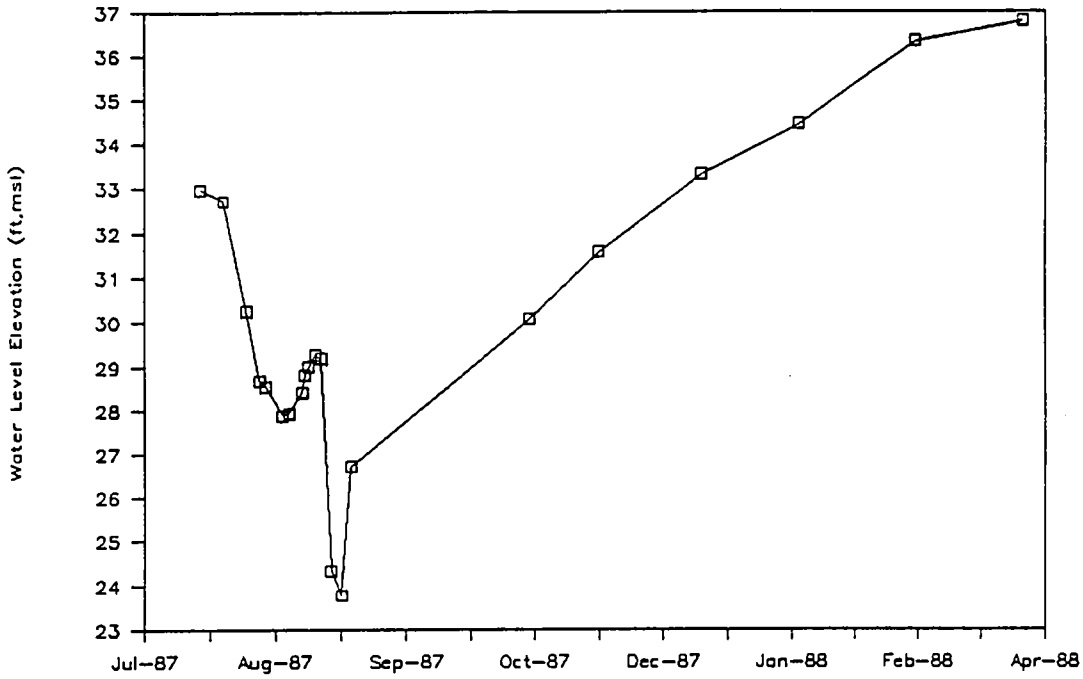

HYDROGRAPH OF WELL MW-17S
Water Level Elevation (ft,msl)
135
134
133
132
131
130
129
128
127
126
125
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

HYDROGRAPH OF WELL MW-18A



HYDROGRAPH OF WELL MW-18B

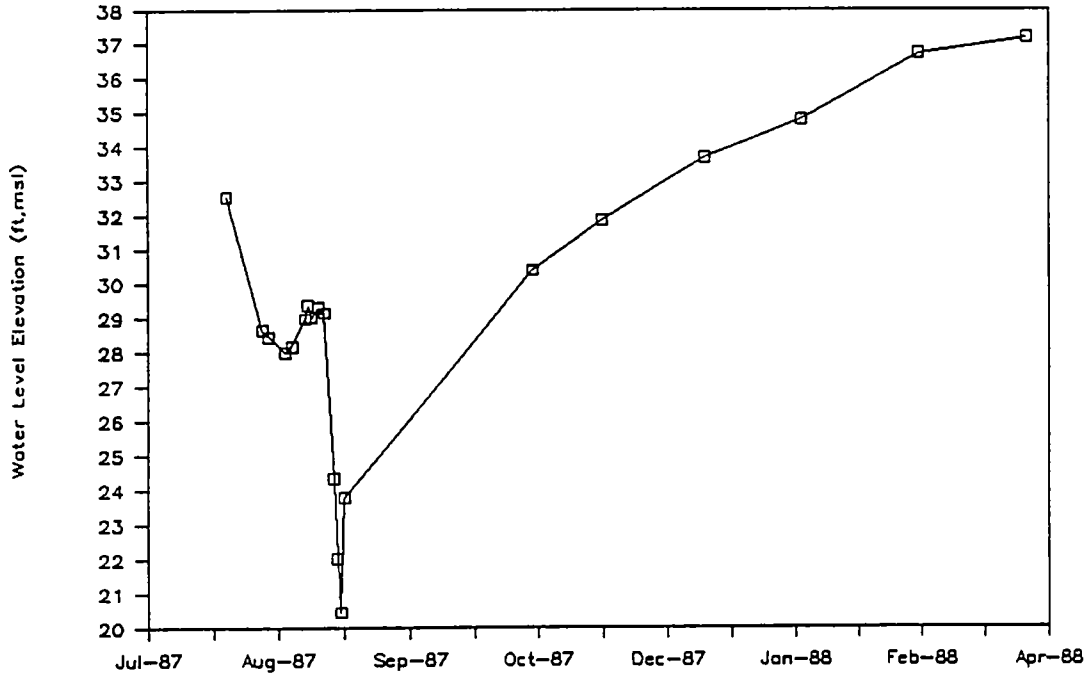
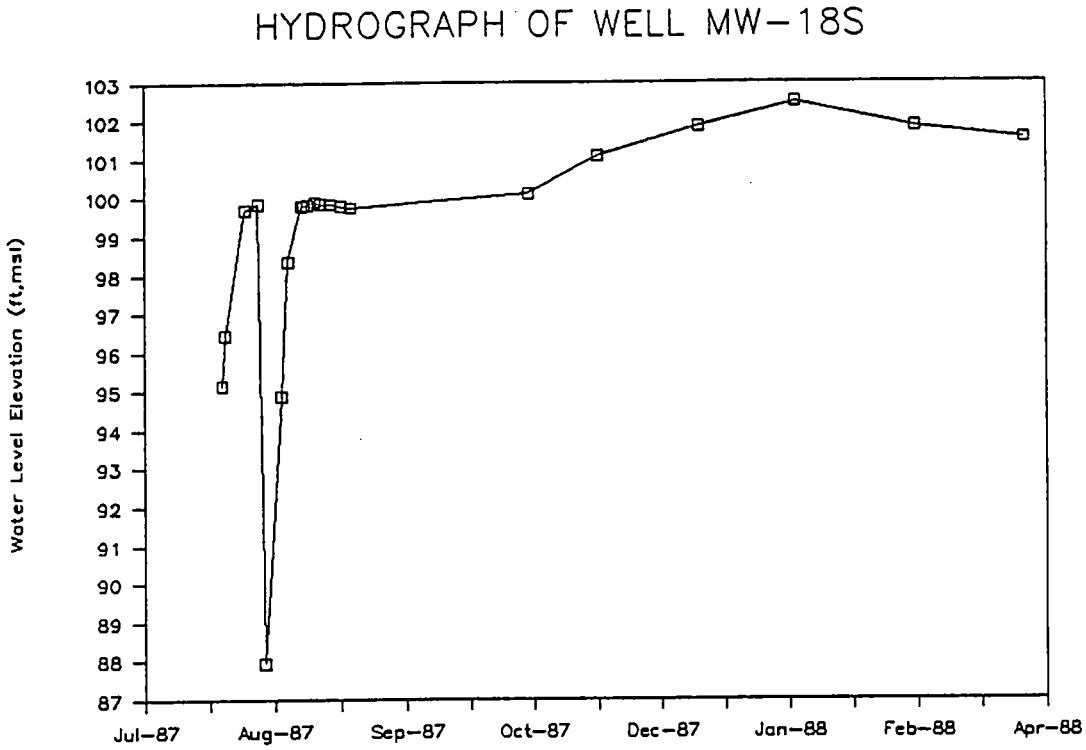


FIGURE 27


HYDROGRAPH OF WELL MW-18S
Water Level Elevation (ft,msl)
103
102
101
100
99
98
97
96
95
94
93
92
91
90
89
88
87
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

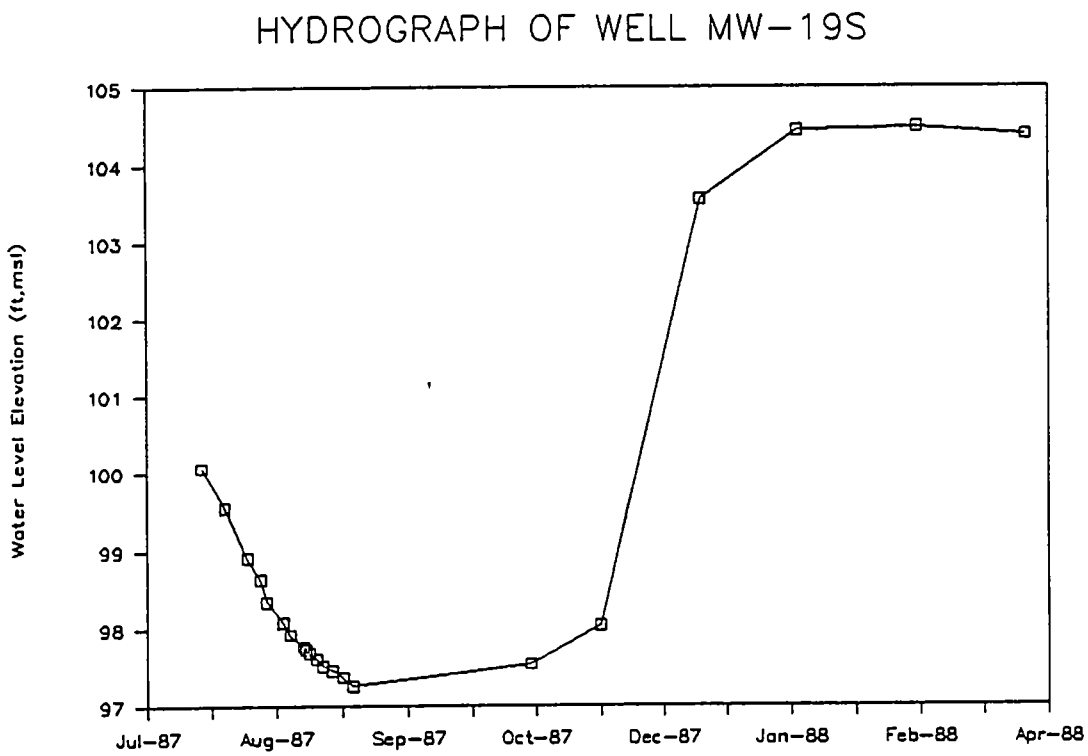
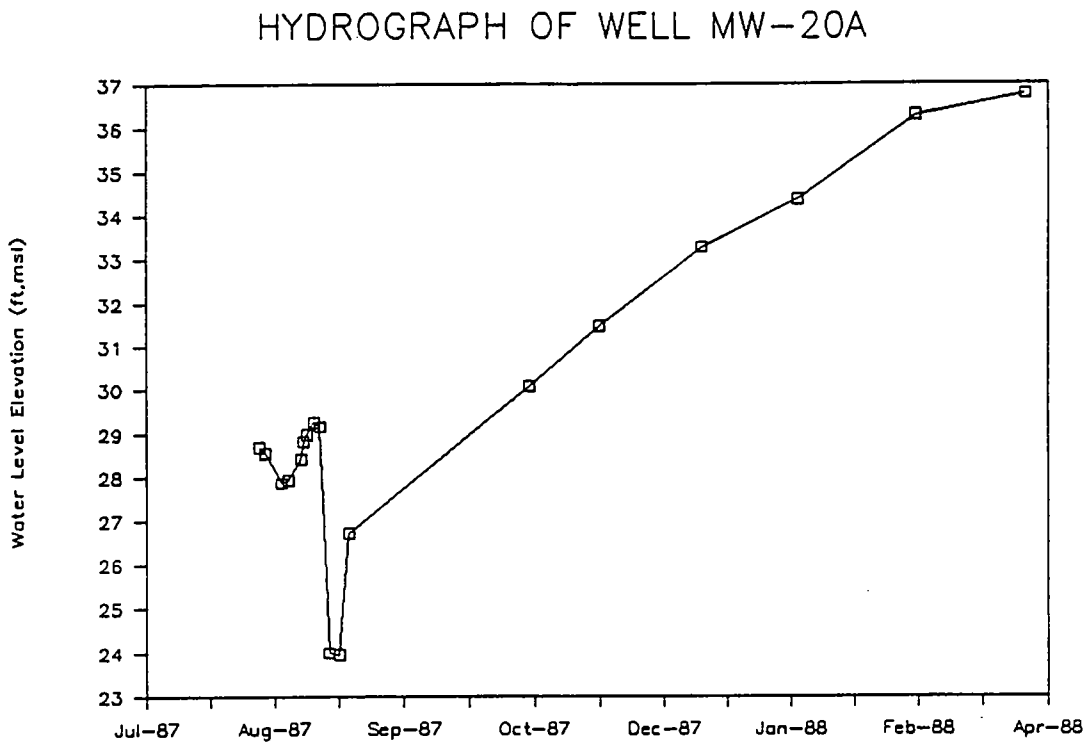

HYDROGRAPH OF WELL MW-19S
Water Level Elevation (ft,msl)
105
104
103
102
101
100
99
98
97
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-20A
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

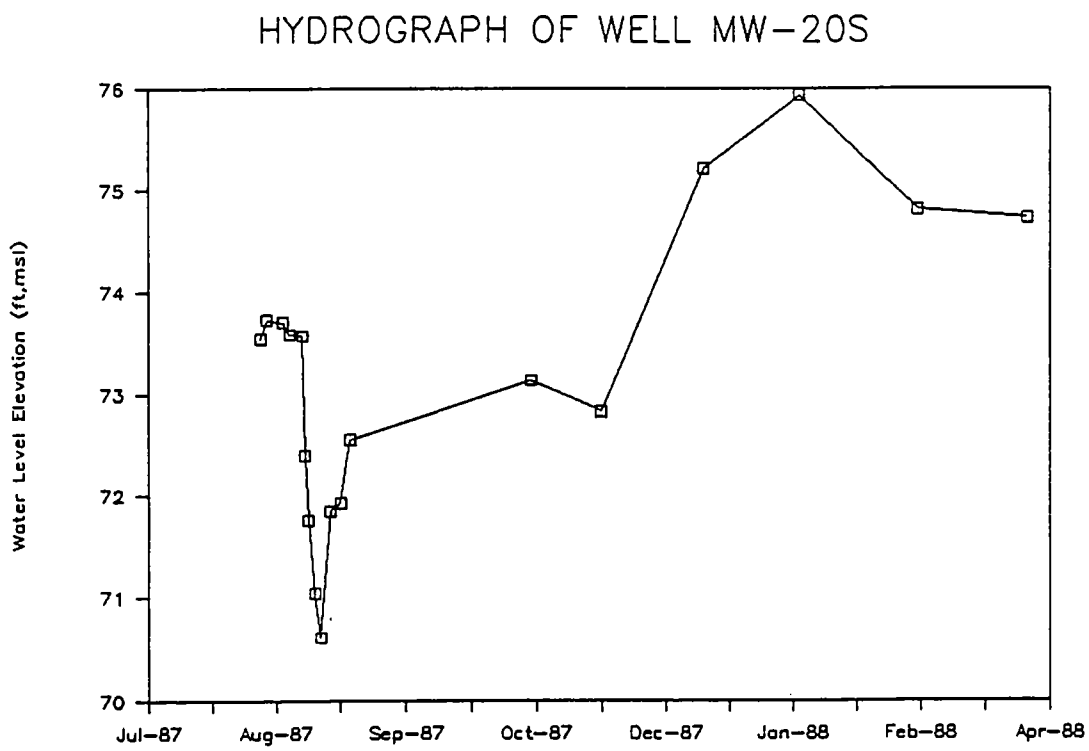
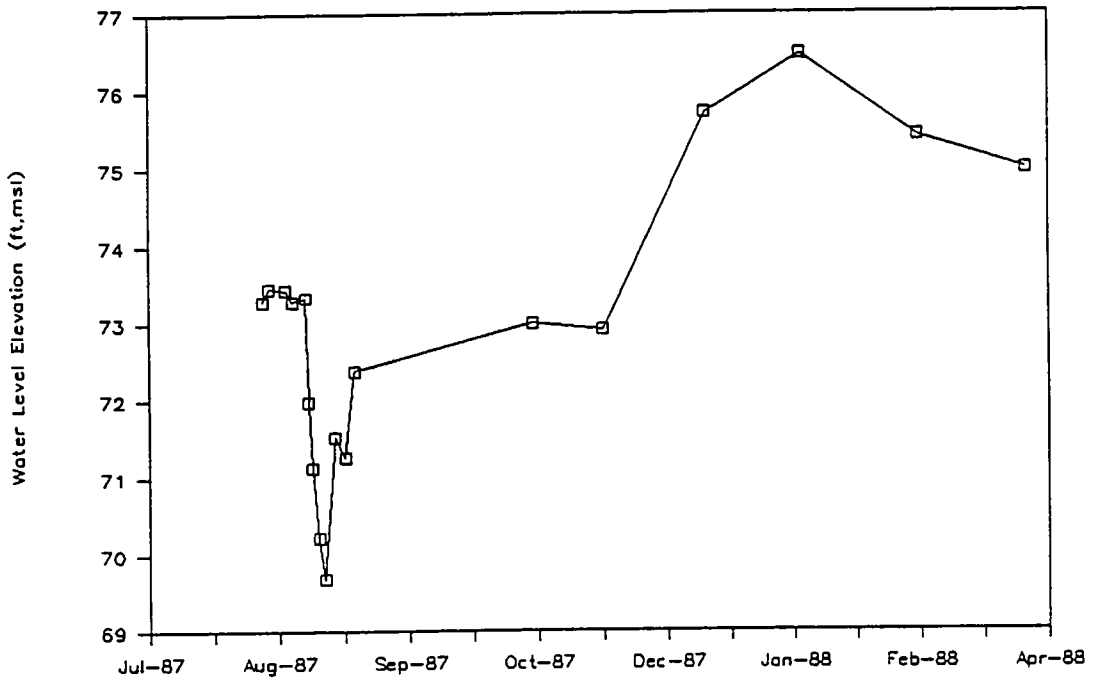

HYDROGRAPH OF WELL MW-20S
Water Level Elevation (ft,msl)
76
75
74
73
72
71
70
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

HYDROGRAPH OF WELL MW-21S



HYDROGRAPH OF WELL MW-22S

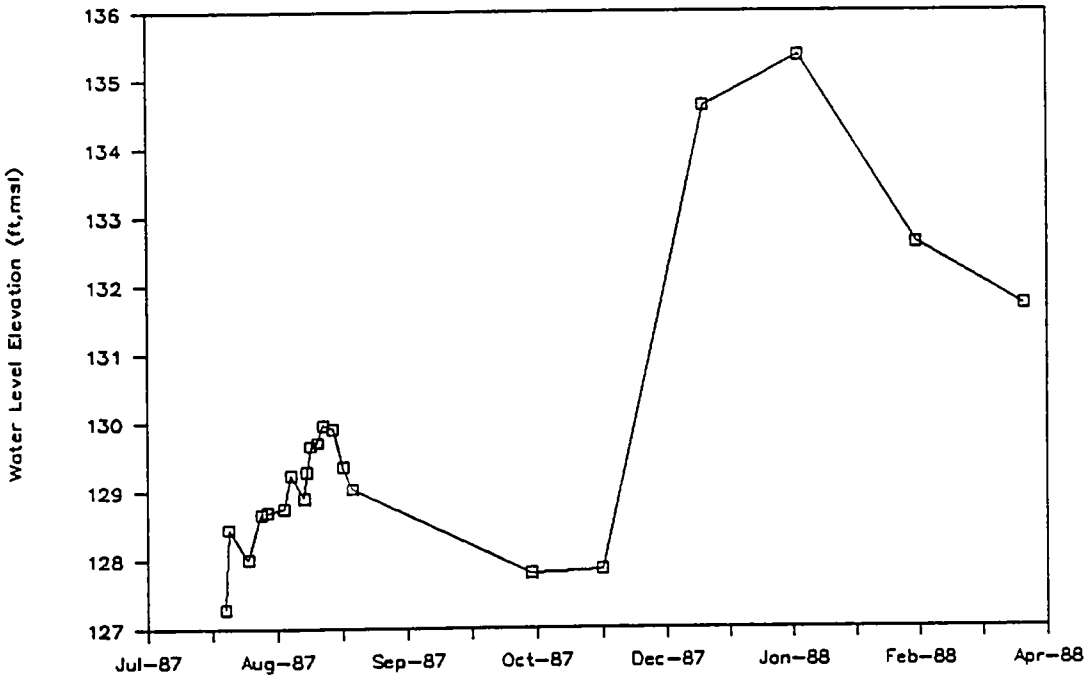
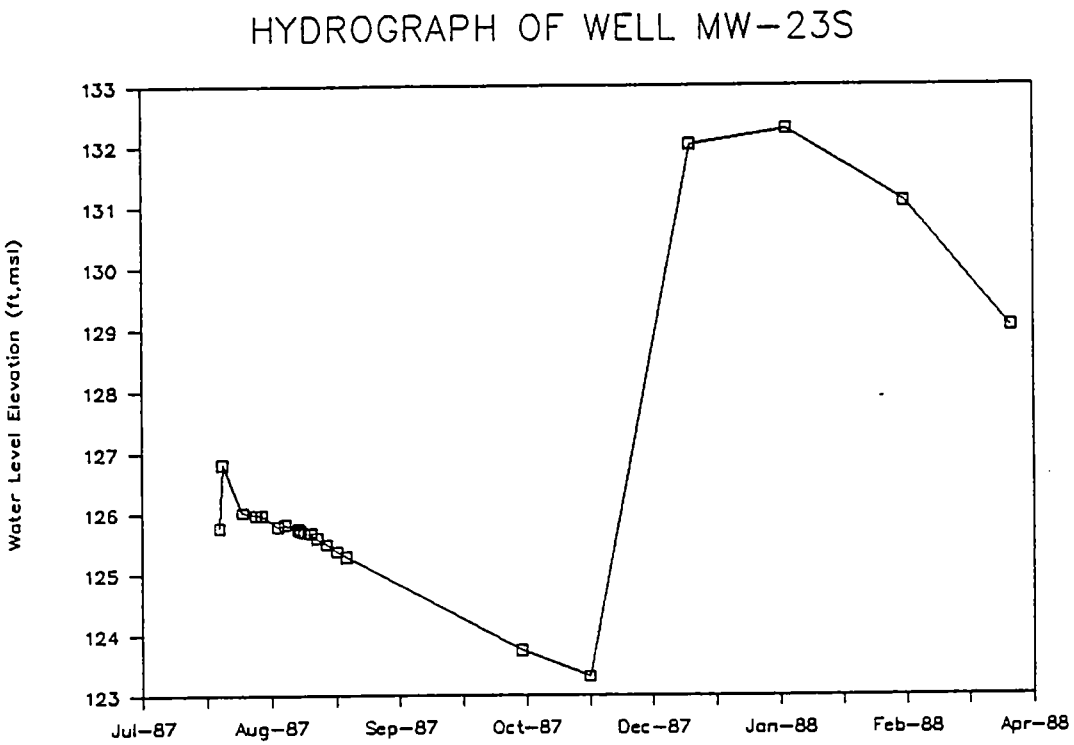


FIGURE 27


HYDROGRAPH OF WELL MW-23S
Water Level Elevation (ft,msl)
133
132
131
130
129
128
127
126
125
124
123
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

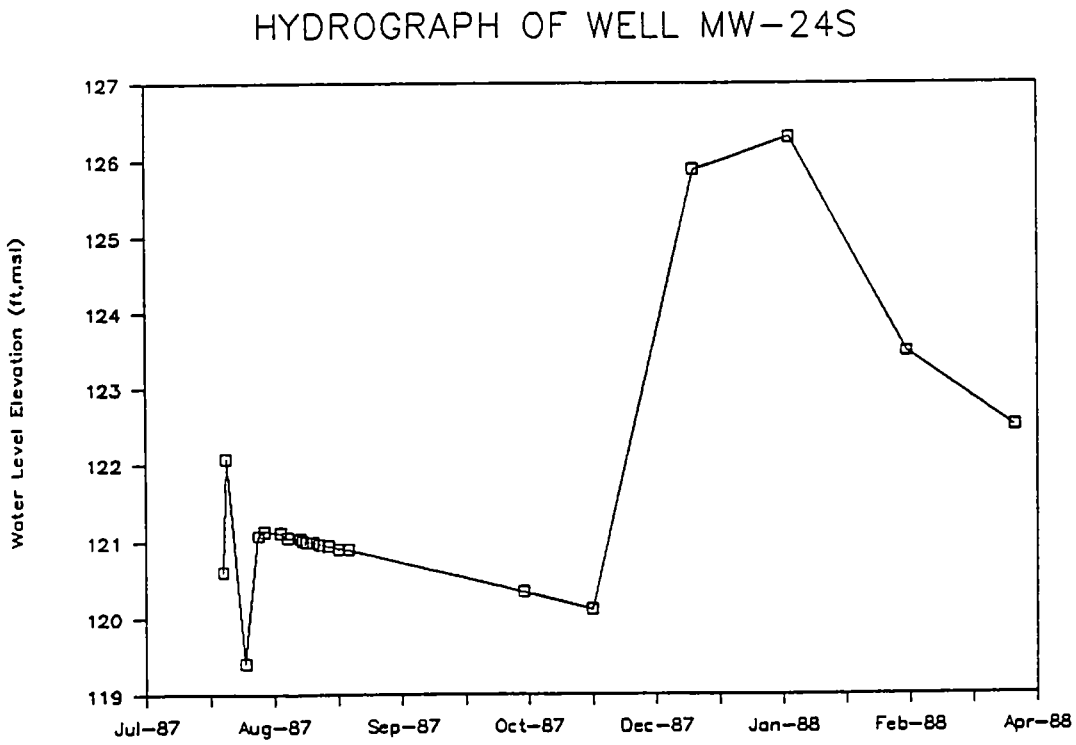
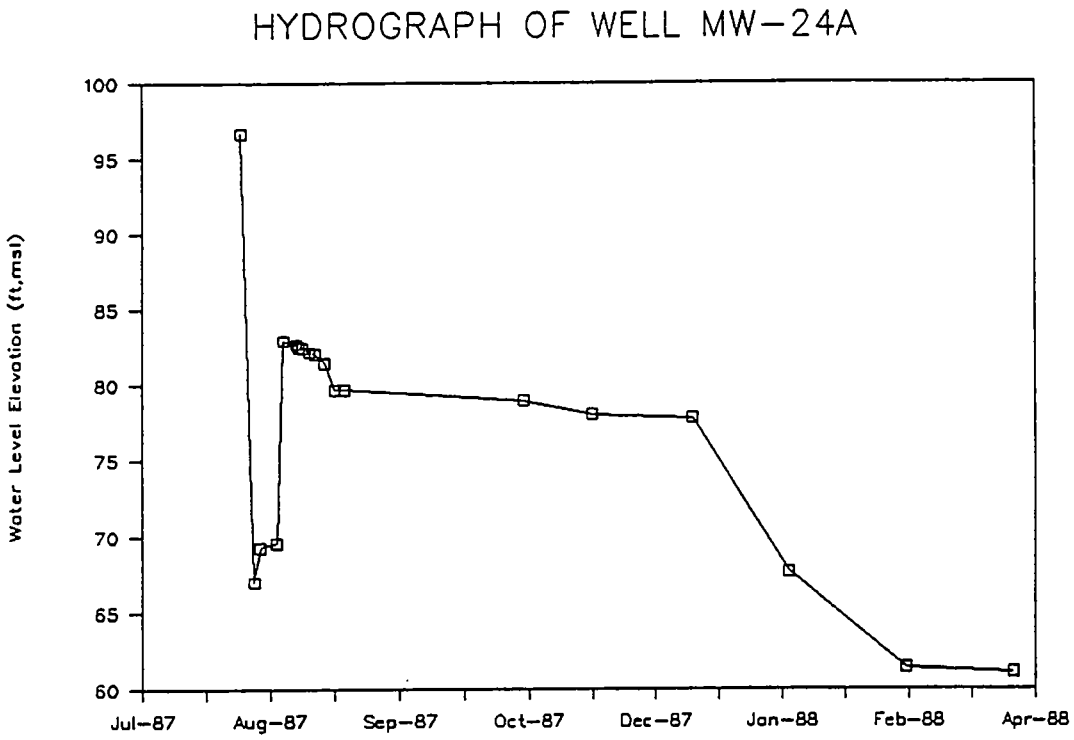

HYDROGRAPH OF WELL MW-24S
Water Level Elevation (ft,msl)
127
126
125
124
123
122
121
120
119
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-24A
Water Level Elevation (ft,msl)
100
95
90
85
80
75
70
65
60
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

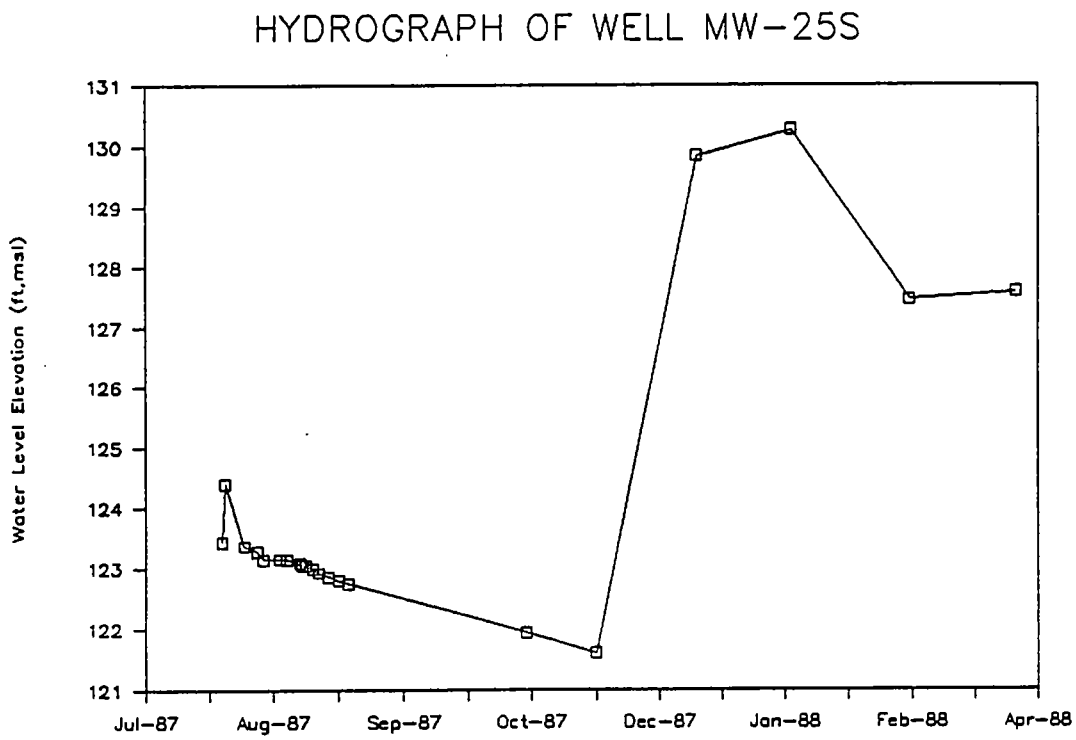
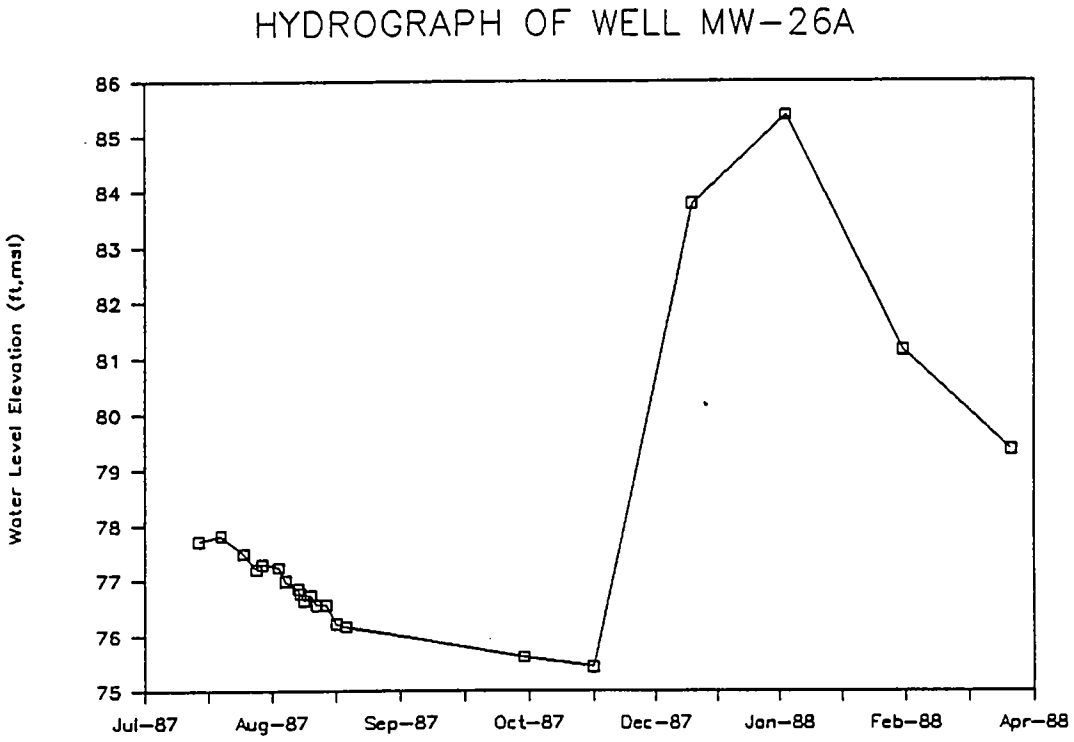

HYDROGRAPH OF WELL MW-25S
Water Level Elevation (ft,msl)
131
130
129
128
127
126
125
124
123
122
121
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-26A
Water Level Elevation (ft,msl)
86
85
84
83
82
81
80
79
78
77
76
75
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

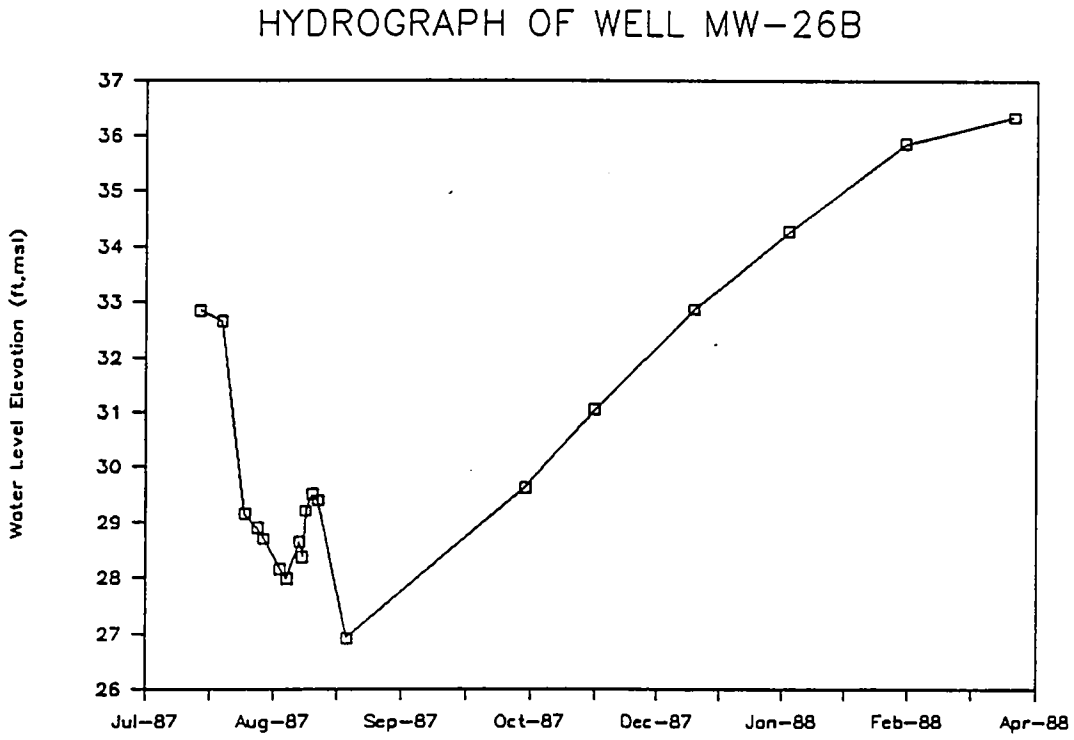
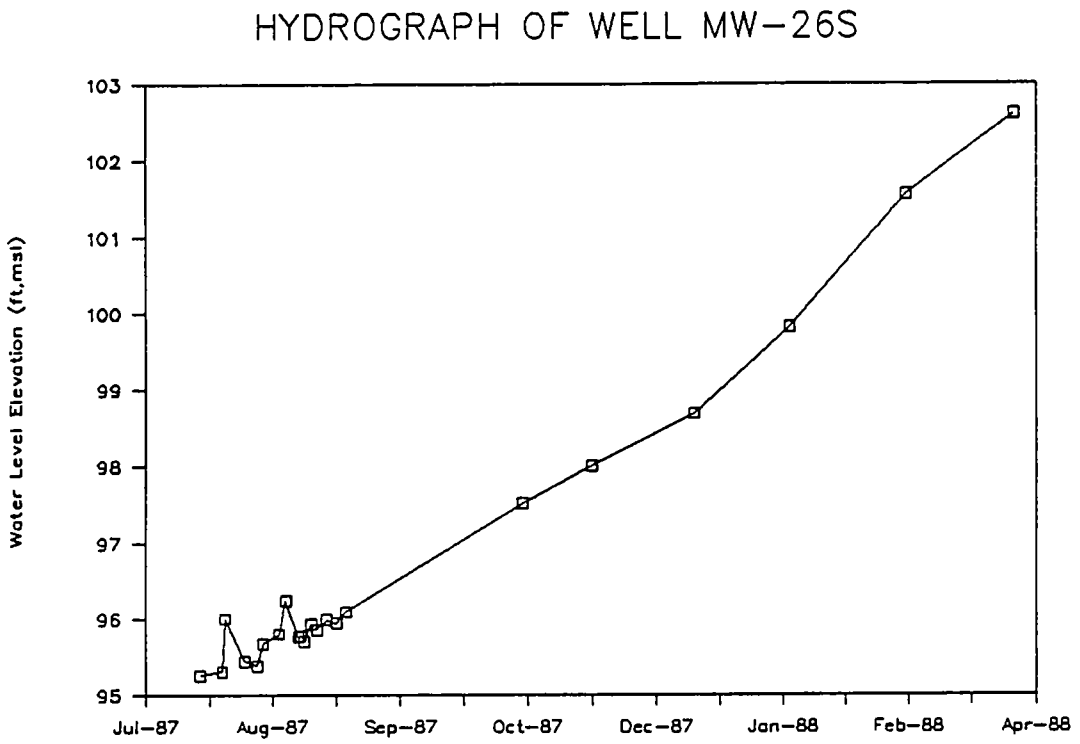

HYDROGRAPH OF WELL MW-26B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
28
27
26
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-26S
Water Level Elevation (ft,msl)
103
102
101
100
99
98
97
96
95
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

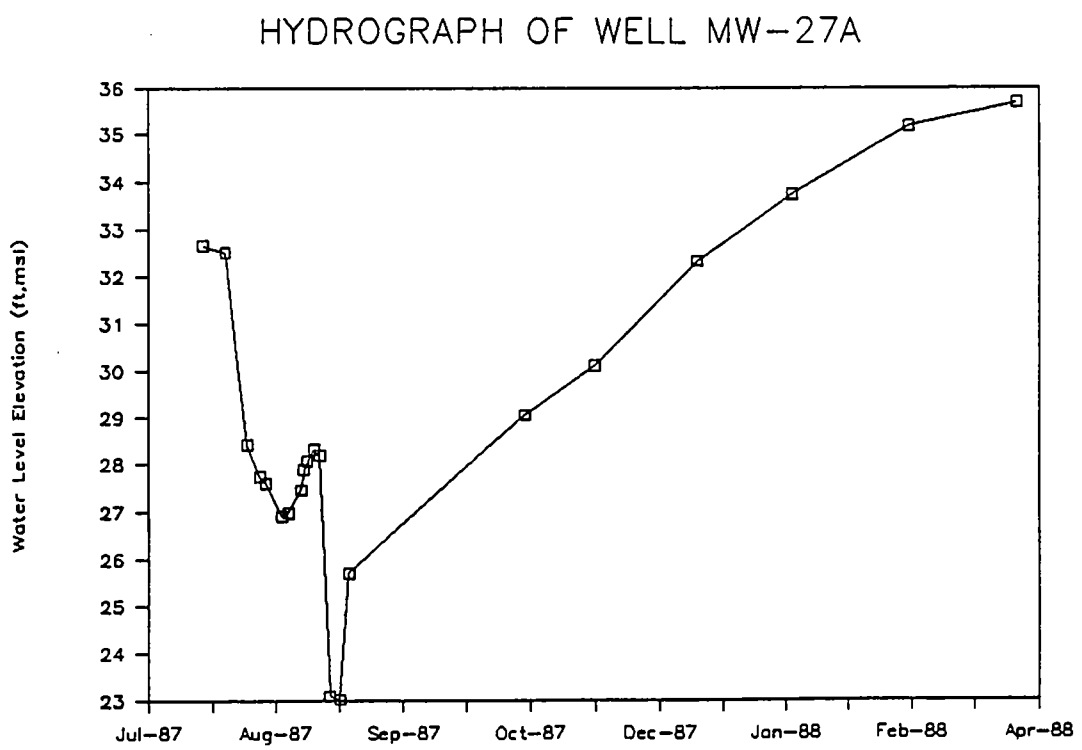
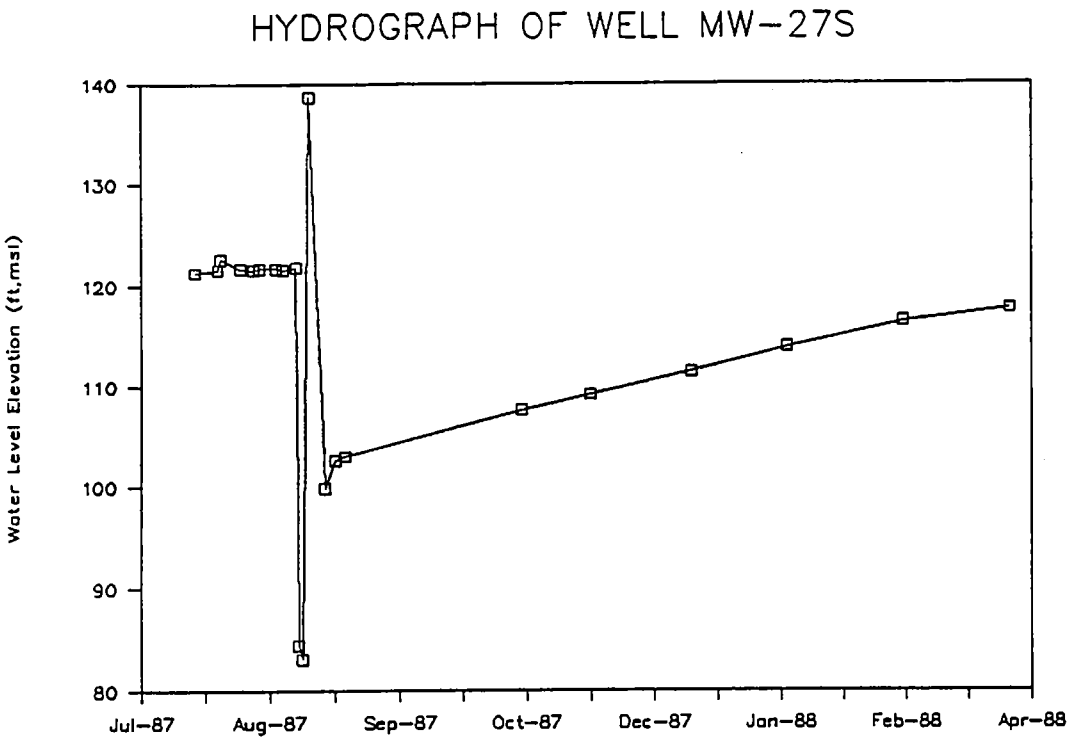

HYDROGRAPH OF WELL MW-27A
Water Level Elevation (ft,msl)
36
35
34
33
32
31
30
29
28
27
26
25
24
23
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-27S
Water Level Elevation (ft,msl)
140
130
120
110
100
90
80
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

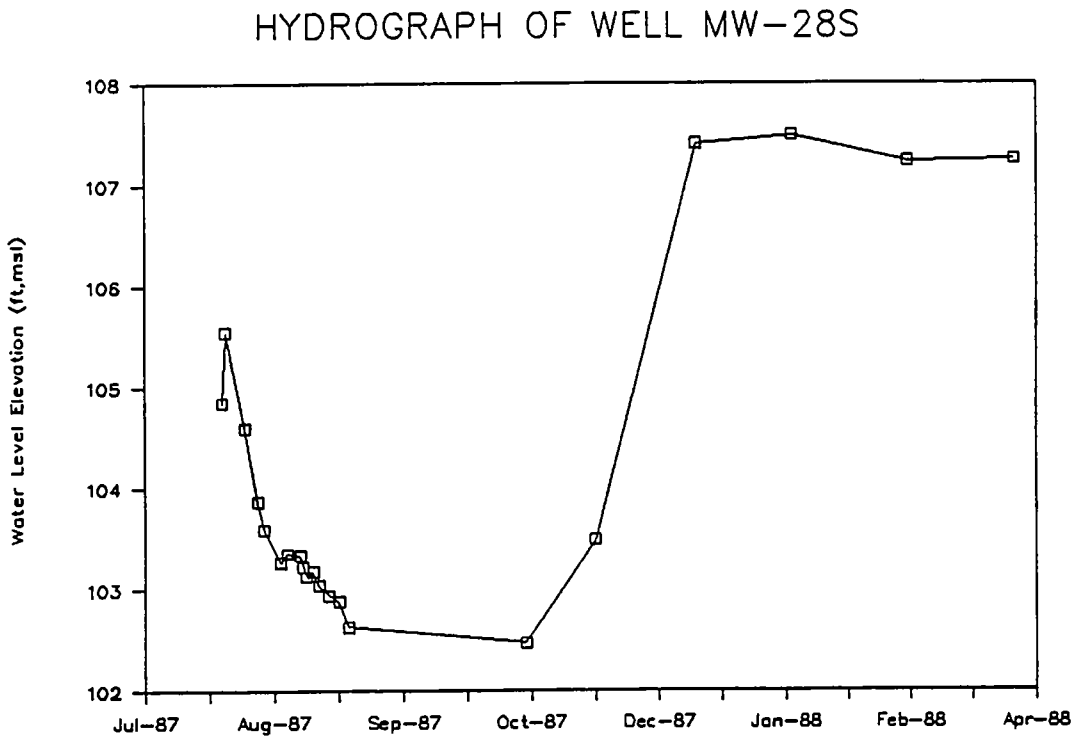
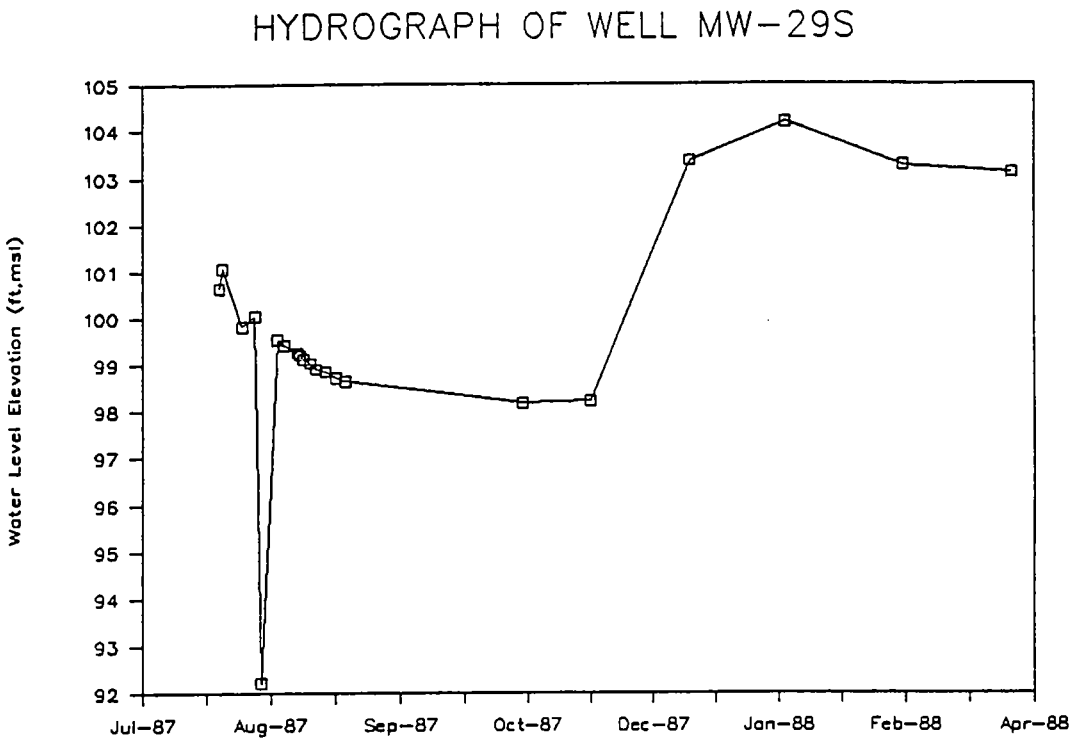

HYDROGRAPH OF WELL MW-28S
Water Level Elevation (ft,msl)
108
107
106
105
104
103
102
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-29S
Water Level Elevation (ft,msl)
105
104
103
102
101
100
99
98
97
96
95
94
93
92
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

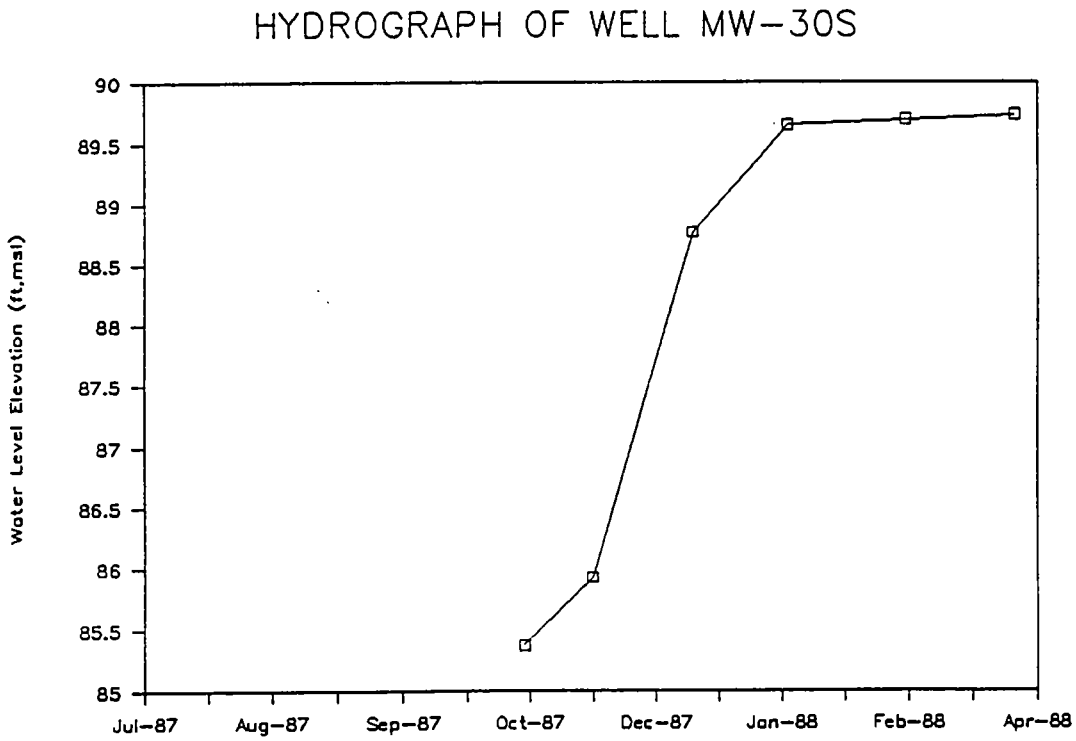
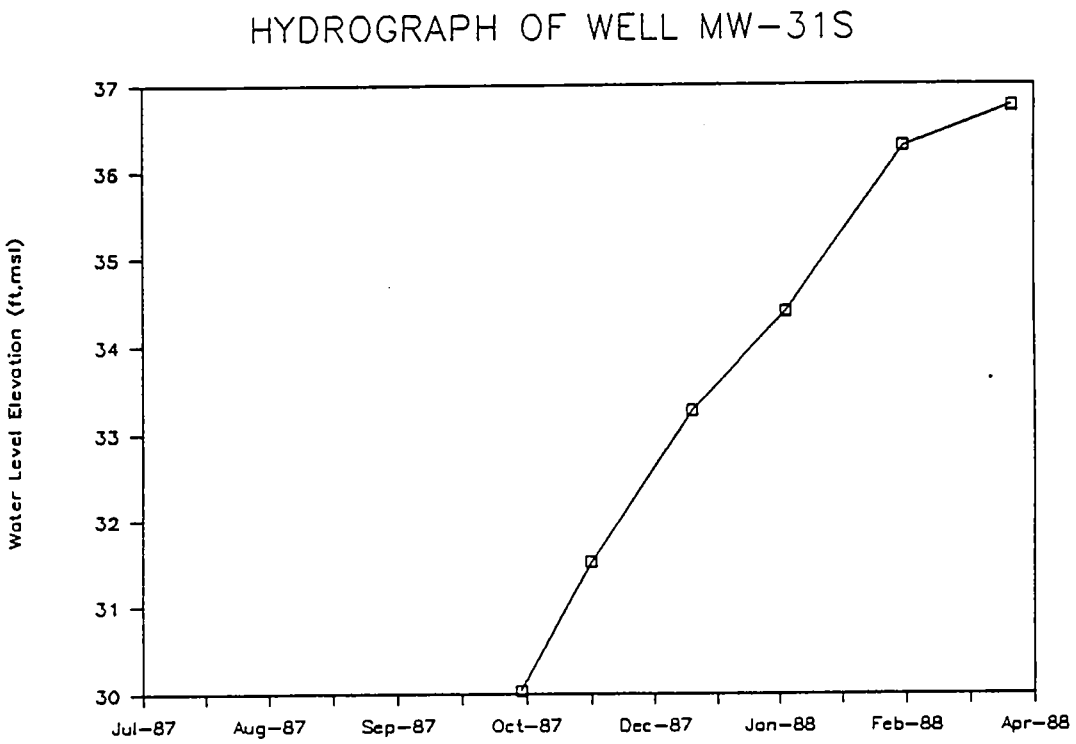

HYDROGRAPH OF WELL MW-30S
Water Level Elevation (ft,msl)
90
89.5
89
88.5
88
87.5
87
86.5
86
85.5
85
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-31S
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

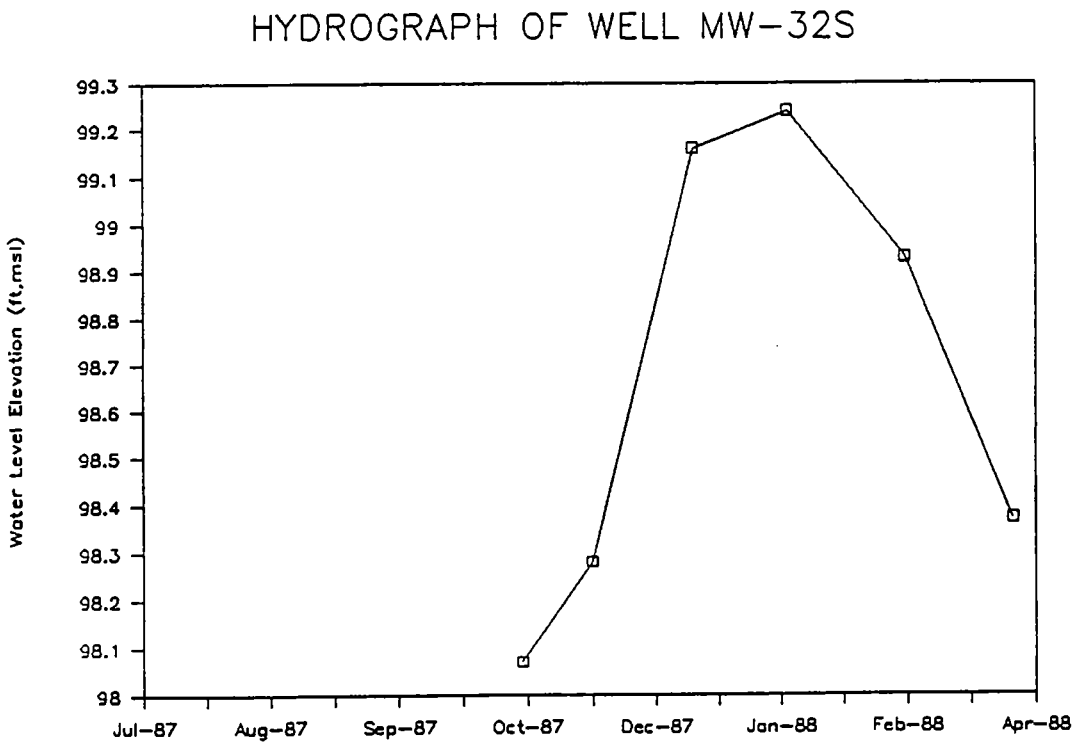
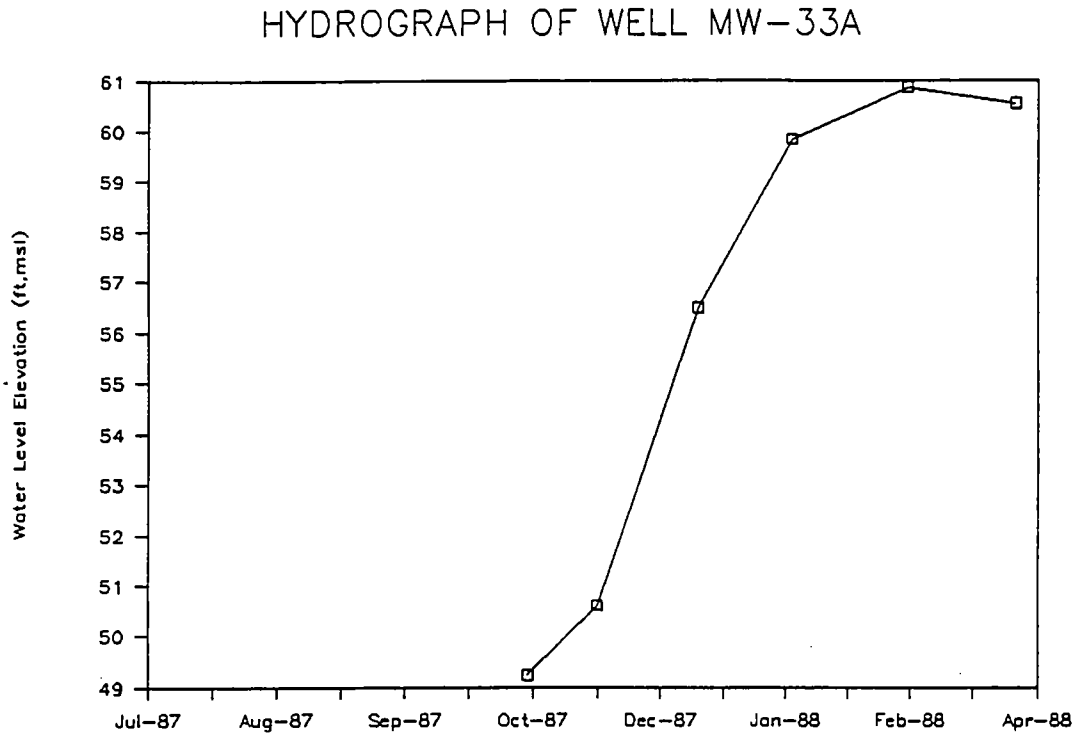

HYDROGRAPH OF WELL MW-32S
Water Level Elevation (ft,msl)
99.3
99.2
99.1
99
98.9
98.8
98.7
98.6
98.5
98.4
98.3
98.2
98.1
98
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-33A
Water Level Elevation (ft,msl)
61
60
59
58
57
56
55
54
53
52
51
50
49
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

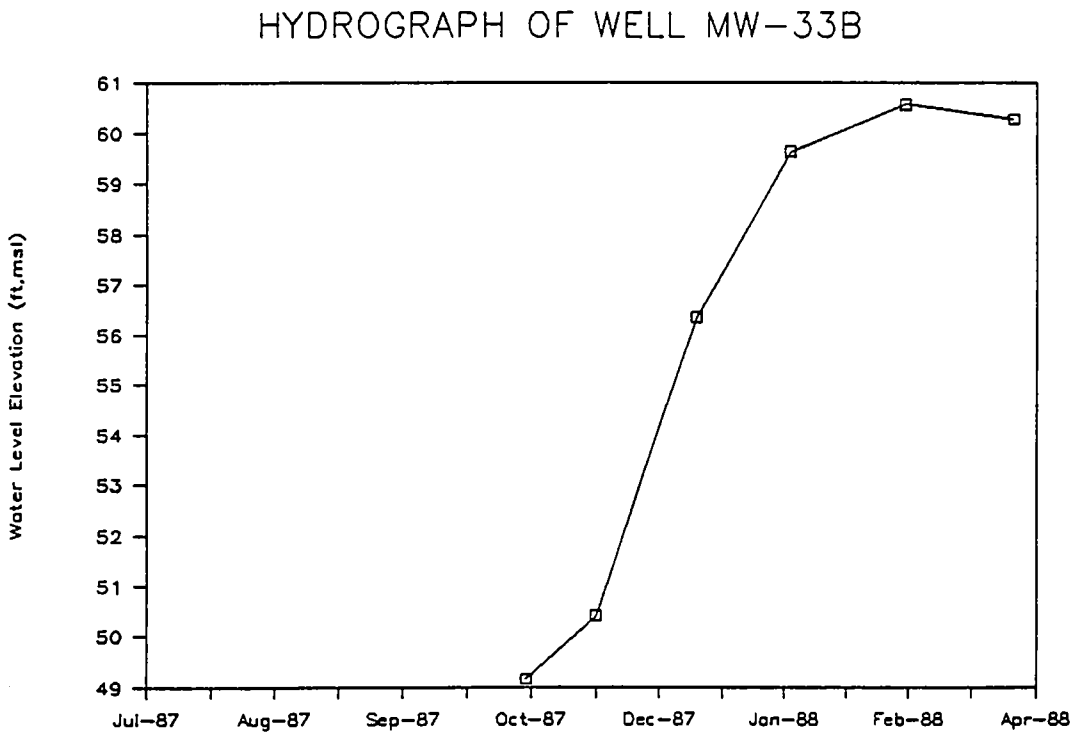
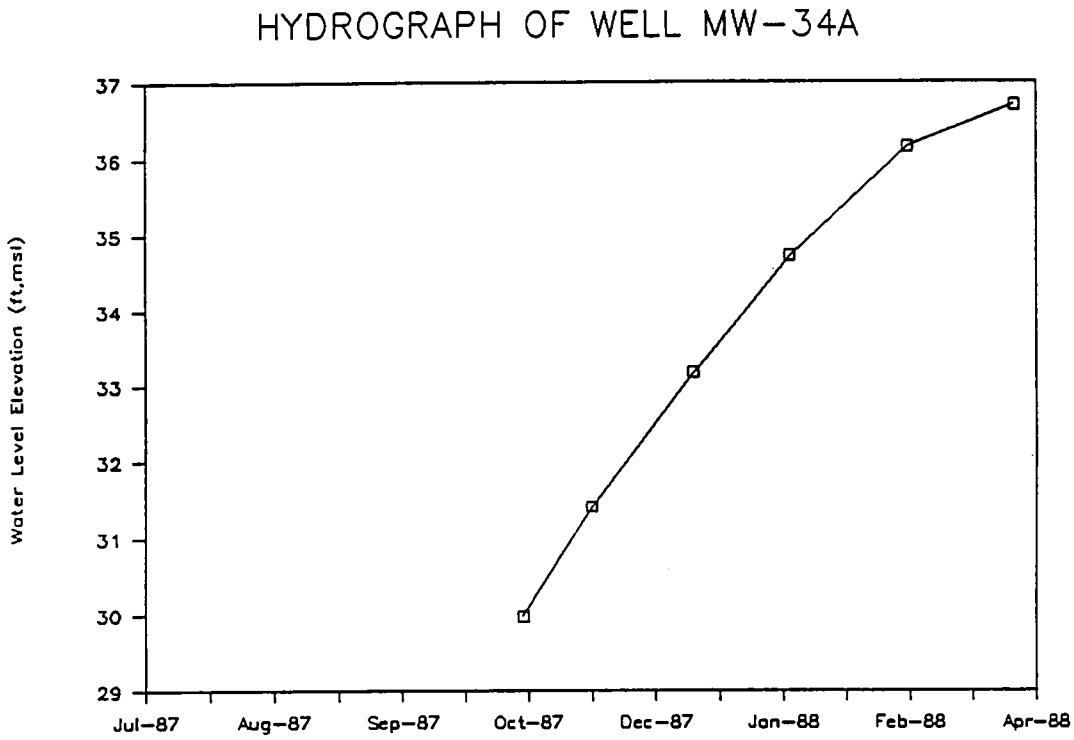

HYDROGRAPH OF WELL MW-33B
Water Level Elevation (ft,msl)
61
60
59
58
57
56
55
54
53
52
51
50
49
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27


HYDROGRAPH OF WELL MW-34A
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

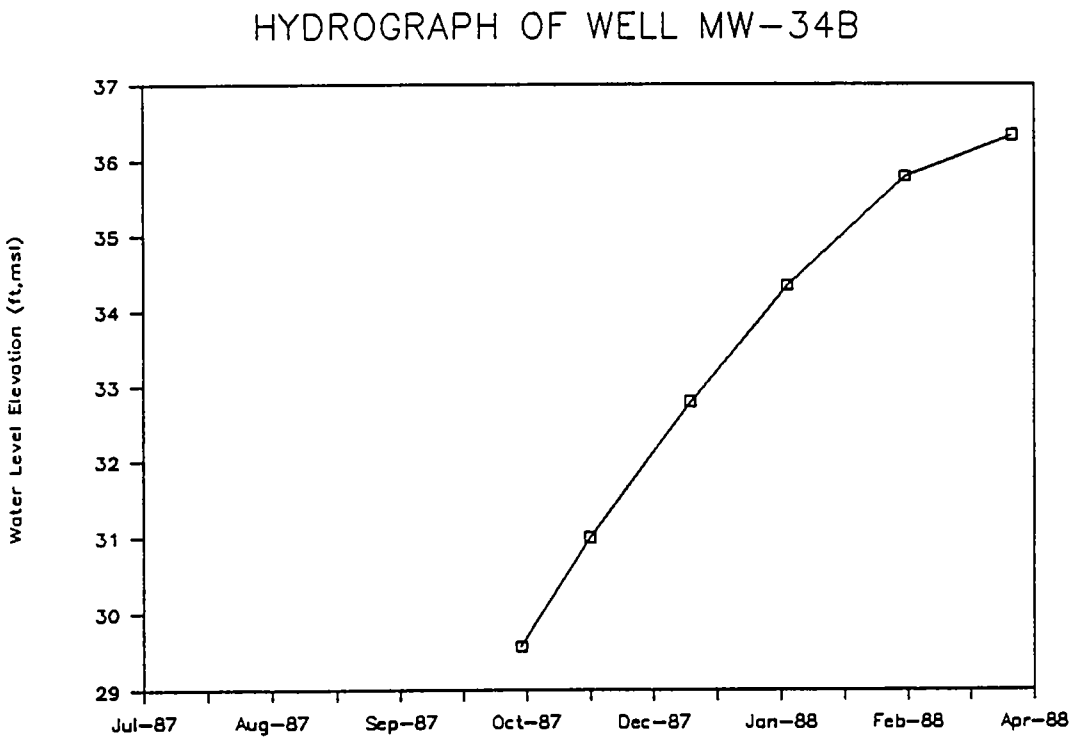

HYDROGRAPH OF WELL MW-34B
Water Level Elevation (ft,msl)
37
36
35
34
33
32
31
30
29
Jul-87
Aug-87
Sep-87
Oct-87
Dec-87
Jan-88
Feb-88
Apr-88

FIGURE 27

WELL ID	TOPC ELEVATION	19-Jul-87	26-Jul-87	2-Aug-87	6-Aug-87	8-Aug-87	13-Aug-87	15-Aug-87	19-Aug-87
MWR-1A	146.62	--	32.52	--	--	--	--	28.02	28.23
MWR-1B	146.81	32.84	32.59	23.66	29.07	28.89	28.03	28.08	28.50
MW -2S	111.47	--	90.34	88.14	86.26	86.34	86.14	85.86	85.76
MWR-2A	111.90	32.88	--	29.34	28.74	28.60	27.93	27.95	28.40
MWR-2B	112.15	34.01	33.64	30.24	28.88	28.71	28.02	28.06	28.55
MW -3S	138.35	--	128.03	127.99	127.82	127.80	126.93	127.47	126.38
MWR-3A	138.50	--	32.47	--	28.60	28.68	27.88	27.97	28.44
MWR-3B	137.65	--	32.64	29.48	28.77	28.62	27.94	28.05	28.51
MWR-4S	140.55	--	123.13	122.09	122.35	122.37	122.27	122.17	122.18
MWR-4A	140.21	--	32.55	29.49	28.83	28.67	27.99	28.13	28.57
MW -4B	140.32	--	32.50	29.34	28.76	28.57	27.90	28.02	28.46
MW -5S	141.56	--	131.06	131.08	131.14	131.23	--	131.29	131.34
MW -5A	140.34	72.52	74.96	87.09	84.11	85.14	--	86.46	86.88
MW -6AA	130.58	38.64	38.60	36.35	36.12	36.05	35.51	35.15	35.05
MWR-6B	132.34	31.96	32.69	29.27	28.79	28.62	27.91	27.97	29.41
MWR-7A	129.38	32.84	32.57	29.25	28.76	28.58	27.93	27.95	28.42
MWR-7B	129.68	--	32.68	29.25	28.86	28.67	28.03	28.04	28.53
MW -8S	140.92	92.18	92.49	92.34	92.39	92.57	92.61	92.42	92.56
MWR-8A	139.02	38.65	38.72	36.43	36.21	36.13	35.61	35.25	35.14
MWR-8B	139.54	32.86	32.62	29.25	28.81	28.62	27.93	27.99	28.43
MW -9S	141.47	120.08	120.95	115.29	113.56	117.76	119.10	118.98	118.96
MWR-9A	141.45	38.43	38.46	36.22	36.02	35.92	35.40	35.02	34.91
MWR-9B	141.73	32.86	32.59	29.20	28.85	28.66	27.99	28.05	28.50
MW -10A	140.59	--	73.79	80.06	81.86	83.60	83.66	83.86	84.25
MW -11D	139.52	33.04	--	36.02	30.68	30.53	29.78	29.75	28.85
MW -12A	141.77	37.36	37.33	34.94	34.66	34.59	33.96	33.58	33.48
MW -12B	142.47	32.72	32.59	29.28	28.69	28.53	27.98	27.98	28.39
MW -13A	140.34	37.46	37.47	35.12	34.86	34.77	34.18	33.78	33.68
MW -13B	140.33	32.81	32.65	29.30	28.74	28.60	27.91	27.94	28.43
MW -14A	138.39	32.89	32.64	29.33	28.82	28.67	27.99	28.01	28.49
MW -14B	138.44	32.86	32.66	29.32	28.78	28.64	27.94	27.97	28.46
MW -15S	142.35	100.43	100.02	100.23	99.28	99.81	99.97	99.86	99.81
MW -15A	141.80	39.25	39.52	37.69	37.50	37.44	36.82	36.51	36.44
MW -15B	141.48	33.07	33.07	29.12	28.69	28.52	27.82	27.87	28.31
MW -16A	144.24	68.33	67.41	67.54	67.47	67.57	67.21	67.10	66.95
MW -16B	144.76	32.94	32.63	29.19	28.79	28.63	27.92	27.97	28.40
MW -16D	144.44	33.06	32.52	31.35	30.26	30.37	29.80	29.89	28.95
MW -17S	139.09	128.51	128.33	128.66	128.06	128.02	127.89	127.86	127.76
MW -18S	111.31	--	95.15	99.68	99.85	87.94	94.87	98.34	99.77
MW -18A	111.61	32.98	32.72	30.27	28.69	28.54	27.88	27.94	28.41
MW -18B	110.62	--	32.56	--	28.65	28.45	27.99	28.17	28.98
MW -19S	108.71	100.07	99.56	98.91	98.64	98.35	98.08	97.92	97.77
MW -20S	110.97	--	--	--	73.55	73.73	73.71	73.59	73.58
MW -20A	110.67	--	--	--	28.68	28.54	27.86	27.92	28.40
MW -21S	106.46	--	--	--	73.29	73.46	73.44	73.29	73.34
MW -22S	141.43	--	127.29	128.01	128.67	128.70	128.76	129.24	128.91
MW -23S	140.94	--	125.76	126.01	125.97	125.96	125.77	125.81	125.74
MW -24S	141.13	--	120.60	119.41	121.07	121.13	121.11	121.05	121.03
MW -24A	140.48	--	--	96.65	67.00	69.26	69.58	82.95	82.71
MW -25S	140.02	--	123.43	123.36	123.28	123.14	123.15	123.14	123.08
MW -26S	132.85	95.26	95.30	95.44	95.38	95.67	95.80	96.24	95.76
MW -26A	133.11	77.71	77.81	77.49	77.21	77.29	77.24	76.99	76.84
MW -26B	132.61	32.85	32.65	29.15	28.90	28.70	28.16	27.99	28.66
MW -27S	138.64	121.33	121.56	121.71	121.59	121.78	121.77	121.61	121.80
MW -27A	137.64	32.66	32.51	28.42	27.75	27.60	26.90	26.98	27.46
MW -27B	138.11	--	--	--	--	--	--	--	--
MW -28S	112.16	--	104.85	104.60	103.87	103.59	103.27	103.36	103.34
MW -29S	114.72	--	100.65	99.82	100.04	92.21	99.54	99.42	99.26
MW -30S	109.25	--	--	--	--	--	--	--	--
MW -31S	101.69	--	--	--	--	--	--	--	--
MW -32S	126.70	--	--	--	--	--	--	--	--
MW -33A	104.42	--	--	--	--	--	--	--	--
MW -33B	104.69	--	--	--	--	--	--	--	--
MW -34A	146.58	--	--	--	--	--	--	--	--
MW -34B	145.39	--	--	--	--	--	--	--	--

NOTE: ALL ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL)
TOPC - TOP OF PROTECTIVE CASING (FT MSL)

WELL ID	TOPC ELEVATION	20-Aug-87	21-Aug-87	23-Aug-87	25-Aug-87	3-Sep-87	28-Oct-87	19-Nov-87	21-Dec-87
MWR-1A	146.62	28.63	28.87	29.30	29.26	--	29.83	30.97	33.20
MWR-1B	146.81	28.97	29.13	29.42	29.35	26.83	29.85	31.02	33.27
MW -2S	111.47	85.67	85.57	85.59	85.47	84.85	83.57	83.26	94.30
MWR-2A	111.90	28.85	29.00	29.25	29.25	26.72	30.15	31.57	33.36
MWR-2B	112.15	28.94	29.10	29.42	29.39	26.84	30.19	31.57	33.38
MW -3S	138.35	127.31	126.47	127.25	127.14	126.86	125.14	124.68	132.16
MWR-3A	138.50	28.86	29.03	29.30	29.09	--	29.90	31.03	33.20
MWR-3B	137.65	28.93	29.11	29.42	29.35	26.87	29.92	31.13	33.21
MWR-4S	140.55	122.12	122.14	122.16	122.14	122.05	121.01	120.65	132.17
MWR-4A	140.21	28.99	29.14	29.34	29.78	--	30.29	31.42	33.56
MW -4B	140.32	28.88	29.04	29.30	--	26.76	29.94	31.07	33.22
MW -5S	141.56	131.40	131.42	131.47	--	131.49	131.35	131.43	135.89
MW -5A	140.34	86.94	86.88	86.92	86.71	--	87.05	87.26	90.84
MW -6AA	130.58	35.11	35.08	26.52	32.20	30.94	35.68	36.93	38.83
MWR-6B	132.34	28.87	29.02	29.32	29.27	26.75	30.19	31.57	33.34
MWR-7A	129.38	28.86	29.00	29.31	29.25	27.09	30.21	31.57	33.50
MWR-7B	129.68	28.96	29.06	29.39	29.29	26.40	30.14	31.49	33.49
MW -8S	140.92	92.50	92.44	92.62	92.52	92.49	92.59	92.42	92.46
MWR-8A	139.02	--	34.80	26.15	31.88	30.67	35.08	36.12	38.48
MWR-8B	139.54	--	28.63	28.98	28.87	26.39	29.62	30.66	32.98
MW -9S	141.47	118.96	118.88	118.78	118.57	118.68	112.12	119.18	120.51
MWR-9A	141.45	34.95	34.92	26.78	32.07	30.77	35.20	36.24	38.55
MWR-9B	141.73	28.97	29.11	29.42	29.29	26.82	29.88	30.98	33.27
MW -10A	140.59	84.21	84.05	84.02	83.73	--	84.21	84.40	88.07
MW -11D	139.52	28.85	28.94	28.68	28.03	--	27.37	28.27	30.17
MW -12A	141.77	33.58	33.59	31.11	31.26	29.31	33.89	35.14	36.98
MW -12B	142.47	28.83	28.94	29.26	29.16	26.67	30.18	31.51	33.41
MW -13A	140.34	33.77	33.77	30.89	31.37	29.47	34.09	35.34	37.17
MW -13B	140.33	28.87	28.99	29.30	29.21	26.72	30.27	31.50	33.45
MW -14A	138.39	28.94	28.60	28.90	29.29	26.78	30.22	31.56	33.49
MW -14B	138.44	28.91	29.03	29.34	29.26	26.74	30.19	31.59	33.50
MW -15S	142.35	99.81	98.44	99.24	99.28	99.45	100.02	99.81	100.16
MW -15A	141.80	36.49	36.39	27.85	33.53	32.54	37.11	38.30	40.76
MW -15B	141.48	28.77	28.93	29.23	29.14	26.63	29.94	31.10	33.25
MW -16A	144.24	66.95	66.78	66.95	66.76	66.62	65.66	65.70	65.53
MW -16B	144.76	28.86	29.01	29.31	29.24	26.73	29.88	31.45	33.26
MW -16D	144.44	28.79	29.00	28.58	28.07	27.39	27.29	28.54	30.15
MW -17S	139.09	127.75	127.73	127.69	127.65	127.47	126.26	125.74	134.42
MW -18S	111.31	99.80	99.82	99.89	99.84	99.74	100.10	101.08	101.85
MW -18A	111.61	28.82	29.01	29.27	29.20	26.72	30.07	31.57	33.32
MW -18B	110.62	29.37	29.02	29.29	29.15	--	29.95	31.41	33.24
MW -19S	108.71	97.73	97.68	97.61	97.52	97.26	97.54	98.04	103.56
MW -20S	110.97	72.40	71.76	71.04	70.61	72.56	73.14	72.84	75.22
MW -20A	110.67	28.82	28.98	29.25	29.15	26.71	30.07	31.48	33.29
MW -21S	106.46	71.98	71.12	70.22	69.68	72.39	73.00	72.92	75.71
MW -22S	141.43	129.29	129.66	129.71	129.97	129.04	127.80	127.85	134.62
MW -23S	140.94	125.70	125.67	125.65	125.58	125.28	123.75	123.31	132.02
MW -24S	141.13	121.00	120.99	120.99	120.96	120.89	120.34	120.11	125.88
MW -24A	140.48	82.55	82.46	82.17	82.06	79.69	78.96	78.04	77.81
MW -25S	140.02	123.04	123.04	122.99	122.92	122.74	121.94	121.60	129.85
MW -26S	132.85	95.78	95.70	95.93	95.86	96.09	97.52	98.02	98.70
MW -26A	133.11	76.76	76.63	76.73	76.56	76.16	75.61	75.44	83.78
MW -26B	132.61	28.38	29.21	29.51	29.40	26.92	30.11	31.53	33.36
MW -27S	138.64	84.46	83.06	138.64	--	103.01	107.64	109.24	111.51
MW -27A	137.64	27.90	28.07	28.32	28.21	25.72	29.06	30.12	32.33
MW -27B	138.11	--	--	--	--	--	29.53	30.59	32.73
MW -28S	112.16	103.23	103.13	103.18	103.04	102.63	102.47	103.49	107.41
MW -29S	114.72	99.21	99.13	99.03	98.91	98.65	98.18	98.22	103.37
MW -30S	109.25	--	--	--	--	--	85.37	85.92	88.77
MW -31S	101.69	--	--	--	--	--	30.04	31.52	33.27
MW -32S	126.70	--	--	--	--	--	98.07	98.28	99.16
MW -33A	104.42	--	--	--	--	--	49.25	50.61	56.50
MW -33B	104.69	--	--	--	--	--	49.36	50.61	56.56
MW -34A	146.58	--	--	--	--	--	29.98	31.41	33.18
MW -34B	145.39	--	--	--	--	--	29.89	31.31	33.12

WELL ID	TOPC ELEVATION	20-Jan-88	26-Feb-88	31-Mar-88	18-Apr-88	31-May-88	29-Jun-88
MWR-1A	146.62	34.72	36.12	36.60	37.19	33.59	28.52
MWR-1B	146.81	34.75	36.16	36.62	37.21	33.66	28.39
MW -2S	111.47	98.39	91.99	89.39	88.66	86.96	85.59
MWR-2A	111.90	34.82	36.38	36.82	37.25	33.58	28.46
MWR-2B	112.15	34.82	36.38	36.86	37.24	33.57	28.48
MW -3S	138.35	132.35	130.54	129.79	129.35	129.03	128.52
MWR-3A	138.50	34.65	36.13	36.65	37.34	33.57	28.36
MWR-3B	137.65	34.71	36.19	36.65	37.33	33.55	28.42
MWR-4S	140.55	133.13	128.03	126.20	125.91	125.05	124.07
MWR-4A	140.21	35.04	36.54	37.04	37.63	34.06	29.13
MW -4B	140.32	34.65	36.17	36.67	37.25	33.44	28.32
MW -5S	141.56	136.14	133.85	133.81	133.37	132.44	132.08
MW -5A	140.34	92.42	92.69	92.11	92.37	92.20	91.11
MW -6AA	130.58	40.62	42.60	43.04	43.60	41.22	37.12
MWR-6B	132.34	34.96	36.36	36.88	37.28	33.83	28.49
MWR-7A	129.38	34.73	36.36	36.82	37.25	33.58	28.46
MWR-7B	129.68	34.68	36.33	36.80	37.22	33.57	28.45
MW -8S	140.92	92.38	92.57	92.25	92.65	92.75	92.86
MWR-8A	139.02	40.35	42.08	42.60	44.79	40.94	36.92
MWR-8B	139.54	34.41	35.83	36.29	37.08	32.73	28.16
MW -9S	141.47	119.62	118.78	118.28	118.30	119.61	120.01
MWR-9A	141.45	40.35	42.12	42.53	43.22	40.85	36.76
MWR-9B	141.73	34.73	36.17	36.67	37.21	33.81	28.44
MW -10A	140.59	89.51	89.74	89.13	88.72	89.03	88.01
MW -11D	139.52	31.60	33.42	34.52	34.65	33.70	30.98
MW -12A	141.77	38.46	40.19	40.64	41.16	38.43	33.94
MW -12B	142.47	34.74	36.32	36.76	37.17	33.56	28.41
MW -13A	140.34	38.59	40.38	40.84	41.55	38.72	34.21
MW -13B	140.33	34.73	36.33	36.77	37.21	33.60	28.45
MW -14A	138.39	34.76	36.39	36.83	37.26	33.64	28.47
MW -14B	138.44	34.77	36.36	36.81	37.29	33.60	28.50
MW -15S	142.35	100.60	101.10	101.41	101.93	102.21	102.00
MW -15A	141.80	42.70	44.55	45.13	45.86	43.52	39.63
MW -15B	141.48	34.75	36.19	36.65	37.24	33.67	28.48
MW -16A	144.24	65.61	66.07	68.32	-5.33	70.49	69.57
MW -16B	144.76	35.11	36.38	36.59	37.23	33.73	28.47
MW -16D	144.44	31.69	33.23	34.34	34.64	33.79	30.94
MW -17S	139.09	134.46	132.90	131.82	131.05	130.05	129.26
MW -18S	111.31	102.48	101.83	101.52	104.48	100.82	100.68
MW -18A	111.61	34.44	36.32	36.78	37.17	33.63	28.26
MW -18B	110.62	34.35	36.27	36.72	37.05	33.41	28.31
MW -19S	108.71	104.44	104.48	104.38	104.30	103.72	102.13
MW -20S	110.97	75.93	74.82	74.74	74.87	73.97	73.87
MW -20A	110.67	34.38	36.27	36.75	37.11	33.48	28.34
MW -21S	106.46	76.46	75.42	74.98	74.96	71.97	73.94
MW -22S	141.43	135.35	132.60	131.70	131.64	129.31	128.93
MW -23S	140.94	132.27	131.09	129.05	128.27	127.19	125.29
MW -24S	141.13	126.30	123.48	122.50	122.24	121.99	121.65
MW -24A	140.48	67.65	61.42	61.10	61.37	58.87	56.58
MW -25S	140.02	130.27	127.48	127.60	125.62	124.50	123.79
MW -26S	132.85	99.83	101.56	102.60	103.34	104.37	104.81
MW -26A	133.11	85.38	81.15	79.38	78.93	79.32	78.53
MW -26B	132.61	34.76	36.34	36.82	36.21	33.58	28.42
MW -27S	138.64	113.97	116.49	117.74	118.24	118.54	118.49
MW -27A	137.64	33.74	35.18	35.68	36.19	32.61	27.43
MW -27B	138.11	34.15	35.59	36.11	36.65	33.07	27.90
MW -28S	112.16	107.49	107.24	107.26	107.03	106.62	105.58
MW -29S	114.72	104.18	103.28	103.12	103.05	102.96	102.59
MW -30S	109.25	89.65	89.69	89.73	89.67	88.63	87.25
MW -31S	101.69	34.40	36.29	36.75	37.14	33.48	28.38
MW -32S	126.70	99.24	98.93	98.37	98.21	98.28	98.24
MW -33A	104.42	59.84	60.86	60.54	60.33	57.74	53.92
MW -33B	104.69	59.84	60.77	60.48	60.25	57.73	53.92
MW -34A	146.58	34.73	36.16	36.70	37.15	33.53	28.37
MW -34B	145.39	34.66	36.10	36.64	37.08	33.53	28.31

Section Ten

10.0 FINAL REMEDIAL INVESTIGATION REPORT ERRATA

10.1. TOPOGRAPHIC MAP OF MMRF AND SURROUNDING AREA

A detailed map of the MMRF was prepared during the RI. The map was drawn from an aerial photo taken in 1985. The contour interval is 2 ft with heavier contour lines every 10 ft. A photographically reduced version of the topographic map is included as Figure 26 (a larger version of this map is included in the Feasibility Study for the MMRF). Selected site features including the some buildings, and the approximately locations of the trace of Chenoweth fault and the Byron Interbed are illustrated on the map. The map can be found following the text in Section 8.0.

10.2. GROUND-WATER MOVEMENT

On page 4-40 of the Final RI Report, a calculated discharge rate of 1 gpd/linear foot for the S-aquifer to the Columbia River is presented. This value should be "less than 40 gpd/linear foot."

10.3. WELL CONSTRUCTION DETAILS AND REVISED WELL CONSTRUCTION LOGS

Table 9 is a summary of well construction details of the monitoring wells currently in use at the MMRF. The table does not include any information regarding wells which have been replaced. Three well construction logs were inadvertently omitted for the Final RI Report. The logs for wells MW-13A, MW-18B, and MW-27B are included following the text in this Section.

Well construction logs for both on-site wells and nearby off-site wells are included in Appendix F of the Final RI Report. In order to facilitate the use of these well logs, a list of well logs

commonly referenced in the RI and their associated page number(s) in the Final RI Report are included below:

WELL ID	PAGE NUMBER FINAL RI REPORT
MW-1	F-229 TO F-230
MW-2	F-231 TO F-232
MW-3	F-233 TO F-234
MW-4	F-235 TO F-238
MW-5	F-239 TO F-240
MW-6	F-241 TO F-246
MW-7	F-247 TO F-250
MW-10	F-251 TO F-252
MW-11	F-253 TO F-255
PW-1	F-164 TO F-167
PW-2	F-168 TO F-172
PW-3	F-173 TO F-174
PW-4	F-175 TO F-177
KLINDT'S	F-185 TO F-187
ROCKLINE	F-190 TO F-191
ANIMAL SHELTER	F-222 TO F-223
MT. FIR	F-214 TO F-215
CHENOWETH #1	F-147 TO F-152
CHENOWETH #2	F-153 TO F-157
CHENOWETH #3	F-158 TO F-163

The most comprehensive geologic data for the site are available for wells completed and logged during the RI; these wells served as the basis for defining the geologic units presented in the cross sections. Other wells and logs were used to supplement the cross sections and for location definition.

10.4. LANDFILL LEACHATE ARSENIC ANALYSES

In Section 3.2.1 Landfill Characterization, an ambiguous statement was made in reference to analyses of landfill leachate samples for arsenic. It was stated that "results of analyses for total arsenic were similar to the EP toxicity test results for arsenic." Standard protocol for EP (extraction procedure) toxicity analyses for aqueous matrix samples requires that the actual extraction procedure be run on only aqueous samples with greater that 0.5% solids. Because the landfill leachate samples were of aqueous matrix with less than 0.5%, the samples were not extracted or pH

adjusted prior to analysis. The samples were filtered and run by the same AA furnace utilized for the total arsenic analysis. Therefore, the total arsenic analytical results and the EP toxicity results were basically the same and the statement made in the Final RI Report is correct.

10.5. CYANIDE SPECIATION

A study measuring iron cyanide complexes concentrations in selected ground-water samples from the site was conducted to determine what species of cyanide were present (Enseco, 1987). It was recently discovered that the initial interpretation of the Enseco data presented in the Final RI Report Section 3.3.1, "... total iron cyanides may comprise up to 40% of the total cyanide present, while free cyanide may comprise 1 to 6 % of the total cyanide present," were incorrect. Additional calculations revealed that most of the cyanide present in the five samples submitted to the Rocky Mountain Analytical Laboratory of Enseco on October 28, 1987 is complexed with iron (see Table 10). The percent of cyanide complexed with iron ranges from 79% to 108% (values greater than 100% indicate some interference). This dramatically reduces the uncertainty surrounding the cyanide species present at the MMRF, i.e. only 9% to 15% of the cyanide was unaccounted for as either complexed or free. A detailed discussion of the environmental fate of cyanide species present at the MMRF prepared by Clement Associates, Inc. is included as Appendix B.

10.6. ADDENDUM TO THE RI ENDANGERMENT ASSESSMENT

The following changes/comments to Appendix B were requested at the meeting between Martin Marietta Corporation, EPA Region X, and the State of Oregon in Seattle on April 25 and 26.

(1) Page B-152 Line 8.

Add the following "Concentrations of sulfate in all 23 wells are below the USEPA Health-based guidance level of 400 mg/L. The concentration of sulfate in one well was slightly above the Oregon MCL of 250 mg/L. Concentrations of zinc in all wells were well below the Oregon MCL for zinc of 5 mg/L.

(2) Page B-156 Line 13.

Change title of B.5.1.3.2 to "Air Exposures of Current Offsite and Future Onsite Residents."

(3) Page B-176 Table 44, 4th line, last column.

Change "$1x10^4$" to "$1x10^{-4}$"

(4) Page B-209 Line 12. Change "exposure event" to "day".

Line 15. Add the following after "lifetime": "Lifetime average soil ingestion rates were calculated using the soil ingestion rates for specific age groups presented in the table below [based on Lagoy (1987)]. A time-weighted average of these soil ingestion rates, which was calculated using the equation below, was assumed to represent lifetime average soil ingestion rates for average and maximum exposure conditions:

$$\text{Lifetime SI} = \frac{(SI_1)(T_1) + (SI_2)(T_2) + \ldots (SI_n)(T_n)}{T_1 + T_2 + \ldots T_n}$$

where

SI = soil ingestion rate (mg/event)

T = years of exposure

Soil Ingestion Rates for Certain Human Age Groups

	Average Exposure			Maximum Exposure		
Age Group (years)	1-6	7-11	12-70	1-6	7-11	12-70
Total Years of Exposure	6	5	59	6	5	59
Incidental Ingestion Rate per exposure event (mg/event)	100	50	50	500	250	100

(5) Page B-210 Table 52. Change "events/year" to "days/year."

(6) EPA risk assessment personnel requested that this errata include a general discussion of how exposure factors (in particular frequency and duration of exposure) for hypothetical exposure pathways evaluated in risk assessments are determined.

It is sometimes possible to utilize published information which provide estimates (or a basis for estimates) of frequency of exposure for populations engaged in various activities. Sources include studies on "use of time", trade association publications, industry studies, labor statistics, and other government studies. While review of these types of published data is desirable, they rarely provide information for a particular site of interest and specifically local population activity patterns. Site-specific considerations can have a very important impact on population activity patterns, especially on frequency and duration of exposure. In the absence of published, site-specific, data, other sources of information, often of a less documentable nature, can be extremely useful in making exposure estimates. Examples of this type of information which can often be obtained from the local population, include industrial working patterns (year round or seasonal work, 5 or 6 day work week), worker mobility (number of years of employment and in a particular job). Information on climatic conditions in the area is also important in determining exposure from direct contact with soil and through inhalation of dust. For example, days when soil would be covered with snow or frozen would preclude direct contact with soil. In addition, the potential for dust generation would be significantly reduced on days of rainfall.

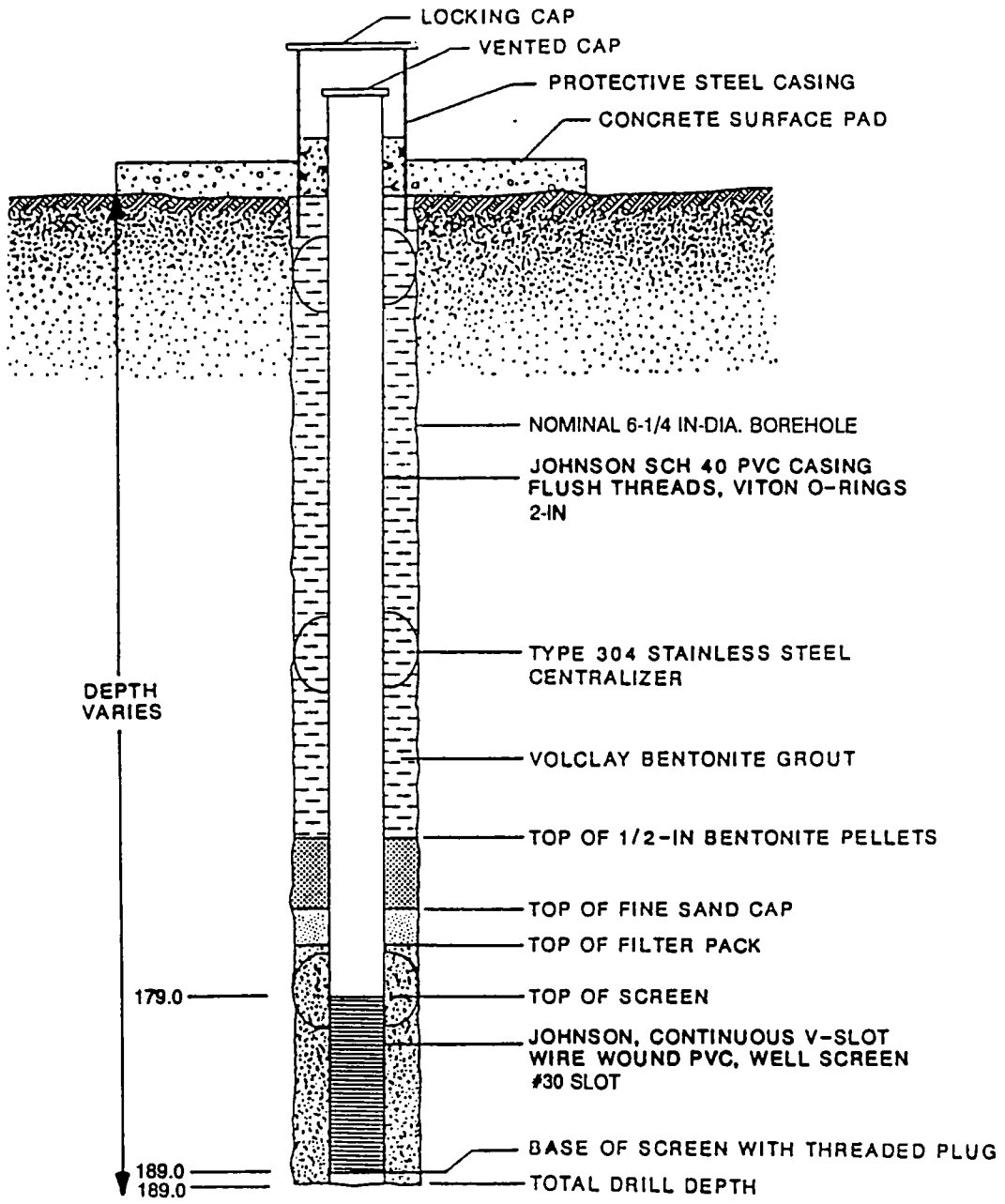
GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION DIAGRAM

WELL NO.: MW-27B

PROJECT: MARTIN MARIETTA REDUCTION FACILITY

LOCATION:	COORDINATES:	GROUND ELEVATION:	MEASURING PT. ELEVATION:
REDUCTION FACILITY		135.83 PAD	138.60
GEOLOGIST:	**DRILLING CONTRACTOR:**	**DRILLING METHOD:**	**RIG TYPE:**
P. REINHART	STACO	AIR ROTARY	SCHRAMM
WELL DEVELOPMENT METHOD:	**VOLUME EVACUATED:**	**WELL COMPLETED:**	**MONITORED FORMATION:**
SWAB-AIR LIFT		08/21/87	



ALL MEASUREMENTS FEET
BELOW LAND SURFACE

NOT TO SCALE

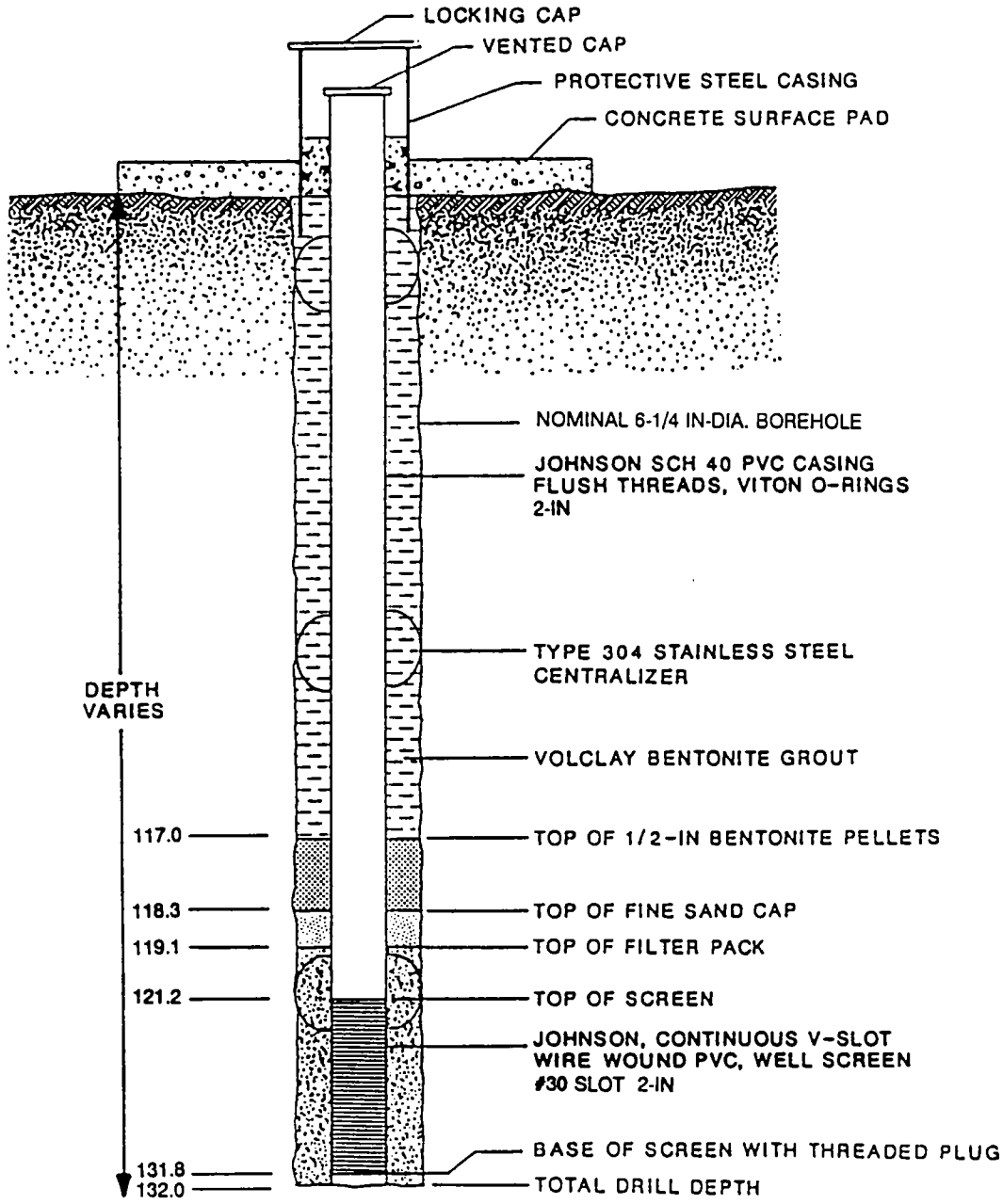
GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION DIAGRAM

WELL NO.: MW-13A

PROJECT: MARTIN MARIETTA REDUCTION FACILITY

LOCATION:	COORDINATES:	GROUND ELEVATION:	MEASURING PT. ELEVATION:
REDUCTION FACILITY		137.85 PAD	140.34
GEOLOGIST:	**DRILLING CONTRACTOR:**	**DRILLING METHOD:**	**RIG TYPE:**
P. REINHART	WEST COAST DRILLING	AIR ROTARY	SCHRAMM
WELL DEVELOPMENT METHOD:	**VOLUME EVACUATED:**	**WELL COMPLETED:**	**MONITORED FORMATION:**
SWAB-AIR LIFT	1 HOUR	06/09/86	



ALL MEASUREMENTS FEET BELOW LAND SURFACE

NOT TO SCALE

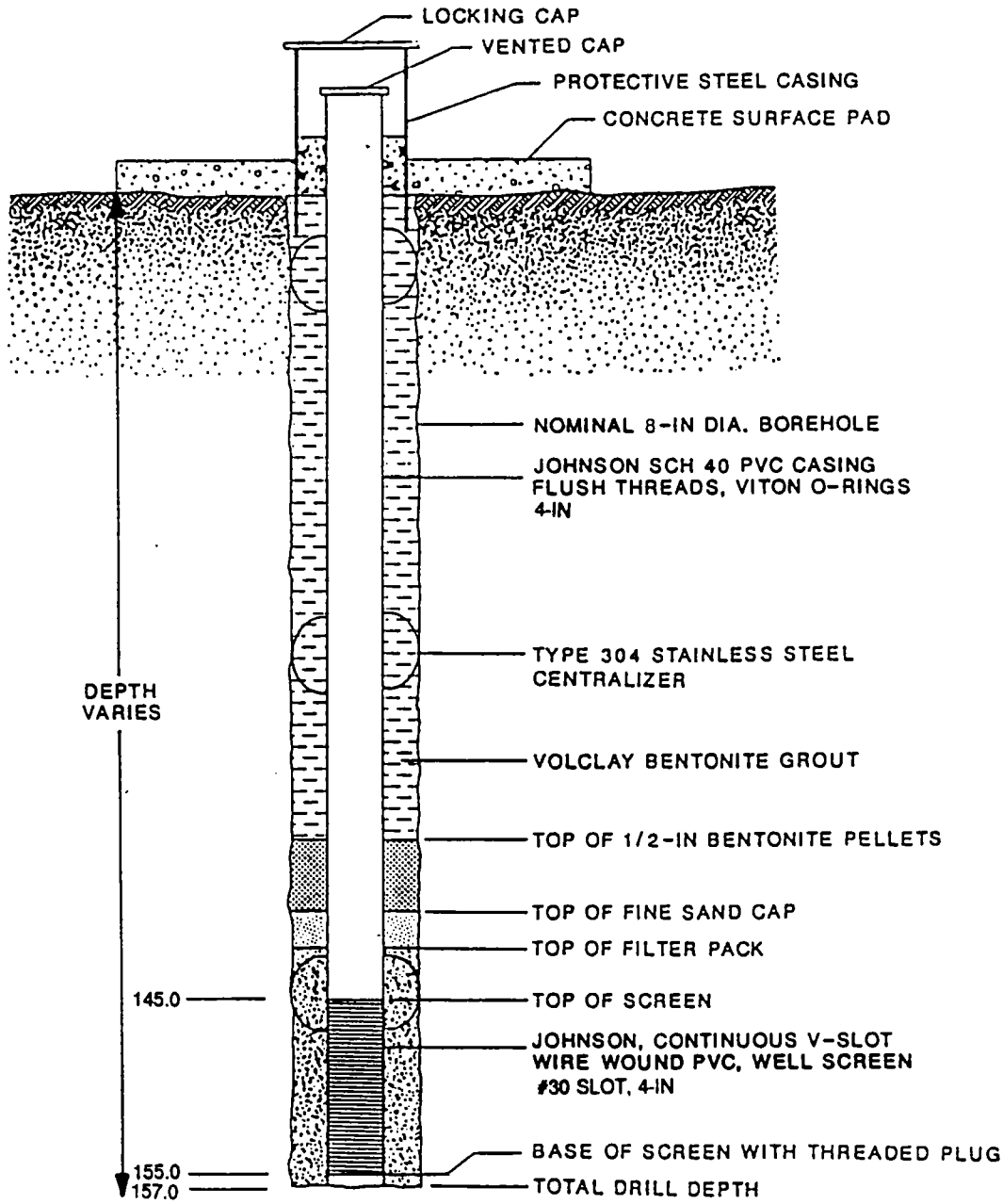
GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION DIAGRAM

WELL NO.: MW-18B

PROJECT: MARTIN MARIETTA REDUCTION FACILITY

LOCATION:	COORDINATES:	GROUND ELEVATION:	MEASURING PT. ELEVATION:
REDUCTION FACILITY		108.26 PAD	110.62
GEOLOGIST:	**DRILLING CONTRACTOR:**	**DRILLING METHOD:**	**RIG TYPE:**
P. REINHART	STACO	AIR ROTARY	SCHRAMM
WELL DEVELOPMENT METHOD:	**VOLUME EVACUATED:**	**WELL COMPLETED:**	**MONITORED FORMATION:**
SWAB-AIR LIFT		07/20/87	



ALL MEASUREMENTS FEET BELOW LAND SURFACE

NOT TO SCALE

WELL ID	WELL DIAM (IN)	WELL TYPE	DATE INSTALLED	SCREENED INTERVAL (FT BLS)	TOTAL DEPTH (FT BLS)	GEOLOGIC UNIT	TOPC ELEVATION (FT MSL)	PUMP PORT ELEVATION (FT MSL)
MWR-1A	2	PVC	20-Jul-87	129.0 - 139.0	140.0	RU	146.62	NA
MWR-1B	4	PVC	17-Jun-87	186.0 - 196.0	197.0	RL	146.81	146.16
MW -2S	2	PVC	17-Jul-87	29.0 - 39.0	40.0	RS	111.47	NA
MWR-2A	2	PVC	16-Jul-87	114.0 - 124.0	124.0	RU	111.90	NA
MWR-2B	4	PVC	24-Jul-87	165.0 - 175.0	176.0	RL	112.15	111.76
MW -3S	2	PVC	18-Jul-87	17.0 - 27.0	27.0	B	138.35	NA
MWR-3A	2	PVC	22-Jul-87	151.5 - 161.5	162.0	RL	138.30	NA
MWR-3B	4	PVC	21-Jul-87	175.0 - 185.0	185.0	RL	137.65	137.35
MWR-4S	2	PVC	23-Jul-87	18.0 - 28.0	28.0	B	140.55	NA
MWR-4A	2	PVC	22-Jul-87	129.0 - 139.0	139.0	RU	140.21	NA
MW -4B	4	PVC	23-Jul-87	182.0 - 192.0	195.0	RL	140.32	139.81
MW -5S	2	PVC	18-Jul-87	10.5 - 20.5	20.5	L	141.56	NA
MW -5A	2	PVC	30-Apr-84	90.0 - 100.0	100.0	RT	140.34	NA
MW -6AA	2	PVC	16-May-84	121.0 - 126.0	126.0	RU	130.58	NA
MWR-6B	8	STEEL	10-Jul-87	159.0 - 189.0	190.5	RL	132.34	NA
MWR-7A	2	PVC	16-Jul-87	127.5 - 137.5	138.0	RU	129.38	NA
MWR-7B	4	PVC	16-Jul-87	181.0 - 191.0	192.0	RL	129.68	129.09
MW -8S	2	PVC	25-Jun-87	40.0 - 50.0	50.0	RS	140.92	NA
MWR-8A	6	STEEL	02-Jul-87	120.0 - 140.0	140.0	RU	139.02	NA
MWR-8B	8	STEEL	02-Jul-87	170.0 - 200.0	200.0	RL	139.54	NA
MW -9S	2	PVC	18-Jun-87	44.0 - 54.0	54.0	RS	141.47	NA
MWR-9A	2	PVC	18-Jun-87	126.0 - 136.0	140.0	RU	141.45	NA
MWR-9B	4	PVC	30-Jun-87	190.0 - 200.0	200.0	RL	141.73	141.24
MW -10A	2	PVC	21-Mar-85	107.0 - 117.0	117.0	RT	140.59	NA
MW -11D	2	PVC	21-Mar-85	275.0 - 295.0	304.0	SG	139.52	NA
MW -12A	2	PVC	05-Jun-86	131.5 - 120.9	131.7	RU	141.77	NA
MW -12B	4	PVC	06-Jun-86	192.4 - 202.5	205.0	RL	142.47	NA
MW -13A	2	PVC	09-Jun-86	121.2 - 131.8	132.0	RU	140.34	NA
MW -13B	4	PVC	03-Jun-86	191.9 - 202.5	205.0	RL	140.33	NA
MW -14A	2	PVC	10-Jun-86	130.2 - 140.8	141.0	RU	138.39	NA
MW -14B	4	PVC	04-Jun-86	192.7 - 203.3	204.0	RL	138.44	NA
MW -15S	2	PVC	15-May-86	46.9 - 57.5	58.0	RS	142.35	NA
MW -15A	2	PVC	12-Jun-86	112.2 - 122.8	123.0	RU	141.80	NA
MW -15B	4	PVC	17-May-86	184.8 - 195.4	198.0	RL	141.48	140.65
MW -16A	2	PVC	11-Jun-86	96.4 - 107.0	107.0	RT	144.24	NA
MW -16B	4	PVC	29-May-86	184.9 - 195.5	196.0	RL	144.76	NA
MW -16D	4	PVC	18-Jun-86	258.4 - 269.0	269.0	SG	144.44	NA
MW -17S	2	PVC	09-Jun-86	19.4 - 30.0	30.0	RS	139.09	NA
MW -18S	2	PVC	09-Jun-86	11.4 - 22.0	22.0	RS	111.31	NA
MW -18A	6	STEEL	14-Jul-87	112.0 - 132.0	132.0	RL	111.61	NA
MW -18B	4	PVC	20-Jul-86	145.0 - 155.0	157.0	RL	110.62	110.11
MW -19S	2	PVC	09-Jun-86	15.4 - 26.0	26.0	RS	108.71	NA
MW -20S	2	PVC	13-Jun-86	59.4 - 70.0	70.0	RT	110.97	NA
MW -20A	2	PVC	12-Jun-86	109.4 - 120.0	120.0	RL	110.67	NA
MW -21S	2	PVC	13-Jun-86	54.4 - 65.0	65.0	RT	106.46	NA
MW -22S	2	PVC	23-Jul-87	18.0 - 28.0	30.0	RS	141.43	NA
MW -23S	2	PVC	18-Jul-87	25.0 - 35.0	35.0	RS	140.94	NA
MW -24S	2	PVC	18-Jul-87	11.5 - 21.5	21.5	L	141.13	NA
MW -24A	2	PVC	24-Jul-87	148.0 - 158.0	158.0	RL	140.48	NA
MW -25S	2	PVC	23-Jul-87	9.0 - 19.0	21.5	B	140.02	NA
MW -26S	2	PVC	08-Jul-87	40.0 - 50.0	50.0	B	132.85	NA
MW -26A	2	PVC	07-Jul-87	113.0 - 123.0	125.0	RT	133.11	NA
MW -26B	4	PVC	08-Jul-87	181.5 - 191.5	192.0	RL	132.61	132.13
MW -27S	2	PVC	Jul-87	42.0 - 52.0	54.0	B	138.64	NA
MW -27A	2	PVC	10-Jul-87	127.0 - 137.0	138.0	RU	137.64	NA
MW -27B	2	PVC	21-Aug-87	179.0 - 189.0	189.0	RL	138.60	NA
MW -28S	2	PVC	23-Jul-87	6.0 - 16.0	23.0	RS	112.16	NA
MW -29S	2	PVC	23-Jul-87	12.0 - 22.0	25.0	RS	114.72	NA
MW -30S	2	PVC	18-Aug-87	51.5 - 61.5	61.5	RU	109.25	NA
MW -31S	2	PVC	Aug-87	98.0 - 108.0	108.0	RL	101.69	NA
MW -32S	2	PVC	18-Aug-87	30.0 - 40.0	40.0	B	126.70	NA
MW -33A	2	PVC	20-Aug-87	117.0 - 127.0	127.0	RU	104.42	NA
MW -33B	2	PVC	Aug-87	156.0 - 166.0	166.0	RL	104.69	104.49
MW -34A	2	PVC	Aug-87	151.0 - 161.0	161.0	RL	146.58	NA
MW -34B	2	PVC	19-Aug-87	176.0 - 186.0	186.0	RL	145.39	145.07

WELL ID	WELL DIAM (IN)	WELL TYPE	DATE INSTALLED	SCREENED INTERVAL (FT BLS)	TOTAL DEPTH (FT BLS)	GEOLOGIC UNIT	TOPC ELEVATION (FT MSL)	PUMP PORT ELEVATION (FT MSL)
TEST PIT SUMPS								
SA-D	12	STEEL	Sep-87	NA	NA	FILL	139.65	NA
OCWP-B	12	STEEL	Sep-87	NA	NA	FILL	140.33	NA
OCWP-D	12	STEEL	Sep-87	NA	NA	FILL	140.03	NA
PRODUCTION WELLS								
PW -1	20	STEEL	01-Jul-57	220.0 - 314.0	314	SG	NA	NA
PW -2	10	STEEL	24-Jul-57	SEALED & ABANDON	302	SG	NA	NA
PW -3	10	STEEL	01-Sep-57	207.0 - 319.0	319	SG	NA	NA
PW -4	10	STEEL	27-Jul-57	223.0 - 303.0	303	SG	NA	NA
OFF-SITE WELLS								
RECREATION		NA	NA	OPEN HOLE	NA	NA	NA	NA
RESIDENCE		NA	NA	OPEN HOLE	120	NA	NA	NA
SHELTER	8	STEEL	17-Dec-73	OPEN HOLE	65	AL	NA	NA
CHEN #1		PARTIAL	May-46	OPEN HOLE	258	R,SG	NA	NA
CHEN #2		PARTIAL	1949	OPEN HOLE	260	R?,SG	NA	NA
CHEN #3		PARTIAL	May-56	OPEN HOLE	275	R?,SG	NA	NA
KLINDT		NA	NA	OPEN HOLE	100	NA	NA	NA
MT. FIR	6	PVC	18-Apr-74	OPEN HOLE	145	SG	NA	NA
ROCKLINE	8	PARTIAL	02-Feb-83	OPEN HOLE	98	SG	NA	NA

NOTES:
FT MSL = FEET ABOVE MEAN SEA LEVEL
FT BLS = FEET BELOW LAND SURFACE
TOPC = TOP OF PROTECTIVE CASING
NA = NOT AVAILABLE/NOT APPLICABLE
AL = ALLUVIUM
B = BYRON
L = LOLO
R = ROSALIA
RS = ROSALIA SUBAERIAL
RT = ROSALIA TRANSITION
RU = ROSALIA UPPER GLASS
RL = ROSALIA LOWER GLASS
SG = SENTINEL GAP

025DAL7:WELLSPEC.WK1

WELL ID	RISER ELEVATION (FT MSL)	PAD ELEVATION (FT MSL)	RISER STICK-UP (FT)	NORTH COORDINATE	EAST COORDINATE	TOTAL DEPTH (FT BTOPC)	TYPICAL EVACUATION METHOD
MWR-1A	146.15	143.49	3.13	715,204.50	1,818,497.94	143.1	BAILER
MWR-1B	146.06	143.71	3.10	715,207.95	1,818,481.56	200.1	SUB-PUMP
MW -2S	110.15	108.63	2.84	717,007.60	1,819,814.12	42.8	BAILER
MWR-2A	111.33	108.98	2.92	717,000.47	1,819,821.36	126.9	BAILER
MWR-2B	111.65	109.50	2.65	716,990.81	1,819,826.72	178.7	SUB-PUMP
MW -3S	136.93	135.12	3.23	714,012.56	1,820,405.37	30.2	BAILER
MWR-3A	137.81	135.62	2.68	714,009.82	1,820,395.66	164.7	HYDROSTAR
MWR-3B	137.30	134.86	2.79	714,006.19	1,820,386.35	187.8	SUB-PUMP
MWR-4S	139.89	138.00	2.55	713,278.31	1,819,954.22	30.6	BAILER
MWR-4A	139.94	138.10	2.11	713,268.56	1,819,952.76	141.1	HYDROSTAR
MW -4B	139.70	137.48	2.84	713,286.48	1,819,947.91	197.8	SUB-PUMP
MW -5S	140.40	138.27	3.29	713,799.64	1,819,950.79	23.8	BAILER
MW -5A	139.11	137.84	2.50	713,801.67	1,819,960.83	102.5	HYDROSTAR
MW -6AA	128.75	128.25	2.33	715,895.46	1,820,317.57	128.3	BAILER
MWR-6B	NA	128.32	4.02	NA	NA	194.5	--
MWR-7A	128.91	126.77	2.61	NA	NA	140.6	BAILER
MWR-7B	128.98	126.47	3.21	716,514.23	1,820,205.35	195.2	SUB-PUMP
MW -8S	140.49	137.63	3.29	715,568.18	1,820,238.72	53.3	BAILER
MWR-8A	NA	137.86	1.16	715,570.07	1,820,222.42	141.2	SUB-PUMP
MWR-8B	NA	138.13	1.41	715,571.48	1,820,200.09	201.4	SUB-PUMP
MW -9S	141.00	138.11	3.36	715,627.45	1,820,134.85	57.4	BAILER
MWR-9A	140.94	138.16	3.29	715,623.51	1,820,122.49	143.3	BAILER
MWR-9B	141.13	138.71	3.02	715,611.97	1,820,135.79	203.0	SUB-PUMP
MW -10A	139.69	138.05	2.54	713,940.82	1,820,124.10	119.5	HYDROSTAR
MW -11D	138.41	137.12	2.40	715,394.87	1,820,404.48	306.4	HYDROSTAR
MW -12A	141.36	139.34	2.43	716,188.01	1,819,164.71	134.1	BAILER
MW -12B	141.69	139.48	2.99	716,194.13	1,819,182.27	208.0	SUB-PUMP
MW -13A	139.47	137.85	2.49	716,577.70	1,819,361.18	134.5	BAILER
MW -13B	139.44	137.48	2.85	716,579.57	1,819,376.92	207.9	SUB-PUMP
MW -14A	137.96	136.07	2.32	716,624.08	1,819,978.83	143.3	BAILER
MW -14B	137.62	135.75	2.69	716,623.32	1,819,955.79	206.7	SUB-PUMP
MW -15S	141.52	139.06	3.29	715,574.91	1,820,399.91	61.3	BAILER
MW -15A	141.37	138.79	3.01	715,588.64	1,820,395.71	126.0	BAILER
MW -15B	140.58	138.68	2.80	715,603.51	1,820,390.87	200.8	SUB-PUMP
MW -16A	143.83	142.03	2.21	715,292.65	1,819,859.92	109.2	BAILER
MW -16B	143.98	141.85	2.91	715,282.02	1,819,870.59	198.9	SUB-PUMP
MW -16D	143.83	141.91	2.53	715,271.46	1,819,880.99	271.5	SUB-PUMP
MW -17S	138.54	136.91	2.18	713,733.85	1,820,280.23	32.2	BAILER
MW -18S	110.92	109.03	2.28	713,002.83	1,821,186.90	24.3	BAILER
MW -18A	NA	108.76	2.85	712,998.69	1,821,172.19	134.9	--
MW -18B	110.01	108.26	2.36	712,988.25	1,821,169.19	159.4	SUB-PUMP
MW -19S	108.37	105.70	3.01	712,552.44	1,821,072.93	29.0	BAILER
MW -20S	110.53	107.96	3.01	713,409.02	1,821,450.93	73.0	BAILER
MW -20A	110.19	107.51	3.16	713,418.37	1,821,464.23	123.2	BAILER
MW -21S	105.94	104.39	2.07	714,092.42	1,821,612.65	67.1	BAILER
MW -22S	140.43	138.32	3.11	713,564.72	1,819,801.95	33.1	BAILER
MW -23S	140.06	137.90	3.04	713,529.83	1,820,037.05	38.0	BAILER
MW -24S	139.91	138.09	3.04	712,665.58	1,820,323.13	24.5	BAILER
MW -24A	140.05	137.98	2.50	712,670.01	1,820,327.51	160.5	BAILER
MW -25S	139.06	136.89	3.13	713,455.63	1,820,505.91	24.6	BAILER
MW -26S	132.29	129.95	2.90	715,781.03	1,820,811.58	52.9	BAILER
MW -26A	132.72	129.87	3.24	715,772.31	1,820,819.61	128.2	BAILER
MW -26B	132.00	129.58	3.03	715,763.51	1,820,825.13	195.0	SUB-PUMP
MW -27S	137.69	135.75	2.89	715,002.89	1,820,519.27	56.9	BAILER
MW -27A	137.52	135.67	1.97	715,013.45	1,820,516.31	140.0	BAILER
MW -27B	138.11	135.83	2.77	715,025.85	1,820,513.94	191.8	--
MW -28S	111.62	109.21	2.95	711,953.08	1,820,747.37	26.0	BAILER
MW -29S	114.18	111.98	2.74	712,011.60	1,821,145.83	27.7	BAILER
MW -30S	108.79	106.30	2.95	712,685.95	1,821,406.12	64.5	--
MW -31S	101.02	98.90	2.79	714,189.17	1,821,388.37	110.8	BAILER
MW -32S	126.08	123.94	2.76	714,908.59	1,820,871.30	42.8	BAILER
MW -33A	103.85	101.42	3.00	716,286.76	1,820,532.47	130.0	BAILER
MW -33B	104.16	101.47	3.22	716,295.05	1,820,531.84	169.2	HYDROSTAR
MW -34A	146.03	143.46	3.12	713,843.96	1,818,851.67	164.1	BAILER
MW -34B	144.75	143.46	1.93	713,853.27	1,818,858.85	187.9	HYDROSTAR

WELL ID	RISER ELEVATION (FT MSL)	PAD ELEVATION (FT MSL)	RISER STICK-UP (FT)	NORTH COORDINATE	EAST COORDINATE	TOTAL DEPTH (FT BTOPC)	TYPICAL EVACUATION METHOD
TEST PIT							
SA-D	NA	NA	NA	715,571.47	1,820,200.09	9.75	SUMP PUMP
OCWP-B	NA	NA	NA	715,444.39	1,820,011.79	9.5	SUMP PUMP
OCWP-D	NA	NA	NA	715,469.68	1,819,908.16	9.5	SUMP PUMP
PRODUCTION							
PW -1	NA	144.30	NA	NA	NA	NA	SUB-PUMP
PW -2	NA	NA	NA	NA	NA	NA	NA
PW -3	NA	139.79	NA	NA	NA	NA	SUB-PUMP
PW -4	NA	139.76	NA	NA	NA	NA	SUB-PUMP
OFF-SITE							
RECREATION	NA	NA	NA	NA	NA	NA	SUB-PUMP
RESIDENCE	NA	NA	NA	NA	NA	NA	SUB-PUMP
SHELTER	NA	NA	NA	NA	NA	NA	SUB-PUMP
CHEN #1	NA	NA	NA	NA	NA	NA	SUB-PUMP
CHEN #2	NA	NA	NA	NA	NA	NA	SUB-PUMP
CHEN #3	NA	NA	NA	NA	NA	NA	SUB-PUMP
KLINDT	NA	NA	NA	NA	NA	NA	SUB-PUMP
MT. FIR	NA	NA	NA	NA	NA	NA	SUB-PUMP
ROCKLINE	NA	NA	NA	NA	NA	NA	SUB-PUMP

PARAMETER		MW-9S	MWR-9A	MWR-9B	CATHODE PAD	LANDFILL LEACHATE
ANALYZED						
TOTAL IRON	(mg/L)	0.3	3.1	1.2	330	0.2
TOTAL IRON CYANIDE (1)	(mg/L)	0.2	2.8	1.0	300	0.2
TOTAL IRON II CYANIDE	(mg/L)	ND	1.9	0.2	ND	ND
TOTAL IRON III CYANIDE	(mg/L)	0.2	0.9	0.8	300	0.2
TOTAL CYANIDE	(mg/L)	0.66	9.3	2.6	940	0.71
FREE CYANIDE	(mg/L)	0.04	0.12	0.1	2.4	0.06
OTHER CYANIDE	(mg/L)	0.42	6.38	1.5	637.6	0.45
CALCULATED						
COMPLEXED CN (2)	(mg/L)	0.56	7.83	2.80	838.71	0.56
COMPLEXED CN (3)		85%	84%	108%	89%	79%
MASS BALANCE (4)						
CN ACCOUNTED		91%	85%	111%	89%	87%
UNKNOWN		9%	15%	--	11%	13%
INTERFERENCE		--	--	11%	--	--

NOTES: SAMPLES COLLECTED OCTOBER 27, 1987; ALL AQUEOUS MATRIX.
ANALYSES COMPLETED BY ROCKY MOUNTAIN ANALYTICAL LABORATORY OF ENSECO.

(1) A COLORIMETRIC METHOD WAS DEVELOPED TO DETERMINE IRON (II) AND IRON (III) CYANIDE COMPLEXES IN THE SAMPLES. THE COMBINED CONCENTRATION OF THE TWO COMPLEXES WAS DETERMINED AS WELL AS THE INDIFIDUAL CONCENTRATION OF THE IRON (II) COMPLEX. THE IRON (III) COMPLEX WAS DETERMINED BY DIFFERENCE.

(2) COMPLEXED CYANIDE = TOTAL IRON CYANIDE X [(g/eq CYANIDE)/(g/eq IRON)]

(3) % COMPLEXED CYANIDE = COMPLEXED CYANIDE (2)/TOTAL CYANIDE ANALYZED

(4) (COMPLEXED CYANIDE + FREE CYANIDE)/TOTAL CYANIDE

MMRFDATA:CYANIDE.WK1

APPENDIX A

APPENDIX A

RI ANALYTICAL DATA SUMMARY

APPENDIX A

RI ANALYTICAL DATA SUMMARY

A-I. EXPLANATION OF DATA TABLES

Data collected during the Remedial Investigation are summarized in three data tables as follows:

- o Table A-1 Parameters analyzed
- o Table A-2 Ground Water Data Summary--Analytical Results Above Detection Limit
- o Table A-3 Surface Water, Sediment, and Soil Data Summary--Analytical Results Above Detection Limit

Table A-1 is a comprehensive list of the parameters that were analyzed. The list is categorized into six groups of compounds which include:

- o Base-Neutral Extractable
- o Acid Extractable
- o Volatile Organic Compounds
- o PCBs
- o Metals
- o Common Ions
- o Site Indicator Parameters

Tables A-2 and A-3 are data tables that summarize the analytical results for ground-water samples and surface water, sediment, and soil samples. The data summary tables include all samples collected during the RI. Additional data collected during Spring 1988 are included in the text of this report. The tables include the following information:

- o All parameters analyzed for any given sample
- o Type (grab or composite) and matrix (soil, water, sediment) of the sample collected
- o All QA samples collected in association with a sample location (except Trip Blanks)
- o All data qualifiers assigned during the data validation and classification

For each data set/table, only those compounds for which analytical results were recorded above the detection limits are included in

the summary tables. For example, the Volatile Organic Compound group, if analytical results indicated that acrolein had never been reported above the detection limit, acrolein would not be included on the data tables; whereas, if toluene was detected in even one sample, the results of toluene for every sample analyzed, whether it was above or below the limits of detection, would be recorded on the data tables. If no parameters within a group of compounds was detected, for example PCBs or Acid Extractable Compounds, then "BDL"(below detection limit) was assigned to the sample which was analyzed for that group of compounds.

Less than values (ie. "<" or "-" before value) on the original data are presented as a value (detection limit) followed by a "U" qualifier. The definition which will be used for the "U" qualifier through out the tables is "U = Parameter was analyzed for but was not detected at the concentration value indicated (detection limit)."

A-II. DATA VALIDATION PROCEDURES

Validation and classification of the analytical data collected during the RI was conducted independently according to EPA Sample Management Office (SMO) procedures. In summarizing the overall laboratory data validation, a majority of the analytical data was rated "Acceptable." No data was rated "Unacceptable" excepting those few samples which exceeded holding times. In these cases, the samples were recollected and analyzed.

The laboratory validation review was strictly an evaluation of the analytical performance of the laboratory without regard to the sample source, field procedures or records. QC parameters assigned to a batch of analyses did not meet acceptance criteria; the same qualifier was applied to the other samples analyzed within that batch as required by the validation guidelines.

For this investigation, the explanation of the U, J and R qualifier codes (flags) are as follows:

J - The value is an estimated quantity; quality control criteria were not completely met.

U - The parameter was analyzed for but was not detected at concentration value indicated (detection limit).

R - Quality control data indicates that the data are unusable (compound may or may not be present). Resampling is necessary for verification.

As a means of summarizing the results of the validation process, the data was rated acceptable (no J or R qualifier codes); data provisional (flagged with J qualifier code) or unacceptable

(flagged with R qualifier code). A complete discussion of the validation and the classification procedures and results are presented in Appendix D of the Final Remedial Investigation Report for the MMRF, March 1988.

A-III. QUALITY ASSURANCE SUMMARY

The laboratory QC difficulties observed that resulted in data being flagged were few but include the following:

- Occasional exceedence of holding times by laboratories--All samples that exceeded holding times were recollected and properly analyzed within required holding times.

- Initial Calibration Verification Standards (ICVS) and Continuing Calibration Verification Standards (CCVS) for Sulfate were outside Control limits--The data for these samples were flagged J in accordance with the guidelines. All other QC data were within control limits.

- Sample Misidentification--Only one instance of sample misidentification appears to have occurred during the investigation. These samples were recollected and reanalyzed.

- Contaminated Laboratory Method Blanks--Laboratory blanks including extraction blanks were generally not a problem. Only two instances occurred during the investigation in which laboratory blanks appear to have contaminants. In the first instance no data were compromised and in the second instance the data were flagged UJ.

- Matrix spike percent recoveries in the analysis of free cyanide in soil samples and total cyanide in some ground-water samples were outside control limits--Matrix spike percent recoveries from the analysis of "free" cyanide (Weak and Dissociable Cyanide) in soil samples collected at the site have consistently (except for one batch) been lower than QC limits; matrix spike percent recoveries in the analysis of total cyanide in two batches of ground-water samples also were low and outside CLP control limits. In both cases the values were flagged J as estimated values.

- Laboratory duplicates for total cyanide in ground water outside CLP Relative Percent Difference (RPD) control limits--Laboratory duplicates for total cyanide in ground-water samples containing considerable amounts of silt were outside CLP RPD control limits in two batches of samples. It is believed these high RPD's were due to sample inhomogeneity. It was felt the data may be considered valid for quantitative use and the values were not flagged.

Detection limits for cyanide and fluoride in Chenoweth Creek surface water samples collected during the RI were not sufficiently low enough to allow for valid comparison with applicable EPA Ambient Water-Quality Criteria and Health Advisories. Therefore, two rounds of surface water and sediment samples were collected from Chenoweth Creek during Spring 1988; double sample volume was collected and analyzed to achieve the required quantitation limits. Values reported between the Limit of Quantitation (LOQ) and the Instrument Detection Limit (IDL) were flagged J as estimated.

Discussion of Free and Total Cyanide Analyses

FREE CYANIDE IN SOIL: The consistently low matrix spike percent recoveries from the analysis of "free" cyanide in soil samples has led to considerable speculation and debate as to the cause of this observed phenomenon, its interpretation, as it applies to the values of free cyanide measured in the samples and also the validity of the analytical method employed in this investigation for the analysis of free cyanide. It must first be noted that there is currently no regulatory definition for "free" cyanide, nor is there a commonly accepted definition based on an analytical method (see Federal Register, Vol. 51, No. 238, page 44720, 11 December 1986).

The principle of method 412.H Standard Methods 16th Ed. (Weak and Dissociable Cyanide) is based on converting to HCN gas, those readily dissociable cyanide species in a slightly acidified (pH, 4.5 to 6.0 using acetate buffer) sample during a 1-hour reflux distillation and absorbing in a sodium hydroxide solution the HCN that is purged from the sample by an air stream. The breakdown of iron cyanides is prevented by eliminating the $MgCl_2$ catalyst used in the total Cyanide Method 335.2 and adding zinc acetate to render the iron cyanides insoluble. Thus, the method is designed not to recover CN^- from the tightly bound complexes such as iron cyanide,that would not be amenable to oxidation by chlorine.

This method was selected for this investigation because the somewhat less vigorous conditions of the procedure (pH only 4.5 to 6.0) make the test slightly more comparable to environmental conditions than the cyanide-amenable-to-chlorination procedure, the method provides better control of test conditions, and the method is not subject to interferences from unidentified organic chemicals which may occur with the cyanide-amenable-to-chlorination procedure.

This method is an exceptionally valid method, barring the presence of interfering substances such as oxidizers and sulfides. To account for these interferences, water samples were screened prior to preservation for the presence of these substances and all samples (water and soil) were prepared (distilled) with a sulfide scrubber (lead acetate scrubber) attached to the distillation flask to assure removal of sulfide. The use of this scrubber during the

distillation process was a requirement added to the cyanide analysis by EPA Region X.

A study measuring the total iron concentrations of soil samples compared to cyanide concentrations was conducted on selected soil samples from the site in which matrix spike recovery problems were experienced. It is proposed the soluble iron species may be forming insoluble iron cyanide complexes with the matrix spike cyanide. This explanation is theoretical since the results of the iron study are inconclusive. Additional research on this hypothesis by qualified analysts is required for verification and substantiation.

An additional factor that may have contributed to the low matrix spike recoveries is the use of the sulfide scrubber on the distillation apparatus. A separate study investigating this possibility was undertaken during the course of the RI by Versar Laboratory. The results of the study appear to indicate the sulfide scrubber may act to lower the recovery of the analyte and matrix spikes. However, further research by other qualified analysts is required to verify the findings.

In conformance with the EPA laboratory data validation guidelines, all samples analyzed for free cyanide in a batch having a low matrix spike were flagged J to indicate they are estimated. However, the method appears to be the best method currently available for measuring weak acid dissociable cyanide, and therefore, the free cyanide values in soil have been used quantitatively in the RI, providing all other QC criteria for the analysis were satisfactory.

TOTAL CYANIDE IN GROUND WATER: Matrix spike percent recoveries in the analysis of total cyanide for two batches of ground-water samples were low and outside CLP control limits. All other QC data for these samples were within required control limit criteria. The method employed for the measurement of total cyanide in this investigation was EPA Method 335.2 and employed the addition of a lead acetate, sulfide scrubber in accordance with Section 8.2 of the method as per EPA Region X directions.

It is known that certain substances in the sample can interfere with the recovery of cyanide from the sample. Most interferences, however, are eliminated or reduced by using the distillation procedure. Certain interfering substances, notably sulfide and oxidizing agents, are not removed by distillation and samples must be prescreened for these substances.

Sulfide screening tests were conducted at the site on every surface or ground-water sample; no positive sulfide or oxidizer screening tests were observed. The results of the sulfide scrubber study on cyanide recovery appear to indicate the scrubber may have the affect of lowering the recovery of cyanide including matrix spikes.

Again, it is understood that the scrubber study is inconclusive.

Since ground-water samples were generally silty, it is also possible some other unidentified compound or substance may have been present in ground-water samples and acted to cause the observed low matrix spike recoveries. The possibility of a laboratory error in spiking samples for the analysis of these two sample batches also cannot be ruled out. However, other QC data was within required control limits.

CONCLUSION: To conclude the discussion on matrix spike recoveries in free and total cyanide analysis, it must be pointed out that as of this date, to our knowledge, an interlaboratory method study for cyanide has not been performed for ground water and soil matrices. Therefore, the CLP-M QA/QC acceptable spike recovery and relative percent difference (RPD) control limits appear to be excessively stringent for soil samples. This point is further supported by the fact that there are no procedures for the removal of potential analytical interfering substances (except for sulfides released during distillation that are removed by the sulfide scrubber) from soil. Data generated from analysis of soils, therefore, should not be required to be invalidated on the basis of apparently arbitrarily assigned QC control limits. This is particularly true for Weak and Dissociable Cyanide Analysis since the CLP control limits have only been developed for total cyanide.

TABLE A-1
ANALYTICAL PARAMETERS

BASE-NEUTRAL EXTRACTABLE

Acenaphthene •
Bis(2-Ethylhexyl)phthalate
Dimethylphthalate
Indeno-1,2,3(c,d)pyrene •
Acenaphthylene •
4-Bromophenylphenylether
Di-n-butylphthalate
Isophorone
Anthracene •
Butylbenzylphthalate
2,4-Dinitrotoluene
Naphthalene •
Benzidine
2-Chloronaphthalene
2,6-Dinitrotoluene
Nitrobenzene
Benzo(a)anthracene •
Chrysene •
Di-n-octylphthalate
N-Nitroso-di-methylamine
Benzo(a)pyrene •
4-Chlorophenylphenylether
N-Nitroso-din-propylamine
Dibenzo(a,h)anthracene •
Fluoranthene •
N-Nitrosodiphenylamine
Benzo(g,h,i)perylene •
1,2-Dichlorobenzene
Fluorene •
Phenanthrene •
Benzo(b&k)fluoroanthenes •
1,3-Dichlorobenzene
Hexachlorobenzene
Pyrene •
Bis(2-Chloroethoxy)methane
1,4-Dichlorobenzene
Hexachlorobutadiene
Bis(2-Chloroethyl)ether
3,3-Dichlorobenzidine
Hexachlorocyclopentadiene
1,2,4-Trichlorobenzene
Bis(2-Chloroisopropyl)ether
Diethylphthalate
Hexachloroethane

ACID EXTRACTABLE

2-Chlorophenol
2,4-Dinitrophenol
4-Nitrophenol
Phenol
2,4-Dichlorophenol
4,6-Dinitro-o-cresol
2,4,6-Trichlorophenol
2,3-Dimethylphenol
2-Nitrophenol
Pentachlorophenol
4-chloro-3-methylphenol

VOLATILE ORGANIC COMPOUNDS

Acrolein
Chloroethane
Trans-1,2-Dichloro-ethylene
Acrylonitrile
2-Chloroethyl vinyl ether
1,2-Dichloropropane
1,1,2,2-Tetrachloro-ethane
Benzene
Chloroform
Cis-1,3-Dichloropropene
1,1,1-Trichloroethane
Bromoform
Dibromochloromethane
Ethylbenzene
1,1,2-Trichloroethane
Carbon Tetrachloride
1,1-Dichloroethane
Trichloroethylene
Chlorobenzene
1,2-Dichloroethane
Toluene
Bromodichloromethane
Bromomethane
Chloromethane
Tetrachloroethylene
Trans-1,3-dichloro-propene
Cis-1,1-Dichloroethylene
Methylene Chloride
Vinyl Chloride

PCBs

Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

METALS

Antimony*
Arsenic
Barium
Beryllium*
Cadmium
Chromium
Copper*
Lead
Mercury
Nickel*
Selenium
Silver
Thallium*
Zinc*

COMMON IONS

Calcium
Potassium
Chloride
Bicarbonate Alkalinity
Carbonate Alkalinity
Magnesium
Sodium

NOTES:

- • Polynuclear Aromatic Hydrocarbons (PAHs)
- * Metal Analyzed only in Ground Water

TABLE A-1 (cont'd)
ANALYTICAL PARAMETERS

SITE INDICATOR PARAMETERS

Parameters	Method
Total Cyanide	Modified 335.2/CLP (7/85)
Free Cyanide	Std. Meth. 412 B,D,H
Fluoride	Water 300.0 Sludges/soils 340.2 + Leaching
Sulfate	300.0
Total Sodium	200.7/273.2
Total Arsenic	206.2

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			SITE INDICATOR PARAMETERS (mg/L)						METALS (ug/L)				
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE (1)	SULFATE (2)	TOTAL SODIUM	TOTAL ARSENIC	TOTAL LEAD	TOTAL ZINC	TOTAL BARIUM	TOTAL COPPER	TOTAL NICKEL
MONITORING WELLS													
MW- 1A	0814	29-AUG-86	0.010 UJ	0.010 U	0.93	48	49	-	-	-	-	-	-
MWR- 1A	870818-007	16-AUG-87	0.010 J	0.010 U	1.0 U	36	56.400	-	-	-	-	-	-
MW- 1B	0797	28-AUG-86	0.010 U	0.010 U	1.3	22	30	-	-	-	-	-	-
MWR- 1B	870820-001	17-AUG-87	0.010	0.010 U	1.0 U	17	41.100	-	-	-	-	-	-
MW- 1C	0802	28-AUG-86	0.010 U	0.010 U	1.0	22	27	-	-	-	-	-	-
MW- 2A	0815	29-AUG-86	0.13	0.010 U	0.65	20	23	-	-	-	-	-	-
MWR- 2A	870818-009	15-AUG-87	0.608 J	0.038	1.0 U	91	31.700	-	-	-	-	-	-
MW- 2B	0785	29-AUG-86	0.57	0.093	0.90	80	35	-	-	-	-	-	-
MWR- 2B	870818-008	16-AUG-87	1.180 J	0.034	1.0 U	100	48.300	-	-	-	-	-	-
MW- 2S	870806-019	04-AUG-87	0.010 U	0.010 U	1.0 U	33	10.500	-	-	-	-	-	-
MW- 3A	0777	27-AUG-86	0.010 U	0.010 U	0.97	30	24	-	-	-	-	-	-
MW- 3A	870811-010	09-AUG-87	0.016	0.010 U	1.0 U	38	23	-	-	-	-	-	-
MW- 3B	0799	28-AUG-86	0.026	0.010 U	1.3	24	26	-	-	-	-	-	-
MWR- 3B	870817-006	13-AUG-87	0.024 J	0.010 U	1.0 U	22	31.300	-	-	-	-	-	-
MW- 3C	0845	02-SEP-86	0.036	0.010 U	0.90	24	28	-	-	-	-	-	-
MW- 3S	870811-004	09-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	28.300	-	-	-	-	-	-
MW- 4A	0810	28-AUG-86	0.059	0.010 U	0.86	135	15	-	-	-	-	-	-
MW- 4A	870811-006	09-AUG-87	0.213	0.010 U	1.0 U	64	29.100	-	-	-	-	-	-
MW- 4B	870817-007	13-AUG-87	0.010 UJ	0.010 U	1.0 U	54	33.900	-	-	-	-	-	-
MW- 4S	0811	28-AUG-86	0.049	0.010 U	0.83	98	15	-	-	-	-	-	-
MW- 4S	870804-013	02-AUG-87	0.024	0.010 U	1.0 U	25 J	12.900	-	-	-	-	-	-
MW- 5A	0803	28-AUG-86	0.010 U	0.010 U	0.51	37	17	-	-	-	-	-	-
MW- 5A	870810-021	07-AUG-87	0.041	0.010 U	1.0 U	59	17.100	-	-	-	-	-	-
MW- 5S	870811-005	09-AUG-87	34.100	0.215	57	680	1270.000	-	-	-	-	-	-
MW- 6A	0895	03-SEP-86	0.38	0.23	1.1	9.1	23	-	-	-	-	-	-
MW- 6AA	0831	01-SEP-86	0.32	0.036	0.97	8.3	24	-	-	-	-	-	-
MW- 6AA	870817-002	12-AUG-87	0.557	0.062	1.0	22	34.900	-	-	-	-	-	-
MW- 6B	0896	03-SEP-86	1.2	0.47	0.93	83	26	-	-	-	-	-	-
MWR- 6B	870730-001	28-JUL-87	1.120	0.051	1.0 U	73	25.100	-	-	-	-	-	-
MW- 7A	0800	28-AUG-86	0.46	0.086	1.2	18	19	-	-	-	-	-	-
MWR- 7A	870806-021	05-AUG-87	0.803	0.099	1.0 U	28	29.000	-	-	-	-	-	-
MW- 7B	0826	01-SEP-86	0.77	0.042	0.71	78	22	-	-	-	-	-	-
MWR- 7B	870818-004	16-AUG-87	0.953 J	0.035	1.0 U	99	27.700	-	-	-	-	-	-
MW- 8A	0900	03-SEP-86	1.1	0.48	1.0	44	38	-	-	-	-	-	-
MWR- 8A	870729-009	28-JUL-87	1.780	0.030 J	1.0	76	42.700	-	-	-	-	-	-
MW- 8B	0899	03-SEP-86	0.48	0.19	1.8	67	25	-	-	-	-	-	-
MWR- 8B	870729-008	27-JUL-87	1.220	0.062 J	2.9	61	43.700	-	-	-	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			SITE INDICATOR PARAMETERS (mg/L)						METALS (ug/L)				
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE (1)	SULFATE (2)	TOTAL SODIUM	TOTAL ARSENIC	TOTAL LEAD	TOTAL ZINC	TOTAL BARIUM	TOTAL COPPER	TOTAL NICKEL
PUMP TEST8B-ST	870831-004	27-AUG-87	0.608	0.057	1.0	60	28.500	-	-	-	-	-	-
PUMP TEST8B-MID	870901-025	29-AUG-87	0.402	0.026	1.0 U	41	18.500	-	-	-	-	-	-
PUMP TEST8B-END	870901-026	30-AUG-87	0.457	0.038	1.0 U	38	18.900	-	-	-	-	-	-
MW- 8S	870805-001	03-AUG-87	7.070	0.136	1.0 U	103	57.200	-	-	-	-	-	-
MW- 9A	0885	05-SEP-86	-	-	-	-	-	-	-	-	-	-	-
MW- 9A	0885	03-SEP-86	1.6	0.053	1.4	40	42	-	-	-	-	-	-
MWR- 9A	870805-006	04-AUG-87	12.600	0.132	10	100	167.000	-	-	-	-	-	-
MW- 9B	0891	04-SEP-86	1.0	0.54	1.4	50	32	-	-	-	-	-	-
MWR- 9B	870818-010	15-AUG-87	10.000 J	0.057	20	92	195.000	-	-	-	-	-	-
MW- 9S	870805-005	04-AUG-87	16.700	0.060	1.9	41	82.200	-	-	-	-	-	-
MW- 10A	0786/0825	29-AUG-86	0.010 U	0.010 U	0.58	22	24	-	-	-	-	-	-
MW- 10A	870810-019	06-AUG-87	0.020	0.010 U	1.0 U	21	26.800	-	-	-	-	-	-
MW- 11D	0790	28-AUG-86	0.010 U	0.010 U	0.77	24	17	-	-	-	-	-	-
MW- 11D	870811-008	08-AUG-87	0.010 U	0.010 U	1.0 U	22	16.400	-	-	-	-	-	-
MW- 12A	0773	27-AUG-86	0.084	0.018	0.90	13	25	-	-	-	-	-	-
MW- 12A	0773	26-AUG-86	-	-	-	-	-	0.010 U	10 U	89	200 U	25 U	40 U
MW- 12A	870730-002	28-JUL-87	0.096 J	0.010 U	1.0 U	5.0 U	29.500	-	-	-	-	-	-
MW- 12B	0775	26-AUG-86	-	-	-	-	-	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 12B	0775	27-AUG-86	0.080	0.010	0.65	22	16	-	-	-	-	-	-
MW- 12B	870730-005	29-JUL-87	0.099 J	0.020 U	1.0 U	9.4	17.400	-	-	-	-	-	-
MW- 13A	0769	26-AUG-86	-	-	-	-	-	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 13A	0769	27-AUG-86	0.13	0.010 U	0.85	20	20	-	-	-	-	-	-
MW- 13A	870731-001	29-JUL-87	0.241	0.037	1.0 U	21 J	20.900	-	-	-	-	-	-
MW- 13B	0776	27-AUG-86	0.15	0.025	0.82	24	13	-	-	-	-	-	-
MW- 13B	0776	26-AUG-86	-	-	-	-	-	0.010 U	10 U	148	200 U	25 U	40 U
MW- 13B	870731-002	30-JUL-87	0.138	0.022	1.0 U	20 J	14.800	-	-	-	-	-	-
MW- 14A	0730	26-AUG-86	0.026	0.010 U	1.3	15	29	0.010 U	10 U	71	200 U	25 U	40 U
MW- 14A	870731-003	29-JUL-87	0.823	0.010 U	1.0 U	77 J	31.800	-	-	-	-	-	-
MW- 14B	0753	26-AUG-86	0.30	0.058	0.86	73	24	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 14B	870731-004	30-JUL-87	0.641	0.041	1.0 U	72 J	24.800	-	-	-	-	-	-
MW- 15A	0750	26-AUG-86	2.4	0.049	1.1	52	33	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 15A	870813-009	11-AUG-87	0.270	0.052	1.0 U	44	37.000	-	-	-	-	-	-
MW- 15B	0752	26-AUG-86	1.5	0.052	1.0	97	22	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 15B	870813-010	11-AUG-87	0.802	0.095	1.0 U	88	23.800	-	-	-	-	-	-
MW- 15S	0751	26-AUG-86	0.67	0.049	7.4	136	59	0.010 U	11	50 U	200 U	25 U	40 U
MW- 15S	3676	20-AUG-87	-	-	-	-	-	-	-	-	-	-	-
MW- 15S	870805-007	03-AUG-87	0.312	0.095	4.7	74	59.700	-	-	-	-	-	-
MW- 16A	0806	26-AUG-86	-	-	-	-	-	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 16A	0806	28-AUG-86	0.033	0.010 U	1.2	22	43	-	-	-	-	-	-
MW- 16A	870812-032	11-AUG-87	0.040 J	0.012	1.0 U	25	41.200	-	-	-	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			SITE INDICATOR PARAMETERS (mg/L)						METALS (ug/L)				
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE (1)	SULFATE (2)	TOTAL SODIUM	TOTAL ARSENIC	TOTAL LEAD	TOTAL ZINC	TOTAL BARIUM	TOTAL COPPER	TOTAL NICKEL
MW- 16B	0807	28-AUG-86	1.1	0.030	4.2	31	34	0.050 U	10 U	51	200 U	25 U	40 U
MW- 16B	870825-008	23-AUG-87	0.260	0.015	1.4	21	25.100	-	-	-	-	-	-
MW- 16D	0779	27-AUG-86	0.010 U	0.010 U	0.68	24	17	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 16D	870812-033	11-AUG-87	0.010 U	0.010	1.0 U	21	17.900	-	-	-	-	-	-
MW- 17S	0727	26-AUG-86	0.78	0.024	0.89	143	22	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 17S	870731-005	30-JUL-87	0.549	0.027	1.0 U	1130 J	31.400	-	-	-	-	-	-
MW- 18A	870730-004	29-AUG-87	0.010 UJ	0.010 U	1.0 U	81	46.700	-	-	-	-	-	-
MW- 18B	870818-005	17-AUG-87	0.010 UJ	0.010 U	1.0 U	271	67.000	-	-	-	-	-	-
MW- 18S	0761	26-AUG-86	0.050	0.010 U	12	617	162	0.010 U	11	142	588	26	40 U
MW- 18S	870811-009	08-AUG-87	0.050	0.010 U	7.1	1810	374.000	-	-	-	-	-	-
MW- 19S	0762	26-AUG-86	0.010 U	0.010 U	8.9	573	184	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 19S	870731-006	30-JUL-87	0.010 U	0.010 U	4.8	117 J	246.000	-	-	-	-	-	-
MW- 20A	0765	27-AUG-86	0.010 U	0.010 U	1.0	35	34	0.010 U	10 U	70	200 U	25 U	40 U
MW- 20A	870807-002	05-AUG-87	0.010 U	0.010 U	1.0 U	27	38.400	-	-	-	-	-	-
MW- 20S	0827	01-SEP-86	0.010 U	0.010 U	0.98	37	39	0.010 U	10 U	50 U	200 U	25 U	40 U
MW- 20S	870803-001	30-JUL-87	0.010 UJ	0.010 U	1.0 U	66 J	49.900	-	-	-	-	-	-
MW- 21S	0766	27-AUG-86	0.010 U	0.010 U	12	74	45	0.010 U	10 U	190	200 U	25 U	40 U
MW- 21S	870807-001	05-AUG-87	0.014	0.010 U	5.5	871	90.500	-	-	-	-	-	-
MW- 22S	870804-014	02-AUG-87	0.112	0.012	1.0 U	46 J	32.000	-	-	-	-	-	-
MW- 23S	870803-002	31-JUL-87	0.180 J	0.015	1.0 U	16 J	18.800	-	-	-	-	-	-
MW- 24A	870817-001	12-AUG-87	0.010 U	0.010 U	1.0	23	44.700	-	-	-	-	-	-
MW- 24S	870805-002	03-AUG-87	0.010 U	0.010 U	1.0 U	10	3.930	-	-	-	-	-	-
MW- 25S	870811-011	08-AUG-87	0.010 U	0.010 U	1.0 U	33	11.300	-	-	-	-	-	-
MW- 26A	870812-027	10-AUG-87	0.312 J	0.025	1.0 U	75	61.200	-	-	-	-	-	-
MW- 26B	870825-001	20-AUG-87	1.280	0.047	1.0 U	83	32.500	-	-	-	-	-	-
MW- 26S	870803-003	31-JUL-87	0.010 UJ	0.010 U	1.0 U	22 J	32.300	-	-	-	-	-	-
MW- 27A	870812-028	10-AUG-87	0.200 J	0.016	1.0	29	28.100	-	-	-	-	-	-
MW- 27B	870831-001	26-AUG-87	0.716	0.033	1.0 U	34	27.000	-	-	-	-	-	-
MW- 27S	870805-008	03-AUG-87	0.795	0.077 U	1.0 U	32	15.700	-	-	-	-	-	-
MW- 28S	870810-022	07-AUG-87	0.010 U	0.010 U	1.0 U	123	82.600	-	-	-	-	-	-
MW- 29S	870811-012	08-AUG-87	0.010 U	0.010 U	1.0 U	3020	658.000	-	-	-	-	-	-
MW- 30S	870827-001	24-AUG-87	0.010 U	0.010 U	1.0 U	924	84.800	-	-	-	-	-	-
MW- 31S	870831-026	27-AUG-87	0.041	0.010 U	1.0	153	58.500	-	-	-	-	-	-
MW- 32S	870825-009	24-AUG-87	1.020	0.052	2.5	45	24.500	-	-	-	-	-	-
MW- 33A	870827-003	24-AUG-87	1.500	0.085	1.0 U	71	43.200	-	-	-	-	-	-
MW- 33B	870827-004	24-AUG-87	0.955	0.100	1.0 U	145	21.700	-	-	-	-	-	-
MW- 34A	870831-003	27-AUG-87	0.010 U	0.010 U	1.0 U	27	61.400	-	-	-	-	-	-
MW- 34B	870827-005	25-AUG-87	0.013	0.010 U	1.0 U	12	37.200	-	-	-	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			SITE INDICATOR PARAMETERS (mg/L)						METALS (ug/L)				
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE (1)	SULFATE (2)	TOTAL SODIUM	TOTAL ARSENIC	TOTAL LEAD	TOTAL ZINC	TOTAL BARIUM	TOTAL COPPER	TOTAL NICKEL
PRODUCTION WELLS													
PW- 1	0839	01-SEP-86	0.010 U	0.010 U	1.2	34	29	-	-	-	-	-	-
PW- 1	0839	02-SEP-86	-	-	-	-	-	0.010 U	10 U	66	200 U	25 U	40 U
PW- 1	870812-031	11-AUG-87	0.010 U	0.010 U	1.0 U	29	29.300	-	-	-			
PW- 3	0823	01-SEP-86	0.010 U	0.010 U	1.1	29	33	0.010 U	10 U	50 U	200 U	25 U	40 U
PW- 3	870812-023	11-AUG-87	0.010 UJ	0.010 U	1.0 U	20	38.900	-	-	-			
PW- 4	0817	02-SEP-86	0.010 U	0.010 U	0.72	21	23	0.010 U	10 U	50 U	200 U	25 U	40 U
PW- 4	870812-024	11-AUG-87	0.010 UJ	0.010 U	1.0 U	16	23.800	-	-	-	-	-	-
OFFSITE WELLS													
KLINDT	0881	02-SEP-86	0.460	0.013	0.63	49.5	10	0.050 U	10 U	213	200 U	25 U	63
KLINDT	870813-014	11-AUG-87	0.177	0.037	1.0 U	55	14.000	-	-	-	-	-	-
MT. FIR LUMBER	0882	02-SEP-86	0.013	0.010 U	1.1	194	19	0.010 U	10 U	1280	200 U	25 U	40 U
MT. FIR LUMBER	870813-013	11-AUG-87	0.010 U	0.010 U	1.0 U	125	20.500	-	-	-	-	-	-
CHENOWETH #3	0889	04-SEP-86	0.010 U	0.010 U	1.0	32	39.000	0.050 U	10 U	50 U	200 U	25 U	40 U
CHENOWETH #3	870817-005	13-AUG-87	0.010 U	0.010 U	1.0	30	44.800	-	-	-	-	-	-
CHENOWETH #1	0888	04-SEP-86	0.010 U	0.010 U	1.1	42	43	0.010 U	10 U	50 U	200 U	25 U	40 U
CHENOWETH #1	870817-004	13-AUG-87	0.010 U	0.010 U	1.0 U	40	47.400	-	-	-	-	-	-
REC WELL	0787	29-AUG-86	0.010 U	0.010 U	1.3	22	36	0.010 U	21	50 U	200 U	25 U	40 U
REC WELL	870810-020	06-AUG-87	0.010	0.010 U	1.0 U	33	40.000	-	-	-	-	-	-
ROCKLINE	0873	03-SEP-86	0.290	0.010 U	2.8	121	35	0.010 U	10 U	126	200 U	25 U	40 U
ROCKLINE	870813-012	11-AUG-87	0.336	0.023	2.2	105	4.160	-	-	-	-	-	-
ANIMAL SHELTER	0874	03-SEP-86	0.036	0.010 U	0.38	26	7.4	0.010 U	10 U	60	200 U	25 U	40 U
ANIMAL SHELTER	870813-011	11-AUG-87	0.023	0.010 U	1.0 U	15	6.230	-	-	-	-	-	-
RESIDENCE WELL	870825-003	19-AUG-87	0.055	0.010 U	6.6	429	95.100	-	-	-	-	-	-
MISCELLANEOUS SAMPLES													
HOLD TANK	870902-001	01-SEP-87	-	0.079	-	-	-	-	-	-	-	-	-
LEACHATE FILTERED	3717AE	27-AUG-87	-	-	-	-	-	-	-	-	-	-	-
LEACHATE UNFILTER	3717BE	01-SEP-87	-	-	-	-	-	-	-	-	-	-	-
QA SAMPLES-FIELD BLANKS													
PW- 4FB	870812-026	11-AUG-87	0.010 UJ	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
AS- FB	870813-007	11-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 2S-FB	870806-020	04-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			SITE INDICATOR PARAMETERS (mg/L)						METALS (ug/L)				
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE (1)	SULFATE (2)	TOTAL SODIUM	TOTAL ARSENIC	TOTAL LEAD	TOTAL ZINC	TOTAL BARIUM	TOTAL COPPER	TOTAL NICKEL
MW- 3S-FB	870811-002	09-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 4A-FB	870811-007	09-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 6AA-FB	870817-003	12-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MWR- 8A-FB	870729-010	28-JUL-87	0.010 U	0.010 UJ	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 12B-FB	870730-006	29-JUL-87	0.010 UJ	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 16A-FB	870812-029	11-AUG-87	0.010 UJ	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 18B-FB	870818-006	17-AUG-87	0.010 UJ	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 20A-FB	870807-003	05-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 21S-FB	870810-018	05-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 24S-FB	870805-003	03-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
MW- 27B-FB	870831-002	26-AUG-87	0.010 U	0.010 U	1.0 U	5.0 U	1.000 U	-	-	-	-	-	-
QA SAMPLES-FIELD REPLICATES													
MW REP- 1 (MWR-2B)	870818-003	16-AUG-87	0.800 J	0.032	1.0 U	86	49.600	-	-	-	-	-	-
MW REP- 2 (MWR-4S)	870811-003	09-AUG-87	0.043	0.011	1.0 U	53	29.500	-	-	-	-	-	-
MW REP- 3 (MWR-6B)	870730-003	28-JUL-87	0.079 J	0.076	1.0 U	85	26.600	-	-	-	-	-	-
MW REP- 4 (MWR-8A)	870729-011	28-JUL-87	1.840	0.035 J	1.0 U	72	43.000	-	-	-	-	-	-
MW REP- 5 (MWR-9A)	870805-004	04-AUG-87	13.000	0.105	12	101	159.000	-	-	-	-	-	-
MW REP- 6 (MW-11D)	870811--13	11-AUG-87	0.010 U	0.010 U	1.0 U	22	16.400	-	-	-	-	-	-
MW REP- 7 (MW-13B)	870731-007	30-JUL-87	0.139	0.029	1.0 U	21 J	14.400	-	-	-	-	-	-
MW REP- 8 (MW-20S)	870803-004	30-JUL-87	0.262 J	0.021	1.0 U	49	50.500	-	-	-	-	-	-
MW REP- 9 (MW-22S)	870804-015	02-AUG-87	0.089	0.012	1.0 U	24 J	31.100	-	-	-	-	-	-
MW REP- 10 (MW-25S)	870811-001	08-AUG-87	0.010 U	0.010 U	1.0 U	9.9	12.200	-	-	-	-	-	-
MW REP- 11 (PW-3)	870812-025	11-AUG-87	0.010 UJ	0.010 U	1.0 U	38	38.400	-	-	-	-	-	-
MW REP- 12 (KLINDT)	870813-008	11-AUG-87	1.190	0.035	1.0 U	47	14.300	-	-	-	-	-	-
MW REP- 14 (MW-16A)	870812-030	11-AUG-87	0.042 J	0.011	1.0 U	22	42.200	-	-	-	-	-	-
MW REP- 15 (MW-15S)	3669	19-AUG-87	-	-	-	-	-	-	-	-	-	-	-
MW REP- 16 (MW-32S)	870825-010	24-AUG-87	1.060	0.065	2.6	41	25.000	-	-	-	-	-	-
REPLICATE (LEACHATE FILTERED)	3716	27-AUG-87	-	-	-	-	-	-	-	-	-	-	-

(1) FLUORIDE RESULTS FROM ISE METHOD, VALUES FROM IC METHOD NOT INCLUDED IN THIS TABLE
(2) SULFATE RESULTS FROM TURBIDIMETRIC METHOD, VALUES FROM IC METHOD NOT INCLUDED IN THIS TABLE
J = VALUE IS AN ESTIMATED QUANTITY; QUALITY CONTROL CRITERIA WERE NOT COMPLETELY MET.
U = PARAMETER WAS ANALYZED FOR BUT WAS NOT DETECTED AT CONCENTRATION VALUE INDICATED (DETECTION LIMIT).
- = NOT ANALYZED
BDL = BELOW DETECTION LIMIT FOR ALL PARAMETERS ANALYZED A GROUP OF ANALYTES (SEE TABLE 1)

SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	COMMON IONS (mg/L) DISSOLVED CALCIUM	DISSOLVED MAGNESIUM	DISSOLVED POTASSIUM	DISSOLVED SODIUM	BICARB ALKALI	CARBON ALKALI	CHLORIDE	BASE/NEUTRAL ACID EXTRACT-ABLES (ug/L)	VOCs (ug/L) TOLUENE	PCBs (ug/L)
MONITORING WELLS												
MW- 1A	0814	29-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	BDL
MWR- 1A	870818-007	16-AUG-87	30.500	12.700	9.320	56.300	211	0.5 U	16	-	-	-
MW- 1B	0797	28-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	BDL
MWR- 1B	870820-001	17-AUG-87	14.200	1.880	7.970	43.900	91	30	9.7	BDL	-	-
MW- 1C	0802	28-AUG-86	-	-	-	-	-	-	-	BDL	6.3	BDL
MW- 2A	0815	29-AUG-86	-	-	-	-	-	-	-	-	-	-
MWR- 2A	870818-009	15-AUG-87	21.700	8.510	7.580	34.000	106	0.5 U	4.4	-	-	-
MW- 2B	0785	29-AUG-86	-	-	-	-	-	-	-	-	-	-
MWR- 2B	870818-008	16-AUG-87	27.700	7.380	9.370	51.700	88	20	8.5	-	-	-
MW- 2S	870806-019	04-AUG-87	15.900	5.930	4.140	10.700	73	4	4.4	-	-	-
MW- 3A	0777	27-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 3A	870811-010	09-AUG-87	26.400	9.740	8.620	25.100	111	1.0 U	13	-	-	-
MW- 3B	0799	28-AUG-86	-	-	-	-	-	-	-	-	-	-
MWR- 3B	870817-006	13-AUG-87	19.500	7.690	7.630	29.700	123	1.0 U	6.7	-	-	-
MW- 3C	0845	02-SEP-86	-	-	-	-	-	-	-	-	-	-
MW- 3S	870811-004	09-AUG-87	15.000	4.300	6.650	30.900	98	1.0 U	5.0	-	-	-
MW- 4A	0810	28-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 4A	870811-006	09-AUG-87	29.500	13.300	7.820	31.200	127	1.0 U	5.0	-	-	-
MW- 4B	870817-007	13-AUG-87	30.400	13.800	7.960	31.400	149	1.0 U	7.9	-	-	-
MW- 4S	0811	28-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 4S	870804-013	02-AUG-87	35.800	10.000	8.570	4.480	97	1.0 U	5.1	-	-	-
MW- 5A	0803	28-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 5A	870810-021	07-AUG-87	35.300	13.000	8.260	17.100	118	1.0 U	14	-	-	-
MW- 5S	870811-005	09-AUG-87	26.800	34.200	6.910	1370.000	2170	64	61	-	-	-
MW- 6A	0895	03-SEP-86	-	-	-	-	-	-	-	-	-	-
MW- 6AA	0831	01-SEP-86	-	-	-	-	-	-	-	-	-	-
MW- 6AA	870817-002	12-AUG-87	15.900	4.990	6.980	31.600	114	1.0 U	2.3	-	-	-
MW- 6B	0896	03-SEP-86	-	-	-	-	-	-	-	-	-	-
MWR- 6B	870730-001	28-JUL-87	41.400	20.400	8.000	24.600	230	1.0 U	8.8	-	-	-
MW- 7A	0800	28-AUG-86	-	-	-	-	-	-	-	-	-	-
MWR- 7A	870806-021	05-AUG-87	35.300	8.430	7.420	29.400	118	1.0 U	4.1	-	-	-
MW- 7B	0826	01-SEP-86	-	-	-	-	-	-	-	-	-	-
MWR- 7B	870818-004	16-AUG-87	50.700	25.300	8.780	26.400	188	0.5 U	8.2	-	-	-
MW- 8A	0900	03-SEP-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MWR- 8A	870729-009	28-JUL-87	25.100	7.570	9.710	39.900	128	1.0 U	6.8	-	-	-
MW- 8B	0899	03-SEP-86	-	-	-	-	-	-	-	-	-	-
MWR- 8B	870729-008	27-JUL-87	27.900	11.800	8.550	41.700	158	1.0 U	14	-	-	-

SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	COMMON IONS (mg/L) DISSOLVED CALCIUM	DISSOLVED MAGNESIUM	DISSOLVED POTASSIUM	DISSOLVED SODIUM	BICARB ALKALI	CARBON ALKALI	CHLORIDE	BASE/NEUTRAL ACID EXTRACT-ABLES (ug/L)	VOCs (ug/L) TOLUENE	PCBs (ug/L)
PUMP TEST8B-ST	870831-004	27-AUG-87	33.000	15.000	7.690	29.800	56	2.0 U	7.3	-	-	-
PUMP TEST8B-MID	870901-025	29-AUG-87	32.200	16.300	6.660	19.000	54	2.0 U	6.1	-	-	-
PUMP TEST8B-END	870901-026	30-AUG-87	30.900	15.900	6.390	18.700	52	2.0 U	5.6	-	-	-
MW- 8S	870805-001	03-AUG-87	21.700	5.480	10.200	53.900	60	8	5.6	-	-	-
MW- 9A	0885	05-SEP-86	-	-	-	-	-	-	-	-	0.005 U	-
MW- 9A	0885	03-SEP-86	-	-	-	-	-	-	-	BDL	-	-
MWR- 9A	870805-006	04-AUG-87	27.300	9.610	10.600	171.000	314	12	9.6	-	-	-
MW- 9B	0891	04-SEP-86	-	-	-	-	-	-	-	-	-	-
MWR- 9B	870818-010	15-AUG-87	16.900	8.690	8.580	204.000	300	34	18	-	-	-
MW- 9S	870805-005	04-AUG-87	12.600	4.290	7.580	88.300	190	2.0 U	4.1	-	-	-
MW- 10A	0786/0825	29-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 10A	870810-019	06-AUG-87	37.200	11.600	10.900	26.700	112	1.0 U	47	-	-	-
MW- 11D	0790	28-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 11D	870811-008	08-AUG-87	20.400	9.690	4.830	18.200	97	1.0 U	6.5	-	-	-
MW- 12A	0773	27-AUG-86	-	-	-	-	-	-	-	-	-	BDL
MW- 12A	0773	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 12A	870730-002	28-JUL-87	14.600	6.630	6.290	26.500	116	1.0 U	4.8	-	-	-
MW- 12B	0775	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 12B	0775	27-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 12B	870730-005	29-JUL-87	24.000	12.900	6.000	15.300	150	1.0 U	4.8	-	-	-
MW- 13A	0769	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 13A	0769	27-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 13A	870731-001	29-JUL-87	19.600	7.200	7.870	19.900	110	1.0 U	5.1	-	-	-
MW- 13B	0776	27-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 13B	0776	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 13B	870731-002	30-JUL-87	24.400	12.800	6.280	14.200	129	1.0 U	5.1	-	-	-
MW- 14A	0730	26-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	BDL
MW- 14A	870731-003	29-JUL-87	71.100	6.670	7.200	30.900	93	1.0 U	3.8	-	-	-
MW- 14B	0753	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 14B	870731-004	30-JUL-87	34.100	17.200	7.180	23.600	152	1.0 U	7.0	-	-	-
MW- 15A	0750	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 15A	870813-009	11-AUG-87	24.600	8.170	9.470	34.900	124	1.0 U	8.8	-	-	-
MW- 15B	0752	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 15B	870813-010	11-AUG-87	45.300	23.400	8.600	22.200	166	1.0 U	8.5	-	-	-
MW- 15S	0751	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 15S	3676	20-AUG-87	-	-	-	-	-	-	-	BDL	-	-
MW- 15S	870805-007	03-AUG-87	8.220	1.630	8.080	60.800	26	52	3.1	-	-	-
MW- 16A	0806	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 16A	0806	28-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 16A	870812-032	11-AUG-87	9.270	2.100	6.610	49.200	106	12	3.2	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			COMMON IONS (mg/L)							BASE/NEUTRAL ACID EXTRACT-ABLES (ug/L)	VOCs (ug/L)	PCBs (ug/L)
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	DISSOLVED CALCIUM	DISSOLVED MAGNESIUM	DISSOLVED POTASSIUM	DISSOLVED SODIUM	BICARB ALKALI	CARBON ALKALI	CHLORIDE		TOLUENE	
MW- 16B	0807	28-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 16B	870825-008	23-AUG-87	24.200	12.100	6.520	26.400	138	2.0 U	13	-	-	-
MW- 16D	0779	27-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 16D	870812-033	11-AUG-87	17.700	9.340	5.350	20.600	106	1.0 U	2.6	-	-	-
MW- 17S	0727	26-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 17S	870731-005	30-JUL-87	74.900	30.300	3.860	28.800	280	1.0 U	9.6	-	-	-
MW- 18A	870730-004	29-AUG-87	30.800	14.000	9.330	42.300	162	1.0 U	9.8	-	-	-
MW- 18B	870818-005	17-AUG-87	5.860	26.800	12.100	64.100	169	0.5 U	14	-	-	-
MW- 18S	0761	26-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 18S	870811-009	08-AUG-87	350.000	118.000	19.400	421.000	146	1.0 U	55	-	-	-
MW- 19S	0762	26-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 19S	870731-006	30-JUL-87	213.000	107.000	11.400	243.000	359	1.0 U	26	-	-	-
MW- 20A	0765	27-AUG-86	-	-	-	-	-	-	-	-	-	-
MW- 20A	870807-002	05-AUG-87	21.400	10.000	8.390	36.900	148	1.0 U	6.5	-	-	-
MW- 20S	0827	01-SEP-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 20S	870803-001	30-JUL-87	26.000	5.660	9.730	45.300	133	1.0 U	8.3	-	-	-
MW- 21S	0766	27-AUG-86	-	-	-	-	-	-	-	BDL	0.005 U	-
MW- 21S	870807-001	05-AUG-87	212.000	89.800	14.700	96.700	166	1.0 U	38	-	-	-
MW- 22S	870804-014	02-AUG-87	15.100	4.320	5.560	32.900	112	18	5.7	-	-	-
MW- 23S	870803-002	31-JUL-87	23.300	5.530	8.170	17.100	100	1.0 U	6.4	-	-	-
MW- 24A	870817-001	12-AUG-87	8.710	3.560	6.420	40.300	124	4.0	2.6	-	-	-
MW- 24S	870805-002	03-AUG-87	21.000	6.710	3.860	3.420	82	2.0 U	2.2	-	-	-
MW- 25S	870811-011	08-AUG-87	23.900	6.890	5.010	8.680	99	1.0 U	9.1	-	-	-
MW- 26A	870812-027	10-AUG-87	9.250	3.680	5.730	73.700	97	34	15	-	-	-
MW- 26B	870825-001	20-AUG-87	46.000	23.000	9.130	35.400	190	2.0 U	10	-	-	-
MW- 26S	870803-003	31-JUL-87	13.300	4.230	7.180	28.600	82	18	7.7	-	-	-
MW- 27A	870812-028	10-AUG-87	20.400	8.540	7.480	33.300	136	1.0 U	3.8	-	-	-
MW- 27B	870831-001	26-AUG-87	22.100	8.130	7.820	27.900	45	2.0 U	7.9	-	-	-
MW- 27S	870805-008	03-AUG-87	29.200	5.730	10.700	16.700	112	2.0 U	4.1	-	-	-
MW- 28S	870810-022	07-AUG-87	12.900	22.000	9.710	78.200	460	32	15	-	-	-
MW- 29S	870811-012	08-AUG-87	296.000	206.000	40.100	716.000	600	1.0 U	38	-	-	-
MW- 30S	870827-001	24-AUG-87	130.000	47.200	16.700	89.600	180	2.0 U	19	-	-	-
MW- 31S	870831-026	27-AUG-87	42.000	17.400	7.120	62.000	58	2.0 U	11	-	-	-
MW- 32S	870825-009	24-AUG-87	37.800	14.400	10.000	24.900	170	4.0	6.1	-	-	-
MW- 33A	870827-003	24-AUG-87	31.300	13.200	8.680	45.400	144	2.0 U	8.8	-	-	-
MW- 33B	870827-004	24-AUG-87	108.000	44.400	11.900	21.500	344	2.0 U	17	-	-	-
MW- 34A	870831-003	27-AUG-87	16.800	12.600	4.950	62.500	31	54	7.3	-	-	-
MW- 34B	870827-005	25-AUG-87	17.500	7.660	7.080	38.000	234	2.0	5.6	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	COMMON IONS (mg/L) DISSOLVED CALCIUM	DISSOLVED MAGNESIUM	DISSOLVED POTASSIUM	DISSOLVED SODIUM	BICARB ALKALI	CARBON ALKALI	CHLORIDE	BASE/NEUTRAL ACID EXTRACT-ABLES (ug/L)	VOCs (ug/L) TOLUENE	PCBs (ug/L)
PRODUCTION WELLS												
PW- 1	0839	01-SEP-86	-	-	-	-	-	-	-	-	-	-
PW- 1	0839	02-SEP-86	-	-	-	-	-	-	-	-	-	BDL
PW- 1	870812-031	11-AUG-87	21.900	11.500	7.080	32.900	141	1.0 U	2.9	-	-	-
PW- 3	0823	01-SEP-86	-	-	-	-	-	-	-	-	-	-
PW- 3	870812-023	11-AUG-87	21.500	11.000	8.070	43.100	160	1.0 U	5.2	-	-	-
PW- 4	0817	02-SEP-86	-	-	-	-	-	-		-	-	-
PW- 4	870812-024	11-AUG-87	15.900	8.090	6.030	26.100	108	1.0 U	3.5	-	-	-
OFFSITE WELLS												
KLINDT	0881	02-SEP-86	-	-	-	-	-	-	-	-		
KLINDT	870813-014	11-AUG-87	49.100	20.400	5.990	12.800	152	1.0 U	5.5	-	-	-
MT. FIR LUMBER	0882	02-SEP-86	-	-	-	-	-	-	-	-	-	-
MT. FIR LUMBER	870813-013	11-AUG-87	96.000	54.300	8.260	18.800	344	1.0 U	8.5	-	-	-
CHENOWETH #3	0889	04-SEP-86	50 U	200 U	25 U	40 U	-	-	-	-	-	-
CHENOWETH #3	870817-005	13-AUG-87	23.700	11.600	7.930	40.900	168	1.0 U	6.7	-	-	-
CHENOWETH #1	0888	04-SEP-86	-	-	-	-	-	-	-	-	-	-
CHENOWETH #1	870817-004	13-AUG-87	31.800	14.500	8.570	44.400	190	1.0 U	10	-	-	-
REC WELL	0787	29-AUG-86	-	-	-	-	-	-	-	-	-	-
REC WELL	870810-020	06-AUG-87	21.500	9.620	6.570	38.500	154	1.0 U	4.7	-	-	-
ROCKLINE	0873	03-SEP-86	-	-	-	-	-	-	-	-	-	-
ROCKLINE	870813-012	11-AUG-87	75.600	32.100	8.670	38.400	270	1.0 U	6.7	-	-	-
ANIMAL SHELTER	0874	03-SEP-86	-	-	-	-	-	-	-	-	-	-
ANIMAL SHELTER	870813-011	11-AUG-87	22.600	9.110	7.310	5.290	90	1.0 U	2.3	-	-	-
RESIDENCE WELL	870825-003	19-AUG-87	118.000	51.100	10.900	92.000	200	2.0 U	25	BDL	-	-
MISCELLANEOUS SAMPLES												
HOLD TANK	870902-001	01-SEP-87	-	-	-	-	-	-	-	-	-	-
LEACHATE FILTERED	3717AE	27-AUG-87	-	-	-	-	-	-	-	BDL	-	-
LEACHATE UNFILTER	3717BE	01-SEP-87	-	-	-	-	-	-	-	BDL	-	-
QA SAMPLES-FIELD BLANKS												
PW- 4FB	870812-026	11-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	2.0	1.0 U	0.29	-	-	-
AS- FB	870813-007	11-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0	1.0 U	0.29 U	-	-	-
MW- 2S-FB	870806-020	04-AUG-87	3.290	0.500 U	1.000 U	1.000 U	2.0	1.0 U	1.2	-	-	-

TABLE A-2: GROUND WATER DATA SUMMARY--ANALYTICAL RESULTS ABOVE DETECTION LIMIT

			COMMON IONS (mg/L)							BASE/NEUTRAL ACID EXTRACT-ABLES (ug/L)	VOCs (ug/L)	PCBs (ug/L)
SAMPLE ID #	VERSAR LAB ID #	DATE COLLECTED	DISSOLVED CALCIUM	DISSOLVED MAGNESIUM	DISSOLVED POTASSIUM	DISSOLVED SODIUM	BICARB ALKALI	CARBON ALKALI	CHLORIDE		TOLUENE	
MW- 3S-FB	870811-002	09-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	2.0	1.0 U	0.88	-	-	-
MW- 4A-FB	870811-007	09-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	3.0	1.0 U	0.29	-	-	-
MW- 6AA-FB	870817-003	12-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0	1.0 U	0.29 U	-	-	-
MWR- 8A-FB	870729-010	28-JUL-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0 U	1.0 U	0.25 U	-	-	-
MW- 12B-FB	870730-006	29-JUL-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0 U	1.0 U	0.25	-	-	-
MW- 16A-FB	870812-029	11-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0	1.0 U	0.29	-	-	-
MW- 18B-FB	870818-006	17-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0	0.50 U	0.29	-	-	-
MW- 20A-FB	870807-003	05-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	4.0	1.0 U	0.29	-	-	-
MW- 21S-FB	870810-018	05-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	2.0	1.0 U	0.29	-	-	-
MW- 24S-FB	870805-003	03-AUG-87	19.300	0.500 U	1.000 U	1.000 U	2.0 U	2.0 U	1.4 U	-	-	-
MW- 27B-FB	870831-002	26-AUG-87	0.500 U	0.500 U	1.000 U	1.000 U	1.0	2.0 U	0.29	-	-	-
QA SAMPLES-FIELD REPLICATES												
MW REP- 1 (MWR-2B)	870818-003	16-AUG-87	27.300	7.330	9.970	47.900	90	20	7.9	-	-	-
MW REP- 2 (MWR-4S)	870811-003	09-AUG-87	30.300	13.200	8.000	31.900	132	1.0 U	5.0	-	-	-
MW REP- 3 (MWR-6B)	870730-003	28-JUL-87	38.900	19.500	7.440	22.800	182	1.0 U	8.8	-	-	-
MW REP- 4 (MWR-8A)	870729-011	28-JUL-87	24.400	7.590	9.270	39.600	120	16	9.8	-	-	-
MW REP- 5 (MWR-9A)	870805-004	04-AUG-87	27.800	9.490	9.820	173.000	268	12	8.2	-	-	-
MW REP- 6 (MW-11D)	870811--13	11-AUG-87	18.500	9.270	5.130	17.400	114	1.0 U	9.7	-	-	-
MW REP- 7 (MW-13B)	870731-007	30-JUL-87	20.700	10.700	5.970	13.600	131	1.0 U	4.5	-	-	-
MW REP- 8 (MW-20S)	870803-004	30-JUL-87	22.500	5.790	10.100	46.300	137	1.0 U	7.7	-	-	-
MW REP- 9 (MW-22S)	870804-015	02-AUG-87	21.500	3.910	5.340	29.600	90	10	12	-	-	-
MW REP- 10 (MW-25S)	870811-001	08-AUG-87	50.700	15.600	5.970	9.080	1.0 U	1.0 U	24	-	-	-
MW REP- 11 (PW-3)	870812-025	11-AUG-87	21.500	11.100	8.080	42.600	178	1.0 U	6.2	-	-	-
MW REP- 12 (KLINDT)	870813-008	11-AUG-87	49.200	20.400	5.820	1.000 U	160	1.0 U	5.3	-	-	-
MW REP- 14 (MW-16A)	870812-030	11-AUG-87	9.040	2.140	6.200	46.400	117	1.0 U	3.2	-	-	-
MW REP- 15 (MW-15S)	3669	19-AUG-87	-	-	-	-	-	-	-	BDL	-	-
MW REP- 16 (MW-32S)	870825-010	24-AUG-87	39.000	14.500	9.840	25.500	172	2.0	4.7	-	-	-
REPLICATE (LEACHATE FILTERED)	3716	27-AUG-87	-	-	-	-	-	-	-	BDL	-	-

						SITE INDICATOR PARAMETERS							BASE/NEUTRAL EXTRACTABLES	
G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE	SULFATE	TOTAL SODIUM	TOTAL ARSENIC	% SOLIDS	DIBENZO (a,h) ANTHRACENE	FLUOR-ANTHENE
BATH RECOVERY														
BRASC	2934	COMP	SOIL	24-JUN-87	MG/KG	17	17	808	-	51800	-	99	-	-
SOILREP 4R (BRASC)	2942	COMP	SOIL	24-JUN-87	MG/KG	26	12	869	-	36400	-	99	-	-
BRFB (FIELD BLANK)	2933	GRAB	AQUE *	24-JUN-87	MG/KG	0.50 U	0.50 U	10 U	-	10 U	-	2 U	-	-
CATHODE WASH AREA														
CWASG	2938	GRAB	SOIL	24-JUN-87	MG/KG	20	9.6	1170	-	6630	-	98	-	-
CWBSG	2939	GRAB	SOIL	24-JUN-87	MG/KG	17	4.8	1330	-	6690	-	98	-	-
CWCSG	2940	GRAB	SOIL	24-JUN-87	MG/KG	19	15	796	-	16900	-	98	-	-
CWASC-1	2991	COMP	SOIL	26-JUN-87	MG/KG	7.3	0.56 J	-	-	2930	-	90	-	-
CHENOWETH CREEK SAMPLES														
CCSWG-1	870804-012	GRAB	AQUE	02-AUG-87	MG/L	0.010 U	0.010 U	0.010 U	22	18.40	-	-	-	-
CCSWG-2	870827-002	GRAB	AQUE	24-AUG-87	MG/L	0.010 U	0.010 U	0.010 U	9.0	6.000	-	-	-	-
CRSWG-1	870827-006	GRAB	AQUE	25-AUG-87	MG/L	0.010 U	0.010 U	0.010 U	11 J	5.230	-	-	-	-
DISCHARGE CHANNEL														
DCAW	2707	GRAB	AQUE	25-MAR-86	MG/L	6.5	0.06	33	66	632	0.01 U	-	0.010 U	0.005 U
DCFBW	2708	GRAB	AQUE	25-MAR-86	MG/L	0.21	0.017 U	5 U	500	0.20	0.01 U		0.010 U	0.005 U
DCAQ	0830	GRAB	AQUE	30-AUG-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
DCAG	2476	GRAB	SEDI	19-MAR-86	MG/KG	-	1 U	492	-	2180	-	50	120	1020
DCBG	2477(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	3.5	1020	-	4080	-	48	100 U	1540
DCCG	2478(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	2.8	385	-	8200	-	55	10 U	120
DCDG	2507(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	4.7	1240	-	7810	-	48	100 U	1080
DCDG	0877	GRAB	SEDI	02-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
DCEG	2508(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	1.2 U	767	-	3250	-	41	100 U	830
DCEG	0892	GRAB	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
SR-3 (REP DCEG)	0893	GRAB	AQUE	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
DCFBS (FIELD BLANK)	2467(M)	GRAB	AQUE *	19-MAR-86	MG/KG	-	0.5 U	10 U	-	40	-	-	10 U	5 U
DRAINAGE DITCH														
DDASG	2712	GRAB	SEDI	25-MAR-86	MG/KG	-	1.3 J	926	-	15400	-	50	-	-
DDBSG	2713	GRAB	SEDI	25-MAR-86	MG/KG	-	3.2 J	271	-	1070	-	43	-	-
DDCSG	2714	GRAB	SEDI	25-MAR-86	MG/KG	-	0.78 UJ	330	-	5490	-	64	-	-
DDDSG	2725	GRAB	SEDI	25-MAR-86	MG/KG	-	0.74 UJ	312	-	5530	-	68	-	-
DDESG	2726	GRAB	SEDI	25-MAR-86	MG/KG	-	1 UJ	416	-	9220	-	50	-	-
DDFBS (FIELD BLANK)	2727	GRAB	AQUE *	25-MAR-86	MG/KG	-	2.5 UJ	1 U	-	70	-	-	-	-

						SITE INDICATOR PARAMETERS							BASE/NEUTRAL EXTRACTABLES	
G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE	SULFATE	TOTAL SODIUM	TOTAL ARSENIC	% SOLIDS	DIBENZO (a,h) ANTHRACENE	FLUOR-ANTHENE
DUCK POND														
DPAW	2600	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	12	42	21	0.01 UJ	-	0.010 U	0.005 U
DPBW	2602	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	11	42	29	0.01 UJ	-	0.010 U	0.005 U
DPCW	2612	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.025 UJ	12	43	30	0.01 UJ	-	0.010 U	0.005 U
DPDW	2613	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	12	43	28	0.01 UJ	-	0.010 U	0.005 U
DPEW	2624	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	12	43	26	0.01 UJ	-	0.010 U	0.005 U
DPFW	2625	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	13	43	26	0.01 UJ	-	0.010 U	0.005 U
DPGW	2598	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	12	43	33	0.01 UJ	-	0.010 U	0.005 U
DPHW	2599	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	12	42	31	0.01 UJ	-	0.010 U	0.005 U
DPIW	2620	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	11	43	25	0.01 UJ	-	0.010 U	0.005 U
DPAS1	2632	COMP	SEDI	24-MAR-86	MG/KG	-	2.3 UJ	76	-	311	-	14	-	-
DPAS2	2633	COMP	SEDI	24-MAR-86	MG/KG	-	3.6 UJ	91	-	463	-	18	-	-
DPBS	2622	COMP	SEDI	24-MAR-86	MG/KG	-	0.5 U	108	-	1037	-	14	-	-
DPCSG	2621	COMP	SEDI	24-MAR-86	MG/KG	-	0.5 U	644	-	1105	-	16	-	-
DPFBS (FIELD BLANK)	2634	GRAB	AQUE *	24-MAR-86	MG/KG	-	1.7 UJ	10 U	-	28	-	-	-	-
DPFBW (FIELD BLANK)	2614	GRAB	AQUE	24-MAR-86	MG/L	0.017 U	0.017 UJ	1 U	5 U	0.17	0.01 UJ	-	0.010 U	0.005 U
DUCK POND	0843	GRAB	AQUE	02-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
REP-SW2 (DUCK POND)	0844	GRAB	AQUE	02-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
LANDFILL														
LFAS	3290	COMP	SOIL	10-MAY-86	MG/KG	0.52	0.27 U	1160	-	63000	-	93	83	340
LFBS	3291	COMP	SOIL	10-MAY-86	MG/KG	0.32	0.30 U	2010	-	66200	-	82	40	240
LFCS	3292	COMP	SOIL	10-MAY-86	MG/KG	11	0.28 U	204	-	3440	-	88	8.4 U	48
LFDS	3294	COMP	SOIL	10-MAY-86	MG/KG	1.7	0.29 U	1250	-	69100	-	87	36	150
LFES	3295	COMP	SOIL	10-MAY-86	MG/KG	70	54	2880	-	82200	-	81	13	100
LFFBS (FIELD BLANK)	3297(M)	GRAB	AQUE *	10-MAY-86	MG/KG	0.01 U	-	100 U	-	100	-	-	2.5 U	5.0
LFCGS	3296	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-	-	-
LANDFILL DITCH														
LDAWG	2927	GRAB	AQUE	23-JUN-87	MG/L	-	-	7620	10500	36600	-	-	0.020 UJ	0.020 UJ
LDBWG	2929	GRAB	AQUE	23-JUN-87	MG/L	-	-	5750	12000	37300	-	-	0.020 UJ	0.028 J
DLSW-REP1E (LDBWG)	2925	GRAB	AQUE	23-JUN-87	MG/L	-	-	5400	11000	37600	-	-	0.020 UJ	0.020 UJ
LDAWG	3340	GRAB	AQUE	2-AUG-87	MG/L	373	34.200	6880	15200	68000	-	-	0.100 U	0.100 U
LDBWG	3338	GRAB	AQUE	2-AUG-87	MG/L	1090	77.200	8000	39900	79200	-	-	0.100 U	0.100 U
DLSW-REP1E (LDBWG)	3339	GRAB	AQUE	2-AUG-87	MG/L	1280	59.700	7750	42300	99800	-	-	0.100 U	0.100 U
LDFB (FIELD BLANK)	2930	GRAB	AQUE	23-JUN-87	MG/L	-	-	1 U	5 U	-	-	-	0.010 U	0.010 U
LDFB	3341	GRAB	AQUE	02-AUG-87	MG/L	0.010 U	0.010 U	1 U	5 U	1.050	-	-	0.100 U	0.100 U

						SITE INDICATOR PARAMETERS							BASE/NEUTRAL EXTRACTABLES	
G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE	SULFATE	TOTAL SODIUM	TOTAL ARSENIC	% SOLIDS	DIBENZO (a,h) ANTHRACENE	FLUOR-ANTHENE
NDAW	2723	GRAB	AQUE	25-MAR-86	MG/L	5.150	0.82	190	146	513	0.037	-	0.010 U	0.005 U
NDBW	2724	GRAB	AQUE	25-MAR-86	MG/L	1.600	0.59	196	148	444	0.022	-	0.010 U	0.005 U
NDAW	0837	GRAB	AQUE	01-SEP-86	MG/L	0.160	0.066	-	-	-	-	-	-	-
NDBW	0836	GRAB	AQUE	01-SEP-86	MG/L	0.260	0.18	-	-	-	-	-	-	-
NDAS	2515	COMP	SEDI	19-MAR-86	MG/KG	-	0.66 U	204	-	3030	-	76	-	-
NDBS	2516	COMP	SEDI	19-MAR-86	MG/KG	-	3.6	189	-	2720	-	53	-	-
LANDFILL LEACHATE														
LLAW	2701	GRAB	AQUE	26-MAR-86	MG/L	10	0.25	1490	840	4270	0.151	-	0.010 U	0.005 U
LLBW	2702	GRAB	AQUE	26-MAR-86	MG/L	31	0.39	2090	2130	5780	0.271	-	0.010 U	0.005 U
LLCW	2704	GRAB	AQUE	26-MAR-86	MG/L	9.400	0.91	2440	2660	5900	0.455	-	0.010 U	0.005 U
LLDW	2705	GRAB	AQUE	26-MAR-86	MG/L	19	1.0	1740	1890	4780	0.182	-	0.010 U	0.005 U
LLFB	2716	GRAB	AQUE	26-MAR-86	MG/L	0.270	0.017 U	0.1 U	10 U	0.3	0.010 U		0.010 U	0.005 U
LLAW	0979	GRAB	AQUE	18-SEP-86	MG/L	0.110	0.010 U	-	-	-	-	-	-	-
LLBW	0980	GRAB	AQUE	18-SEP-86	MG/L	29	4.7	-	-	-	-	-	-	-
LLCW	0981	GRAB	AQUE	18-SEP-86	MG/L	14	3.6	-	-	-	-	-	-	-
LLCW-D	0982	GRAB	AQUE	18-SEP-86	MG/L	15	2.5	-	-	-	-	-	-	-
LLDW	0983	GRAB	AQUE	18-SEP-86	MG/L	14	1.6	-	-	-	-	-	-	-
LLFB (FIELD BLANK)	0984	GRAB	AQUE	18-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
LANDFILL RUNOFF														
LRASC	2910	COMP	SOIL	22-JUN-87	MG/KG	10	0.66 J	2300	510 UJ	10500	10 U	98	-	-
LRBSC	2911	COMP	SOIL	22-JUN-87	MG/KG	7.400	0.80 J	1830	3440 J	12400	11 U	93	-	-
LRCSC	2912	COMP	SOIL	22-JUN-87	MG/KG	60	5.0 J	604	3440 J	12900	19	96	-	-
LRDSC	2914	COMP	SOIL	22-JUN-87	MG/KG	4.000	0.50 J	347	510 UJ	5030	10 U	98	-	-
SOILREP 1E (LRBSC)	2913	COMP	SOIL	22-JUN-87	MG/KG	3.800	0.68 J	1510	3330 J	11600	11 U	93	-	-
LRFB (FIELD BLANK)	2915	GRAB	AQUE *	22-JUN-87	MG/KG	0.50 U	0.50 U	10 U	100.0 U	100 U	10 U	-	-	-
LINED POND														
LPAW	2480(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPBW	2547(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPCW	2490(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPDW	2481(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPEW	2533(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPFW	2524(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPGW	2545(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPHW	2521(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPIW	2535(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPW ** (LAB COMP OF ABOVE)	2556(M)	COMP	AQUE	20-MAR-86	MG/L	0.010 U	0.025 U	31.5	2360	881	0.039	-	0.010 U	0.005 U

						SITE INDICATOR PARAMETERS							BASE/NEUTRAL EXTRACTABLES	
G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE	SULFATE	TOTAL SODIUM	TOTAL ARSENIC	% SOLIDS	DIBENZO (a,h) ANTHRACENE	FLUOR-ANTHENE
LPFBW	2492(M)	GRAB	AQUE	20-MAR-86	MG/L	0.010 U	0.025 U	0.5 U	1 U	0.600 U	0.010 U	-	0.010 U	0.005 U
LPS	2502(M)	COMP	SEDI	20-MAR-86	MG/KG	-	0.02 U	3730	-	-	-	62	110	1460
LPFB (FIELD BLANK)	2462(M)	GRAB	AQUE *	20-MAR-86	MG/MG	-	0.5 U	5.0 U	-	-	-	-	2.5 U	1.25 U
LINED POND	0879	GRAB	AQUE	02-SEP-86	MG/KG	0.010 U	0.010 U	-	-	-	-	-	-	-
REP-SW3 (LINED POND)	0880	GRAB	AQUE	02-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
METAL PAD STORAGE														
MPAS	2733	COMP	SOIL	26-MAR-86	MG/KG	-	0.59 UJ	465	-	10100	-	84	-	-
MPASG	2935	GRAB	SOIL	24-JUN-87	MG/KG	1.5	0.52 U	856	-	49800	-	97	-	-
MPBSG	2936	GRAB	SOIL	24-JUN-87	MG/KG	0.62	0.52 U	687	-	19900	-	99	-	-
MPCSG	2937	GRAB	SOIL	24-JUN-87	MG/KG	0.54	0.50 U	778	-	19500	-	99	-	-
SOILREP 3R (MPASG)	2941	GRAB	SOIL	24-JUN-87	MG/KG	2.3	0.52 U	714	-	50000	-	98	-	-
NORTH DRAINAGE DITCH														
NDCW	2710	GRAB	AQUE	25-MAR-86	MG/L	0.37	0.017 U	10 U	37	51	0.01 U	-	0.010 U	0.005 U
NDDW	2711	GRAB	AQUE	25-MAR-86	MG/L	0.39	0.017 U	3.8	33	88	0.01 U	-	0.010 U	0.005 U
NDEW	2728	GRAB	AQUE	25-MAR-86	MG/L	0.037	0.017 U	3.7	25	35	0.01 U	-	0.010 U	0.005 U
NDFBW (FIELD BLANK)	2729	GRAB	AQUE	25-MAR-86	MG/L	0.017 U	0.017 U	0.1 U	10 U	0.3	0.01 U	-	0.010 U	0.005 U
NDCW	0835	GRAB	AQUE	01-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
NDDW	0834	GRAB	AQUE	01-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
REP-SW1 (NDDW)	0838	GRAB	AQUE	02-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
NDEW	0833	GRAB	AQUE	01-SEP-86	MG/L	0.010 U	0.010 U	-	-	-	-	-	-	-
NDCS	2517	COMP	SEDI	19-MAR-86	MG/KG	-	1 U	92	-	4160	-	48	-	-
NDDS	2518	COMP	SEDI	19-MAR-86	MG/KG	-	2 U	92	-	10400	-	25	-	-
NDES	2520	COMP	SEDI	19-MAR-86	MG/KG	-	0.91 U	172	-	1210	-	55	-	-
NDFBS (FIELD BLANK)	2519	GRAB	AQUE *	19-MAR-86	MG/KG	-	0.5 U	5 U	-	36	-	-	-	-
OLD CATHODE WASTE PILE														
OCS	2718	COMP	SOIL	26-MAR-86	MG/KG	-	23 J	475	-	7919	40 U	89	-	-
OCFBS (FIELD BLANK)	2719	GRAB	AQUE *	26-MAR-86	MG/KG	-	0.5 U	0.5 U	-	-	0.010 U	-	-	-
OCWPSC-A	2994	COMP	SOIL	26-JUN-87	MG/KG	29	0.72 J	-	-	4600	-	86	-	-
OCWPSC-B	2993	COMP	SOIL	26-JUN-87	MG/KG	26	0.56 UJ	-	-	4380	-	90	-	-
OCWPSC-C	2995	COMP	SOIL	26-JUN-87	MG/KG	19	5.20 J	-	-	10900	-	93	-	-
OCWP PITB H20	2988	GRAB	AQUE	26-JUN-87	MG/L	294	3.010	3000	-	10500	-	-	0.020 U	0.050
OLD NPDES DISCHARGE CHANNEL														
ODCSC-1	2932	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	1.670 U	1.670 U

						SITE INDICATOR PARAMETERS							BASE/NEUTRAL EXTRACTABLES	
G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE	SULFATE	TOTAL SODIUM	TOTAL ARSENIC	% SOLIDS	DIBENZO (a,h) ANTHRACENE	FLUOR-ANTHENE
POTLINER HANDLING														
PHASC	2916	COMP	SOIL	23-JUN-87	MG/KG	14	4.00 J	673	-	29600	-	98	274	1600
SOILREP 2 (PHASC)	2917	COMP	SOIL	23-JUN-87	MG/KG	16	4.80 J	898	-	28600	-	98	451	1200
PHFB (FIELD BLANK)	2918	GRAB	AQUE	23-JUN-87	MG/KG								1.670 U	1.670 U
RECYCLE POND														
RPAW	2588	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	0.010 U	0.005 U
RPBW	2589	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	0.010 U	0.005 U
RPCW	2591	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPDW	2592	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPEW	2616	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPFW	2617	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPGW	2594	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPHW	2595	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPIW	2626	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPJW	2627	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPW ** (LAB COMP)	2643(M)	COMP	AQUE	22-MAR-86	MG/L	0.190	0.017 UJ	21.6	94.4	100	0.010 U	-	0.010 U	0.005 U
RPFBW (FIELD BLANK)	2603	GRAB	AQUE	22-MAR-86	MG/L	0.017 U	0.017 UJ	0.05 U	0.5 U	16	0.010 U	-	0.010 U	0.005 U
RPAS	2605	COMP	SEDI	22-MAR-86	MG/KG	-	1.1 U	856	-	12000	-	46	125 U	2170
RPBS	2606	COMP	SEDI	22-MAR-86	MG/KG	-	1.2 UJ	1260	-	11800	-	43	125 U	1580
RPCS	2608(M)	COMP	SEDI	22-MAR-86	MG/KG	-	1.1 U	1320	-	14200	-	44	50 U	2410
RPDS	2609	COMP	SEDI	22-MAR-86	MG/KG	-	1.1 U	1020	-	11800	-	45	125 U	1220
RPFBS (FIELD BLANK)	2604	GRAB	AQUE *	22-MAR-86	MG/KG	-	0.017 U	1.0 U	-	-	-	-	2.5 U	1.25 U
RPS-1	0923	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	603	884
RPS-2	0924	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	79.50	1100
RPS-3	0925	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	82.40	941
RPS-4	0926	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	50.000 U	775
RPS-5 (REP RPS-2)	0927	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	75.400	968
RPS-6 (REP RPS-4)	0928	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	76.300	935
RPS COMP	2605(M)	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS	0943	COMP	SOIL	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RECYCLE POND	0822	COMP	AQUE	30-AUG-86	MG/L	0.020	0.010 U	-	-	-	-	-	-	-
SAMPLE A-J (REP RECYCLE POND)	0820	COMP	AQUE	30-AUG-86	MG/L	0.027	0.010 U	-	-	-	-	-	-	-
RIVER ROAD DITCH														
RRAS	2730	COMP	SOIL	26-MAR-86	MG/KG	-	0.96 UJ	232	-	3620	-	52	-	-

						SITE INDICATOR PARAMETERS							BASE/NEUTRAL EXTRACTABLES	
G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	TOTAL CYANIDE	FREE CYANIDE	FLUORIDE	SULFATE	TOTAL SODIUM	TOTAL ARSENIC	% SOLIDS	DIBENZO (a,h) ANTHRACENE	FLUOR-ANTHENE
RIVER ROAD CURB														
RRBS	2731	COMP	SOIL	26-MAR-86	MG/KG	-	0.81 UJ	166	-	1480	-	62	-	-
SALVAGE AREA														
OCAS	2732	COMP	SOIL	26-MAR-86	MG/KG	-	4.4 J	67.3	-	3704	-	75	-	-
SASC	2990	COMP	SOIL	26-JUN-87	MG/KG	196	86 J	-	-	54500	-	95	-	-
SAFB (FIELD BLANK)	2992	GRAB	AQUE *	26-JUN-87	MG/KG	-	0.85 U	0.5 U	-	100	-	-	-	-
SCRUBBER SLUDGE PONDS														
SSP1AS	2792	GRAB	SEDI	28-MAR-86	MG/KG	-	1.0 UJ	204	-	15400	40 U	50	50 U	970
SSP1BS	2793	GRAB	SEDI	28-MAR-86	MG/KG	-	1.1 UJ	291	-	20600	42 U	45	125 U	2310
SSP1CS	2794	GRAB	SEDI	28-MAR-86	MG/KG	-	1.1 UJ	407	-	20700	48 U	44	50 U	770
SSP1DS	2795	GRAB	SEDI	28-MAR-86	MG/KG	-	1.3 UJ	285	-	18700	64	39	50 U	700
SSP2ES	2796	GRAB	SEDI	28-MAR-86	MG/KG	-	1.3 UJ	263	-	17700	71	38	125 U	1780
SSP2FS	2798	GRAB	SEDI	28-MAR-86	MG/KG	-	0.83 UJ	317	-	14500	34	60	50 U	560
SSP3GS	2799	GRAB	SEDI	28-MAR-86	MG/KG	-	1.3 UJ	613	-	45000	77	39	125 U	630
SSP3HS	2800	GRAB	SEDI	27-MAR-86	MG/KG	-	1.1 UJ	387	-	18400	66	47	125 U	2590
SSP4IS	2801	GRAB	SEDI	27-MAR-86	MG/KG	-	0.94 UJ	258	-	13600	50	53	125 U	1130
SSP4JS	2802	GRAB	SEDI	27-MAR-86	MG/KG	-	0.74 UJ	212	-	6250	12 U	68	125 U	450
SSPFBS (FIELD BLANK)	2804	GRAB	AQUE *	28-MAR-86	MG/KG	-	0.017 UJ	0.050	-	0.524	0.010 U	-	10 U	5.0 U
SCRUBBER PIPE-EFF	2989	GRAB	AQUE	26-JUN-87	MG/L	0.053	0.01 U	0.120	-	2550	-	-	0.020 U	0.616
SURFACE DRAINAGE DITCH														
SDAS	2720	COMP	SEDI	26-MAR-86	MG/KG	-	0.62 UJ	519	-	5600	-	80	0.500 U	0.270
SDFBS (FIELD BLANK)	2717	GRAB	AQUE *	26-MAR-86	MG/KG	-	0.5 U	0.5	-	31	-	-	0.500 U	0.250 U
SSD-1	0870	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-	1.670 U	1.670 U
SSD-2	0871	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-	1.670 U	1.670 U
SSD-3	0872	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-	3.170	7.890

* AQUEOUS FIELD BLANK FOR SOIL AND SEDIMENT SAMPLES.
** REPORTED CONCENTRATIONS ARE FROM SEVERAL COMPOSITE SAMPLES TESTED FOR DIFFERENT CONSTITUENTS. WHEN TWO OR MORE SAMPLES WERE TESTED FOR THE SAME CONSTITUENT THE AVERAGE WAS REPORTED.
\- = NOT ANALYZED
U = PARAMETER WAS ANALYZED FOR BUT WAS NOT DETECTED AT CONCENTRATION VALUE INDICATED (DETECTION LIMIT).
J = VALUE IS AN ESTIMATED QUANTITY; QUALITY CONTROL CRITERIA WERE NOT COMPLETELY MET.
(M) = MULTIPLE LAB ID NUMBERS WERE GIVEN FOR THE SAME SAMPLE; LOWEST ID NUMBER IN SERIES WAS REPORTED.
(1) DUPLICATE ANALYSIS TAKEN; HIGHEST VALUE RECORDED.
(2) = SAMPLES WITH <0.5% TOTAL SOLIDS WERE ANALYZED FOR TOTAL METALS WITHOUT EXTRACTION; SAMPLES WITH >0.5% TOTAL SOLIDS WERE RUN THROUGH EXTRACTION PROCESS.
BDL = BELOW DETECTION LIMIT FOR ALL PARAMETERS ANALYZED IN A GROUP OF ANALYTES (SEE TABLE 1)

TABLE A-3: SURFACE WATER, SEDIMENT, AND SOIL SAMPLE ANALYTICAL DATA--ANALYTICAL RESULTS ABOVE DETECTION LIMITS

(CONT.)
BASE/NEUTRAL EXTRACTABLES

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	FLUORENE	IDENO-1,2,3 (c,d) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE	ACENAPH-THENE	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (a) PYRENE
BATH RECOVERY														
BRASC	2934	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SOILREP 4R (BRASC)	2942	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
BRFB (FIELD BLANK)	2933	GRAB	AQUE *	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CATHODE WASH AREA														
CWASG	2938	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CWBSG	2939	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CWCSG	2940	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CWASC-1	2991	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CHENOWETH CREEK SAMPLES														
CCSWG-1	870804-012	GRAB	AQUE	02-AUG-87	MG/L	-	-	-	-	-	-	-	-	-
CCSWG-2	870827-002	GRAB	AQUE	24-AUG-87	MG/L	-	-	-	-	-	-	-	-	-
CRSWG-1	870827-006	GRAB	AQUE	25-AUG-87	MG/L	-	-	-	-	-	-	-	-	-
DISCHARGE CHANNEL														
DCAW	2707	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DCFBW	2708	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DCAQ	0830	GRAB	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-	-	-
DCAG	2476	GRAB	SEDI	19-MAR-86	MG/KG	50 U	210	50 U	190	640	50 U	54	410	310
DCBG	2477(M)	GRAB	SEDI	19-MAR-86	MG/KG	50 U	170	50 U	110	980	50 U	50 U	460	200
DCCG	2478(M)	GRAB	SEDI	19-MAR-86	MG/KG	5 U	10 U	5 U	10	100	5 U	5 U	24	5 U
DCDG	2507(M)	GRAB	SEDI	19-MAR-86	MG/KG	50 U	150	50 U	200	830	50 U	50 U	350	180
DCDG	0877	GRAB	SEDI	02-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
DCEG	2508(M)	GRAB	SEDI	19-MAR-86	MG/KG	50 U	150	50 U	50 U	650	50 U	50 U	280	180
DCEG	0892	GRAB	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
SR-3 (REP DCEG)	0893	GRAB	AQUE	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
DCFBS (FIELD BLANK)	2467(M)	GRAB	AQUE *	19-MAR-86	MG/KG	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
DRAINAGE DITCH														
DDASG	2712	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDBSG	2713	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDCSG	2714	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDDSG	2725	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDESG	2726	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDFBS (FIELD BLANK)	2727	GRAB	AQUE *	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-

(CONT.)
BASE/NEUTRAL EXTRACTABLES

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	FLUORENE	IDENO-1,2,3 (c,d) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE	ACENAPH-THENE	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (a) PYRENE
DUCK POND														
DPAW	2600	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPBW	2602	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPCW	2612	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPDW	2613	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPEW	2624	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPFW	2625	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPGW	2598	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPHW	2599	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPIW	2620	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DPAS1	2632	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPAS2	2633	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPBS	2622	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPCSG	2621	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPFBS (FIELD BLANK)	2634	GRAB	AQUE *	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPFBW (FIELD BLANK)	2614	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
DUCK POND	0843	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
REP-SW2 (DUCK POND)	0844	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LANDFILL														
LFAS	3290	COMP	SOIL	10-MAY-86	MG/KG	15	210	10	170	260	19	19	230	200
LFBS	3291	COMP	SOIL	10-MAY-86	MG/KG	16	110	7	180	200	28	40	120	120
LFCS	3292	COMP	SOIL	10-MAY-86	MG/KG	5	15	7	38	37	4.2 U	7	22	22
LFDS	3294	COMP	SOIL	10-MAY-86	MG/KG	9	100	4.2 U	82	120	11	11	100	110
LFES	3295	COMP	SOIL	10-MAY-86	MG/KG	4.2 U	42	4.2 U	73	95	6	16	47	45
LFFBS (FIELD BLANK)	3297(M)	GRAB	AQUE *	10-MAY-86	MG/KG	1.25 U	0.5 U	1.25 U	1.25 U	5.3	1.25 U	1.25 U	1.25 U	0.25 U
LFCGS	3296	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-	-	-
LANDFILL DITCH														
LDAWG	2927	GRAB	AQUE	23-JUN-87	MG/L	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.021 J	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ
LDBWG	2929	GRAB	AQUE	23-JUN-87	MG/L	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ
DLSW-REP1E (LDBWG)	2925	GRAB	AQUE	23-JUN-87	MG/L	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.032 J	0.020 UJ	0.020 UJ	0.025 J	0.020 UJ
LDAWG	3340	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
LDBWG	3338	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
DLSW-REP1E (LDBWG)	3339	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
LDFB (FIELD BLANK)	2930	GRAB	AQUE	23-JUN-87	MG/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
LDFB	3341	GRAB	AQUE	02-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U

(CONT.)
BASE/NEUTRAL EXTRACTABLES

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	FLUORENE	IDENO-1,2,3 (c,d) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE	ACENAPH-THENE	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (a) PYRENE
NDAW	2723	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NDBW	2724	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NDAW	0837	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDBW	0836	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDAS	2515	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
NDBS	2516	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
LANDFILL LEACHATE														
LLAW	2701	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
LLBW	2702	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
LLCW	2704	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
LLDW	2705	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
LLFB	2716	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
LLAW	0979	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLBW	0980	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLCW	0981	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLCW-D	0982	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLDW	0983	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLFB (FIELD BLANK)	0984	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LANDFILL RUNOFF														
LRASC	2910	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
LRBSC	2911	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
LRCSC	2912	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
LRDSC	2914	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SOILREP 1E (LRBSC)	2913	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
LRFB (FIELD BLANK)	2915	GRAB	AQUE *	22-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
LINED POND														
LPAW	2480(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPBW	2547(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPCW	2490(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPDW	2481(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPEW	2533(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPFW	2524(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPGW	2545(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPHW	2521(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPIW	2535(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
LPW ** (LAB COMP OF ABOVE)	2556(M)	COMP	AQUE	20-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U

(CONT.)
BASE/NEUTRAL EXTRACTABLES

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	FLUORENE	IDENO-1,2,3 (c,d) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE	ACENAPH-THENE	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (a) PYRENE
LPFBW	2492(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
LPS	2502(M)	COMP	SEDI	20-MAR-86	MG/KG	6.25 U	290	6.25 U	19	640	6.25 U	10	1030	500
LPFB (FIELD BLANK)	2462(M)	GRAB	AQUE *	20-MAR-86	MG/MG	1.25 U	2.5 U	1.25 U	1.25 U	1.25 U	1.25 U	1.25 U	1.25 U	1.25 U
LINED POND	0879	GRAB	AQUE	02-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
REP-SW3 (LINED POND)	0880	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
METAL PAD STORAGE														
MPAS	2733	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
MPASG	2935	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
MPBSG	2936	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
MPCSG	2937	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SOILREP 3R (MPASG)	2941	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
NORTH DRAINAGE DITCH														
NDCW	2710	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NDDW	2711	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NDEW	2728	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NDFBW (FIELD BLANK)	2729	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
NDCW	0835	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDDW	0834	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
REP-SW1 (NDDW)	0838	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDEW	0833	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDCS	2517	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
NDDS	2518	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
NDES	2520	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
NDFBS (FIELD BLANK)	2519	GRAB	AQUE *	19-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
OLD CATHODE WASTE PILE														
OCS	2718	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
OCFBS (FIELD BLANK)	2719	GRAB	AQUE *	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
OCWPSC-A	2994	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
OCWPSC-B	2993	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
OCWPSC-C	2995	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
OCWP PITB H20	2988	GRAB	AQUE	26-JUN-87	MG/L	0.020 U	0.020 U	0.020 U	0.029	0.066	0.020 U	0.02 U	0.024	0.020 U
OLD NPDES DISCHARGE CHANNEL														
ODCSC-1	2932	COMP	SOIL	24-JUN-87	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U

(CONT.)
BASE/NEUTRAL EXTRACTABLES

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	FLUORENE	IDENO-1,2,3 (c,d) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE	ACENAPH-THENE	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (a) PYRENE
POTLINER HANDLING														
PHASC	2916	COMP	SOIL	23-JUN-87	MG/KG	83.5 U	559	83.5 U	696	893	114	83.5 U	989	778
SOILREP 2 (PHASC)	2917	COMP	SOIL	23-JUN-87	MG/KG	83.5 U	444	83.5 U	553	783	91.3	83.5 U	820	585
PHFB (FIELD BLANK)	2918	GRAB	AQUE	23-JUN-87	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U
RECYCLE POND														
RPAW	2588	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
RPBW	2589	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
RPCW	2591	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPDW	2592	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPEW	2616	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPFW	2617	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPGW	2594	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPHW	2595	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPIW	2626	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPJW	2627	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-	-	-
RPW ** (LAB COMP)	2643(M)	COMP	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
RPFBW (FIELD BLANK)	2603	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
RPAS	2605	COMP	SEDI	22-MAR-86	MG/KG	6.25 U	150	6.25 U	140	1230	62.5 U	62.5 U	470	190
RPBS	2606	COMP	SEDI	22-MAR-86	MG/KG	6.25 U	125 U	6.25 U	130	1000	62.5 U	62.5 U	370	145
RPCS	2608(M)	COMP	SEDI	22-MAR-86	MG/KG	25 U	160	6.25 U	270	1330	25 U	25 U	790	310
RPDS	2609	COMP	SEDI	22-MAR-86	MG/KG	6.25 U	125 U	6.25 U	98	770	62.5 U	62.5 U	340	130
RPFBS (FIELD BLANK)	2604	GRAB	AQUE *	22-MAR-86	MG/KG	1.25 U	0.5 U	1.25 U	1.25 U	1.25 U	1.25 U	1.25 U	1.25 U	1.25 U
RPS-1	0923	COMP	SEDI	04-SEP-86	MG/KG	50 U	141	50 U	147	692	50 U	52	380	182
RPS-2	0924	COMP	SEDI	04-SEP-86	MG/KG	50 U	156	50 U	173	921	50 U	59.9	491	228
RPS-3	0925	COMP	SEDI	04-SEP-86	MG/KG	50 U	149	50 U	199	781	50 U	57.6	488	209
RPS-4	0926	COMP	SEDI	04-SEP-86	MG/KG	50 U	139	50 U	138	599	50 U	50.8	394	194
RPS-5 (REP RPS-2)	0927	COMP	SEDI	04-SEP-86	MG/KG	50 U	174	50 U	157	883	50 U	60.1	450	200
RPS-6 (REP RPS-4)	0928	COMP	SEDI	04-SEP-86	MG/KG	50 U	170	50 U	161	712	50 U	57.6	429	197
RPS COMP	2605(M)	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS	0943	COMP	SOIL	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RECYCLE POND	0822	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-	-	-
SAMPLE A-J (REP RECYCLE POND)	0820	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-	-	-
RIVER ROAD DITCH														
RRAS	2730	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-

(CONT.)
BASE/NEUTRAL EXTRACTABLES

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	FLUORENE	IDENO-1,2,3 (c,d) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE	ACENAPH-THENE	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (a) PYRENE
RIVER ROAD CURB														
RRBS	2731	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
SALVAGE AREA														
OCAS	2732	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
SASC	2990	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SAFB (FIELD BLANK)	2992	GRAB	AQUE *	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SCRUBBER SLUDGE PONDS														
SSP1AS	2792	GRAB	SEDI	28-MAR-86	MG/KG	50 U	140	25 U	25 U	560	25 U	25 U	270	280
SSP1BS	2793	GRAB	SEDI	28-MAR-86	MG/KG	62.5 U	320	62.5 U	130	2000	62.5 U	62.5 U	530	360
SSP1CS	2794	GRAB	SEDI	28-MAR-86	MG/KG	25 U	130	25 U	25 U	540	25 U	25 U	250	170
SSP1DS	2795	GRAB	SEDI	28-MAR-86	MG/KG	25 U	50 U	25 U	140	590	25 U	25 U	200	200
SSP2ES	2796	GRAB	SEDI	28-MAR-86	MG/KG	62.5 U	370	62.5 U	62.5 U	1220	62.5 U	62.5 U	340	330
SSP2FS	2798	GRAB	SEDI	28-MAR-86	MG/KG	25 U	50 U	25 U	100	280	25 U	25 U	120	160
SSP3GS	2799	GRAB	SEDI	28-MAR-86	MG/KG	62.5 U	180	62.5 U	260	530	62.5 U	62.5 U	300	180
SSP3HS	2800	GRAB	SEDI	27-MAR-86	MG/KG	62.5 U	260	62.5 U	880	1400	62.5 U	62.5 U	430	430
SSP4IS	2801	GRAB	SEDI	27-MAR-86	MG/KG	62.5 U	125 U	62.5 U	62.5 U	870	62.5 U	62.5 U	280	160
SSP4JS	2802	GRAB	SEDI	27-MAR-86	MG/KG	62.5 U	220	62.5 U	62.5 U	260	62.5 U	62.5 U	62.5 U	160
SSPFBS (FIELD BLANK)	2804	GRAB	AQUE *	28-MAR-86	MG/KG	5.0 U	10 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
SCRUBBER PIPE-EFF	2989	GRAB	AQUE	26-JUN-87	MG/L	0.02 U	0.025	0.02 U	0.02 U	0.36	0.028 U	0.020 U	0.118	0.024
SURFACE DRAINAGE DITCH														
SDAS	2720	COMP	SEDI	26-MAR-86	MG/KG	0.500 U	0.500 U	0.500 U	0.250 U	0.280	0.250 U	0.250 U	0.270	0.250 U
SDFBS (FIELD BLANK)	2717	GRAB	AQUE *	26-MAR-86	MG/KG	0.250 U	0.500 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U
SSD-1	0870	GRAB	SOIL	03-SEP-86	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U
SSD-2	0871	GRAB	SOIL	03-SEP-86	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	1.670 U	0.670 U	1.670 U
SSD-3	0872	GRAB	SOIL	03-SEP-86	MG/KG	1.670 U	7.290	1.670 U	2.200	9.160	1.670 U	1.670 U	5	4.660

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	(CONT.) BASE/NEUTRAL EXTRACTABLES: BENZO (b&k) FLUOR-ANTHENES	BENZO (g,h,l) PERYLENE	BIS (2-ETHYLHEXYL) PHTHALATE	CHRYSENE	SUM OF ABOVE DETECT LIMIT BASE/NEUTRALS	PCBs	ACID EXTRACTABLES
BATH RECOVERY												
BRASC	2934	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 4R (BRASC)	2942	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
BRFB (FIELD BLANK)	2933	GRAB	AQUE *	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CATHODE WASH AREA												
CWASG	2938	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CWBSG	2939	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CWCSG	2940	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CWASC-1	2991	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
CHENOWETH CREEK SAMPLES												
CCSWG-1	870804-012	GRAB	AQUE	02-AUG-87	MG/L	-	-	-	-	-	-	-
CCSWG-2	870827-002	GRAB	AQUE	24-AUG-87	MG/L	-	-	-	-	-	-	-
CRSWG-1	870827-006	GRAB	AQUE	25-AUG-87	MG/L	-	-	-	-	-	-	-
DISCHARGE CHANNEL												
DCAW	2707	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DCFBW	2708	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DCAQ	0830	GRAB	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-
DCAG	2476	GRAB	SEDI	19-MAR-86	MG/KG	640	320	100 U	560	4474	-	BDL
DCBG	2477(M)	GRAB	SEDI	19-MAR-86	MG/KG	540	210	100 U	610	4820	-	BDL
DCCG	2478(M)	GRAB	SEDI	19-MAR-86	MG/KG	30	12	10 U	38	334	-	BDL
DCDG	2507(M)	GRAB	SEDI	19-MAR-86	MG/KG	440	210	100 U	470	3910	-	BDL
DCDG	0877	GRAB	SEDI	02-SEP-86	MG/KG	-	-	-	-	-	-	-
DCEG	2508(M)	GRAB	SEDI	19-MAR-86	MG/KG	470	270	100 U	430	3260	-	BDL
DCEG	0892	GRAB	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
SR-3 (REP DCEG)	0893	GRAB	AQUE	04-SEP-86	MG/KG	-	-	-	-	-	-	-
DCFBS (FIELD BLANK)	2467(M)	GRAB	AQUE *	19-MAR-86	MG/KG	5 U	10 U	5 U	5 U	BDL	-	BDL
DRAINAGE DITCH												
DDASG	2712	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDBSG	2713	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDCSG	2714	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDDSG	2725	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDESG	2726	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDFBS (FIELD BLANK)	2727	GRAB	AQUE *	25-MAR-86	MG/KG	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	(CONT.) BASE/NEUTRAL EXTRACTABLES: BENZO (b&k) FLUOR-ANTHENES	BENZO (g,h,i) PERYLENE	BIS (2-ETHYLHEXYL) PHTHALATE	CHRYSENE	SUM OF ABOVE DETECT LIMIT BASE/NEUTRALS	PCBs	ACID EXTRACTABLES
DUCK POND												
DPAW	2600	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.61	0.005 U	0.61	BDL	BDL
DPBW	2602	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.016	0.005 U	0.016	BDL	BDL
DPCW	2612	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DPDW	2613	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DPEW	2624	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DPFW	2625	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DPGW	2598	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.084	0.005 U	0.084	BDL	BDL
DPHW	2599	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DPIW	2620	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
DPAS1	2632	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPAS2	2633	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPBS	2622	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPCSG	2621	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPFBS (FIELD BLANK)	2634	GRAB	AQUE *	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPFBW (FIELD BLANK)	2614	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	-	BDL	-
DUCK POND	0843	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
REP-SW2 (DUCK POND)	0844	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
LANDFILL												
LFAS	3290	COMP	SOIL	10-MAY-86	MG/KG	440	200	8.4 U	210	2406	-	BDL
LFBS	3291	COMP	SOIL	10-MAY-86	MG/KG	210	96	8.4 U	110	1517	-	BDL
LFCS	3292	COMP	SOIL	10-MAY-86	MG/KG	36	14	8.4 U	28	279	-	BDL
LFDS	3294	COMP	SOIL	10-MAY-86	MG/KG	210	91	8.4 U	110	1140	-	BDL
LFES	3295	COMP	SOIL	10-MAY-86	MG/KG	79	37	8.4 U	58	611	-	BDL
LFFBS (FIELD BLANK)	3297(M)	GRAB	AQUE *	10-MAY-86	MG/KG	1.25 U	2.5 U	2.5 U	1.25 U	10.3	BDL	BDL
LFCGS	3296	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	BDL	-
LANDFILL DITCH												
LDAWG	2927	GRAB	AQUE	23-JUN-87	MG/L	0.023 J	0.020 UJ	0.077 J	0.024 J	0.145	-	-
LDBWG	2929	GRAB	AQUE	23-JUN-87	MG/L	0.020 UJ	0.020 UJ	0.020 UJ	0.020 UJ	0.028	-	-
DLSW-REP1E (LDBWG)	2925	GRAB	AQUE	23-JUN-87	MG/L	0.041 J	0.020 UJ	0.064 J	0.025 J	0.187	-	-
LDAWG	3340	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	BDL	-	-
LDBWG	3338	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	BDL	-	-
DLSW-REP1E (LDBWG)	3339	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	BDL	-	-
LDFB (FIELD BLANK)	2930	GRAB	AQUE	23-JUN-87	MG/L	0.010 U	0.010 U	0.010 U	0.010 U	BDL	-	-
LDFB	3341	GRAB	AQUE	02-AUG-87	MG/L	0.100 U	0.100 U	0.206	0.100 U	0.206	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	(CONT.) BASE/NEUTRAL EXTRACTABLES: BENZO (b&k) FLUOR-ANTHENES	BENZO (g,h,i) PERYLENE	BIS (2-ETHYLHEXYL) PHTHALATE	CHRYSENE	SUM OF ABOVE DETECT LIMIT BASE/NEUTRALS	PCBs	ACID EXTRACTABLES
NDAW	2723	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
NDBW	2724	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.025	0.005 U	0.025	BDL	BDL
NDAW	0837	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
NDBW	0836	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
NDAS	2515	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDBS	2516	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
LANDFILL LEACHATE												
LLAW	2701	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
LLBW	2702	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.016	0.005 U	0.016	BDL	BDL
LLCW	2704	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
LLDW	2705	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
LLFB	2716	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
LLAW	0979	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLBW	0980	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLCW	0981	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLCW-D	0982	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLDW	0983	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLFB (FIELD BLANK)	0984	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LANDFILL RUNOFF												
LRASC	2910	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRBSC	2911	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRCSC	2912	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRDSC	2914	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 1E (LRBSC)	2913	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRFB (FIELD BLANK)	2915	GRAB	AQUE *	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LINED POND												
LPAW	2480(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPBW	2547(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPCW	2490(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPDW	2481(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPEW	2533(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPFW	2524(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPGW	2545(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPHW	2521(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPIW	2535(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPW ** (LAB COMP OF ABOVE)	2556(M)	COMP	AQUE	20-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	(CONT.) BASE/NEUTRAL EXTRACTABLES: BENZO (b&k) FLUOR-ANTHENES	BENZO (g,h,i) PERYLENE	BIS (2-ETHYLHEXYL) PHTHALATE	CHRYSENE	SUM OF ABOVE DETECT LIMIT BASE/NEUTRALS	PCBs	ACID EXTRACTABLES
LPFBW	2492(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	-
LPS	2502(M)	COMP	SEDI	20-MAR-86	MG/KG	2120	270	12.500 U	1310	7759	BDL	BDL
LPFB (FIELD BLANK)	2462(M)	GRAB	AQUE *	20-MAR-86	MG/MG	1.25 U	2.5 U	2.500 U	1.25 U	BDL	-	BDL
LINED POND	0879	GRAB	AQUE	02-SEP-86	MG/KG	-	-	-	-	-	-	-
REP-SW3 (LINED POND)	0880	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
METAL PAD STORAGE												
MPAS	2733	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
MPASG	2935	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
MPBSG	2936	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
MPCSG	2937	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 3R (MPASG)	2941	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
NORTH DRAINAGE DITCH												
NDCW	2710	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
NDDW	2711	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
NDEW	2728	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
NDFBW (FIELD BLANK)	2729	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
NDCW	0835	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	BDL
NDDW	0834	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	BDL
REP-SW1 (NDDW)	0838	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
NDEW	0833	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	BDL
NDCS	2517	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDDS	2518	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDES	2520	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDFBS (FIELD BLANK)	2519	GRAB	AQUE *	19-MAR-86	MG/KG	-	-	-	-	-	-	-
OLD CATHODE WASTE PILE												
OCS	2718	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
OCFBS (FIELD BLANK)	2719	GRAB	AQUE *	26-MAR-86	MG/KG	-	-	-	-	-	-	-
OCWPSC-A	2994	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
OCWPSC-B	2993	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
OCWPSC-C	2995	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
OCWP PITB H20	2988	GRAB	AQUE	26-JUN-87	MG/L	0.048	0.020 U	0.020 U	0.038	0.255	-	-
OLD NPDES DISCHARGE CHANNEL												
ODCSC-1	2932	COMP	SOIL	24-JUN-87	MG/KG	3.70	1.670 U	1.670 U	2.71	6.41	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	(CONT.) BASE/NEUTRAL EXTRACTABLES: BENZO (b&k) FLUOR-ANTHENES	BENZO (g,h,l) PERYLENE	BIS (2-ETHYLHEXYL) PHTHALATE	CHRYSENE	SUM OF ABOVE DETECT LIMIT BASE/NEUTRALS	PCBs	ACID EXTRACTABLES
POTLINER HANDLING												
PHASC	2916	COMP	SOIL	23-JUN-87	MG/KG	1800	466	83.5 U	872	9041	-	-
SOILREP 2 (PHASC)	2917	COMP	SOIL	23-JUN-87	MG/KG	1500	700	83.5 U	815	7942	-	-
PHFB (FIELD BLANK)	2918	GRAB	AQUE	23-JUN-87	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	BDL	-	-
RECYCLE POND												
RPAW	2588	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	-	-
RPBW	2589	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	-	-
RPCW	2591	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPDW	2592	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPEW	2616	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPFW	2617	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPGW	2594	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPHW	2595	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPIW	2626	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPJW	2627	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPW ** (LAB COMP)	2643(M)	COMP	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
RPFBW (FIELD BLANK)	2603	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.010 U	0.010 U	0.005 U	BDL	BDL	BDL
RPAS	2605	COMP	SEDI	22-MAR-86	MG/KG	470	140	125 U	710	5670	-	BDL
RPBS	2606	COMP	SEDI	22-MAR-86	MG/KG	400	125 U	125 U	580	4205	-	BDL
RPCS	2608(M)	COMP	SEDI	22-MAR-86	MG/KG	920	140	50 U	1040	7370	-	BDL
RPDS	2609	COMP	SEDI	22-MAR-86	MG/KG	380	125 U	125 U	510	3448	-	BDL
RPFBS (FIELD BLANK)	2604	GRAB	AQUE *	22-MAR-86	MG/KG	1.25 U	2.5 U	2.5 U	1.25 U	BDL	-	BDL
RPS-1	0923	COMP	SEDI	04-SEP-86	MG/KG	527	106	50 U	594	4308	-	-
RPS-2	0924	COMP	SEDI	04-SEP-86	MG/KG	649	145	50 U	742	4744	-	-
RPS-3	0925	COMP	SEDI	04-SEP-86	MG/KG	623	148	50 U	728	4406	-	-
RPS-4	0926	COMP	SEDI	04-SEP-86	MG/KG	571	126	50 U	698	3685	-	-
RPS-5 (REP RPS-2)	0927	COMP	SEDI	04-SEP-86	MG/KG	588	147	50 U	700	4403	-	-
RPS-6 (REP RPS-4)	0928	COMP	SEDI	04-SEP-86	MG/KG	608	137	50 U	692	4175	-	-
RPS COMP	2605(M)	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	BDL	-
RPS	0943	COMP	SOIL	04-SEP-86	MG/KG	-	-	-	-	-	BDL	-
RECYCLE POND	0822	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-
SAMPLE A-J (REP RECYCLE POND)	0820	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-
RIVER ROAD DITCH												
RRAS	2730	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	(CONT.) BASE/NEUTRAL EXTRACTABLES: BENZO (b&k) FLUOR-ANTHENES	BENZO (g,h,i) PERYLENE	BIS (2-ETHYLHEXYL) PHTHALATE	CHRYSENE	SUM OF ABOVE DETECT LIMIT BASE/NEUTRALS	PCBs	ACID EXTRACTABLES
RIVER ROAD CURB												
RRBS	2731	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
SALVAGE AREA												
OCAS	2732	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
SASC	2990	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
SAFB (FIELD BLANK)	2992	GRAB	AQUE *	26-JUN-87	MG/KG	-	-	-	-	-	-	-
SCRUBBER SLUDGE PONDS												
SSP1AS	2792	GRAB	SEDI	28-MAR-86	MG/KG	690	150	50 U	670	3730	-	BDL
SSP1BS	2793	GRAB	SEDI	28-MAR-86	MG/KG	1310	380	125 U	1230	8570	-	BDL
SSP1CS	2794	GRAB	SEDI	28-MAR-86	MG/KG	610	130	50 U	640	3240	-	BDL
SSP1DS	2795	GRAB	SEDI	28-MAR-86	MG/KG	450	50 U	50 U	480	2760	-	BDL
SSP2ES	2796	GRAB	SEDI	28-MAR-86	MG/KG	1430	470	125 U	1240	7180	-	BDL
SSP2FS	2798	GRAB	SEDI	28-MAR-86	MG/KG	360	50 U	50 U	360	1940	-	BDL
SSP3GS	2799	GRAB	SEDI	28-MAR-86	MG/KG	790	250	125 U	830	3950	-	BDL
SSP3HS	2800	GRAB	SEDI	27-MAR-86	MG/KG	1090	260	125 U	1020	8360	-	BDL
SSP4IS	2801	GRAB	SEDI	27-MAR-86	MG/KG	670	244	125 U	625	3979	-	BDL
SSP4JS	2802	GRAB	SEDI	27-MAR-86	MG/KG	700	290	125 U	590	2670	-	BDL
SSPFBS (FIELD BLANK)	2804	GRAB	AQUE *	28-MAR-86	MG/KG	5.0 U	10 U	10 U	5.0 U	BDL	-	BDL
SCRUBBER PIPE-EFF	2989	GRAB	AQUE	26-JUN-87	MG/L	0.096	0.020 U	0.020 U	0.134	1.4	-	-
SURFACE DRAINAGE DITCH												
SDAS	2720	COMP	SEDI	26-MAR-86	MG/KG	0.540	0.500 U	0.500 U	0.430	1.79	-	BDL
SDFBS (FIELD BLANK)	2717	GRAB	AQUE *	26-MAR-86	MG/KG	0.250 U	0.500 U	0.500 U	0.250 U	BDL	-	BDL
SSD-1	0870	GRAB	SOIL	03-SEP-86	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	BDL	-	-
SSD-2	0871	GRAB	SOIL	03-SEP-86	MG/KG	1.670 U	1.670 U	1.670 U	1.670 U	BDL	-	-
SSD-3	0872	GRAB	SOIL	03-SEP-86	MG/KG	1.670 U	6.360	1.670 U	8.260	53.99	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	VOLATILE ORGANIC COMPOUNDS: CHLOROFORM	1,1,1-TRICHLOROETHANE	TRICHLOROETHYLENE	TOLUENE	EP TOXICITY (2) (MG/L): ARSENIC	BARIUM	CADMIUM	CHROMIUM	MERCURY
BATH RECOVERY														
BRASC	2934	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SOILREP 4R (BRASC)	2942	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
BRFB (FIELD BLANK)	2933	GRAB	AQUE *	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CATHODE WASH AREA														
CWASG	2938	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CWBSG	2939	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CWCSG	2940	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CWASC-1	2991	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
CHENOWETH CREEK SAMPLES														
CCSWG-1	870804-012	GRAB	AQUE	02-AUG-87	MG/L	-	-	-	-	-	-	-	-	-
CCSWG-2	870827-002	GRAB	AQUE	24-AUG-87	MG/L	-	-	-	-	-	-	-	-	-
CRSWG-1	870827-006	GRAB	AQUE	25-AUG-87	MG/L	-	-	-	-	-	-	-	-	-
DISCHARGE CHANNEL														
DCAW	2707	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DCFBW	2708	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DCAQ	0830	GRAB	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-	-	-
DCAG	2476	GRAB	SEDI	19-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.230	0.050 U	0.050 U	0.00034 (1)
DCBG	2477(M)	GRAB	SEDI	19-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0004
DCCG	2478(M)	GRAB	SEDI	19-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00037
DCDG	2507(M)	GRAB	SEDI	19-MAR-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DCDG	0877	GRAB	SEDI	02-SEP-86	MG/KG	0.025 U	0.025 U	0.025 U	0.025 U	-	-	-	-	-
DCEG	2508(M)	GRAB	SEDI	19-MAR-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DCEG	0892	GRAB	SEDI	04-SEP-86	MG/KG	0.025 U	0.025 U	0.025 U	0.025 U	-	-	-	-	-
SR-3 (REP DCEG)	0893	GRAB	AQUE	04-SEP-86	MG/KG	0.025 U	0.025 U	0.025 U	0.025 U	-	-	-	-	-
DCFBS (FIELD BLANK)	2467(M)	GRAB	AQUE *	19-MAR-86	MG/KG	0.025 U	0.025 U	0.025 U	0.025 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DRAINAGE DITCH														
DDASG	2712	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDBSG	2713	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDCSG	2714	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDDSG	2725	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDESG	2726	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DDFBS (FIELD BLANK)	2727	GRAB	AQUE *	25-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	VOLATILE ORGANIC COMPOUNDS: CHLORO-FORM	1,1,1-TRI-CHLOROETHANE	TRICHLORO-ETHYLENE	TOLUENE	EP TOXICITY (2) (MG/L): ARSENIC	BARIUM	CADMIUM	CHROMIUM	MERCURY
DUCK POND														
DPAW	2600	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00074
DPBW	2602	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00071
DPCW	2612	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0004
DPDW	2613	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00093
DPEW	2624	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0004
DPFW	2625	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00063
DPGW	2598	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DPHW	2599	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DPIW	2620	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
DPAS1	2632	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPAS2	2633	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPBS	2622	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPCSG	2621	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPFBS (FIELD BLANK)	2634	GRAB	AQUE *	24-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
DPFBW (FIELD BLANK)	2614	GRAB	AQUE	24-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00104
DUCK POND	0843	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
REP-SW2 (DUCK POND)	0844	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LANDFILL														
LFAS	3290	COMP	SOIL	10-MAY-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LFBS	3291	COMP	SOIL	10-MAY-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LFCS	3292	COMP	SOIL	10-MAY-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.234	0.050 U	0.050 U	0.0003 U
LFDS	3294	COMP	SOIL	10-MAY-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LFES	3295	COMP	SOIL	10-MAY-86	MG/KG	0.050 U	0.050 U	0.050 U	0.050 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LFFBS (FIELD BLANK)	3297(M)	GRAB	AQUE *	10-MAY-86	MG/KG	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LFCGS	3296	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-	-	-
LANDFILL DITCH														
LDAWG	2927	GRAB	AQUE	23-JUN-87	MG/L	0.025 U	0.025 U	0.025 U	0.025 U	-	-	-	-	-
LDBWG	2929	GRAB	AQUE	23-JUN-87	MG/L	0.025 U	0.025 U	0.025 U	0.025 U	-	-	-	-	-
DLSW-REP1E (LDBWG)	2925	GRAB	AQUE	23-JUN-87	MG/L	0.025 U	0.025 U	0.025 U	0.025 U	-	-	-	-	-
LDAWG	3340	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	-	-	-	-	-
LDBWG	3338	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	-	-	-	-	-
DLSW-REP1E (LDBWG)	3339	GRAB	AQUE	2-AUG-87	MG/L	0.100 U	0.100 U	0.100 U	0.100 U	-	-	-	-	-
LDFB (FIELD BLANK)	2930	GRAB	AQUE	23-JUN-87	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LDFB	3341	GRAB	AQUE	02-AUG-87	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	VOLATILE ORGANIC COMPOUNDS: CHLORO-FORM	1,1,1-TRI-CHLOROETHANE	TRICHLORO-ETHYLENE	TOLUENE	EP TOXICITY (2) (MG/L): ARSENIC	BARIUM	CADMIUM	CHROMIUM	MERCURY
NDAW	2723	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
NDBW	2724	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
NDAW	0837	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDBW	0836	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDAS	2515	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	0.200 U	0.252	0.050 U	0.050 U	0.0003 U
NDBS	2516	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	0.200 U	0.361	0.050 U	0.050 U	0.0003 U
LANDFILL LEACHATE														
LLAW	2701	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.005 U	8	0.005 U	0.261	0.200 U	0.050 U	0.161	0.00069
LLBW	2702	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.39	0.200 U	0.050 U	0.087	0.00038
LLCW	2704	GRAB	AQUE	26-MAR-86	MG/L	0.010 U	0.010 U	0.010 U	0.010 U	0.354	0.200 U	0.050 U	0.088	0.00055
LLDW	2705	GRAB	AQUE	26-MAR-86	MG/L	0.010 U	0.010 U	0.010 U	0.010 U	0.361	0.200 U	0.050 U	0.073	0.00036
LLFB	2716	GRAB	AQUE	26-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00039
LLAW	0979	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLBW	0980	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLCW	0981	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLCW-D	0982	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLDW	0983	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LLFB (FIELD BLANK)	0984	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
LANDFILL RUNOFF														
LRASC	2910	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LRBSC	2911	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LRCSC	2912	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	0.200 U	0.314	0.050 U	0.050 U	0.0003 U
LRDSC	2914	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
SOILREP 1E (LRBSC)	2913	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LRFB (FIELD BLANK)	2915	GRAB	AQUE *	22-JUN-87	MG/KG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LINED POND														
LPAW	2480(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPBW	2547(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPCW	2490(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPDW	2481(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPEW	2533(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPFW	2524(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPGW	2545(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPHW	2521(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPIW	2535(M)	GRAB	AQUE	20-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
LPW ** (LAB COMP OF ABOVE)	2556(M)	COMP	AQUE	20-MAR-86	MG/L	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	VOLATILE ORGANIC COMPOUNDS: CHLORO-FORM	1,1,1-TRI-CHLOROETHANE	TRICHLORO-ETHYLENE	TOLUENE	EP TOXICITY (2) (MG/L): ARSENIC	BARIUM	CADMIUM	CHROMIUM	MERCURY
LPFBW	2492(M)	GRAB	AQUE	20-MAR-86	MG/L	5	6	0.005 U	BDL	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LPS	2502(M)	COMP	SEDI	20-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	BDL	0.280	0.200 U	0.081	0.050 U	0.0003 U
LPFB (FIELD BLANK)	2462(M)	GRAB	AQUE *	20-MAR-86	MG/MG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
LINED POND	0879	GRAB	AQUE	02-SEP-86	MG/KG					-	-	-	-	-
REP-SW3 (LINED POND)	0880	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
METAL PAD STORAGE														
MPAS	2733	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
MPASG	2935	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
MPBSG	2936	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
MPCSG	2937	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SOILREP 3R (MPASG)	2941	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
NORTH DRAINAGE DITCH														
NDCW	2710	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
NDDW	2711	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0024
NDEW	2728	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00036
NDFBW (FIELD BLANK)	2729	GRAB	AQUE	25-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
NDCW	0835	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDDW	0834	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
REP-SW1 (NDDW)	0838	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDEW	0833	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-	-	-
NDCS	2517	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	0.200 U	0.275	0.050 U	0.050 U	0.0003 U
NDDS	2518	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	0.200 U	0.271	0.050 U	0.050 U	0.0003 U
NDES	2520	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	0.200 U	0.253	0.050 U	0.050 U	0.0003 U
NDFBS (FIELD BLANK)	2519	GRAB	AQUE *	19-MAR-86	MG/KG	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.00037
OLD CATHODE WASTE PILE														
OCS	2718	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
OCFBS (FIELD BLANK)	2719	GRAB	AQUE *	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
OCWPSC-A	2994	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
OCWPSC-B	2993	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
OCWPSC-C	2995	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
OCWP PITB H20	2988	GRAB	AQUE	26-JUN-87	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
OLD NPDES DISCHARGE CHANNEL														
ODCSC-1	2932	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	VOLATILE ORGANIC COMPOUNDS: CHLORO-FORM	1,1,1-TRI-CHLOROETHANE	TRICHLORO-ETHYLENE	TOLUENE	EP TOXICITY (2) (MG/L): ARSENIC	BARIUM	CADMIUM	CHROMIUM	MERCURY
POTLINER HANDLING														
PHASC	2916	COMP	SOIL	23-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SOILREP 2 (PHASC)	2917	COMP	SOIL	23-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
PHFB (FIELD BLANK)	2918	GRAB	AQUE	23-JUN-87	MG/KG					-	-	-	-	-
RECYCLE POND														
RPAW	2588	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPBW	2589	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPCW	2591	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPDW	2592	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPEW	2616	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPFW	2617	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPGW	2594	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPHW	2595	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPIW	2626	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPJW	2627	GRAB	AQUE	22-MAR-86	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
RPW ** (LAB COMP)	2643(M)	COMP	AQUE	22-MAR-86	MG/L	-	-	-	-	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
RPFBW (FIELD BLANK)	2603	GRAB	AQUE	22-MAR-86	MG/L	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
RPAS	2605	COMP	SEDI	22-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
RPBS	2606	COMP	SEDI	22-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
RPCS	2608(M)	COMP	SEDI	22-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
RPDS	2609	COMP	SEDI	22-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
RPFBS (FIELD BLANK)	2604	GRAB	AQUE *	22-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00074
RPS-1	0923	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS-2	0924	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS-3	0925	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS-4	0926	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS-5 (REP RPS-2)	0927	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS-6 (REP RPS-4)	0928	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS COMP	2605(M)	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
RPS	0943	COMP	SOIL	04-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
RECYCLE POND	0822	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-	-	-
SAMPLE A-J (REP RECYCLE POND)	0820	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-	-	-
RIVER ROAD DITCH														
RRAS	2730	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	VOLATILE ORGANIC COMPOUNDS: CHLORO-FORM	1,1,1-TRI-CHLOROETHANE	TRICHLORO-ETHYLENE	TOLUENE	EP TOXICITY (2) (MG/L): ARSENIC	BARIUM	CADMIUM	CHROMIUM	MERCURY
RIVER ROAD CURB														
RRBS	2731	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
SALVAGE AREA														
OCAS	2732	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-	-	-
SASC	2990	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SAFB (FIELD BLANK)	2992	GRAB	AQUE *	26-JUN-87	MG/KG	-	-	-	-	-	-	-	-	-
SCRUBBER SLUDGE PONDS														
SSP1AS	2792	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP1BS	2793	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP1CS	2794	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP1DS	2795	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP2ES	2796	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP2FS	2798	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP3GS	2799	GRAB	SEDI	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP3HS	2800	GRAB	SEDI	27-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP4IS	2801	GRAB	SEDI	27-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSP4JS	2802	GRAB	SEDI	27-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SSPFBS (FIELD BLANK)	2804	GRAB	AQUE *	28-MAR-86	MG/KG	0.045 U	0.045 U	0.045 U	0.045 U	-	-	-	-	-
SCRUBBER PIPE-EFF	2989	GRAB	AQUE	26-JUN-87	MG/L	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-	-
SURFACE DRAINAGE DITCH														
SDAS	2720	COMP	SEDI	26-MAR-86	MG/KG	0.025 U	0.025 U	0.025 U	0.025 U	0.200 U	0.200 U	0.050 U	0.050 U	0.0003 U
SDFBS (FIELD BLANK)	2717	GRAB	AQUE *	26-MAR-86	MG/KG	0.025 U	0.025 U	0.025 U	0.025 U	0.200 U	0.200 U	0.050 U	0.050 U	0.00034
SSD-1	0870	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
SSD-2	0871	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-
SSD-3	0872	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	COMMON IONS CALCIUM	POTASSIUM	CHLORIDE	BICARB ALKALI	CARB ALKALI	MAGNESIUM	SODIUM
BATH RECOVERY												
BRASC	2934	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 4R (BRASC)	2942	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
BRFB (FIELD BLANK)	2933	GRAB	AQUE *	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CATHODE WASH AREA												
CWASG	2938	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CWBSG	2939	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CWCSG	2940	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
CWASC-1	2991	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
CHENOWETH CREEK SAMPLES												
CCSWG-1	870804-012	GRAB	AQUE	02-AUG-87	MG/L	27.300	4.060	8.9	144	1.0 U	16.000	18.100
CCSWG-2	870827-002	GRAB	AQUE	24-AUG-87	MG/L	20.100	1.290	2.3	52	2.0 U	6.010	6.220
CRSWG-1	870827-006	GRAB	AQUE	25-AUG-87	MG/L	17.800	1.0 U	5.0	63	2.0 U	4.890	5.280
DISCHARGE CHANNEL												
DCAW	2707	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
DCFBW	2708	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
DCAQ	0830	GRAB	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-
DCAG	2476	GRAB	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
DCBG	2477(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
DCCG	2478(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
DCDG	2507(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
DCDG	0877	GRAB	SEDI	02-SEP-86	MG/KG	-	-	-	-	-	-	-
DCEG	2508(M)	GRAB	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
DCEG	0892	GRAB	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
SR-3 (REP DCEG)	0893	GRAB	AQUE	04-SEP-86	MG/KG	-	-	-	-	-	-	-
DCFBS (FIELD BLANK)	2467(M)	GRAB	AQUE *	19-MAR-86	MG/KG	-	-	-	-	-	-	-
DRAINAGE DITCH												
DDASG	2712	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDBSG	2713	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDCSG	2714	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDDSG	2725	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDESG	2726	GRAB	SEDI	25-MAR-86	MG/KG	-	-	-	-	-	-	-
DDFBS (FIELD BLANK)	2727	GRAB	AQUE *	25-MAR-86	MG/KG	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	COMMON IONS CALCIUM	POTASSIUM	CHLORIDE	BICARB ALKALI	CARB ALKALI	MAGNESIUM	SODIUM
DUCK POND												
DPAW	2600	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPBW	2602	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPCW	2612	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPDW	2613	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPEW	2624	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPFW	2625	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPGW	2598	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPHW	2599	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPIW	2620	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DPAS1	2632	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPAS2	2633	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPBS	2622	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPCSG	2621	COMP	SEDI	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPFBS (FIELD BLANK)	2634	GRAB	AQUE *	24-MAR-86	MG/KG	-	-	-	-	-	-	-
DPFBW (FIELD BLANK)	2614	GRAB	AQUE	24-MAR-86	MG/L	-	-	-	-	-	-	-
DUCK POND	0843	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
REP-SW2 (DUCK POND)	0844	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
LANDFILL												
LFAS	3290	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LFBS	3291	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LFCS	3292	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LFDS	3294	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LFES	3295	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LFFBS (FIELD BLANK)	3297(M)	GRAB	AQUE *	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LFCGS	3296	COMP	SOIL	10-MAY-86	MG/KG	-	-	-	-	-	-	-
LANDFILL DITCH												
LDAWG	2927	GRAB	AQUE	23-JUN-87	MG/L	5.000 U	146.000	826	16000	42000	-	-
LDBWG	2929	GRAB	AQUE	23-JUN-87	MG/L	5.000 U	104.000	645	16000	46500	-	-
DLSW-REP1E (LDBWG)	2925	GRAB	AQUE	23-JUN-87	MG/L	5.000 U	98.200	748	15000	47000	-	-
LDAWG	3340	GRAB	AQUE	2-AUG-87	MG/L	5.000 U	169.000	1210	33500	73000	-	-
LDBWG	3338	GRAB	AQUE	2-AUG-87	MG/L	7.100	606.000	3140	63500	76500	-	-
DLSW-REP1E (LDBWG)	3339	GRAB	AQUE	2-AUG-87	MG/L	16.400	798.000	3430	36000	73400	-	-
LDFB (FIELD BLANK)	2930	GRAB	AQUE	23-JUN-87	MG/L	-	-	0.0011 U	10 U	10 U	-	-
LDFB	3341	GRAB	AQUE	02-AUG-87	MG/L	0.500 U	1.000 U	1.0 U	10 U	10 U	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	COMMON IONS CALCIUM	POTASSIUM	CHLORIDE	BICARB ALKALI	CARB ALKALI	MAGNESIUM	SODIUM
NDAW	2723	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
NDBW	2724	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
NDAW	0837	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
NDBW	0836	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
NDAS	2515	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDBS	2516	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
LANDFILL LEACHATE												
LLAW	2701	GRAB	AQUE	26-MAR-86	MG/L	-	-	-	-	-	-	-
LLBW	2702	GRAB	AQUE	26-MAR-86	MG/L	-	-	-	-	-	-	-
LLCW	2704	GRAB	AQUE	26-MAR-86	MG/L	-	-	-	-	-	-	-
LLDW	2705	GRAB	AQUE	26-MAR-86	MG/L	-	-	-	-	-	-	-
LLFB	2716	GRAB	AQUE	26-MAR-86	MG/L	-	-	-	-	-	-	-
LLAW	0979	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLBW	0980	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLCW	0981	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLCW-D	0982	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLDW	0983	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LLFB (FIELD BLANK)	0984	GRAB	AQUE	18-SEP-86	MG/L	-	-	-	-	-	-	-
LANDFILL RUNOFF												
LRASC	2910	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRBSC	2911	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRCSC	2912	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRDSC	2914	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 1E (LRBSC)	2913	COMP	SOIL	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LRFB (FIELD BLANK)	2915	GRAB	AQUE *	22-JUN-87	MG/KG	-	-	-	-	-	-	-
LINED POND												
LPAW	2480(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPBW	2547(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPCW	2490(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPDW	2481(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPEW	2533(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPFW	2524(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPGW	2545(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPHW	2521(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPIW	2535(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPW ** (LAB COMP OF ABOVE)	2556(M)	COMP	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	COMMON IONS CALCIUM	POTASSIUM	CHLORIDE	BICARB ALKALI	CARB ALKALI	MAGNESIUM	SODIUM
LPFBW	2492(M)	GRAB	AQUE	20-MAR-86	MG/L	-	-	-	-	-	-	-
LPS	2502(M)	COMP	SEDI	20-MAR-86	MG/KG	-	-	-	-	-	-	-
LPFB (FIELD BLANK)	2462(M)	GRAB	AQUE *	20-MAR-86	MG/MG	-	-	-	-	-	-	-
LINED POND	0879	GRAB	AQUE	02-SEP-86	MG/KG	-	-	-	-	-	-	-
REP-SW3 (LINED POND)	0880	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
METAL PAD STORAGE												
MPAS	2733	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
MPASG	2935	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
MPBSG	2936	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
MPCSG	2937	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 3R (MPASG)	2941	GRAB	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-
NORTH DRAINAGE DITCH												
NDCW	2710	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
NDDW	2711	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
NDEW	2728	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
NDFBW (FIELD BLANK)	2729	GRAB	AQUE	25-MAR-86	MG/L	-	-	-	-	-	-	-
NDCW	0835	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
NDDW	0834	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
REP-SW1 (NDDW)	0838	GRAB	AQUE	02-SEP-86	MG/L	-	-	-	-	-	-	-
NDEW	0833	GRAB	AQUE	01-SEP-86	MG/L	-	-	-	-	-	-	-
NDCS	2517	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDDS	2518	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDES	2520	COMP	SEDI	19-MAR-86	MG/KG	-	-	-	-	-	-	-
NDFBS (FIELD BLANK)	2519	GRAB	AQUE *	19-MAR-86	MG/KG	-	-	-	-	-	-	-
OLD CATHODE WASTE PILE												
OCS	2718	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
OCFBS (FIELD BLANK)	2719	GRAB	AQUE *	26-MAR-86	MG/KG	-	-	-	-	-	-	-
OCWPSC-A	2994	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
OCWPSC-B	2993	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
OCWPSC-C	2995	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
OCWP PITB H20	2988	GRAB	AQUE	26-JUN-87	MG/L	-	-	-	-	-	-	-
OLD NPDES DISCHARGE CHANNEL												
ODCSC-1	2932	COMP	SOIL	24-JUN-87	MG/KG	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	COMMON IONS CALCIUM	POTASSIUM	CHLORIDE	BICARB ALKALI	CARB ALKALI	MAGNESIUM	SODIUM
POTLINER HANDLING												
PHASC	2916	COMP	SOIL	23-JUN-87	MG/KG	-	-	-	-	-	-	-
SOILREP 2 (PHASC)	2917	COMP	SOIL	23-JUN-87	MG/KG	-	-	-	-	-	-	-
PHFB (FIELD BLANK)	2918	GRAB	AQUE	23-JUN-87	MG/KG	-	-	-	-	-	-	-
RECYCLE POND												
RPAW	2588	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPBW	2589	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPCW	2591	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPDW	2592	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPEW	2616	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPFW	2617	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPGW	2594	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPHW	2595	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPIW	2626	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPJW	2627	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPW ** (LAB COMP)	2643(M)	COMP	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPFBW (FIELD BLANK)	2603	GRAB	AQUE	22-MAR-86	MG/L	-	-	-	-	-	-	-
RPAS	2605	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-
RPBS	2606	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-
RPCS	2608(M)	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-
RPDS	2609	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-
RPFBS (FIELD BLANK)	2604	GRAB	AQUE *	22-MAR-86	MG/KG	-	-	-	-	-	-	-
RPS-1	0923	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RPS-2	0924	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RPS-3	0925	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RPS-4	0926	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RPS-5 (REP RPS-2)	0927	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RPS-6 (REP RPS-4)	0928	COMP	SEDI	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RPS COMP	2605(M)	COMP	SEDI	22-MAR-86	MG/KG	-	-	-	-	-	-	-
RPS	0943	COMP	SOIL	04-SEP-86	MG/KG	-	-	-	-	-	-	-
RECYCLE POND	0822	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-
SAMPLE A-J (REP RECYCLE POND)	0820	COMP	AQUE	30-AUG-86	MG/L	-	-	-	-	-	-	-
RIVER ROAD DITCH												
RRAS	2730	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-

G&M SAMPLE	VERSAR LAB ID #	SAMPLE TYPE	SAMPLE MATRIX	DATE COLLECTED	UNITS	COMMON IONS CALCIUM	POTASSIUM	CHLORIDE	BICARB ALKALI	CARB ALKALI	MAGNESIUM	SODIUM
RIVER ROAD CURB												
RRBS	2731	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
SALVAGE AREA												
OCAS	2732	COMP	SOIL	26-MAR-86	MG/KG	-	-	-	-	-	-	-
SASC	2990	COMP	SOIL	26-JUN-87	MG/KG	-	-	-	-	-	-	-
SAFB (FIELD BLANK)	2992	GRAB	AQUE *	26-JUN-87	MG/KG	-	-	-	-	-	-	-
SCRUBBER SLUDGE PONDS												
SSP1AS	2792	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP1BS	2793	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP1CS	2794	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP1DS	2795	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP2ES	2796	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP2FS	2798	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP3GS	2799	GRAB	SEDI	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP3HS	2800	GRAB	SEDI	27-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP4IS	2801	GRAB	SEDI	27-MAR-86	MG/KG	-	-	-	-	-	-	-
SSP4JS	2802	GRAB	SEDI	27-MAR-86	MG/KG	-	-	-	-	-	-	-
SSPFBS (FIELD BLANK)	2804	GRAB	AQUE *	28-MAR-86	MG/KG	-	-	-	-	-	-	-
SCRUBBER PIPE-EFF	2989	GRAB	AQUE	26-JUN-87	MG/L	-	-	-	-	-	-	-
SURFACE DRAINAGE DITCH												
SDAS	2720	COMP	SEDI	26-MAR-86	MG/KG	-	-	-	-	-	-	-
SDFBS (FIELD BLANK)	2717	GRAB	AQUE *	26-MAR-86	MG/KG	-	-	-	-	-	-	-
SSD-1	0870	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-
SSD-2	0871	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-
SSD-3	0872	GRAB	SOIL	03-SEP-86	MG/KG	-	-	-	-	-	-	-

APPENDIX B

APPENDIX B

ENVIRONMENTAL FATE OF CYANIDE SPECIES PRESENT AT THE MMRF

ENVIRONMENTAL FATE OF CYANIDE SPECIES PRESENT AT THE MMRF

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June 8, 1988

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1.0 INTRODUCTION

As a result of a review of the draft RI for the MMRF conducted by EPA, some questions arose on the availability of further information on the expected environmental behavior of cyanide detected in groundwater, surface water and soil at the MMRF. Additional information has also been obtained on the form of cyanide present at the MMRF. Analytical measurements specifically for the ferrocyanide complex, $(FeCN_6)^{-4}$, and the ferricyanide complex, $(FeCN_6)^{-3}$, have indicated that cyanide bound with iron appears to be the predominant form of cyanide present in groundwater and leachate from the landfill and the cathode waste pad.

In view of these developments, an additional extensive search of the literature was performed. This document summarizes information relevant to the environmental fate of the species of cyanide present at the MMRF.

2.0 FORM OF CYANIDE PRESENT AT THE MMRF

In October 1987, the Rocky Mountain Analytical Laboratory of Enseco analyzed several water samples from the MMRF, specifically for ferri-and ferro cyanide complexes. Samples analyzed were from monitoring wells 9S, 9B, 9A, leachate from the cathode pad and the landfill, and a field blank. The results of this analysis are summarized in Table 1, and the analytical data is included in the Appendix. As can be seen from these results, most of the total cyanide is present largely as the ferricyanide (Fe^{3+}) complex, although in well 9B, most of the cyanide is present as ferrocyanide (Fe^{2+}) complex. The percent of total cyanide present as the iron cyanide complex ranged from 79% to 107% in the analyzed samples (a result greater than 100% indicates a positive

Table 1
SUMMARY OF ROCKY MOUNTAIN ANALYTICAL LABORATORY RESULTS
FOR IRON CYANIDES AT THE MMRF

Location of Sample	Cyanide Complexed With Iron	Free Cyanide	Cyanide Neither Complexed W/Iron or Free	Ratio of Ferri to Ferro Complexes
MW 9S	85%	6%	9%	2a)
MW 9A	84%	1%	15%	0.5
MW 9B	107%b)	4%	--	4
Cathode Pad	89%	.2%	11%	30a)
Landfill Leachate	79%	8%	13%	2

a) When ferrocyanide reported as ND or not detected, concentration of ferricyanide was divided by the detection limit.
b) Indicates positive interference

interference). The percent of cyanide which represents species other than iron cyanide or free cyanide ranged from 9% to 15%. Because the laboratory reported the results as iron, and not as the iron-cyanide complex itself, the concentration of iron cyanide present was calculated as shown in the Appendix. The laboratory also analyzed elemental iron by ICP in the same samples and these measurements were found to be in good agreement with the iron measured as part of the ferro/ferricyanide complexes. Although this analysis was not performed according to an approved EPA procedure (since none is in existence), it nevertheless indicates that iron cyanide complexes are the predominant form of cyanide measured as total cyanide in the samples analyzed at the MMRF. Available information on the fate of ferri/ferrocyanide complexes in the environment, as well as the fate of free cyanide present as hydrogen cyanide (HCN) is discussed below.

3.0 FATE OF CYANIDE IN SURFACE WATER

In general, cyanide species in surface water may undergo transformations due to the presence of sunlight (photolysis), the presence of oxygen or oxidizing species such as ferric iron (oxidation), the presence of sulfide (reduction), reaction with water (dissociation), metabolism by microorganisms (biodegradation), and reaction with other metal cations (substitution and precipitation). The migration of cyanide in or from surface water by precipitation, complex exchange or volatilization will be affected to some extent by these transformation processes. The following sections will discuss the iron cyanide complexes and hydrogen cyanide within the context of transformation and migration processes relevant to these species in surface water.

3.1 Iron Cyanide Complexes

Ferri- and ferrocyanide complexes are interrelated by oxidation/reduction processes as shown by the half-reaction:

$$Fe(CN)^{-3} + e \rightleftharpoons Fe(CN)^{-4}$$

The interconversion of these compounds can therefore occur under different environmental conditions.

3.1.1. Photolysis

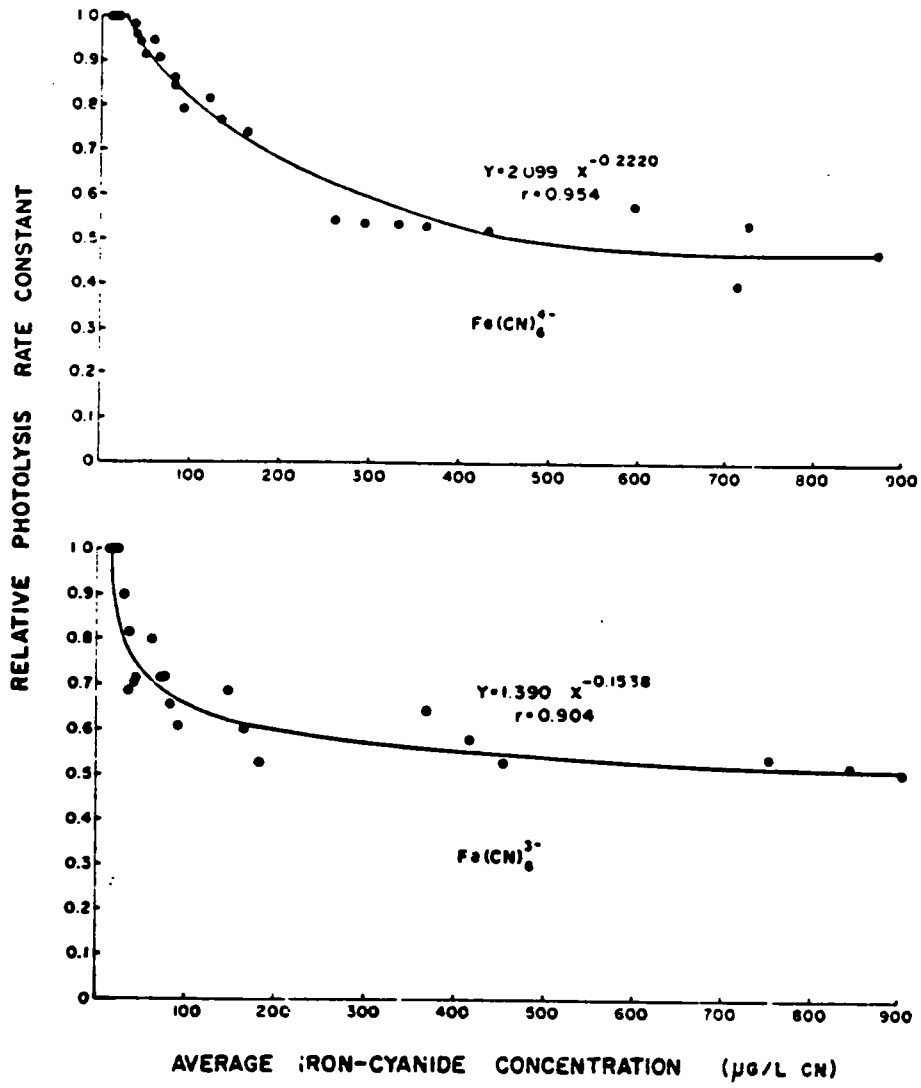
The photolysis or transformations of ferri/ferrocyanide complexes due to radiation from the sun has been extensively studied by Broderius and Smith (1980). These complexes are capable of releasing free cyanide (the biologically active form) upon reaction with sunlight, although the exact mechanism of release is not completely understood. It has been hypothesized that under the reaction of sunlight, a molecule of water is substituted for one of cyanide in the case of both ferri- and ferrocyanide complexes, with the subsequent release of a molecule of free cyanide. This reaction is believed to be reversible if irradiation is not "prolonged", that is, the cyanide is capable of complexing back with iron with the subsequent release of water. If irradiation is prolonged, however, it has been suggested that additional release of cyanide will occur. Researchers have reported that under prolonged irradiation in aerated and concentrated solutions, $Fe(OH)_3$ (in alkaline solutions) and Prussian Blue, $FeFe(CN)_6^-$, (in acid solutions) are formed (Broderius and Smith, 1980). This implies that in alkaline solutions, all of the cyanide is ultimately released, however, the solution must be sufficiently alkaline to provide one hydroxide ion for every two cyanide ions, a condition

not likely to occur in the environment.

Research performed by Broderius and Smith (1980) suggests, however, that all of the cyanide may not be liberated. The authors found that the maximum amount of cyanide that could be photochemically liberated as HCN from prolonged irradiation of dilute ferro- and ferricyanide complexes was 85% and 49% respectively, or that one molecule of ferrocyanide released five molecules of cyanide, while one molecule of ferricyanide released three molecules of cyanide. This means that even under optimum conditions, approximately one half of the total cyanide present as ferricyanide in groundwater which is released to surface water will be photolytically liberated as free cyanide, but only in the upper depths of the river under conditions of low turbidity and intense and continuous irradiation. The efficiency of photolytic degradation decreases dramatically with the depth and turbidity of the water body. For example, the average percent of light penetration in the Ohio River was measured as 80.8% at a depth of 0.15 meters, 18.2% at a depth of 1 meter, and 0% at a depth of 5 meters (Ecological Analysts, 1979).

Broderius and Smith (1980) also studied the rate of photodecomposition of these complexes in both deionized water (laboratory conditions) and in natural water. The authors found that at lower concentrations, below 100 ug/L, the rate of photolysis of ferri- and ferrocyanides was faster than at higher concentrations as shown in Figure 1. Ferrocyanide appears to decompose somewhat faster than ferricyanide at low concentrations, but at higher

Figure 1



Relative photolysis rate constants normalized to the values determined for solutions with an initial total cyanide concentration of 25 µg/l CN and as a function of the average iron-cyanide concentration during the rate determination period. (Broderius and Smith 1980)

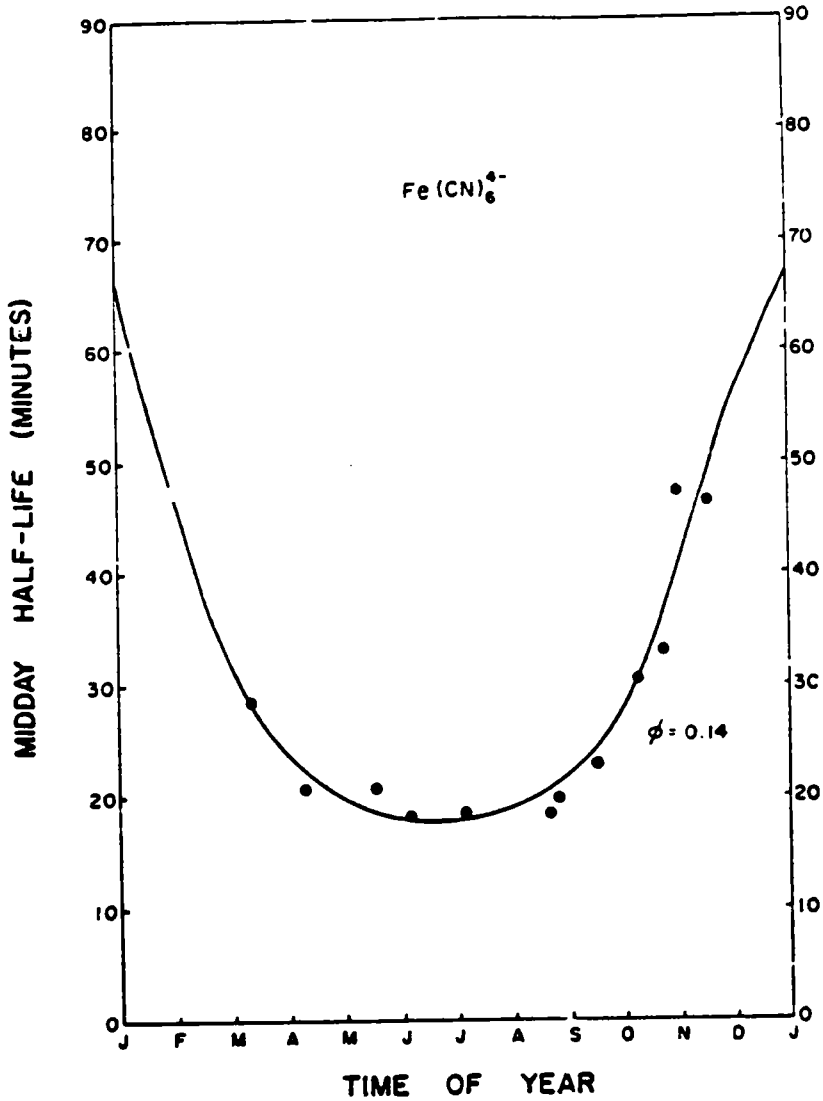
concentrations (2 mg/L and above), ferricyanide decomposed more rapidly than ferrocyanide (not shown on Figure 1). Increasing pH was generally found to moderately decrease the rate of photolysis in a linear fashion for ferri- and ferrocyanide over the pH range 6.6 to 8.

Under optimum conditions (mid-day sun, clear pure water, and at a 4 centimeter depth) the half-life of the iron cyanide complexes is very short, or approximately 18 minutes for ferrocyanide and 65 minutes for ferricyanide during summer months as shown in Figures 2 and 3. Conditions in the environment are rarely optimum, however, and it should be stressed that photolysis is a complex process; the rate of transformation is extremely site specific, dependent upon such things as time of day, season of the year, latitude, light absorption capacity of the water body due to dissolved organics and ions, turbidity, water depth, concentration of the iron cyanide complex, pH, and the presence of oxidizing agents (such as the ferric ion) or reducing agents (such as sulfide) which could affect ferri/ferrocyanide interconversions.

3.1.2 Biodegradation

It appears that bacteria are capable of liberating free cyanide from iron cyanide complexes. Cherryholmes et al. (1985) studied the formation of free cyanide from a solution of ferricyanide in river water inoculated with bacteria and a sterile solution of ferricyanide in river water; both solutions were protected from light (to guard against the effects of photolysis). The authors found that free cyanide was liberated to a much greater degree in the inoculated solution, but the maximum liberated cyanide over the time-period

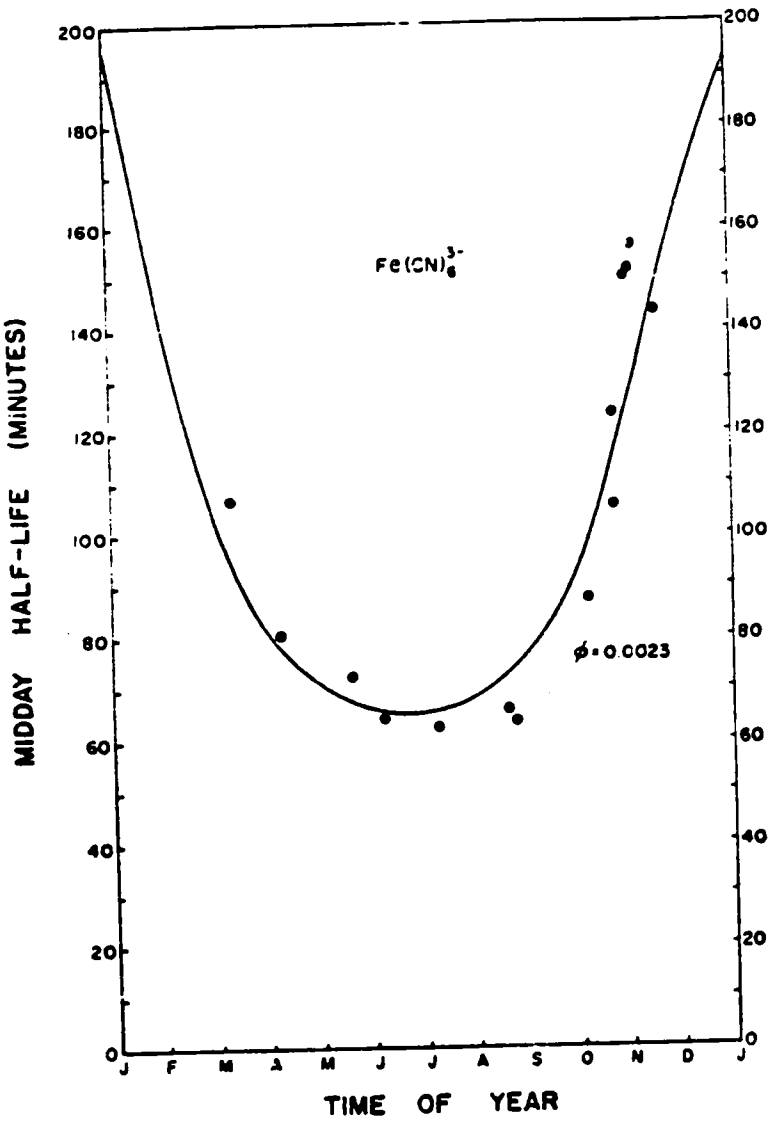
Figure 2



Midday half-lives for 100 μg/l CN hexacyanoferrate (II) solutions at near surface depths for different times of the year under full sunlight conditions at St. Paul, Minn.

(Broderius and Smith 1980)

Figure 3



Midday half-lives for 100 µg/l CN hexacyanoferrate (III) solutions at near surface depths for different times of the year under full sunlight conditions at St. Paul, Minn.
(Broderius and Smith 1980)

studied (24.8 days) made up only 0.09% of the total cyanide originally present as the ferricyanide complex. The concentrations of free cyanide reached a maximum concentration and then decreased over time. The total cyanide concentration in the inoculated solution at the end of the study (24.8 days) was 8.5% lower than the original total cyanide concentration, while the total cyanide concentration in the sterile solution at the end of the study was only 0.5% lower than original concentration. While it is quite possible that the overall disappearance of cyanide from the inoculated solution is due to biodegradation, it is not clear from the authors work whether loss from volatilization was uniformly minimized or even considered in the case of both solutions. The authors concluded that photodegradation of iron cyanides would, in most cases, be a more likely cause of high free cyanide values encountered in surface water.

3.2 HYDROGEN CYANIDE

Degradation of iron cyanide complexes forms hydrogen cyanide in the environment, which is the biologically active species. This section will focus on fate processes of most concern with respect to this species in surface water.

3.2.1 Dissociation

Hydrogen cyanide is a weak acid and enters into the following equilibrium reaction in water:

$$HCN \rightleftharpoons H^+ + CN^-$$

At a pH of 9.2, and a temperature of 20°C, one-half of the free cyanide species exists (on a molar basis) as molecular hydrogen cyanide, and the other

half as the cyanide anion. Below a pH of 9.2, most of the free cyanide present will be in the form of hydrogen cyanide (HCN); above pH 9.2, most of the cyanide will be in the anionic (CN^-) form. Cyanide will exist in the form of hydrogen cyanide at most pH values encountered in the environment. The effect of temperature and pH on the dissociation of hydrogen cyanide is shown on Table 2.

3.2.2 Biodegradation

Biodegradation of hydrogen cyanide is known to occur in surface water, as shown by the work of Cherryholmes et al discussed above, and also discussed in the Remedial Investigation Report (Geraghty & Miller, 1988). Although known to occur, the rate of biodegradation of cyanide is likely to be lower than the rate of loss from other processes such as volatilization. Based on the work of The Chester Engineers (1977), half-lives for free cyanide in river water ranged from 10 hours to 60 hours for a range of microorganism concentrations (1.7 - 7.8 mg cells/L), at temperatures of 4,7 and 25°C (EPA 1981). The study of the Chester Engineers and the reported half-lives may reflect volatilization loss of HCN, however, since it is not clear that such loss was considered during the study. It must be stressed that the rate of biodegradation is very dependent upon the concentration of microorganisms present, and if the microbes are acclimated to cyanide.

3.2.3 Oxidation

Investigations have suggested that cyanide may be converted to cyanate under aerobic conditions, but it is not clear whether such a transformation is

Table 2. Fraction of Free Cyanide ($HCN + CN^-$) as Hydrocyanic Acid (HCN) in Aqueous Solutions of Low Ionic Strength (Broderius 1981).

temp, °C	pH 6.0	pH 6.2	pH 6.4	pH 6.6	pH 6.8	pH 7.0	pH 7.2	pH 7.4
5	1.000	1.000	0.999	0.999	0.999	0.998	0.996	0.994
6	1.000	1.000	0.999	0.999	0.998	0.998	0.996	0.994
7	1.000	1.000	0.999	0.999	0.998	0.997	0.996	0.994
8	1.000	1.000	0.999	0.999	0.998	0.997	0.996	0.993
9	1.000	1.000	0.999	0.999	0.998	0.997	0.996	0.993
10	1.000	1.000	0.999	0.999	0.998	0.997	0.995	0.993
11	1.000	1.000	0.999	0.999	0.998	0.997	0.995	0.992
12	1.000	0.999	0.999	0.999	0.998	0.997	0.995	0.992
13	1.000	0.999	0.999	0.999	0.998	0.997	0.995	0.992
14	1.000	0.999	0.999	0.999	0.998	0.996	0.994	0.991
15	1.000	0.999	0.999	0.999	0.998	0.996	0.994	0.991
16	1.000	0.999	0.999	0.998	0.998	0.996	0.994	0.990
17	1.000	0.999	0.999	0.998	0.997	0.996	0.994	0.990
18	1.000	0.999	0.999	0.998	0.997	0.996	0.993	0.989
19	1.000	0.999	0.999	0.998	0.997	0.996	0.993	0.989
20	1.000	0.999	0.999	0.998	0.997	0.995	0.993	0.988
21	1.000	0.999	0.999	0.998	0.997	0.995	0.992	0.988
22	0.999	0.999	0.999	0.998	0.997	0.995	0.992	0.987
23	0.999	0.999	0.999	0.998	0.997	0.995	0.992	0.987
24	0.999	0.999	0.999	0.998	0.996	0.994	0.991	0.986
25	0.999	0.999	0.999	0.998	0.996	0.994	0.991	0.986
26	0.999	0.999	0.998	0.998	0.996	0.994	0.990	0.985
27	0.999	0.999	0.998	0.997	0.996	0.994	0.990	0.984
28	0.999	0.999	0.998	0.997	0.996	0.993	0.990	0.984
29	0.999	0.999	0.998	0.997	0.996	0.993	0.989	0.983
30	0.999	0.999	0.998	0.997	0.995	0.993	0.989	0.982

temp, °C	pH 7.6	pH 7.8	pH 8.0	pH 8.2	pH 8.4	pH 8.6	pH 8.8	pH 9.0
5	0.991	0.986	0.977	0.964	0.945	0.915	0.872	0.811
6	0.990	0.985	0.976	0.963	0.942	0.911	0.866	0.804
7	0.990	0.984	0.975	0.961	0.939	0.907	0.861	0.796
8	0.989	0.983	0.974	0.959	0.937	0.903	0.855	0.788
9	0.989	0.982	0.973	0.957	0.934	0.899	0.849	0.780
10	0.988	0.982	0.971	0.955	0.931	0.894	0.842	0.771
11	0.988	0.981	0.970	0.953	0.928	0.890	0.836	0.763
12	0.987	0.980	0.968	0.951	0.924	0.885	0.829	0.754
13	0.987	0.979	0.967	0.949	0.921	0.880	0.823	0.745
14	0.986	0.978	0.965	0.946	0.918	0.875	0.816	0.737
15	0.985	0.977	0.964	0.944	0.914	0.870	0.809	0.727
16	0.985	0.976	0.962	0.941	0.910	0.865	0.802	0.718
17	0.984	0.975	0.961	0.939	0.906	0.860	0.794	0.709
18	0.983	0.974	0.959	0.936	0.903	0.854	0.787	0.699
19	0.982	0.972	0.957	0.934	0.899	0.848	0.779	0.690
20	0.982	0.971	0.955	0.931	0.894	0.842	0.771	0.680
21	0.981	0.970	0.953	0.928	0.890	0.836	0.763	0.671
22	0.980	0.969	0.951	0.925	0.886	0.830	0.755	0.661
23	0.979	0.967	0.949	0.922	0.881	0.824	0.747	0.651
24	0.978	0.966	0.947	0.918	0.877	0.818	0.739	0.641
25	0.977	0.964	0.945	0.915	0.872	0.811	0.730	0.631
26	0.976	0.963	0.942	0.912	0.867	0.804	0.722	0.621
27	0.975	0.961	0.940	0.908	0.862	0.798	0.713	0.611
28	0.974	0.960	0.938	0.905	0.857	0.791	0.704	0.601
29	0.973	0.958	0.935	0.901	0.852	0.784	0.696	0.591
30	0.972	0.956	0.933	0.897	0.846	0.777	0.687	0.580

biologically mediated (Huiatt et al. 1983). The following reaction has been suggested:

$$HCN + 1/2\ O_2 \longrightarrow HCNO$$

Cyanate is then hydrolyzed to carbonate and ammonia at environmental pH, although this conversion is greatly accelerated at low pH:

$$HCNO + H_2O \longrightarrow NH_3 + CO_2$$

The Chester Engineers (1977) examined the rate of oxidation (referred to as hydrolysis in their report) of HCN in distilled water. Based on this work, half-lives at 0°, 10°, and 20°C were calculated at 23, 15, and 10 days respectively (EPA 1981). Again, it is unclear if loss through volatilization was considered in this study.

3.2.4 Volatilization

The tendency of a compound to volatilize from water into air can be judged from the magnitude of its Henry's Law constant. Dodge and Zabban (1952) measured the effect of temperature on the Henry's Law constant for very dilute hydrogen cyanide solutions (less than 0.4%). At 18°C and a pH of approximately 5, the Henry's Law constant was calculated by the authors to be 5.0 atm/mole fraction, or 9.0x10-5 atm-m3/mole.

In order to compare the significance of the formation of free cyanide through photolysis with the loss of HCN from surface water through volatilization, we calculated a volatilization half-life for HCN under the same conditions used by Broderius and Smith (1980) to determine a photolytic half-life for ferro- and ferricyanide complexes; the calculations can be found in the Appendix.

Using the Henry's Law Constant calculated by Dodge and Zabban (1952), and assuming a depth of 4 centimeters (the depth used in the photolysis experiments by Broderius and Smith 1980), we have calculated a volatilization half-life of 25 minutes for HCN by the method of Liss and Slater (Lyman 1982). A comparison of this half-life to those measured by Broderius and Smith (1980) for the photolytic degradation of ferrocyanide (18 minutes) and ferricyanide (65 minutes) under optimum conditions, reveal that these processes are strongly competitive, and that as HCN is formed in surface water bodies by photolytic degradation, it is quickly volatilized into the atmosphere. Once in the air, HCN would be readily dispersed annd diluted.

4.0 FATE OF CYANIDE IN GROUNDWATER

Cyanide in groundwater will not be affected by as many transformation processes as it would be in surface water. Photolysis is not a relevant transformation process for this medium, and the significance of biodegradation is, in general, very much reduced when compared to surface water. The fate processes of most concern in this medium for the species of concern are discussed below.

4.1 Iron Cyanide Complexes

The relevant transformation processes for cyanide complexes in groundwater are oxidation, dissociation, and complex interchange.

4.1.1 Oxidation

Broderius (1973) measured the concentration of HCN in ferro-and ferricyanide solutions allowed to remain undisturbed in the dark at 20°C for 450 days. He

found that the formation of HCN in ferrocyanide solutions rapidly declined after a period of approximately 63 days and approached the equilibrium concentration measured for the ferricyanide solution. Broderius hypothesized that oxidation of ferrocyanide to ferricyanide had occurred in the dark, and this supposition was also corroborated by spectral changes measured for the ferrocyanide solution.

4.1.2 Complex Interchange

The metal in a metal cyanide complex in solution may be replaced by a different metal existing in solution if the new complex is thermodynamically more stable than the original complex. A measure of stability can be found in the formation or stability constant. The higher the numerical value of the stability constant for a complex, the lower is the tendency of that complex to dissociate and reform as the less stable complex. Table 3 lists stability constants for several cyanide complexes. As apparent from this table, the ferri/ferrocyanide complexes are among the most stable of those listed, and ferricyanide is more stable than ferrocyanide. Ferricyanide, which is likely the oxidative transformation product of ferrocyanide in groundwater, would persist in groundwater containing most other cations, with the exception of gold. Thus it is evident that iron cyanide complexes would not readily interchange and form new complexes with cations naturally present in groundwater at the MMRF.

4.1.3 Dissociation at Stomach pH

Little quantitative information is available on the actual extent of dissociation of iron cyanide complexes in the stomach upon ingestion. Of

Table 3

STABILITY CONSTANTS OF METAL-CYANIDE COMPLEX IONS

COMPLEX ION	STABILITY CONSTANT[a]
$Cr(CN)_6^{3-}$	10^{33}
$Cr(CN)_6^{4-}$	10^{21}
$Fe(CN)_6^{4-}$	10^{47}[b]
$Fe(CN)_6^{3-}$	10^{52}[b]
$Co(CN)_6^{4-}$	10^{50}
$Ni(CN)_4^{2-}$	10^{30}
$Pd(CN)_4^{2-}$	10^{42}
$Pt(CN)_4^{2-}$	10^{40}
$Cu(CN)_2^{-}$	$10^{23.9}$
$Cu(CN)_3^{2-}$	$10^{29.2}$
$Cu(CN)_4^{2-}$	$10^{30.7}$
$Ag(CN)_2^{-}$	$10^{20.4}$
$Ag(CN)_3^{2-}$	$10^{21.9}$
$Au(CN)_2^{-}$	10^{37}
$Au(CN)_4^{-}$	10^{85} (estimate)
$Zn(CN)_4^{2-}$	10^{21}
$Cd(CN)_4^{2-}$	10^{19}
$Hg(CN)_4^{2-}$	10^{39}

[a] Huiatt et al. 1983.
[b] Broderius 1973.

particular interest is the study by Kruse and Thibault (1973), which looked at the extent of dissociation of solutions of 5% potassium ferrocyanide at pH 2.0 (as well pH 5 and 7) in the dark after 24 hours. These conditions most simulate conditions in the stomach, although ingested cyanide would be expected to remain at stomach pH for approximately 2-3 hours, rather than 24 hours. Of the range of pH values tested, Kruse and Thibault found more of the dissociation of ferrocyanide occurred at pH 2.0 than at the higher pH values studied which would be expected. The extent of this dissociation was not significant, however, as can be seen in Table 4. Although dissociation of ferricyanide at pH 2 was not measured, it can be inferred from the stability constants shown in Table 2 as well as actual measurements at pH 7 in both light and dark conditions that the dissociation of ferricyanide will be less than that of ferrocyanide.

4.2 HYDROGEN CYANIDE

Hydrogen cyanide in groundwater can react with dissolved oxygen and/or microbial populations to form ultimately ammonia (or ammonium) and carbon dioxide (or bicarbonate/carbonate). The extent of this transformation, and the rate at which it occurs is expected to be much lower than in surface water, however, due to lower concentrations of dissolved oxygen and microbes.

Hydrogen cyanide can also complex with metal cations existing in groundwater, and either remain or precipitate out of solution.

5.0 SUMMARY AND CONCLUSIONS

Analyses performed specifically for the ferro- and ferricyanides in

Table 4

Summary of Results from Kruse and Thibault (1973)

Species	pH	Illumination	Percent Free Cyanide Versus Total Cyanide
Ferrocyanide	2	Dark	0.6%
Ferrocyanide	5	Dark	0.03%
Ferrocyanide	7	Dark	0.02%
Ferrocyanide	7	Dark	0.02%
Ferrocyanide	7	Light	0.10%
Ferricyanide	7	Dark	0.003%
Ferricyanide	7	Light	0.02%

groundwater, landfill leachate and leachate from the cathode waste pad at the MMRF indicates that most of the cyanide measured as total cyanide in these samples is present as iron cyanide complexes, and more ferricyanide than ferrocyanide was measured overall. As a result of this finding, we have explored the fate of iron cyanide complexes as well as HCN in more detail. Ferro-and ferricyanides present in surface water will photolyze in the upper depths and liberate free cyanide, but research performed by Broderius and Smith (1980) has indicated that this dissociation will not be complete, that is, one molecule of ferro-or ferricyanide will not liberate six molecules of the cyanide anion. Once a cyanide anion is released into the upper surface water depths, it will form HCN at environmental pH and will rapidly volatilize into the air. In the atmosphere, HCN will be readily dispersed and diluted. Although biodegradation and oxidation of cyanide can also occur, they are not significant fate process in surface water compared to the combination of photolysis and volatilization. Ferricyanide, the predominant species measured in samples from the MMRF, will photolyze more slowly than ferrocyanide at low concentrations, but not significantly so.

Ferro- and ferricyanides present in groundwater will persist much longer than in surface water since photolytic degradation cannot occur. The iron cyanide complexes are very stable, and will not readily break down and form new complexes with cations commonly found in groundwater. Over long periods of time, it has been found that ferrocyanide will be oxidized to ferricyanide in the dark, and ferricyanide has been found to be most prevalent overall in the samples analyzed from the MMRF. Ferricyanide is a more stable complex than ferrocyanide, and will dissociate less readily than ferrocyanide at both

ambient pH and stomach pH, although neither complex dissociates greatly in the absence of light.

Hydrogen cyanide in groundwater can be degraded by dissolved oxygen and microbial populations, although such degradation would be expected to occur to a lesser extent than in surface water, due to lower concentrations of both dissolved oxygen and microbes. Hydrogen cyanide can form complexes with metal cations found in groundwater, and either remain or precipitate out of solution.

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Enseco

CYANIDE SPECIATION
PROJECT 64882

A colorimetric method was developed to determine Iron (II) and Iron (III) Cyanide complexes in the samples. The combined concentration of the two complexes was determined as well as the individual concentration of the Iron (II) complex. The Iron (III) complex was determined by difference.

The samples were also analyzed for Total Cyanide and Free Cyanide. Complexed Cyanide was determined by difference and calculated as Iron, assuming the complexes present were $Fe(CN)_6$. Within the limits of error of the methods, the results agreed with the first analysis.

Finally, the samples were analyzed for Iron by ICP. These results were also consistent with the other determinations.

All results are summarized in the attached table.

Enseco

Sample Number	CN COMPLEXES, AS Fe: Fe (II)	Fe (III)	Total	Detection Limit	Fe by ICP	Total CN	CN BY TECHNICON: Free CN	Complexed (by Difference)	Calculated as Fe
64882-01 9S	ND	0.2	0.2	0.1	0.3	0.66	0.04	0.62	0.2
64882-02 CP	ND	350	350	10	330	940	2.4	938	340
64882-03 LL	ND	0.2	0.2	0.1	0.2	0.71	0.06	0.65	0.2
64882-04 9B	0.2	0.8	1.0	0.1	1.2	2.6	0.10	2.5	0.9
64882-05 9A	1.9	0.9	2.8	0.1	3.1	9.3	0.12	9.2	3.3
64882-06 FB	ND	ND	ND	0.1	ND	ND	ND	ND	ND

All results in mg/L.

Monitor well
9S
9B
9A
CP = Cathode PAD
LL = Landfill leachate
FB = Field Blank

ICF INCORPORATED

Calculations

SUBJECT: Summary of Rocky Mountain Laboratory Results

Job Number
File Number
Sheet 1 Of 4
By Date
App Date

Fe = 55.8 g/mole
6CN = 156 g/mole

1 equivalent Fe reacts with 1 equivalent CN^-
1 mole Fe reacts with 6 moles CN^-
1 equivalent Fe = 55.8 g/eq = 1 mole Fe
1 equivalent CN = 156 g/eq = 6 moles CN^-

9S:

$$\frac{.2\ mg}{L}\ Fe\left(\frac{156\ g\ CN/eq}{55.8\ g\ Fe/eq}\right) = 0.559\ \frac{mg}{L}\ CN \text{ complexed}$$

$$\frac{0.559\ mg/L\ CN\ (\text{complexed})}{0.66\ mg/L\ CN\ (\text{total})} \times 100 = 85\%\ \text{complexed cyanide}$$

CP (cathode pad):

$$\frac{300\ mg}{L}\left(\frac{156\ g\ CN/eq}{55.8\ g\ Fe/eq}\right) = 839\ \frac{mg}{L}\ \text{complexed cyanide}$$

$$\frac{839\ mg/L\ CN\ (\text{complexed})}{940\ mg/L\ CN\ (\text{total})} \times 100 = 89\%\ \text{complexed cyanide}$$

ICF INCORPORATED

Calculations

SUBJECT: Rocky Mountain (continued)

Job Number
File Number
Sheet 2 Of 4
By Date
App Date

LL (Landfill leachate):

$$0.2 \frac{mg}{L} Fe \left(\frac{156 g CN/eq}{55.8 g Fe/eq}\right) = 0.559 mg/L \text{ complexed cyanide}$$

$$\frac{0.559 \frac{mg}{L} CN(complexed)}{0.710 mg/L CN(total)} \times 100 = 79\% \text{ complexed cyanide}$$

9B:

$$1.0 \frac{mg}{L} Fe \left(\frac{156 g CN/eq}{55.8 g Fe/eq}\right) = 2.795 mg/L \text{ complexed cyanide}$$

$$\frac{2.80 mg/L CN(complexed)}{2.6 mg/L CN(total)} \times 100 = 107\% \text{ complexed cyanide}$$

9A:

$$2.8 \frac{mg}{L} Fe \left(\frac{156 g CN/eq}{55.8 g Fe/eq}\right) = 7.82 mg/L \text{ complexed cyanide}$$

$$\frac{7.8 mg/L CN(complexed)}{9.3 mg/L CN(total)} \times 100 = 84\% \text{ complexed cyanide}$$

ICF INCORPORATED

Calculations

SUBJECT: Rocky Mountain (continued)

Job Number
File Number
Sheet 3 Of 4
By Date
App Date

"complexed" means complexed with iron

SS:

$0.56 \frac{mg}{L}$ CN complexed + $0.04 \frac{mg}{L}$ CN free = $0.60 \frac{mg}{L}$

$\frac{0.60 \text{ mg/L CN (complexed + free)}}{0.66 \text{ mg/L CN (total)}} \times 100 = 91\%$

∴ 9% of cyanide is of unknown form

CP:

$839 \frac{mg}{L}$ CN complexed + $2.4 \frac{mg}{L}$ CN free = $841.4 \frac{mg}{L}$

$\frac{841 \text{ mg/L CN (complexed + free)}}{940 \text{ mg/L CN (total)}} \times 100 = 89\%$

∴ 11% of cyanide is of unknown form

LL:

$0.56 \frac{mg}{L}$ CN (complexed) + $0.06 \frac{mg}{L}$ CN (free) = $0.62 \frac{mg}{L}$

$\frac{0.62 \frac{mg}{L} \text{ CN (complexed + free)}}{0.71 \frac{mg}{L} \text{ CN (total)}} \times 100 = 87\%$

∴ 13% of cyanide is of unknown form

ICF INCORPORATED

Calculations

SUBJECT: Rocky Mountain (continued)

Job Number
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9B:

$2.8 \frac{mg}{L}$ CN(complexed) + $0.1 \frac{mg}{L}$ CN (free) = $2.9 \frac{mg}{L}$

$$\frac{2.9 \frac{mg}{L} \text{ CN(complexed and free)}}{2.6 \frac{mg}{L} \text{ CN (total)}} \times 100 = 111\%$$

∴ 11% positive interference

9A:

$7.82 \frac{mg}{L}$ CN(complexed) + $0.12 \frac{mg}{L}$ CN(free) = $7.9 \frac{mg}{L}$

$$\frac{7.9 \frac{mg}{L} \text{ CN (complexed and free)}}{9.3 \frac{mg}{L} \text{ CN (total)}} \times 100 = 85\%$$

∴ 15% of cyanide is of unknown form

ICF INCORPORATED

Calculations

SUBJECT: Volatilization half-life for HCN compared to photolysis half-life

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Method of Liss & Slater (Lyman et al 1982)

$$k_g = 3000\sqrt{18/M} \quad cm/hr$$

$$k_\ell = 20\sqrt{44/M} \quad cm/hr$$

$$K_L = \frac{(H/RT)\,k_g\,k_\ell}{(H/RT)\,k_g + k_\ell} \quad cm/hr$$

$$k_v = \frac{K_L}{d} = hr^{-1}$$

$$t_{1/2} = \frac{0.693}{k_v} = hr$$

where:

k_g = gas phase exchange coefficient (cm/hr)
M = molecular weight of HCN = 27 g/mole
k_ℓ = liquid phase exchange coefficient (cm/hr)
K_L = overall mass transfer coefficient, (cm/hr)
H = Henry's Law Constant for HCN in H_2O, $\frac{atm\text{-}m^3}{mole}$
RT = 2.4×10^{-2} atm-m^3/mole @ 20°C
k_v = volatilization rate constant, hr^{-1}
d = depth of water body, cm
$t_{1/2}$ = half-life for volatilization, hr

Use Henry's Law Constant = 9.0×10^{-5} $\frac{atm\text{-}m^3}{mole}$ for HCN

(at 18°C per Dodge and Zabban 1952)

ICF INCORPORATED

Calculations

SUBJECT: Volatilization versus Photolysis continued

Job Number
File Number
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Henry's constant converted from 5.0 atm/mole fr:

$$\text{mole fraction} = \frac{\text{moles HCN}}{\text{moles } H_2O + \text{moles HCN}} \rightarrow 0$$

$$\therefore\ 5\ \text{atm} \times \frac{\text{moles } H_2O}{\text{moles HCN}} \times \frac{1}{55.6\ \text{moles } H_2O} \times \frac{m^3}{10^3\ L}$$

$$= 9.0 \times 10^{-5}\ \frac{\text{atm-}m^3}{\text{mole}}$$

$$k_l = 20\sqrt{44/27} = 25.5\ \text{cm/hr}$$

$$k_g = 3000\sqrt{18/27} = 2449.4\ \text{cm/hr}$$

$$K_L = \frac{(9\times10^{-5}/2.4\times10^{-2})(2449.4)(25.5)}{(9\times10^{-5}/2.4\times10^{-2})(2449.4) + 25.5}$$

$$= 6.75\ \text{cm/hr}$$

Assume mean surface = 4 cm (Broderius and Smith 1980)

$$k_v = \frac{6.75\ \text{cm/hr}}{4\ \text{cm}} = 1.68 = 1.7\ \text{hr}^{-1}$$

$$t_{1/2} = \frac{0.693}{k_v} = \frac{.693}{1.68} = .412\ \text{hr}$$

$$= 24.6\ \text{minutes}$$

ICF INCORPORATED

Calculations

SUBJECT: Volatilization vs. Photolysis continued

Job Number
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FROM FIGURE 2:

$t_{1/2}$ FOR PHOTOLYSIS OF FERROCYANIDE = ~18 MINUTES IN SUMMER MONTHS

$t_{1/2}$ = 18 MIN = 0.3 HR

$t_{1/2}$ FOR PHOTOLYSIS OF FERRICYANIDE = ~65 MINUTES IN SUMMER MONTHS

$t_{1/2}$ = 65 MINUTES = 1.08 HR

ICF INCORPORATED

Calculations

SUBJECT: Kruse and Thibault 1973 Dissociation of iron cyanide

Job Number
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FERROCYANIDE:

5 ml of 5% $K_4Fe(CN)_6$ at pH 2 in dark (24 hrs):

$50{,}000 \frac{mg}{L} K_4Fe(CN)_6 (0.005 L) = 250 mg K_4Fe(CN)_6$

Molecular Wt $K_4Fe(CN)_6$ = 4 (39.1) = 156.4
1 (55.8) = 55.8
6 (12.0) = 72.0
6 (14.0) = 84.0
368.2 g/mole

Molecular Wt CN^- = 26 g/mole
Molecular Wt HCN = 27 g/mole

$250 mg K_4Fe(CN)_6 \left(\frac{26 g/mole CN}{368.2 g/mole K_4Fe(CN)_6}\right)\left(\frac{6 moles CN}{1 mole K_4Fe(CN)_6}\right)$

= 105.9 = 106 mg CN (total)

703 ug HCN recovered $\left(\frac{26 g/mole CN}{27 g/mole HCN}\right)$

= 677 ug CN or 0.677 mg CN

$\frac{0.677 mg CN}{106 mg total CN} \times 100 = 0.638 = 0.64\%$ cyanide dissociated

ICF INCORPORATED

Calculations

SUBJECT: Kruse & Thibault 1973 continued

Job Number
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pH 5.0 in dark:

$$0.034 \text{ mg HCN recovered} \left(\frac{26 \text{ g/mole CN}}{27 \text{ g/mole HCN}}\right)$$

$$= 0.0327 = 0.033 \text{ mg CN recovered}$$

$$\frac{0.033 \text{ mg CN}}{106 \text{ mg CN (total)}} \times 100 = 0.03\%$$

pH 7.0 in dark:

$$0.024 \text{ mg HCN recovered} \left(\frac{26 \text{ g/mole CN}}{27 \text{ g/mole HCN}}\right)$$

$$= 0.023 \text{ mg CN recovered}$$

$$\frac{0.023 \text{ mg CN}}{106 \text{ mg CN (total)}} \times 100 = 0.02\%$$

pH 7.0 in dark:

$$0.025 \text{ mg HCN recovered} \left(\frac{26 \text{ g/mole CN}}{27 \text{ g/mole HCN}}\right)$$

$$= 0.024 \text{ mg CN recovered}$$

$$\frac{0.024 \text{ mg CN}}{106 \text{ mg CN (total)}} \times 100 = 0.02\%$$

ICF INCORPORATED

Calculations

SUBJECT: Kruise + Thibault 1973 continued

Job Number
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pH 7.0 in light:

0.105 mg HCN recovered $\left(\frac{26\ g/mole\ CN}{27\ g/mole\ HCN}\right)$

= 0.101 mg CN recovered

$\frac{0.101\ mg\ CN}{106\ mg\ CN\ (total)} \times 100 = 0.095\ \% = 0.1\ \%$

FERRICYANIDE

5 ml of 5% $K_3Fe(CN)_6$ at pH 7.0 in dark for 24 hours:

Molecular Wt of $K_3Fe(CN)_6$ = 3(39.1) = 117.3
1(55.8) = 55.8
6(12.0) = 72.0
6(14.0) = 84.0
329.1 g/mole

$50{,}000\ \frac{mg}{L}\ K_3Fe(CN)_6\ (0.005\ L) = 250\ mg\ K_3Fe(CN)_6$

$250\ mg\ K_3Fe(CN)_6 \left(\frac{26\ g/mole\ CN}{329.1\ g/mole\ K_3Fe(CN)_6}\right)\left(\frac{6\ moles\ CN}{1\ mole\ K_3Fe(CN)_6}\right)$

= 118.5 = 118 mg CN (total) in solution

ICF INCORPORATED

Calculations

SUBJECT: Kruse and Thibault 1973 continued

Job Number
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$0.004 \text{ mg HCN recovered} \left(\frac{26 \text{ g/mole CN}}{27 \text{ g/mole HCN}}\right)$

$= 0.0038 \text{ mg CN recovered}$

$\frac{0.0038 \text{ mg CN recovered}}{118 \text{ mg CN (total)}} \times 100 = 0.003\%$

pH 7.0 in light:

$0.019 \text{ mg HCN recovered} \left(\frac{26 \text{ g/mole CN}}{27 \text{ g/mole HCN}}\right)$

$= 0.018 \text{ mg CN recovered}$

$\frac{0.018 \text{ mg CN}}{118 \text{ mg CN (total)}} \times 100 = 0.015\% = 0.02\%$

APPENDIX C

APPENDIX C

DATA VALIDATION AND CLASSIFICATION SUPPORTING DOCUMENTATION

APPENDIX C

DATA VALIDATION AND CLASSIFICATION SUPPORTING DOCUMENTATION

The validation and classification of the analytical data collected during Spring 1988 was completed according to the USEPA Sample Management Office (SMO) procedures described in detail in Appendix D of the Final RI Report. A discussion of the results of the validation and classification of the analytical data collected during Spring 1988 is presented in Section 5.0 of this document; Appendix C presents the data validation and classification supporting documentation.

Each data set was independently evaluated and the supporting documentation is presented by data set in chronological order. The supporting documentation for each data set is divided into three sections:

- Data Classification Check List and Validated Data Summary Table
- Methods of Analysis, Levels of Quantitation and Detection Limit Discussion
- Validation Summary Forms and QC Support Data

DATA CLASSIFICATION CHECK LIST AND SUMMARY TABLE

A classification check list was used to summarize the over-all usefullness of the data based on the validation. As a means of consolidating the results of the validation and the classification process, letter codes were assigned to each quality control parameter on the classification check list and the validation summary forms. The letter codes include the following:

A - acceptable	All quality control criteria within acceptable limits (no flag or U data qualifier is assigned)
P - provisional	Some quality control criteria not within acceptable limits (data are estimated and flagged with J qualifier code).

U - unacceptable	All or most quality control criteria not within acceptable limits (data are unusable and flagged with R qualifier code).
N - not applicable or not required	

Based on screening criteria condensed in the classification check list, the chemical data are classified into three "use" categories:

Unusable data	These data do not meet Level A criteria or are flagged with an R in the laboratory validation process.
Level A	These data meet the first level of screening criteria but not the second level (Level B). These data may or may not have been flagged with a J during data validation. These data may be used for qualitative purposes.
Level B	These data meet both sets of screening criteria (A and B) and have not been flagged with an R or J qualifier during data validation. These data may be used for quantitative purposes.

The validated data summary table present all the data included in the data set evaluated with the appropriate data qualifiers assigned during the validation process.

METHODS OF ANALYSIS, LEVELS OF QUANTITATION AND DETECTION LIMIT DISCUSSION

A copy of the method of analysis, levels of quantitation and a discussion of detection limits prepared by the laboratory is included for reference purposes.

VALIDATION SUMMARY FORMS AND QC SUPPORT DATA

Validation summary forms were prepared for each quality control parameter prior to the completion of the classification check list. Each parameter has a particular range of acceptable quality control criteria which is noted on each form. The same "A" (acceptable), "P" (provisional), "U" (unusable), and "N" (not required or not applicable) nomenclature used in the classification tables is utilized to summarize the QC parameters on the summary forms. Each validation summary form is followed by the appropriate laboratory

documentation (if required). In cases where QC samples were run with particular batches of samples, a table summarizing the results of the QC analysis immediately follows the validation summary form. By presenting the QC information in a summary table it is readily apparent which individual samples (batches) are effected by the QC parameter evaluated.

Validation summary forms were completed for the following QC parameters:

- Holding Times
- Laboratory Blanks
- Laboratory Duplicates
- Matrix Spike Recovery
- Calibration Curve Standards
- Initial and Continuing Calibration Verification
- Laboratory Control Samples
- ICP Serial Dilutions
- AA - Post Digestion Spike Recovery
- Trip Blanks
- Field Blanks
- Field Replicates
- Split Samples

Sporadic quality control problems are noted on the validation summary forms; however, if other laboratory quality control criteria are acceptable, then no samples bias is assigned.

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C-1 VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA FOR SAMPLES COLLECTED JANUARY 29 TO FEBRUARY 11, 1988
- A. Data Classification Check List and Validated Data Summary Table
- B. Methods of Analysis, Levels of Quantitation and Detection Limits Discussion
- C. Validation Summary Forms and QC Support Data
  1. Holding Times
  2. Laboratory Blanks
  3. Laboratory Duplicates
  4. Matrix Spike Recovery
  5. Calibration Curve Standards
  6. Initial and Continuing Calibration Verification
  7. Laboratory Control Samples
  8. ICP Serial Dilutions
  9. AA - Post Digestion Spike Recovery
  10. Trip Blanks
  11. Field Blanks
  12. Field Replicates
  13. Split Samples

C-2 VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA FOR SAMPLES COLLECTED MARCH 3 TO MARCH 7, 1988
- A. Data Classification Check List and Validated Data Summary Table
- B. Methods of Analysis, Levels of Quantitation and Detection Limit Discussion
- C. Validation Summary Forms and QC Support Data
  1. Holding Times
  2. Laboratory Blanks
  3. Laboratory Duplicates
  4. Matrix Spike Recovery
  5. Calibration Curve Standards
  6. Initial and Continuing Calibration Verification
  7. Laboratory Control Samples
  8. ICP Serial Dilutions
  9. AA - Post Digestion Spike Recovery
  10. Trip Blanks
  11. Field Blanks
  12. Field Replicates
  13. Split Samples

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C-3 VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA FOR SAMPLES COLLECTED APRIL 19 - 27, 1988 AND JUNE 1 - 4, 1988
- A. Data Classification Check List and Validated Data Summary Table
- B. Methods of Analysis, Levels of Quantitation and Detection Limit Discussion
- C. Validation Summary Forms and QC Support Data
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  2. Laboratory Blanks
  3. Laboratory Duplicates
  4. Matrix Spike Recovery
  5. Calibration Curve Standards
  6. Initial and Continuing Calibration Verification
  7. Laboratory Control Samples
  8. ICP Serial Dilutions
  9. AA - Post Digestion Spike Recovery
  10. Trip Blanks
  11. Field Blanks
  12. Field Replicates
  13. Split Samples

C-1

VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA FOR SAMPLES COLLECTED JANUARY 29 TO FEBRUARY 11, 1988

DATA CLASSIFICATION CHECK LIST AND VALIDATED DATA SUMMARY TABLE

DATA CLASSIFICATION SUMMARY CHECK LIST

Level A Criteria

Matrix: **Surface Water, Sediments/Ground Water**

Sampling Event: **Chenoweth Creek/EM Survey Test Pits**

Date: **January 29 to February 11, 1988**

To be classified for Level A use, the data must meet the following criteria:

	Criteria	Evaluation Result
1.	Sampling dates were recorded;	**A**
2.	Signatures of Sampling Team on each water sample log or soil sample log;	**A**
3.	Sampling locations were clearly designated and described;	**A**
4.	Sampling depth increment for soils was recorded;	**A**
5.	Sample collection technique was described on water sample log or soil sample log;	**A**
6.	Field preparation techniques were clearly described where applicable;	**A**
7.	Sample preservation techniques were clearly described, consistent, and adequate for the parameters to be analyzed and the sample matrix;	**A**
8.	Shipping bill of lading or constant surveillance documentation is available;	**A**
9.	The laboratory sample preparation or extraction date is recorded and available;	**A**
10.	The laboratory sample analysis date is recorded and available;	**A**

Criteria	Evaluation Result
11. The laboratory sample preparation technique is recorded and available either in the laboratory report or in the laboratories approved SOP;	**A**
12. The methods of analysis are listed in the laboratory reports and are consistent with the methods specified in the QAPP and laboratory contract;	**A**
13. The laboratory analytical detection limits or limits of quantitation (LOQ) are given in lab reports and are adequate for project objectives;	**A**
14. Field records include:	
o Soil/sediment log sheets	**A**
o Water sampling log sheets	**A**
o QC field checklist	**N**
o Field instrument calibration logs	**A**
o Master log book bound with sequentially numbered pages	**A**
o Daily log book	**A**
o Chain-of-Custody forms	**A**
15. All applicable records described above were properly created and are on file;	**A**
16. Samples passed laboratory data validation without any R flags (samples with J flags may be accepted at this level).	**A**

Remarks:

None

DATA CLASSIFICATION SUMMARY CHECK LIST

Level B Criteria

Matrix: **Surface Water, Sediments/Ground Water**

Sampling Event: **Chenoweth Creek/EM Survey Test Pits**

Date: **January 29 to February 11, 1988**

To be classified for Level B use, the data must meet the following criteria:

Criteria	Evaluation Result
A. Data Validation Result:	
1. Samples of this matrix have not been flagged J or R during data validation;	**P**
2. All samples of this matrix have been classified as Level A data;	**A**
B. Quantitative Statistical Significance:	
1. Laboratory and field instruments were properly standardized (calibrated) employing proper methods and records are available;	**A**
2. Sample bottle preparation was proper and appropriate for the parameters measured and the sample matrix;	**A**
3. All laboratory procedures were referenced to approved EPA methods and were contained in an approved SOP manual;	**A**
4. Analytical QC data was available to demonstrate proper instrument calibration;	**A**
5. Laboratory QC check sample standards are EPA and NBS traceable and were used at least once each three months;	**A**

Criteria	Evaluation Result
6. Laboratory reagent (method) blanks were analyzed at a frequency of at least 1 per 20 samples;	A
7. Laboratory duplicates were analyzed at a frequency of at least 1 per 20 samples;	A
8. Laboratory matrix spikes and matrix spike duplicates were analyzed at a frequency of at least 1 per 20 samples;	A
9. Field replicates were analyzed at a frequency of at least 1 per 20 samples;	A
10. Field blanks were submitted at a frequency of at least 1 per 20 samples;	A
11. One trip blank was submitted for analysis with each cooler;	P
12. Field split samples were analyzed at a frequency of at least 1 per 10 samples per matrix;	A
13. Appropriate and sufficient QC data with acceptance criteria were presented to allow data validation by the project QA officer;	A
14. The laboratories used were approved by the EPA for participation in the Contract Laboratory Program (CLP);	A
15. The laboratories participated in round-robin testing program by EPA or other accrediting agency;	A
16. Quality control limits were consistent with the limits established for EPA's CLP;	A
17. All samples submitted were analyzed for the requested parameters.	A

Criteria	Evaluation Result
C. <u>Custody and Document Control</u>:	
1. Field custody of all samples was noted in a bound field log book;	A
2. Transfer of custody documentation (chain-of-custody form) signed by field and laboratory sample custodians is available and properly completed;	A
3. Laboratory custody is documented by a designated lab sample custodian in a master log and a secured sample storage area;	A
4. Sample identification and assigned laboratory tracking numbers are traceable through the entire monitoring system;	A
5. Field notebooks, log sheets, log books, checklists, reports, data validations, and all custody documents are stored in a secure repository or under the control of a document custodian;	A
6. All records, forms, log books, etc., are filled out completely in indelible ink without alterations except as initialed;	A
7. All sample log sheets have been signed by the sample collector;	A
8. Field log book sheets signed by the field sample custodian.	A
D. <u>Sample Representativeness</u>:	
1. Compatibility exists between field and laboratory measurements, where applicable, or incompatibilities have been suitably explained;	A

Criteria	Evaluation Result
2. Laboratory analysis and/or sample preparation or extraction were within allowable holding times established for the sample preservation and methods used;	**A**
3. Sample storage was maintained within suitable temperature, light and moisture conditions to guarantee sample integrity;	**A**
4. Proper sample containers were used for the parameters analyzed;	**A**
5. Proper sample collection equipment was used such that the equipment would neither contribute nor remove any substance to or from the sample;	**A**
6. The sample site selection criteria are consistent with the objectives of the investigation and will provide the required data.	**A**

Remarks:

A-1: **Low matrix spike recovery for free cyanide analyses associated with test pits required that the values be flagged with a J.**

B-11: **Trip blanks were submitted for all parameters analyzed at a frequency of 1 per 20 samples.**

Conclusion:

Free cyanide data associated with test pits is classified as Level A and should only be used qualitatively. All data other can be classified as Level B and used quantitatively.

VALIDATED DATA SUMMARY TABLE
CHENOWETH CREEK & EM SURVEY TEST PIT SAMPLING
MMRF, THE DALLES
FEBRUARY 1988

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)	PERCENT SOLIDS
SURFACE WATER						MG/L	MG/L	MG/L	UG/L	UG/L	MG/L	
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.084]	3.0 U	5960	7.4	NA
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.13]	3.0 U	5600	6.9	NA
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.12]	[3.6]	5940	7.4	NA
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.11]	3.0 U	5850	7.4	NA
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.1]	3.0 U	5550	6.7	NA
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0039 U	[0.1]	3.0 U	6160	6.5	NA
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	0.048 U	3.0 U	1440	1.0 U	NA
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	0.0026 U	0.0026 U	[0.093]	3.0 U	5720	7.2	NA
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	0.0026 U	0.0026 U	0.048 U	3.0 U	289 U	1.0 U	NA
SEDIMENTS						MG/KG	MG/KG	MG/KG				
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	0.033 U	0.033 U	[1.2]	NR	NR	NR	80
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	0.037 U	0.037 U	2.4	NR	NR	NR	70
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	0.036 U	0.036 U	[1.4]	NR	NR	NR	73
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	0.035 U	0.035 U	[0.96]	NR	NR	NR	74
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	0.030 U	0.59	[0.97]	NR	NR	NR	86
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	0.035 U	0.035 U	[1.6]	NR	NR	NR	74
CCSDG-7R	880208-048	FIELD BLANK	WATER*	04-Feb-88	06-Feb-88	0.026 U	0.0026 U	0.048 U	NR	NR	NR	NA
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	0.031 U	0.031 U	[1.2]	NR	NR	NR	85
CCSDG-9R	880208-049	SAMP RINSATE	WATER*	04-Feb-88	06-Feb-88	0.026 U	0.0026 U	0.048 U	NR	NR	NR	NA
TRIP BLK 6	880208-054	TRIP BLANK	WATER*	29-Jan-88	06-Feb-88	0.026 U	0.0026 U	0.048 U	NR	NR	1.0 U	NA
TEST PIT ANALYSES						MG/L	MG/L	MG/L	UG/L	UG/L	MG/L	
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	0.028 J	18	34	3.0 U	91500	30	NA
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	3.6 J	26	11	[3.9]	215000	490	NA
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	33 J	190	288	51	810000	131	NA
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	0.48 J	1.2	0.52	9.9	15000	47	NA
RRTPW-110G	880612-005	PIT 10	WATER	11-Feb-88	16-Feb-88	0.13 J	24	73	480	620000	78	NA
RRTPW-111G	880612-006	PIT 11	WATER	11-Feb-88	16-Feb-88	0.30 J	27	78	568	949000	116	NA
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	[0.0045] J	0.0026 U	[0.057]	[3.2]	1000	[1.1]	NA
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	0.36 J	1.2	0.39	[15] J(1)	16000	42	NA
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	[0.0073] J	0.0026 U	[0.05]	3.0 U	[628]	1.0 U	NA
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	0.0026 UJ	0.0026 U	0.048 U	[3.6]	[558]	1.0 U	NA

NOTES:
U - ANALYTE WAS ANALYZED FOR BUT NOT DETECTED ABOVE THE INSTRUMENT DETECTION LIMIT (IDL)
[ ]- RESULTS GREATER THAN IDL, BUT LESS THAN THE QUANTITATION LIMIT; VALUE IS ESTIMATED
J - ESTIMATED VALUE
* - AQUEOUS RESULTS RECALCULATED AS SOILS
(1)- SAMPLE DILUTED 3x DUE TO MATRIX INTERFERENCE, THUS 15 UG/L IS BELOW THE ADJUSTED QUANTITION LIMIT AND IS REPORTED WITH "J" FOOTNOTE
NR - ANALYSIS NOT REQUESTED
NA - ANALYSIS NOT APPLICABLE

METHODS OF ANALYSIS, LEVELS OF QUANTITATION, AND DETECTION LIMITS DISCUSSION

February 1988

QUANTITATION LIMITS

Water Samples

Parameter	IDL (a)	Lowest Calibration Standard	Quantitation Limit
Arsenic	3.0 µg/L	10 µg/L	10 µg/L
Sodium	17 µg/L	50000 µg/L	1000 µg/L
Cyanide (free)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Cyanide (total)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Fluoride	0.048 mg/L	0.10 mg/L	0.15 mg/L
Sulfate	1.0 mg/L *	5.0 mg/L	5.0 mg/L

Soil Samples
(Calculated From Water Quantitation Limits)

Parameter	IDL (a)	Lowest Calibration Standard	Quantitation Limit
Cyanide (free)	0.026 mg/kg	0.20 mg/kg	0.20 mg/kg
Cyanide (total)	0.026 mg/kg	0.20 mg/kg	0.20 mg/kg
Fluoride	0.48 mg/kg	1.0 mg/kg	1.5 mg/kg

Methods of Analysis

Parameter	Method	Reference
Arsenic	206.2	EPA-600/4-79-20, Rev. 3/83
Sodium	200.7	EPA-600/4-79-20, Rev. 3/83
Cyanide (free)	412.H	Standard Methods, 16th Ed.
Cyanide (total)	335.2	EPA-600/4-79-20, Rev. 3/83
Fluoride	340.2	EPA-600/4-79-20, Rev. 3/83
Sulfate	375.4	EPA-600/4-79-20, Rev. 3/83

* Sulfate detection limit is based on the method detection limit of 1.0 mg/L, as noted in EPA-600/4-79-020 method 375.4

February 1988

DETECTION LIMIT DISCUSSION

Summary of Detection Limit Determinations

Metals

Detection limit calculation were performed according to the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

Soil detection limits have been calculated from water detection limits as per information sent by Joe Arlauskas (Versar) to Mr. C.W. Ankerberg (Geraghty & Miller) on 15 January 1988. Detection limits were calculated using water LOD's and correcting for the sample weight as specified by the method.

Non-metals

a. Cyanide - total and free

Cyanide detection limits for water and soils were determined using the procedures in the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

In order to attain lower detection limits for water samples analysed for cyanide 500 ml rather than 250 ml of sample was distilled. To lower detection limits for soil samples 25 grams of sample rather than 10 grams was distilled.

As noted in the metals section, soil detection limits have been calculated from water detection limits.

b. Miscellaneous parameters

Detection limit calculations for fluoride were performed according to the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

Detection limit data for sulfate is based on the method detection limit (MDL) noted in EPA-600/4-79-020, method 375.4.

As noted in the metals section, soil detection limits have been calculated from water detection limits.

February 1988

DETECTION LIMITS DISCUSSION
(continued)

Summary discussion

The detection limits reported by Versar ESM Operation Laboratory were determined and calculated in accordance with EPA-CLP protocols for the CLP parameters; arsenic, sodium, and cyanide. For non- CLP parameters, fluoride and sulfate, CLP detection limit procedures were used as guidelines to determine the detection limit for fluoride, and the method detection limit was used as the detection limit for sulfate.

For reporting purposes, the EPA-CLP detection limits were used providing that the calculated detection limit values were lower. In addition, and following a letter from Geraghty & Miller sent by K. Duchac, C.W. Ankenberg, and E.R. Rothschild, dated 1 February 1988 the following limits have been reported:

Cyanide, free and total	LOQ = 0.010 mg/L	IDL = 0.0026 mg/L
Fluoride,	LOQ = 0.15 mg/L	

VALIDATION SUMMARY FORMS AND QC SUPPORT DATA

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

HOLDING TIMES

SAMPLING EVENT: **Chenoweth Creek/EM Survey Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**P**	SODIUM:	**P**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All QAPP and 40 CFR 136 specified holding times met.

P - Provisional: Some QAPP and 40 CFR 136 specified holding times are met.

U - Unacceptable: All holding time exceeded.

N - Not Applicable

REMARKS:

Holding time exceeded for Trip Blanks 880208-052 and 880208-054 for Total and Free Cyanide, Sulfate analyses -- No samples biased

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME: MET	ALLOWED
Arsenic	880208-043-047, 050-051,053	Water	04-Feb-88	06-Feb-88	11-Feb-88	17-Feb-88	13 days	6 months
Arsenic	880208-052	Water	29-Jan-88	06-Feb-88	11-Feb-88	17-Feb-88	19 days	6 months
Arsenic	880212-011-012, 014-018	Water	10-Feb-88	12-Feb-88	18-Feb-88	22-Feb-88	12 days	6 months
Arsenic	880212-013	Water	09-Feb-88	12-Feb-88	18-Feb-88	22-Feb-88	13 days	6 months
Arsenic	880216-005-006	Water	11-Feb-88	16-Feb-88	18-Feb-88	07-Mar-88	25 days	6 months
Sodium	880208-043-047, 050-051,053	Water	04-Feb-88	06-Feb-88	11-Feb-88	12-Feb-88	8 days	6 months
Sodium	880208-052	Water	29-Jan-88	06-Feb-88	11-Feb-88	12-Feb-88	14 days	6 months
Sodium	880212-011-012, 014-018	Water	10-Feb-88	12-Feb-88	18-Feb-88	22-Feb-88	12 days	6 months
Sodium	880212-013	Water	09-Feb-88	12-Feb-88	18-Feb-88	22-Feb-88	13 days	6 months
Sodium	880216-005-006	Water	11-Feb-88	16-Feb-88	18-Feb-88	22-Feb-88	11 days	6 months
Fluoride	880208-043-051, 053	Water	04-Feb-88	06-Feb-88		23-Feb-88	19 days	28 days
Fluoride	880208-052 ,054	Water	29-Jan-88	06-Feb-88		23-Feb-88	25 days	28 days
Fluoride	880208-055-061	Soil	04-Feb-88	06-Feb-88	22-Feb-88	23-Feb-88	19 days	28 days
Fluoride	880212-011-012, 014-018	Water	10-Feb-88	12-Feb-88		23-Feb-88	13 days	28 days
Fluoride	880212-013	Water	09-Feb-88	12-Feb-88		23-Feb-88	14 days	28 days
Fluoride	880216-005-006	Water	11-Feb-88	16-Feb-88		23-Feb-88	12 days	28 days
Sulfate	880208-043-047, 050-051,053	Water	04-Feb-88	06-Feb-88		01-Mar-88	25 days	28 days
Sulfate	880208-052,054	Water	29-Jan-88	06-Feb-88		01-Mar-88	31 days *	28 days
Sulfate	880212-011-012, 014-018	Water	10-Feb-88	12-Feb-88		01-Mar-88	19 days	28 days
Sulfate	880212-013	Water	09-Feb-88	12-Feb-88		01-Mar-88	20 days	28 days
Sulfate	880216-005-006	Water	11-Feb-88	16-Feb-88		01-Mar-88	18 days	28 days

* Holding time exceeded for 880208-052, and 880208-054. Both of these samples are trip blanks.

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME: MET	ALLOWED
Free Cyanide	880208-043-045, 048-051,053	Water	04-Feb-88	06-Feb-88	10-Feb-88	16-Feb-88	12 days	14 days
Free Cyanide	880208-046-047,	Water	04-Feb-88	06-Feb-88	10-Feb-88	18-Feb-88	14 days	14 days
Free Cyanide	880208-052,054	Water	29-Jan-88	06-Feb-88	11-Feb-88	16-Feb-88	18 days *	14 days
Free Cyanide	880208-055	Soil	04-Feb-88	06-Feb-88	12-Feb-88	16-Feb-88	12 days	14 days
Free Cyanide	880208-056-061	Soil	04-Feb-88	06-Feb-88	16-Feb-88	16-Feb-88	13 days	14 days
Free Cyanide	880212-011	Water	10-Feb-88	12-Feb-88	17-Feb-88	18-Feb-88	8 days	14 days
Free Cyanide	880212-012,014, 015-018	Water	10-Feb-88	12-Feb-88	22-Feb-88	23-Feb-88	13 days	14 days
Free Cyanide	880212-013	Water	09-Feb-88	12-Feb-88	17-Feb-88	18-Feb-88	9 days	14 days
Free Cyanide	880216-005-006	Water	11-Feb-88	16-Feb-88	25-Feb-88	25-Feb-88	14 days	14 days
Total Cyanide	880208-043-049	Water	04-Feb-88	06-Feb-88	10-Feb-88	16-Feb-88	12 days	14 days
Total Cyanide	880208-050-051, 053	Water	04-Feb-88	06-Feb-88	11-Feb-88	16-Feb-88	12 days	14 days
Total Cyanide	880208-052,054	Water	29-Jan-88	06-Feb-88	11-Feb-88	16-Feb-88	18 days *	14 days
Total Cyanide	880208-055	Soil	04-Feb-88	06-Feb-88	11-Feb-88	16-Feb-88	12 days	14 days
Total Cyanide	880208-056-061	Soil	04-Feb-88	06-Feb-88	12-Feb-88	16-Feb-88	12 days	14 days
Total Cyanide	880212-011-012	Water	10-Feb-88	12-Feb-88	19-Feb-88	23-Feb-88	13 days	14 days
Total Cyanide	880212-013	Water	09-Feb-88	12-Feb-88	19-Feb-88	23-Feb-88	14 days	14 days
Total Cyanide	880212-014-018	Water	10-Feb-88	12-Feb-88	18-Feb-88	23-Feb-88	13 days	14 days
Total Cyanide	880216-005-006	Water	11-Feb-88	16-Feb-88	18-Feb-88	25-Feb-88	14 days	14 days

* Holding time exceeded for 880208-052, and 880208-054. Both of these samples are trip blanks.

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY BLANKS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**P**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: No contaminants above minimum detection limit, no interference with sample results, appropriate blank used for each GC/MS system, extraction method, and inorganic analytical system.

P - Provisional: Contaminants present but minimal interference with sample results.

U - Unacceptable: Gross contamination, too much interference to use data for certain compounds or for the entire fraction; appropriate blanks not analyzed.

N - Not Applicable

REMARKS:

Total sodium results were greater than IDL, but less than quantitation limit -- No samples biased

CHENOWETH CREEK & EM SURVEY TEST PIT SAMPLING
MMRF, THE DALLES
FEBRUARY 1988

QA DATA SUMMARY FOR: LABORATORY BLANKS

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER											
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	- 1 -	X
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	X	- 1 -	X
SEDIMENTS											
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-7R	880208-048	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-9R	880208-049	SAMP RINSATE	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
TRIP BLK 6	880208-054	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	N	N	N
TEST PIT ANALYSES											
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
RRTPW-110G	880216-005	PIT 10	WATER	11-Feb-88	16-Feb-88	X	X	X	X	- 1 -	X
RRTPW-111G	880216-006	PIT 11	WATER	11-Feb-88	16-Feb-88	X	X	X	X	- 1 -	X
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	X	X	X	X	- 1 -	X

NOTES:
X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = RESULT GREATER THAN IDL, BUT LESS THAN QUANTIFICATION LIMIT

Table A-1. QC Summary -- Laboratory Blanks

Matrix: Soil Analysis Type: Units: mg/kg

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Fluoride	880208-055-061	1.5	0.48U	340.2
Free Cyanide	880208-055-061	0.2	0.026U	412.H
Total Cyanide	880208-055-061	0.2	0.026U	335.2

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table B-1. QC Summary -- Laboratory Blanks

Matrix: Water Analysis Type: Total Units: µg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank* Result	Method
Arsenic	880208-043-047,050-053	10	3.0U	Furnace
Arsenic	880212-011-018 880216-005-006	10	3.0U	Furnace
Sodium	880208-043-047,050-053	1000	[268]	ICP
Sodium	880212-011-018 880216-005-006	1000	[472]	ICP

* Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table B-4. QC Summary -- Laboratory Blanks

Matrix: Water Analysis Type: Total Units: mg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Fluoride	880208-043-050	0.15	0.048U	340.2
Fluoride	880208-051-054	0.15	0.048U	340.2
Fluoride	880212-011-016	0.15	0.048U	340.2
Fluoride	880212-017,018 880216-005-006	0.15	0.048U	340.2
Sulfate	880208-043-049 880212-018	5.0	1.0U	375.4
Sulfate	880208-050-054	5.0	1.0U	375.4
Sulfate	880212-011-017	5.0	1.0U	375.4
Sulfate	880216-005-006	5.0	1.0U	375.4
CN (free)	880208-043-045,048,049	0.01	0.0026U	412.H
CN (free)	880208-050-054	0.01	0.0026U	412.H
CN (free)	880208-046,047 880212-011,013	0.01	0.0026U	412.H
CN (free)	880212-012,014-018	0.01	0.0026U	412.H
CN (free)	880216-005-006	0.01	0.0026U	412.H
CN (total)	880208-043-049	0.01	0.0026U	335.2
CN (total)	880208-050-054	0.01	0.0026U	335.2
CN (total)	880212-011-013	0.01	0.0026U	335.2
CN (total	880212-014-018 880216-005-006	0.01	0.0026U	335.2

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY DUPLICATES

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All relative percent differences (RPDs) are within QC limits (± 20% RPD).
P - Provisional:	Some RPDs outside of QC limits.
U - Unacceptable:	All RPDs outside QC limits.

REMARKS:

None

CHENOWETH CREEK & EM SURVEY TEST PIT SAMPLING
MMRF, THE DALLES
FEBRUARY 1988

QA DATA SUMMARY FOR: DUPLICATE ANALYSES

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER											
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	X	X	X
SEDIMENTS											
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-7R	880208-048	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-9R	880208-049	SAMP RINSATE	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
TRIP BLK 6	880208-054	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	N	N	N
TEST PIT ANALYSES											
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
RRTPW-110G	880216-005	PIT 10	WATER	11-Feb-88	16-Feb-88	X	X	X	X	X	X
RRTPW-111G	880216-006	PIT 11	WATER	11-Feb-88	16-Feb-88	X	X	X	X	X	X
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	X
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	X	X	X	X	X	X

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED

Table A-2. QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Soil Associated Samples:880208-055-061 (ESM ID RANGE) Units: mg/kg

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Fluoride (c)	0208-055	1.5	[1.2]	[1.2]	NC(d)
Free Cyanide (c)	0208-055	0.20	0.026U	0.026U	NC
Free Cyanide (c)	0208-061	0.20	0.026U	0.026U	NC
Total Cyanide (c)	0208-055	0.20	0.026U	0.026U	NC
Total Cyanide (c)	0208-061	0.20	0.026U	0.026U	NC

(a) Duplicate samples are digestion duplicates
(b) RPD = (SR-DR)/[(SR+DR)/2] X 100
(c) Associated with samples 880208-055-061
(d) RPD not calculated (NC), result <QL

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table B-2. QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples: 880208-043-047,050-053
(ESM ID RANGE) : 880212-011-018
: 880216-005-006 Units: µg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)(a)	Duplicate Result (DR)(a)(b)	Calc RPD (c)
Arsenic	0208-043	10	[3.6]	[6.4]	NC(d)
Arsenic	0212-011	10	3.0U	[3.1]	NC
Sodium	0208-043	1000	5940	5370	10
Sodium	0212-011	1000	91500	81400	12

(a) Results reported as total metals
(b) Duplicate samples are digestion duplicates
(c) RPD = (SR-DR)/[(SR+DR)/2] X 100
(d) RPD not calculated (NC), result <QL

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table B-5. QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples: 880208-043-054
(ESM ID RANGE) : 880212-011-018
: 880216-005-006 Units: mg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Fluoride (c)	0208-050	0.15	[0.084]	[0.10]	NC(d)
Fluoride (c)	0208-051	0.15	[0.13]	[0.13]	NC
Fluoride (e)	0212-017	0.15	[0.057]	[0.062]	NC
Sulfate (f)	0208-050	5.0	7.4	7.7	4.0(g)
Sulfate (h)	0212-014	5.0	47	48	2.1
Sulfate (i)	0212-018	5.0	42	43	2.4
Free Cyanide (j)	0208-049	0.01	0.0026U	0.0026U	NC
Free Cyanide (k)	0212-011	0.01	0.028	0.029	3.5(g)
Free Cyanide (l)	0212-018	0.01	0.36	0.36	0
Total Cyanide (j)	0208-049	0.01	0.0026U	0.0026U	NC
Total Cyanide (m)	0212-011	0.01	18	15	18

(a) Duplicate samples are digestion duplicates
(b) RPD = (SR-DR)/[(SR+DR)/2] X 100
(c) Associated with samples 880208-043-054
(d) RPD not calculated (NC), result <QL

Table B-5. Continued

(e) Associated with samples 880212-011-018,880216-005-006
(f) Associated with samples 880208-050-054
(g) For results < 5 x QL, values must agree within ± QL
(h) Associated with samples 880212-011-017,880216-005-006
(i) Associated with samples 880208-043-049,880212-018
(j) Associated with samples 880208-043-054
(k) Associated with samples 880208-046-047,880212-011.013
(l) Associated with samples 880212-012,014-018,880216-005-006
(m) Associated with samples 880212-011-018,880216-005-006

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

MATRIX SPIKE RECOVERY - INORGANICS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**P_2**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits (75-125%) or meet CLP criteria or >125%R and reported sample result is <IDL.
P_1 - Provisional:	Some %R not within QC limits but are between 30% to 74%; or are >125% and analyte was reported <IDL--Flag UJ.
P_2 - Provisional:	Some %R not within QC limits but are between 30% to 74% and analyte was reported at >LOQ/IDL--Flag J.
P_3 - Provisional:	%R are less than 30% or greater than 125% and analyte was detected at >LOQ/IDL--Flag J.
U - Unacceptable:	%R <30% and sample results are reported as <IDL -- Flag R.

REMARKS:

Test pit samples (880212-05, -06, -011 through -018) will be flagged with a "J" for free cyanide results

CHENOWETH CREEK & EM SURVEY TEST PIT SAMPLING
MMRF, THE DALLES
FEBRUARY 1988

QA DATA SUMMARY FOR: MATRIX SPIKE RECOVERIES

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER											
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	X
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	X	X	X
SEDIMENTS											
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-7R	880208-048	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-9R	880208-049	SAMP RINSATE	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
TRIP BLK 6	880208-054	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	N	N	N
TEST PIT ANALYSES											
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
RRTPW-110G	880216-005	PIT 10	WATER	11-Feb-88	16-Feb-88	- 1 -	X	X	X	X	X
RRTPW-111G	880216-006	PIT 11	WATER	11-Feb-88	16-Feb-88	- 1 -	X	X	X	X	X
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	- 1 -	X	X	X	X	X

NOTES:
X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = LOW SPIKE RECOVERY (62%) DUE TO MATRIX INTERFERENCE

Table A-3. QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Soil Associated Samples:880208-055-061 (ESM ID RANGE) Units: mg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Fluoride(b)	-055	75 - 125	9.8	[1.2]	10	86
Free Cyanide(b)	-061	75 - 125	0.33	0.0026U	0.40	82
Total Cyanide(b)	-061	75 - 125	0.37	0.0026U	0.40	93

(a) %R = [(SSR-SR)/SA] x 100
(b) Spike calculated from aqueous aliquot concentration

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table B-3. QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples:880208-043-047,050-053
(ESM ID RANGE) :880212-011-018
:880216-005-006 Units: µg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result(a)	Sample Result(a)	Spike Added	%R (b)
Arsenic	-043	75 - 125	27	[3.6]	20	117
Arsenic	-011	75 - 125	25	3.0U	20	125
Sodium	-043	75 - 125	14200	5940	10000	83
Sodium	-011	75 - 125	---	---	10000	NC(c)
Sodium(d)	-011	85 - 115	23900	18300	5000	112

(a) Results reported as total metals
(b) %R = [(SSR-SR)/SA] x 100
(c) %R not calculated (NC), Sample result out of calibration range. Dilute sample and spike analytically
(d) Analytical spike; sample diluted 5x

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table B-6. QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples (ESM ID RANGE): 880208-043-054, 880212-011-018, 880216-005-006 Units: mg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Fluoride(b)	-050	75 - 125	12	[0.084]	10	119
Fluoride(b)	-051	75 - 125	12	[0.13]	10	119
Fluoride(c)	-017	75 - 125	10	[0.057]	10	99
Sulfate(d)	-050	75 - 125	17	7.4	10	96
Sulfate(e)	-014	75 - 125	34	23	10	110
Sulfate(f)	-018	75 - 125	30	21	10	86
Free Cyanide(g)	-053	75 - 125	0.41	0.0026U	0.40	102
Free Cyanide(h)	-013	75 - 125	0.40	0.0026U	0.40	100
Free Cyanide(i)	-006	75 - 125	0.55	0.30	0.40	62(j)
Total Cyanide(g)	-053	75 - 125	0.38	0.0026U	0.40	95
Total Cyanide(i)	-006	75 - 125	34	27	0.40	(k)

(a) %R = [(SSR-SR)/SA] x 100
(b) Associated with samples 880208-043-054
(c) Associated with samples 880212-011-018,880216-005-006
(d) Associated with samples 880208-050-054
(e) Associated with samples 880212-011-017,880216-005-006

Table B-6. Continued

(f) Associated with samples 880208-043-049,880212-018
(g) Associated with samples 880208-043-054
(h) Associated with samples 880208-046-047,880212-011,013
(i) Associated with samples 880212-011-018,880216-005-006
(j) Low spike recovery due to matrix interferences
(k) Sample concentration >4 x SA, %R not calculated

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

CALIBRATION CURVE STANDARDS - INORGANICS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All curves three- to five-point curves with lowest standard at the LOQ; ICP - one point.

U - Unacceptable: Less than three-point curve and/or lowest standard not at the LOQ; no one-point verification for ICP.

REMARKS:

None

Table C-1. Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Arsenic	206.2	10	µg/L
Arsenic	206.2	25	µg/L
Arsenic	206.2	50	µg/L
Sodium	200.7	50000	µg/L

Table C-6. Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Cyanide (free) Cyanide(total)	412.H 335.2	0.010	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.050	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.200	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.400	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.800	mg/L
Fluoride	340.2	0.1	mg/L
Fluoride	340.2	1.0	mg/L
Fluoride	340.2	5.0	mg/L
Fluoride	340.2	10	mg/L
Fluoride	340.2	50	mg/L
Fluoride	340.2	100	mg/L
Sulfate	375.4	5.0	mg/L
Sulfate	375.4	10	mg/L
Sulfate	375.4	20	mg/L
Sulfate	375.4	30	mg/L
Sulfate	375.4	40	mg/L

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

INITIAL AND CONTINUING CALIBRATION VERIFICATION - INORGANICS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**P**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	%R of ICVS and CCVS inside of QC limits (± 10% R).
P - Provisional:	%R of ICVS or CCVS outside of QC limits, but not less than 50% or greater than 150%.
U - Unacceptable:	%R of ICVS or CCVS outside QC limits but less than 50% or greater than 150%.

N - Not Applicable

REMARKS:

One value for sulfate continuing calibration curve was 84% R -- No samples biased

CHENOWETH CREEK & EM SURVEY TEST PIT SAMPLING
MMRF, THE DALLES
FEBRUARY 1988

QA DATA SUMMARY FOR: INITIAL AND CONTINUING CALIBRATION VERIFICATION

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER											
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	X	X	X	- 1 -
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	X	X	- 1 -
SEDIMENTS											
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-7R	880208-048	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	X	N	N	N
CCSDG-9R	880208-049	SAMP RINSATE	WATER	04-Feb-88	06-Feb-88	X	X	X	N	N	N
TRIP BLK 6	880208-054	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	X	N	N	N
TEST PIT ANALYSES											
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
RRTPW-110G	880216-005	PIT 10	WATER	11-Feb-88	16-Feb-88	X	X	X	X	X	- 1 -
RRTPW-111G	880216-006	PIT 11	WATER	11-Feb-88	16-Feb-88	X	X	X	X	X	- 1 -
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	X	X	X	X	X	- 1 -

NOTES:
X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 - ONE CONTINUING CALIBRATION % RECOVERY = 84%; ALL SAMPLES RUN IN ONE BATCH

Table C-2. Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: µg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
Arsenic(b)	30	32	107	30	32	107	32	107
Arsenic				30	31	103	30	100
Arsenic(c)	30	29	97	30	31	103	31	103
Arsenic				30	33	110	31	103
Arsenic				30	31	103	32	107
Arsenic(d)	30	32	107	30	28	93	31	103
Arsenic(d)	30	29	97	30	27	90	28	93
Arsenic(e)	23	23	100	23	23	100	23	100
Arsenic				23	23	100		
Sodium (b)	7500	7800	104	7500	7970	106	8170	109
Sodium				7500	7930	106		
Sodium (f)	7500	8010	107	7500	8140	109		
Sodium (f)	7500	7980	106	7500	7880	105	8080	108
Sodium				7500	8190	109	8140	109
Sodium				7500	8280	110		

(a) %R = (Amount Found / True Value) x 100 Control Limits=90-110%
(b) Associated with samples 880208-043-047,050-053
(c) Associated with samples 880212-012-018
(d) Associated with sample 880212-011
(e) Associated with sample 880216-005-006
(f) Associated with samples 880212-011-018,880216-005-006

Table C-7. Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration" columns. The column to the left will contain values for the first continuing calibration verification, and the column to the right and below will contain values for the second, third and etc. continuing calibration verifications. The column to the right and/or below will be empty if no second continuing calibration verification was performed. Each subsequent initial calibration is listed in the "Initial Calibration" column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
CN (free) (b)	0.400	0.399	100	0.400	0.396	99	0.361	90
CN (free)				0.400	0.401	100	0.407	102
CN (free)				0.400	0.363	91	0.388	97
CN (free)				0.400	0.391	98		
CN (free) (c)	0.400	0.416	104	0.400	0.413	103	0.409	102
CN (free) (d)	0.400	0.390	98	0.400	0.386	97	0.384	96
CN (free)				0.400	0.433	108		
CN (free) (e)	0.400	0.406	102	0.400	0.404	101	0.393	98
CN (free)				0.400	0.387	97		

(a) %R = (Amount Found/True Value) x 100
Control Limits = 90-110%
(b) Associated with samples 880208-043-045,048-061
(c) Associated with samples 880208-046,047 and 880212-011,013
(d) Associated with samples 880212-012,014-018
(e) Associated with samples 880216-005-006

Table C-8. Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration" columns. The column to the left will contain values for the first continuing calibration verification, and the column to the right and below will contain values for the second, third and etc. continuing calibration verifications. The column to the right and/or below will be empty if no second continuing calibration verification was performed. Each subsequent initial calibration is listed in the "Initial Calibration" column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
CN (total)	0.400	0.399	100	0.400	0.382	96	0.396	99
(b)								
CN (total)				0.400	0.361	90	0.401	100
CN (total)				0.400	0.407	102	0.363	91
CN (total)				0.400	0.388	97	0.391	98
CN (total)	0.400	0.416	104	0.400	0.413	103	0.409	102
(c)								
CN (total)	0.400	0.390	98	0.400	0.389	97	0.386	97
(d)								
CN (total)				0.400	0.368	92	0.393	98
CN (total)	0.400	0.406	102	0.400	0.393	98	0.387	97
(e)								
CN (total)				0.400	0.377	94		

(a) %R = (Amount Found / True Value) x 100
Control Limits=90-110%
(b) Associated with samples 880208-043-045,048-061
(c) Associated with samples 880208-046,047
(d) Associated with samples 880212-011-015,017,018
(e) Associated with samples 880212-016 and 880216-005-006

Table C-9. Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration" columns. The column to the left will contain values for the first continuing calibration verification, and the column to the right and below will contain values for the second, third and etc. continuing calibration verifications. The column to the right and/or below will be empty if no second continuing calibration verification was performed. Each subsequent initial calibration is listed in the "Initial Calibration" column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
Fluoride(b)	10	10	100	10	10.5	105	10.5	105
Fluoride				10	9.6	96	9.6	96
Fluoride				10	9.2	92	9.9	99
Sulfate(b)	20	18.2	91	20	18.5	92	18.7	84
Sulfate				20	18.7	94	18.5	92
Sulfate				20	18.0	90		

(a) %R = (Amount Found / True Value) x 100
Control Limits = 90-110%
(b) Associated with samples 880208-043-061,
880212-011-018,
and 880216-005,006

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY CONTROL SAMPLES (LCS) - INORGANICS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**N**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**N**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits or CLP criteria (± 20% R).
P - Provisional:	%R outside QC limits but not <30% or >120%. Flag all data associated as J.
U - Unacceptable:	If LCS falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable -Flag R.
N - Not Applicable:	LCS are not required; LCS are used to evaluate method/sample preparation; analysis does not require preparation.

REMARKS:

None

CHENOWETH CREEK & EM SURVEY TEST PIT SAMPLING
MMRF, THE DALLES
FEBRUARY 1988

QA DATA SUMMARY FOR: LABORATORY CONTROL SAMPLES

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER											
CCSWG-1R	880208-050	LOC 1	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-2R	880208-051	LOC 2	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-3R	880208-043	LOC 3	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-4R	880208-053	LOC 4	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-5R	880208-046	LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-6R	880208-047	LOC 6	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-7R	880208-044	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
CCSWG-8R	880208-045	REP OF LOC 5	WATER	04-Feb-88	06-Feb-88	X	X	N	X	X	N
TRIP BLK 1	880208-052	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	N	X	X	N
SEDIMENTS											
CCSDG-1R	880208-055	LOC 1	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-2R	880208-056	LOC 2	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-3R	880208-057	LOC 3	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-4R	880208-058	LOC 4	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-5R	880208-059	LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-6R	880208-060	LOC 6	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-7R	880208-048	FIELD BLANK	WATER	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-8R	880208-061	REP OF LOC 5	SOIL	04-Feb-88	06-Feb-88	X	X	N	N	N	N
CCSDG-9R	880208-049	SAMP RINSATE	WATER	04-Feb-88	06-Feb-88	X	X	N	N	N	N
TRIP BLK 6	880208-054	TRIP BLANK	WATER	29-Jan-88	06-Feb-88	X	X	N	N	N	N
TEST PIT ANALYSES											
BRTPW-1G	880212-011	PIT 1	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
BRTPW-2G	880212-012	PIT 2	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
SATPW-3G	880212-016	PIT 3	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
RRTPW-5G	880212-014	PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
RRTPW-110G	880216-005	PIT 10	WATER	11-Feb-88	16-Feb-88	X	X	N	X	X	N
RRTPW-111G	880216-006	PIT 11	WATER	11-Feb-88	16-Feb-88	X	X	N	X	X	N
OCTPW-10G	880212-017	FIELD BLANK	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
OCTPW-11G	880212-018	REP OF PIT 5	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
OCTPW-12G	880212-015	SAMP RINSATE	WATER	10-Feb-88	12-Feb-88	X	X	N	X	X	N
TRIP BLK 8	880212-013	TRIP BLANK	WATER	09-Feb-88	12-Feb-88	X	X	N	X	X	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED

Table C-3. QC Summary -- Laboratory Control Sample

Matrix: Water Units: µg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
Arsenic	80-120	880208-043-047,050-053	30	30	100
Arsenic	80-120	880212-011-018 880216-005-006	30	30	100
Sodium	80-120	880208-043-047,050-053	10000	9380	94
Sodium	80-120	880212-011-018 880216-005-006	10000	9560	96

(a) %R = (Amount Found / True Value) x 100

Table C-10. QC Summary -- Laboratory Control Sample

Matrix: Water and Soil — Units: mg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
CN (free)	80-120	880208-043-045,048,049	0.400	0.384	96
CN (free)	80-120	880208-050-054	0.400	0.415	104
CN (free)	80-120	880208-055-061 (b)	0.400	0.401	100
CN (free)	80-120	880208-046,047 880212-011,013	0.400	0.396	99
CN (free)	80-120	880212-012,014-018	0.400	0.397	99
CN (free)	80-120	880216-005,006	0.400	0.394	98
CN (total)	80-120	880208-043-049	0.400	0.349	86
CN (total)	80-120	880208-050-054	0.400	0.385	96
CN (total)	80-120	880208-055-061 (b)	0.400	0.391	98
CN (total)	80-120	880212-011-013	0.400	0.395	99
CN (total)	80-120	880212-014-018 880216-005,006	0.400	0.395	99
Sulfate	80-120	880208-055-061 (b)	20	17.8	89

(a) %R = (Amount Found / True Value) x 100
Control limits = 80-120 %

(b) Samples 880208-055-061 are soil samples, all other samples are water samples

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

ICP SERIAL DILUTIONS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**N**	SULFATE:	**N**
FREE CYANIDE:	**N**	SODIUM:	**A**
FLUORIDE:	**N**	ARSENIC:	**N**

CRITERIA:

A - Acceptable: All %D within QC limits or CLP criteria (± 10% D).

P - Provisional: %D outside QC limits but not <30% or >120%. Flag all data associated as J.

U - Unacceptable: If %D falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable - Flag R.

N - Not Applicable: Serial dilutions are not required.

REMARKS:

None

Table C-4. ICP Serial Dilutions

Matrix: Water Units: µg/L

Parameter	Control Limits	ESM Sample ID	Initial Sample Result(I)	Serial Dilution Result(S)	%D*
Sodium	± 10%	880212-011	91500	94700	3.5

* Percent Difference (%D) = [(I - S) / I] x 100

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

AA - POST DIGESTION SPIKE RECOVERY

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**N**	SULFATE:	**N**
FREE CYANIDE:	**N**	SODIUM:	**N**
FLUORIDE:	**N**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All %R within QC limits or CLP criteria (± 15% R).

P - Provisional: %R outside QC limits but not <30% or >120%. Flag all data associated as J.

U - Unacceptable: If %R falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable - Flag R.

N - Not Applicable: Post digestion spike recovery analyses are not required.

REMARKS:

None

Table C-5.Post Digested (Analytical) Spike Sample Recoveries

Matrix: Water Units: µg/L

Parameter	ESM ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Arsenic	880208-043	85-115	25.4	[3.6]	20	109
Arsenic	880208-044	85-115	18.9	3.0U	20	94(b)
Arsenic	880208-045	85-115	24.6	3.0U	20	123(b)
Arsenic	880208-046	85-115	23.4	3.0U	20	117(b)
Arsenic	880208-047	85-115	24.8	3.0U	20	124(b)
Arsenic	880208-050	85-115	24.0	3.0U	20	120(b)
Arsenic	880208-051	85-115	25.7	3.0U	20	128(b)
Arsenic	880208-052	85-115	22.9	3.0U	20	114(b)
Arsenic	880208-053	85-115	23.7	3.0U	20	118(b)
Arsenic	880212-011	85-115	26.0	3.0U	20	130(b)
Arsenic	880212-012	85-115	22.3	[3.9]	20	92
Arsenic	880212-013	85-115	24.3	[3.6]	20	104
Arsenic	880212-014	85-115	26.9	[9.9]	20	85
Arsenic	880212-015	85-115	23.2	3.0U	20	116(b)
Arsenic(c)	880212-016	85-115	35.3	16.8	20	92
Arsenic	880212-017	85-115	24.5	[3.2]	20	106
Arsenic(c)	880212-018	85-115	26.6	[5.0]	20	108
Arsenic(d)	880216-005	85-115	43.0	24.0	20	95
Arsenic(e)	880216-006	85-115	34.2	14.2	20	100

(a) %R =[(Spiked Sample Result - Sample Result)/Spike Added] x 100
(b) %R > 40% and sample result ≤ 50% of the spike absorbance. By EPA/CLP SOW 7/87, samples are reported as < CRDL, 85-115 %R control limits do not apply.
(c) Sample diluted 3 X
(d) Sample diluted 20 X
(e) Sample diluted 40 X

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

TRIP BLANKS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**P**
FLUORIDE:	**A**	ARSENIC:	**P**

CRITERIA:gbcvf

A - Acceptable:	No evidence of contamination above minimum detection limits.
P - Provisional:	Contaminants present but minimal or no evidence of interference with sample results.
U - Unacceptable:	Gross contamination resulting in definite compromise to the sample data integrity.

REMARKS:

Trip blank 8 (880212-013) had trace concentration of arsenic and sodium between IDL and LOQ -- No samples biased.

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

FIELD BLANKS

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**P**
FREE CYANIDE:	**P**	SODIUM:	**P**
FLUORIDE:	**P**	ARSENIC:	**P**

CRITERIA:

A - Acceptable: No contamination in any blank;

P - Provisional: Some blanks contaminated, no apparent interference with any sample results;

U - Unacceptable: Gross contamination in blanks indicating poor sampling technique, bottle contamination, airborne contamination, preservative contamination, or improper handling. Data for batch invalid or suspect.

REMARKS:

Field blanks 880212-017 and 880212-015 had minor amounts of free cyanide, fluoride, sodium, arsenic and sulfate; trace amounts of sodium were detected in 880208 - 044 -- No samples biased

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

FIELD REPLICATES

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**P**

CRITERIA:

A - Acceptable: All RPDs are within QC limits (± 30% RPD);

P - Provisional: Some RPDs are outside QC limits;

U - Unacceptable: All RPDs are outside QC limits.

REMARKS:

Creek sediments replicate 180% RPD for Total Cyanide; Test Pits replicate 41% RPD for Arsenic; most likely due to sample inhomogeneity -- No samples biased

FIELD REPLICATE ANALYSES
CHENOWETH CREEK / EM SURVEY TEST PITS
MMRF, THE DALLES, OR
FEBRUARY 1988

SURFACE WATER

FIELD REPLICATE CCSWG-5R		VERSAR 880208-46	VERSAR 880208-045	RPD
TOTAL CN	MG/L	0.0026 U	0.0026 U	NC
FREE CN	MG/L	0.0026 U	0.0026 U	NC
FLUORIDE	MG/L	[0.1]	[0.093]	7.3
SULFATE	MG/L	6.7	7.2	7.2
SODIUM	MG/L	5.55	5.72	3.0
ARSENIC	MG/L	0.003 U	0.003 U	NC

SEDIMENT

FIELD REPLICATE CCSDG-5R		VERSAR 880208-059	VERSAR 880309-027	RPD
TOTAL CN	MG/KG	0.590	0.031 U	180.0
FREE CN	MG/KG	0.030 U	0.031 U	NC
FLUORIDE	MG/KG	[0.97]	1.2 U	21.2
PERCENT SOLIDS		86	85	NA

PERCHED WATER

FIELD REPLICATE RRTPW-5G		VERSAR 880212-014	VERSAR 880212-018	RPD
TOTAL CN	MG/L	1.2	1.2	0.0
FREE CN	MG/L	0.48	0.36	28.6
FLUORIDE	MG/L	0.52	0.39	28.6
SULFATE	MG/L	47	42	11.2
SODIUM	MG/L	15	16	6.5
ARSENIC	MG/L	0.0099	0.015 J	41.0

NOTES: NC - NOT CALCULATED
RPD - RELATIVE PERCENT DIFFERENCE

021DAL4:FEBSPLIT.WK1

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

SPLIT SAMPLES

SAMPLING EVENT: **Chenoweth Creek/EM Test Pits**

DATE: **February 1988**

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**P**	SODIUM:	**A**
FLUORIDE:	**P**	ARSENIC:	**P**

CRITERIA:

A - Acceptable: All RPDs are within QC limits (± 30% RPD);

P - Provisional: Some RPDs are outside QC limits;

U - Unacceptable: All RPDs are outside QC limits.

REMARKS:

Surface water split - 82% RPD for Arsenic; however, one value below IDL, the other value greater than IDL but less than LOQ -- No samples biased

Test pit samples - high RPD for Free Cyanide (34.5%), Total Cyanide (143%), Fluoride (168%) and Arsenic (144%); most likely due to sample inhomogeneity -- No samples biased

SPLIT SAMPLE ANALYSES
CHENOWETH CREEK / EM SURVEY TEST PITS
MMRF, THE DALLES, OR
FEBRUARY 1988

SURFACE WATER

SPLIT SAMPLE		VERSAR	COMPUCHEM	
CCSWG-3R		880208-043	180395	RPD
TOTAL CN	MG/L	0.0026 U	0.01 U	NC
FREE CN	MG/L	0.0026 U	0.01 U	NC
FLUORIDE	MG/L	[0.12]	0.095	23.3
SULFATE	MG/L	7.4	6.3	16.1
SODIUM	MG/L	5.94	5.23	12.7
ARSENIC	MG/L	[0.0036]	0.0015 U	82.4

SEDIMENT

SPLIT SAMPLE		VERSAR	COMPUCHEM	
CCSDG-3R		880208-057	180407	RPD
TOTAL CN	MG/KG	0.036 U	0.01 U	NC
FREE CN	MG/KG	0.036 U	0.01 U	NC
FLUORIDE	MG/KG	[1.4]	1.15 U	19.6
PERCENT SOLIDS		82	71.1	NA

PERCHED WATER

SPLIT SAMPLE		VERSAR	COMPUCHEM	
RRTPW-5G		880212-014	180408	RPD
TOTAL CN	MG/L	1.2	0.2	142.9
FREE CN	MG/L	0.48	0.68	34.5
FLUORIDE	MG/L	0.52	0.046	167.5
SULFATE	MG/L	47	42	11.2
SODIUM	MG/L	15	15.3	2.0
ARSENIC	MG/L	0.0099	[0.0016]	144.3

NOTES: NC - NOT CALCULATED
RPD - RELATIVE PERCENT DIFFERENCE

021DAL4:FEBSPLIT.WK1

C-2

VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA FOR SAMPLES COLLECTED MARCH 3 TO MARCH 7, 1988

DATA CLASSIFICATION CHECK LIST AND VALIDATED DATA SUMMARY TABLE

DATA CLASSIFICATION SUMMARY CHECK LIST

Level A Criteria

Matrix: **Surface Water and Sediments**

Sampling Event: **Chenoweth Creek Sampling**

Date: **March 3 to 7, 1988**

To be classified for Level A use, the data must meet the following criteria:

	Criteria	Evaluation Result
1.	Sampling dates were recorded;	**A**
2.	Signatures of Sampling Team on each water sample log or soil sample log;	**A**
3.	Sampling locations were clearly designated and described;	**A**
4.	Sampling depth increment for soils was recorded;	**A**
5.	Sample collection technique was described on water sample log or soil sample log;	**A**
6.	Field preparation techniques were clearly described where applicable;	**A**
7.	Sample preservation techniques were clearly described, consistent, and adequate for the parameters to be analyzed and the sample matrix;	**A**
8.	Shipping bill of lading or constant surveillance documentation is available;	**A**
9.	The laboratory sample preparation or extraction date is recorded and available;	**A**
10.	The laboratory sample analysis date is recorded and available;	**A**

Criteria	Evaluation Result
11. The laboratory sample preparation technique is recorded and available either in the laboratory report or in the laboratories approved SOP;	**A**
12. The methods of analysis are listed in the laboratory reports and are consistent with the methods specified in the QAPP and laboratory contract;	**A**
13. The laboratory analytical detection limits or limits of quantitation (LOQ) are given in lab reports and are adequate for project objectives;	**A**
14. Field records include:	
o Soil/sediment log sheets	**A**
o Water sampling log sheets	**A**
o QC field checklist	**N**
o Field instrument calibration logs	**A**
o Master log book bound with sequentially numbered pages	**A**
o Daily log book	**A**
o Chain-of-Custody forms	**A**
15. All applicable records described above were properly created and are on file;	**A**
16. Samples passed laboratory data validation without any R flags (samples with J flags may be accepted at this level).	**A**

Remarks:

None

DATA CLASSIFICATION SUMMARY CHECK LIST

Level B Criteria

Matrix: **Surface Water and Sediments**

Sampling Event: **Chenoweth Creek**

Date: **March 3 to 7, 1988**

To be classified for Level B use, the data must meet the following criteria:

Criteria	Evaluation Result
A. Data Validation Result:	
1. Samples of this matrix have not been flagged J or R during data validation;	**A**
2. All samples of this matrix have been classified as Level A data;	**A**
B. Quantitative Statistical Significance:	
1. Laboratory and field instruments were properly standardized (calibrated) employing proper methods and records are available;	**A**
2. Sample bottle preparation was proper and appropriate for the parameters measured and the sample matrix;	**A**
3. All laboratory procedures were referenced to approved EPA methods and were contained in an approved SOP manual;	**A**
4. Analytical QC data was available to demonstrate proper instrument calibration;	**A**
5. Laboratory QC check sample standards are EPA and NBS traceable and were used at least once each three months;	**A**

Criteria	Evaluation Result
6. Laboratory reagent (method) blanks were analyzed at a frequency of at least 1 per 20 samples;	A
7. Laboratory duplicates were analyzed at a frequency of at least 1 per 20 samples;	A
8. Laboratory matrix spikes and matrix spike duplicates were analyzed at a frequency of at least 1 per 20 samples;	A
9. Field replicates were analyzed at a frequency of at least 1 per 20 samples;	A
10. Field blanks were submitted at a frequency of at least 1 per 20 samples;	A
11. One trip blank was submitted for VOCs analysis with each cooler;	P
12. Field split samples were analyzed at a frequency of at least 1 per 10 samples per matrix;	A
13. Appropriate and sufficient QC data with acceptance criteria were presented to allow data validation by the project QA officer;	A
14. The laboratories used were approved by the EPA for participation in the Contract Laboratory Program (CLP);	A
15. The laboratories participated in round-robin testing program by EPA or other accrediting agency;	A
16. Quality control limits were consistent with the limits established for EPA's CLP;	A
17. All samples submitted were analyzed for the requested parameters.	A

Criteria	Evaluation Result
C. <u>Custody and Document Control</u>:	
1. Field custody of all samples was noted in a bound field log book;	A
2. Transfer of custody documentation (chain-of-custody form) signed by field and laboratory sample custodians is available and properly completed;	A
3. Laboratory custody is documented by a designated lab sample custodian in a master log and a secured sample storage area;	A
4. Sample identification and assigned laboratory tracking numbers are traceable through the entire monitoring system;	A
5. Field notebooks, log sheets, log books, checklists, reports, data validations, and all custody documents are stored in a secure repository or under the control of a document custodian;	A
6. All records, forms, log books, etc., are filled out completely in indelible ink without alterations except as initialed;	A
7. All sample log sheets have been signed by the sample collector;	A
8. Field log book sheets signed by the field sample custodian.	A
D. <u>Sample Representativeness</u>:	
1. Compatibility exists between field and laboratory measurements, where applicable, or incompatibilities have been suitably explained;	A

Criteria	Evaluation Result
2. Laboratory analysis and/or sample preparation or extraction were within allowable holding times established for the sample preservation and methods used;	**A**
3. Sample storage was maintained within suitable temperature, light and moisture conditions to guarantee sample integrity;	**A**
4. Proper sample containers were used for the parameters analyzed;	**A**
5. Proper sample collection equipment was used such that the equipment would neither contribute nor remove any substance to or from the sample;	**A**
6. The sample site selection criteria are consistent with the objectives of the investigation and will provide the required data.	**A**

Remarks:

B-11: Trip blanks were submitted for all parameters analyzed at a frequency of 1 per 20 samples.

Conclusion:

All data is classified as Level B and can be used quantitatively.

VALIDATED DATA SUMMARY TABLE
CHENOWETH CREEK SURFACE WATER AND SEDIMENT SAMPLING
MMRF, THE DALLES
MARCH 1988

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)	PERCENT SOLIDS
SURFACE WATER						MG/L	MG/L	MG/L	UG/L	UG/L	MG/L	
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.12]	[3.6]	7900	6.7	NA
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.13]	[3.1]	7630	6.7	NA
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.13]	[3.4]	7920	9.2	NA
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.12]	3.0 U	7740	9.7	NA
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	0.15	[4.2]	8120	10.0	NA
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.13]	[3.9]	8270	9.4	NA
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	[0.1]	[3.6]	7720	7.7	NA
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	0.0026 U	0.0026 U	0.048 U	3.0 U	[211]	1.0 U	NA
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	0.0026 U	0.0026 U	0.048 U	3.0 U	[309]	1.0 U	NA
SEDIMENTS						MG/KG	MG/KG	MG/KG				
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	0.035 U	0.035 U	[1.5]	NR	NR	NR	74
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	0.038 U	0.038 U	[1.2]	NR	NR	NR	69
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	0.033 U	0.033 U	[1.1]	NR	NR	NR	79
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	0.032 U	0.032 U	[1.5]	NR	NR	NR	82
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	0.033 U	0.033 U	[1]	NR	NR	NR	78
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	0.030 U	0.030 U	[0.77]	NR	NR	NR	86
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	0.032 U	0.032 U	[0.82]	NR	NR	NR	81
CCSDG-8R2	880309-028	FIELD BLANK	WATER*	07-Mar-88	09-Mar-88	0.026 U	0.026 U	0.048 U	NR	NR	NR	NA
CCSDG-9R2	880309-029	SAMP RINSATE	WATER*	07-Mar-88	09-Mar-88	0.026 U	0.026 U	0.048 U	NR	NR	NR	NA
TRIP BLK 5	880309-030	TRIP BLANK	WATER*	29-Jan-88	09-Mar-88	0.026 U	[0.027]	NR	NR	NR	NR	NA
TRIP BLK 6	880309-031	TRIP BLANK	WATER*	03-Mar-88	09-Mar-88	NR	0.64	NR	NR	NR	NR	NA
TRIP BLK 4	880309-032	TRIP BLANK	WATER*	03-Mar-88	09-Mar-88	NR	NR	[1.3]	NR	NR	NR	NA

NOTES:
U - ANALYTE WAS ANALYZED FOR BUT NOT DETECTED ABOVE THE INSTRUMENT DETECTION LIMIT (IDL)
[ ]- VALUE IN BRACKETS GREATER THAN IDL, BUT LESS THAN THE QUANTITATION LIMIT; VALUE IS ESTIMATED
* - AQUEOUS BLANK RECALCULATED AS SOIL
NR - ANALYSIS NOT REQUESTED

METHODS OF ANALYSIS, LEVELS OF QUANTITATION, AND DETECTION LIMITS DISCUSSION

March 1988

QUANTITATION LIMITS

Water Samples

Parameter	IDL	Lowest Calibration Standard	Quantitation Limit
Arsenic	3.0 µg/L	10 µg/L	10 µg/L
Sodium	17 µg/L	50000 µg/L	1000 µg/L
Cyanide (free)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Cyanide (total)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Fluoride	0.048 mg/L	0.10 mg/L	0.15 mg/L
Sulfate	1.0 mg/L *	5.0 mg/L	5.0 mg/L

Soil Samples
(Calculated From Water Quantitation Limits)

Parameter	IDL	Lowest Calibration Standard	Quantitation Limit
Cyanide (free)	0.026 mg/kg	0.20 mg/kg	0.20 mg/kg
Cyanide (total)	0.026 mg/kg	0.20 mg/kg	0.20 mg/kg
Fluoride	0.48 mg/kg	1.0 mg/kg	1.5 mg/kg

Methods of Analysis

Parameter	Method	Reference
Arsenic	206.2	EPA-600/4-79-20, Rev. 3/83
Sodium	200.7	EPA-600/4-79-20, Rev. 3/83
Cyanide (free)	412.H	Standard Methods, 16th Ed.
Cyanide (total)	335.2	EPA-600/4-79-20, Rev. 3/83
Fluoride	340.2	EPA-600/4-79-20, Rev. 3/83
Sulfate	375.4	EPA-600/4-79-20, Rev. 3/83

* Sulfate detection limit is based on the method detection limit of 1.0 mg/L, as noted in EPA-600/4-79-020 method 375.4

March 1988

DETECTION LIMIT DISCUSSION

Summary of Detection Limit Determinations

Metals

Detection limit calculation were performed according to the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

Soil detection limits have been calculated from water detection limits as per information sent by Joe Arlauskas (Versar) to Mr. C.W. Ankerberg (Geraghty & Miller) on 15 January 1988. Detection limits were calculated using water LOD's and correcting for the sample weight as specified by the method.

Non-metals

a. Cyanide - total and free

Cyanide detection limits for water and soils were determined using the procedures in the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

In order to attain lower detection limits for water samples analysed for cyanide 500 ml rather than 250 ml of sample was distilled. To lower detection limits for soil samples 25 grams of sample rather than 10 grams was distilled.

As noted in the metals section, soil detection limits have been calculated from water detection limits.

b. Miscellaneous parameters

Detection limit calculations for fluoride were performed according to the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

Detection limit data for sulfate is based on the method detection limit (MDL) noted in EPA-600/4-79-020, method 375.4.

As noted in the metals section, soil detection limits have been calculated from water detection limits.

March 1988

DETECTION LIMITS DISCUSSION
(continued)

Summary discussion

The detection limits reported by Versar ESM Operation Laboratory were determined and calculated in accordance with EPA-CLP protocols for the CLP parameters; arsenic, sodium, and cyanide. For non- CLP parameters, fluoride and sulfate, CLP detection limit procedures were used as guidelines to determine the detection limit for fluoride, and the method detection limit was used as the detection limit for sulfate.

For reporting purposes, the EPA-CLP detection limits were used providing that the calculated detection limit values were lower. In addition, and following a letter from Geraghty & Miller sent by K. Duchac, C.W. Ankenberg, and E.R. Rothschild, dated 1 February 1988 the following limits have been reported:

Cyanide, free and total	LOQ = 0.010 mg/L	IDL = 0.0026 mg/L
Fluoride,	LOQ = 0.15 mg/L	

VALIDATION SUMMARY FORMS AND QC SUPPORT DATA

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

HOLDING TIMES

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**P**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All QAPP and 40 CFR 136 specified holding times met.

P - Provisional: Some QAPP and 40 CFR 136 specified holding times are met.

U - Unacceptable: All holding time exceeded.

N - Not Applicable

REMARKS:

Holding time exceeded for Trip Blanks 880309-030 & -031 for total cyanide and 880309-030 for free cyanide -- No samples biased

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	HOLDING TIME ALLOWED
Arsenic	880309-033-039, 045	Water	07-Mar-88	09-Mar-88	14-Mar-88	15-Mar-88	8 days	6 months
Arsenic	880309-040	Water	03-Mar-88	09-Mar-88	14-Mar-88	15-Mar-88	12 days	6 months
Cadmium	880309-046	Water	07-Mar-88	09-Mar-88	28-Mar-88	29-Mar-88	22 days	6 months
Sodium	880309-033-039, 045	Water	07-Mar-88	09-Mar-88	14-Mar-88	23-Mar-88	16 days	6 months
Sodium	880309-040	Water	03-Mar-88	09-Mar-88	14-Mar-88	23-Mar-88	20 days	6 months
Fluoride	880309-025-027	Soil	07-Mar-88	09-Mar-88	18-Mar-88	19-Mar-88	12 days	28 days
Fluoride	880309-041-044	Soil	07-Mar-88	09-Mar-88	18-Mar-88	21-Mar-88	14 days	28 days
Fluoride	880309-028-029, 033-040,045	Water	07-Mar-88	09-Mar-88		31-Mar-88	24 days	28 days
Fluoride	880309-032	Water	03-Mar-88	09-Mar-88		31-Mar-88	28 days	28 days
Sulfate	880309-033-040, 045	Water	07-Mar-88	09-Mar-88		10-Mar-88	3 days	28 days
Free Cyanide	880309-025-027, 041-044	Soil	07-Mar-88	09-Mar-88	17-Mar-88	18-Mar-88	11 days	14 days
Free Cyanide	880309-028-029, 033-034	Water	07-Mar-88	09-Mar-88	15-Mar-88	18-Mar-88	11 days	14 days
Free Cyanide	880309-030	Water	29-Jan-88	09-Mar-88	15-Mar-88	18-Mar-88	49 days*	14 days
Free Cyanide	880309-035-040, 045	Water	07-Mar-88	09-Mar-88	16-Mar-88	18-Mar-88	11 days	14 days

* Holding time exceeded for trip blank sample 880309-030.

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	ALLOWED
Total Cyanide	880309-025-026,	Soil	07-Mar-88	09-Mar-88	17-Mar-88	18-Mar-88	11 days	14 days
Total Cyanide	880309-027, 041-044	Soil	07-Mar-88	09-Mar-88	18-Mar-88	18-Mar-88	11 days	14 days
Total Cyanide	880309-028-029, 033-036	Water	07-Mar-88	09-Mar-88	11-Mar-88	18-Mar-88	11 days	14 days
Total Cyanide	880309-030	Water	29-Jan-88	09-Mar-88	11-Mar-88	18-Mar-88	49 days*	14 days
Total Cyanide	880309-031	Water	03-Mar-88	09-Mar-88	11-Mar-88	18-Mar-88	15 days*	14 days
Total Cyanide	880309-037-040, 045	Water	07-Mar-88	09-Mar-88	14-Mar-88	18-Mar-88	11 days	14 days

* Holding time exceeded for 880309-030, and 880309-031. Both of these samples are trip blanks.

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY BLANKS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**P**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: No contaminants above minimum detection limit, no interference with sample results, appropriate blank used for each GC/MS system, extraction method, and inorganic analytical system.

P - Provisional: Contaminants present but minimal interference with sample results.

U - Unacceptable: Gross contamination, too much interference to use data for certain compounds or for the entire fraction; appropriate blanks not analyzed.

N - Not Applicable

REMARKS:

Sodium analyses results are greater than IDL but less than quantitation limit -- No samples biased

CHENOWETH CREEK SURFACE WATER AND SEDIMENT SAMPLING
MMRF, THE DALLES
MARCH 1988

QA DATA SUMMARY FOR: LABORATORY BLANKS

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER-MARCH											
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	X	X	X	X	- 1 -	X
SEDIMENTS-MARCH											
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-8R2	880309-028	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-9R2	880309-029	SAMP RINSATE	WATER	07-Mar-88	09-Mar-88	X	X	X	N	N	N
TRIP BLK 5	880309-030	TRIP BLANK	WATER	29-Jan-88	09-Mar-88	X	X	N	N	N	N
TRIP BLK 6	880309-031	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	X	N	N	N	N
TRIP BLK 4	880309-032	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	N	X	N	N	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = RESULTS GREATER THAN IDL, BUT LESS THAN QUANTIFICATION LIMIT

Metals QC Summary -- Laboratory Blanks

Matrix: Water Analysis Type: Total Units: µg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank* Result	Method
Arsenic	880309-033-040,045	10	3.0U	Furnace
Cadmium	880309-046	10	1.7U	ICP
Sodium	880309-033-040,045	1000	[328]	ICP

* Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Laboratory Blanks

Matrix: Soil

Units: mg/kg

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Fluoride	880309-025-027,041-044	1.5	0.48U	340.2
Free Cyanide	880309-025-027,041-044	0.2	0.026U	412.H
Total Cyanide	880309-025-027,041-044	0.2	0.026U	335.2

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Laboratory Blanks

Matrix: Water

Units: mg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Fluoride	880309-028-029,032-040 880309-045	0.15	0.048U	340.2
Sulfate	880309-033-040,045	5.0	1.0U	375.4
Free Cyanide	880309-028-030,033-040 880309-045	0.01	0.0026U	412.H
Total Cyanide	880309-028-031, 880309-033-040,045	0.01	0.0026U	335.2

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY DUPLICATES

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All relative percent differences (RPDs) are within QC limits (± 20% RPD).

P - Provisional: Some RPDs outside of QC limits.

U - Unacceptable: All RPDs outside QC limits.

REMARKS:

None

CHENOWETH CREEK SURFACE WATER AND SEDIMENT SAMPLING
MMRF, THE DALLES
MARCH 1988

QA DATA SUMMARY FOR: DUPLICATE ANALYSES

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER-MARCH											
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	X	X	X	X	X	- 1 -
SEDIMENTS-MARCH											
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-8R2	880309-028	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-9R2	880309-029	SAMP RINSATE	WATER	07-Mar-88	09-Mar-88	X	X	X	N	N	N
TRIP BLK 5	880309-030	TRIP BLANK	WATER	29-Jan-88	09-Mar-88	X	X	N	N	N	N
TRIP BLK 6	880309-031	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	X	N	N	N	N
TRIP BLK 4	880309-032	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	N	X	N	N	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = FOR RESULTS <5 X QL, VALUES MUST AGREE WITHIN +/- QL

Metals QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples:880309-033-040,045
(ESM ID RANGE) :880309-046 Units: µg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)(a)	Duplicate Result (DR)(a)(b)	Calc RPD (c)
Arsenic	0309-033	10	3.0U	3.0U	NC(d)
Cadmium	0309-046	10	238000	222000	7.0
Sodium	0309-034	1000	8120	8660	6.4

(a) Results reported as total metals
(b) Duplicate samples are digestion duplicates
(c) RPD = (SR-DR)/[(SR+DR)/2] X 100
(d) RPD not calculated (NC), result <QL

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Soil Associated Samples: 880309-025-027, (ESM ID RANGE) :880309-041-044 Units: mg/kg

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Fluoride	0309-025	1.5	[1.0]	[1.2]	NC(c)
Free Cyanide	0309-025	0.20	0.033U	0.033U	NC
Free Cyanide	0309-044	0.20	0.032U	0.032U	NC
Total Cyanide	0309-025	0.20	0.033U	0.033U	NC
Total Cyanide	0309-044	0.20	0.032U	0.032U	NC

(a) Duplicate samples are digestion duplicates
(b) RPD = (SR-DR)/[(SR+DR)/2] X 100
(c) RPD not calculated (NC), result <QL

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) : Units: mg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Fluoride (c)	0309-028	0.15	0.048U	0.048U	NC(d)
Fluoride (c)	0309-033	0.15	[0.12]	[0.12]	NC
Sulfate (e)	0309-033	5.0	9.7	8.9	(f)
Free Cyanide (g)	0309-028	0.01	0.0026U	0.0026U	NC
Free Cyanide (g)	0309-035	0.01	0.0026U	0.0026U	NC
Total Cyanide (g)	0309-029	0.01	0.0026U	0.0026U	NC
Total Cyanide (g)	0309-037	0.01	0.0026U	0.0026U	NC

(a) Duplicate samples are digestion duplicates
(b) RPD = (SR-DR)/[(SR+DR)/2] X 100
(c) Associated with samples 880309-028-029,032-040,045
(d) RPD not calculated (NC), result <QL
(e) Associated with samples 880309-033-040,045
(f) For results < 5 x QL, values must agree within ± QL
(g) Associated with samples 880309-028-031,033-040,045

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

MATRIX SPIKE RECOVERY - INORGANICS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits (75-125%) or meet CLP criteria or >125%R and reported sample result is <IDL.
P_1 - Provisional:	Some %R not within QC limits but are between 30% to 74%; or are >125% and analyte was reported <IDL--Flag UJ.
P_2 - Provisional:	Some %R not within QC limits but are between 30% to 74% and analyte was reported at >LOQ/IDL--Flag J.
P_3 - Provisional:	%R are less than 30% or greater than 125% and analyte was detected at >LOQ/IDL--Flag J.
U - Unacceptable:	%R <30% and sample results are reported as <IDL - Flag R.

REMARKS:

None

CHENOWETH CREEK SURFACE WATER AND SEDIMENT SAMPLING
MMRF, THE DALLES
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QA DATA SUMMARY FOR: SPIKE RECOVERY

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER-MARCH											
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	X	X	X	X
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	X	X	X	X	X	X
SEDIMENTS-MARCH											
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-8R2	880309-028	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	X	N	N	N
CCSDG-9R2	880309-029	SAMP RINSATE	WATER	07-Mar-88	09-Mar-88	X	X	X	N	N	N
TRIP BLK 5	880309-030	TRIP BLANK	WATER	29-Jan-88	09-Mar-88	X	X	N	N	N	N
TRIP BLK 6	880309-031	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	X	N	N	N	N
TRIP BLK 4	880309-032	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	N	X	N	N	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED

Metals QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples:880309-033-040,045
(ESM ID RANGE) :880309-046 Units: µg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result(a)	Sample Result(a)	Spike Added	%R (b)
Arsenic	-033	75 - 125	22	3.0U	20	110
Cadmium	-046	75 - 125	(c)	238000	50	NC(d)
Sodium	-034	75 - 125	16600	8120	10000	85

(a) Results reported as total metals
(b) %R = [(SSR-SR)/SA] x 100
(c) Sample concentration > 4 x SA, spiked sample was not analyzed
(d) %R not calculated (NC), Sample concentration > 4 x SA

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Soil Associated Samples:880309-025-027,
(ESM ID RANGE) :880309-041-044 Units: µg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Fluoride(b)	-025	75 - 125	2.5mg/L	[0.08]mg/L	2.5mg/L	97
Free Cyanide(c)	-025	75 - 125	326	0.033U	400	82
Total Cyanide(c)	-025	75 - 125	384	0.033U	400	96

(a) %R = [(SSR-SR)/SA] x 100
(b) Spike calculated from aqueous leachate, units in mg/L
(c) Spike calculated from aliquot concentration, units in µg/L

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) Units: mg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Fluoride(b)	-028	75 - 125	8.6	0.048U	10	86
Fluoride(b)	-033	75 - 125	9.1	[0.12]	10	90
Sulfate (c)	-033	75 - 125	21	9.7	10	113
Free Cyanide (d)	-029	75 - 125	0.37	0.0026U	0.40	92
Free Cyanide (d)	-036	75 - 125	0.31	0.0026U	0.40	78
Total Cyanide (d)	-028	75 - 125	0.37	0.0026U	0.40	93
Total Cyanide (d)	-036	75 - 125	0.36	0.0026U	0.40	90

(a) %R = [(SSR-SR)/SA] x 100
(b) Associated with samples 880309-028-029,032-040,045
(c) Associated with samples 880309-033-040,045
(d) Associated with samples 880309-028-031,033-040,045

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

CALIBRATION CURVE STANDARDS - INORGANICS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All curves three- to five-point curves with lowest standard at the LOQ; ICP - one point.

U - Unacceptable: Less than three-point curve and/or lowest standard not at the LOQ; no one-point verification for ICP.

REMARKS:

None

Analytical QC Data -- Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Arsenic	206.2	10	µg/L
Arsenic	206.2	25	µg/L
Arsenic	206.2	50	µg/L
Cadmium	200.7	2000	µg/L
Sodium	200.7	50000	µg/L

Analytical QC Data -- Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Cyanide (free) Cyanide(total)	412.H 335.2	0.010	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.050	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.200	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.400	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.800	mg/L
Fluoride	340.2	0.1	mg/L
Fluoride	340.2	1.0	mg/L
Fluoride	340.2	5.0	mg/L
Fluoride	340.2	10	mg/L
Fluoride	340.2	50	mg/L
Fluoride	340.2	100	mg/L
Sulfate	375.4	1.0	mg/L
Sulfate	375.4	5.0	mg/L
Sulfate	375.4	10	mg/L
Sulfate	375.4	15	mg/L
Sulfate	375.4	25	mg/L
Sulfate	375.4	40	mg/L

LABORATORY DATA VALIDATION
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RI SUPPLEMENT
MMRF, THE DALLES

INITIAL AND CONTINUING CALIBRATION VERIFICATION - INORGANICS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**P**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: %R of ICVS and CCVS inside of QC limits (± 10 % R).

P - Provisional: %R of ICVS or CCVS outside of QC limits, but not less than 50% or greater than 150%.

U - Unacceptable: %R of ICVS or CCVS outside QC limits but less than 50% or greater than 150%.

N - Not Applicable

REMARKS:

One continuing calibration value for both free and total cyanide was 88% R -- No samples biased

CHENOWETH CREEK SURFACE WATER AND SEDIMENT SAMPLING
MMRF, THE DALLES
MARCH 1988

QA DATA SUMMARY FOR: INITIAL AND CONTINUING CALIBRATION VERIFICATION

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER-MARCH											
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	- 1 -	- 1 -	X	X	X	X
SEDIMENTS-MARCH											
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-8R2	880309-028	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
CCSDG-9R2	880309-029	SAMP RINSATE	WATER	07-Mar-88	09-Mar-88	- 1 -	- 1 -	X	N	N	N
TRIP BLK 5	880309-030	TRIP BLANK	WATER	29-Jan-88	09-Mar-88	- 1 -	- 1 -	N	N	N	N
TRIP BLK 6	880309-031	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	- 1 -	N	N	N	N
TRIP BLK 4	880309-032	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	N	X	N	N	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = ONE CONTINUING CALIBRATION VALUE AT 88%R

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: µg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
Arsenic(b)	30	30	100	30	31	103	29	97
Arsenic				30	28	93	39	97
Cadmium(c)	1000	903	90	1000	915	92	919	92
Sodium (b)	25400	26500	104	25400	27300	107	27500	108
Sodium				25400	27000	106		

(a) %R = (Amount Found / True Value) x 100 Control Limits=90-110%
(b) Associated with samples 880309-033-040,045
(c) Associated with samples 880309-046

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes (ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration True Value	Initial Calibration Amount Found	Initial Calibration %R (a)	Continuing Calibration True Value	Continuing Calibration Amount Found	Continuing Calibration %R (a)	Continuing Calibration Amount Found	Continuing Calibration %R (a)
CN (free)(b)	0.400	0.376	94	0.400	0.372	93	0.367	92
CN (free)(b)				0.400	0.352	88	0.366	92
CN (free)(b)				0.400	0.367	92	0.379	95
CN (free)(b)				0.400	0.408	102	0.393	98
CN (free)(b)				0.400	0.404	101	0.403	101
CN(total)(c)	0.400	0.376	94	0.400	0.372	93	0.367	92
CN(total)(c)				0.400	0.352	88	0.366	92
CN(total)(c)				0.400	0.367	92	0.379	95
CN(total)(c)				0.400	0.408	102	0.393	98
CN(total)(c)				0.400	0.404	101	0.403	101

(a) %R = (Amount Found / True Value) x 100
Control Limits=90-110%
(b) Associated with samples 880309-025-030,033-045
(c) Associated with samples 880309-025-031,033-045

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
Fluoride (b)	10	9.9	99	10	10.2	102	9.9	99
Fluoride (c)	10	10	100	10	10.5	105	10	100
Fluoride				10	10	100		
Sulfate (d)	20	19.8	99	20	19.5	98	20.2	101
				20	19.5	98		

(a) %R = (Amount Found / True Value) x 100
Control Limits = 90-110%
(b) Associated with samples 880309-025-027,033
(c) Associated with samples 880309-028-029,032,034-045
(d) Associated with samples 880309-033-040,045

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
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MMRF, THE DALLES

LABORATORY CONTROL SAMPLES (LCS) - INORGANICS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**N**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**N**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits or CLP criteria (± 20% R).
P - Provisional:	%R outside QC limits but not <30% or >120%. Flag all data associated as J.
U - Unacceptable:	If LCS falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable -Flag R.
N - Not Applicable:	LCS are not required; LCS are used to evaluate method/sample preparation; analysis does not require preparation.

REMARKS:

None

CHENOWETH CREEK SURFACE WATER AND SEDIMENT SAMPLING
MMRF, THE DALLES
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QA DATA SUMMARY FOR: LABORATORY CONTROL SAMPLES

SAMPLE ID	LAB ID	LOCATION/ DESCRIPTION	MATRIX	DATE COLLECTED	DATE RECEIVED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE (TURBIDIMETRIC)
SURFACE WATER-MARCH											
CCSWG-1R2	880309-037	LOC 1	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-2R2	880309-038	LOC 2	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-3R2	880309-039	LOC 3	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-4R2	880309-033	LOC 4	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-5R2	880309-034	LOC 5	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-6R2	880309-035	LOC 6	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-7R2	880309-045	REP OF 6R2	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
CCSWG-8R2	880309-036	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
TRIP BLK 1	880309-040	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	X	X	- 1 -	X	X	- 1 -
SEDIMENTS-MARCH											
CCSDG-1R2	880309-041	LOC 1	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-2R2	880309-042	LOC 2	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-3R2	880309-043	LOC 3	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-4R2	880309-044	LOC 4	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-5R2	880309-025	LOC 5	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-6R2	880309-026	LOC 6	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-7R2	880309-027	REP OF 6	SOIL	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-8R2	880309-028	FIELD BLANK	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
CCSDG-9R2	880309-029	SAMP RINSATE	WATER	07-Mar-88	09-Mar-88	X	X	- 1 -	N	N	N
TRIP BLK 5	880309-030	TRIP BLANK	WATER	29-Jan-88	09-Mar-88	X	X	N	N	N	N
TRIP BLK 6	880309-031	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	X	N	N	N	N
TRIP BLK 4	880309-032	TRIP BLANK	WATER	03-Mar-88	09-Mar-88	N	N	- 1 -	N	N	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = NO LABORATORY CONTROL SAMPLES ARE INCLUDED

Analytical QC Data -- Laboratory Control Sample

Matrix: Water Units: µg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
Arsenic	80-120	880309-033-040,045	30	25	83
Cadmium	80-120	880309-046	1000	797	80
Sodium	80-120	880309-033-040,045	10000	9510	95

(a) %R = (Amount Found / True Value) x 100

Analytical QC Data -- Laboratory Control Sample

Matrix: Water and Soil Units: mg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
CN (free)	80-120	880309-025-027(b) 880309-028-030,033-034	0.400	0.325	81
CN (free)	80-120	880309-035-040, 880309-041-043(b)	0.400	0.363	91
CN (free)	80-120	880309-044 (b)	0.400	0.380	95
CN (free)	80-120	880309-045	0.400	0.386	97
CN (total)	80-120	880309-025-026,(b) 880309-028,037-040	0.400	0.413	103
CN (total)	80-120	880309-029-031,033-036	0.400	0.369	92
CN (total)	80-120	880309-027,041-044(b)	0.400	0.381	95
CN (total)	80-120	880309-045	0.400	0.371	93

(a) %R = (Amount Found / True Value) x 100
(b) Samples 880309-025-027,041-044 are soil samples, all other samples are water samples

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

ICP SERIAL DILUTIONS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**N**	SULFATE:	**N**
FREE CYANIDE:	**N**	SODIUM:	**A**
FLUORIDE:	**N**	ARSENIC:	**N**

CRITERIA:

A - Acceptable: All %D within QC limits or CLP criteria (± 10% D).

P - Provisional: %D outside QC limits but not <30% or >120%. Flag all data associated as J.

U - Unacceptable: If %R falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable - Flag R.

N - Not Applicable: Serial dilution analyses are not required.

REMARKS:

None

Analytical QC Data -- ICP Serial Dilutions

Matrix: Water Units: µg/L

Parameter	Control Limits	ESM Sample ID	Initial Sample Result(I)	Serial Dilution Result(S)	%D*
Cadmium	± 10%	880309-046	238000	242000	1.7
Sodium	± 10%	880309-039	7920	8590	8.5

* Percent Difference (%D) = [(I - S) / I] x 100

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

AA - POST DIGESTION SPIKE RECOVERY

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**N**	SULFATE:	**N**
FREE CYANIDE:	**N**	SODIUM:	**N**
FLUORIDE:	**N**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All %R within QC limits or CLP criteria (± 15% R).

P - Provisional: %R outside QC limits but not <30% or >120%. Flag all data associated as J.

U - Unacceptable: If %R falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable - Flag R.

N - Not Applicable: Post digestion spike recovery analyses are not required.

REMARKS:

None

Analytical QC Data -- Post Digested (Analytical) Spike Recoveries

Matrix: Water Units: µg/L

Parameter	ESM ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Arsenic	880309-033	85-115	22.3	3.0U	20	112
Arsenic	880309-034	85-115	21.8	[4.2]	20	88
Arsenic	880309-035	85-115	21.7	[3.9]	20	89
Arsenic	880309-036	85-115	18.9	3.0U	20	95
Arsenic	880309-037	85-115	22.4	[3.6]	20	94
Arsenic	880309-038	85-115	20.4	[3.1]	20	87
Arsenic	880309-039	85-115	23.0	[3.4]	20	98
Arsenic	880309-040	85-115	20.8	3.0U	20	104
Arsenic	880309-045	85-115	23.6	[3.6]	20	100

(a) %R =[(Spiked Sample Result - Sample Result)/Spike Added] x 100

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

TRIP BLANKS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	No evidence of contamination above minimum detection limits.
P - Provisional:	Contaminants present but minimal or no evidence of interference with sample results.
U - Unacceptable:	Gross contamination resulting in definite compromise to the sample data integrity.

REMARKS:

Trip blank 880309-031 had 0.032 mg/kg total cyanide -- No samples biased

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

FIELD BLANKS

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**P**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: No contamination in any blank;

P - Provisional: Some blanks contaminated, no apparent interference with any sample results;

U - Unacceptable: Gross contamination in blanks indicating poor sampling technique, bottle contamination, airborne contamination, preservative contamination, or improper handling. Data for batch invalid or suspect.

REMARKS:

Field blank 880309-0367 total sodium value is between LOQ and IDL -- No samples biased

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

FIELD REPLICATES

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All RPDs are within QC limits (± 30% RPD);

P - Provisional: Some RPDs are outside QC limits;

U - Unacceptable: All RPDs are outside QC limits.

REMARKS:

None

FIELD REPLICATE ANALYSES
CHENOWETH CREEK
MMRF, THE DALLES, OR
MARCH 1988

SURFACE WATER

FIELD REPLICATE CCSWG-6R2		VERSAR 880309-035	VERSAR 880309-045	RPD
TOTAL CN	MG/L	0.0026 U	0.0026 U	NC
FREE CN	MG/L	0.0026 U	0.0026 U	NC
FLUORIDE	MG/L	[0.13]	[0.1]	26.1
SULFATE	MG/L	9.7	9.4	3.1
SODIUM	MG/L	8.27	7.72	6.9
ARSENIC	MG/L	[0.0039]	0.0036 U	8.0

SEDIMENT

FIELD REPLICATE CCSDG-6R2		VERSAR 880309-026	VERSAR 880309-027	RPD
TOTAL CN	MG/KG	0.030 U	0.032 U	NC
FREE CN	MG/KG	0.030 U	0.032	6.5
FLUORIDE	MG/KG	[0.77]	0.82 U	6.3
PERCENT SOLIDS		82	71.1	NA

NOTES: NC-NOT CALCULATED
RPD - RELATIVE PERCENT DIFFERENCE

021DAL4:MARSPLIT.WK1

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

SPLIT SAMPLES

SAMPLING EVENT: **Chenoweth Creek**

DATE: **March 1988**

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**P**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All RPDs are within QC limits (± 30% RPD);

P - Provisional: Some RPDs are outside QC limits;

U - Unacceptable: All RPDs are outside QC limits.

REMARKS:

Creek sediment split 100% RPD for fluoride; most likely due to sample inhomogeneity -- No samples biased

SPLIT SAMPLE ANALYSES
CHENOWETH CREEK
MMRF, THE DALLES, OR
MARCH 1988

SURFACE WATER

SPLIT SAMPLE CCSWG-4R2	VERSAR 880309-033	ECOVA EAS 704-01	RPD
TOTAL CN MG/L	0.0026 U	0.005 U	NC
FREE CN MG/L	0.0026 U	NA	NC
FLUORIDE MG/L	[0.12]	0.11	8.7
SULFATE MG/L	9.7	12	21.2
SODIUM MG/L	7.74	9.91	24.6
ARSENIC MG/L	0.003 U	0.005 U	NC

SEDIMENT

SPLIT SAMPLE CCSDG-4R2	VERSAR 880309-033	ECOVA EAS 704-01	RPD
TOTAL CN MG/KG	0.032 U	1.4 U	NC
FREE CN MG/KG	0.032 U	NA	NC
FLUORIDE MG/KG	[0.15]	0.5 U	100.0
PERCENT SOLIDS	82	71.1	NA

NOTES: NC-NOT CALCULATED
RPD - RELATIVE PERCENT DIFFERENCE

021DAL4:MARSPLIT.WK1

C-3

VALIDATION AND CLASSIFICATION OF ANALYTICAL DATA FOR SAMPLES COLLECTED APRIL 19 - 27, 1988 AND JUNE 1 - 4, 1988

DATA CLASSIFICATION CHECK LIST AND VALIDATED DATA SUMMARY TABLE

DATA CLASSIFICATION SUMMARY CHECK LIST

Level A Criteria

Matrix: **Ground Water**

Sampling Event: **22 Wells and 3 Test Pits**

Date: **April 19 to 27 and June 1-4, 1988**

To be classified for Level A use, the data must meet the following criteria:

	Criteria	Evaluation Result
1.	Sampling dates were recorded;	**A**
2.	Signatures of Sampling Team on each water sample log or soil sample log;	**A**
3.	Sampling locations were clearly designated and described;	**A**
4.	Sampling depth increment for soils was recorded;	**N**
5.	Sample collection technique was described on water sample log or soil sample log;	**A**
6.	Field preparation techniques were clearly described where applicable;	**A**
7.	Sample preservation techniques were clearly described, consistent, and adequate for the parameters to be analyzed and the sample matrix;	**A**
8.	Shipping bill of lading or constant surveillance documentation is available;	**A**
9.	The laboratory sample preparation or extraction date is recorded and available;	**A**
10.	The laboratory sample analysis date is recorded and available;	**A**

Criteria	Evaluation Result
11. The laboratory sample preparation technique is recorded and available either in the laboratory report or in the laboratories approved SOP;	**A**
12. The methods of analysis are listed in the laboratory reports and are consistent with the methods specified in the QAPP and laboratory contract;	**A**
13. The laboratory analytical detection limits or limits of quantitation (LOQ) are given in lab reports and are adequate for project objectives;	**A**
14. Field records include:	
o Soil/sediment log sheets	**N**
o Water sampling log sheets	**A**
o QC field checklist	**N**
o Field instrument calibration logs	**A**
o Master log book bound with sequentially numbered pages	**A**
o Daily log book	**A**
o Chain-of-Custody forms	**A**
15. All applicable records described above were properly created and are on file;	**A**
16. Samples passed laboratory data validation without any R flags (samples with J flags may be accepted at this level).	**P**

Remarks:

B-16: Free and total cyanide analyses were flagged R (unusable); all samples were recollected in June. Only June analyses for free and total cyanide will be carried through for Level B classification.

DATA CLASSIFICATION SUMMARY CHECK LIST

Level B Criteria

Matrix: **Ground Water**

Sampling Event: **22 Wells and 3 Test Pits**

Date: **April 19-27 and June 1-4, 1988**

To be classified for Level B use, the data must meet the following criteria:

Criteria	Evaluation Result
A. Data Validation Result:	
1. Samples of this matrix have not been flagged J or R during data validation;	**P**
2. All samples of this matrix have been classified as Level A data;	**A**
B. Quantitative Statistical Significance:	
1. Laboratory and field instruments were properly standardized (calibrated) employing proper methods and records are available;	**A**
2. Sample bottle preparation was proper and appropriate for the parameters measured and the sample matrix;	**A**
3. All laboratory procedures were referenced to approved EPA methods and were contained in an approved SOP manual;	**A**
4. Analytical QC data was available to demonstrate proper instrument calibration;	**A**
5. Laboratory QC check sample standards are EPA and NBS traceable and were used at least once each three months;	**A**

Criteria	Evaluation Result
6. Laboratory reagent (method) blanks were analyzed at a frequency of at least 1 per 20 samples;	A
7. Laboratory duplicates were analyzed at a frequency of at least 1 per 20 samples;	A
8. Laboratory matrix spikes and matrix spike duplicates were analyzed at a frequency of at least 1 per 20 samples;	A
9. Field replicates were analyzed at a frequency of at least 1 per 20 samples;	A
10. Field blanks were submitted at a frequency of at least 1 per 20 samples;	A
11. One trip blank was submitted for VOCs analysis with each cooler;	P
12. Field split samples were analyzed at a frequency of at least 1 per 10 samples per matrix;	A
13. Appropriate and sufficient QC data with acceptance criteria were presented to allow data validation by the project QA officer;	A
14. The laboratories used were approved by the EPA for participation in the Contract Laboratory Program (CLP);	A
15. The laboratories participated in round-robin testing program by EPA or other accrediting agency;	A
16. Quality control limits were consistent with the limits established for EPA's CLP;	A
17. All samples submitted were analyzed for the requested parameters.	A

Criteria	Evaluation Result
C. Custody and Document Control:	
1. Field custody of all samples was noted in a bound field log book;	A
2. Transfer of custody documentation (chain-of-custody form) signed by field and laboratory sample custodians is available and properly completed;	A
3. Laboratory custody is documented by a designated lab sample custodian in a master log and a secured sample storage area;	A
4. Sample identification and assigned laboratory tracking numbers are traceable through the entire monitoring system;	A
5. Field notebooks, log sheets, log books, checklists, reports, data validations, and all custody documents are stored in a secure repository or under the control of a document custodian;	A
6. All records, forms, log books, etc., are filled out completely in indelible ink without alterations except as initialed;	A
7. All sample log sheets have been signed by the sample collector;	A
8. Field log book sheets signed by the field sample custodian.	A
D. Sample Representativeness:	
1. Compatibility exists between field and laboratory measurements, where applicable, or incompatibilities have been suitably explained;	A

Criteria	Evaluation Result
2. Laboratory analysis and/or sample preparation or extraction were within allowable holding times established for the sample preservation and methods used;	**A**
3. Sample storage was maintained within suitable temperature, light and moisture conditions to guarantee sample integrity;	**A**
4. Proper sample containers were used for the parameters analyzed;	**A**
5. Proper sample collection equipment was used such that the equipment would neither contribute nor remove any substance to or from the sample;	**A**
6. The sample site selection criteria are consistent with the objectives of the investigation and will provide the required data.	**A**

Remarks:

A-1: **Only free and total cyanide analyses completed in June are carried through the Level B classification.**

B-11: **Trip blanks were submitted for all parameters analyzed at a frequency of 1 per 20 samples.**

Conclusion:

Excluding free and cyanide analyses completed in April which were recollected, all data is classified as Level B and can be used quantitatively.

VALIDATED DATA SUMMARY TABLE
GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

			JUNE 1988				APRIL 1988					
WELL NUMBER	DESCRIPTION	MATRIX	LAB ID	DATE COLLECTED	FREE CYANIDE (MG/L)	TOTAL CYANIDE (MG/L)	LAB ID	DATE COLLECTED	FLUORIDE (BY ISE) (MG/L)	TOTAL ARSENIC (UG/L)	TOTAL SODIUM (UG/L)	SULFATE (TURBIDIMETRIC) (MG/L)
MWR-2B		WATER	880606-018	03-Jun-88	0.051	0.21	880426-001	23-Apr-88	0.84	3.0 U	46700	82
MW-5S		WATER	880606-023	03-Jun-88	0.3	18	880425-009	21-Apr-88	28	3.0 U	547000	85
MW-7B		WATER	880606-010	02-Jun-88	0.075	1.0	880422-002	20-Apr-88	0.48	3.0 U	24700	85
MW-8S		WATER	880606-007	02-Jun-88	0.15	8.2	880421-015	19-Apr-88	0.68	3.0 U	57500	152
MWR-8A		WATER	880606-011	02-Jun-88	0.064	1.1	880422-008	20-Apr-88	0.67	3.0 U	35200	86
MWR-8B		WATER	880606-012	02-Jun-88	0.048	0.50	880422-005	20-Apr-88	0.71	3.0 U	17200	38
REP1	REP OF MW-8B	WATER	880606-001	02-Jun-88	0.042	0.53	880422-004	20-Apr-88	0.60	3.0 U	17100	47
MW-9S		WATER	880606-006	02-Jun-88	0.043	0.8	880421-016	20-Apr-88	1.5	3.0 U	48500	25
MWR-9A		WATER	880606-005	02-Jun-88	0.065	3.4	880422-001	20-Apr-88	5.8	3.0 U	73800	57
MW-9B		WATER	880606-002	02-Jun-88	0.063	3.0	880422-006	20-Apr-88	9.7	[4.7]	109000	53
MW-14B		WATER	880606-009	02-Jun-88	0.11	0.72	880422-003	20-Apr-88	0.56	3.0 U	20600	64
MW-17S		WATER	880606-017	03-Jun-88	0.022	0.39	880425-008	21-Apr-88	0.51	3.0 U	28300	76
MW-18S		WATER	880606-019	04-Jun-88	[0.0058]	0.040	880426-002	23-Apr-88	3.7	3.0 U	244000	1480
MW-19S		WATER	880606-008	03-Jun-88	0.01	0.034	880426-005	22-Apr-88	4.2	3.0 U	168000	3.9
MW-21S		WATER	880606-021	03-Jun-88	0.015	0.022	880426-006	22-Apr-88	5.3	3.0 U	224000	1680
REP2	REP OF MW-21S	WATER	880606-022	03-Jun-88	0.012	0.039	880426-007	22-Apr-88	5.4	3.0 U	230000	1550
MW-29S		WATER	880606-004	03-Jun-88	0.0026 U	[0.0068]	880426-008	22-Apr-88	2.3	3.0 U	61900	844
MW-33B		WATER	880603-002	01-Jun-88	0.10	2.2	880426-003	22-Apr-88	0.28	3.0 U	19100	191
MW-34B		WATER	880603-003	01-Jun-88	[0.0037]	0.012	880425-011	22-Apr-88	0.73	3.0 U	33100	12
CHENOWETH #1		WATER	880603-006	01-Jun-88	0.0026 U	0.0026 U	880420-027	19-Apr-88	0.96	3.0 U	45300	48
CHENOWETH #2		WATER	--	--	NA	NA	880420-028	19-Apr-88	0.98	[4.5]	49400	47
CHENOWETH #3		WATER	880603-007	01-Jun-88	0.0026 U	0.0026 U	880429-005	27-Apr-88	0.84	3.0 U	41100	34
ANIMAL SHELTER		WATER	880603-005	01-Jun-88	[0.0045]	0.023	880420-029	19-Apr-88	0.25	[3.3]	5080	14
RESIDENTIAL WELL		WATER	880603-001	01-Jun-88	[0.0085]	0.017	880429-004	27-Apr-88	4.2	3.0 U	172000	987
SA-D	TEST PIT SUMP	WATER	880606-013	04-Jun-88	0.50	76	880429-007	27-Apr-88	288	123	2090000	571
OCWP-B	TEST PIT SUMP	WATER	880606-014	04-Jun-88	0.65	260	880429-008	27-Apr-88	513	610	7400000	1430
OCWP-D	TEST PIT SUMP	WATER	880606-015	04-Jun-88	0.39	106	880429-009	27-Apr-88	1300	860	6290000	863
MW-5FB	FIELD BLANK	WATER	880606-024	03-Jun-88	0.0026 U	0.0026 U	880425-010	21-Apr-88	0.18	3.0 U	[269]	1.0 U
MWR-9FB	FIELD BLANK	WATER	880606-003	02-Jun-88	0.0026 U	0.0026 U	880422-007	20-Apr-88	0.22	3.0 U	[209]	[1.3]
MW9-SR2	SAMPLER RINSATE	WATER	--	--	NA	NA	880421-014	19-Apr-88	0.048 U	3.0 U	534	[1.0]
OCWP-SR1	SAMPLER RINSATE	WATER	880606-016	04-Jun-88	0.012	[0.0038]	880429-010	27-Apr-88	0.048 U	[4.3]	1380	1.0 U
TRIP BLANK #1		WATER	880603-004	27-May-88	0.0026 U	0.0026 U	880420-030	15-Apr-88	0.048 U	3.0 U	[166]	1.0 U
TRIP BLANK #2		WATER	--	--	NA	NA	880426-004	15-Apr-88	[0.050]	3.0 U	17 U	1.0 U
TRIP BLANK #1		WATER	880606-020	31-May-88	0.0026 U	[0.0034]	880429-006	20-Apr-88	0.048 U	3.0 U	[280]	[1.0]

NOTES:
U = RESULTS LESS THAN INSTRUMENT DETECTION LIMIT (IDL)
J = ESTIMATED VALUES
[ ] = RESULTS GREATER THAN IDL, BUT LESS THAN QUANTITATION LIMIT
NA = NOT ANALYZED, NOT COLLECTED

METHODS OF ANALYSIS, LEVELS OF QUANTITATION, AND DETECTION LIMITS DISCUSSION

April 1988

QUANTITATION LIMITS

Water Samples

Parameter	IDL (a)	Lowest Calibration Standard	Quantitation Limit
Arsenic	3.0 µg/L	10 µg/L	10 µg/L
Sodium	17 µg/L	50000 µg/L	1000 µg/L
Cyanide (free)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Cyanide (total)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Fluoride	0.048 mg/L	0.10 mg/L	0.15 mg/L
Sulfate	1.0 mg/L *	5.0 mg/L	5.0 mg/L

Methods of Analysis

Parameter	Method	Reference
Arsenic	206.2	EPA-600/4-79-20, Rev. 3/83
Sodium	200.7	EPA-600/4-79-20, Rev. 3/83
Cyanide (free)	412.H	Standard Methods, 16th Ed.
Cyanide (total)	335.2	EPA-600/4-79-20, Rev. 3/83
Fluoride	340.2	EPA-600/4-79-20, Rev. 3/83
Sulfate	375.4	EPA-600/4-79-20, Rev. 3/83

* Sulfate detection limit is based on the method detection limit of 1.0 mg/L, as noted in EPA-600/4-79-020 method 375.4

April 1988

DETECTION LIMIT DISCUSSION

Summary of Detection Limit Determinations

Metals

Detection limit calculation were performed according to the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

Non-metals

a. Cyanide - total and free

Cyanide detection limits for water and soils were determined using the procedures in the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

In order to attain lower detection limits for water samples analysed for cyanide 500 ml rather than 250 ml of sample was distilled.

b. Miscellaneous parameters

Detection limit calculations for fluoride were performed according to the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

Detection limit data for sulfate is based on the method detection limit (MDL) noted in EPA-600/4-79-020, method 375.4.

April 1988

DETECTION LIMITS DISCUSSION
(continued)

Summary discussion

The detection limits reported by Versar ESM Operation Laboratory were determined and calculated in accordance with EPA-CLP protocols for the CLP parameters; arsenic, sodium, and cyanide. For non- CLP parameters, fluoride and sulfate, CLP detection limit procedures were used as guidelines to determine the detection limit for fluoride, and the method detection limit was used as the detection limit for sulfate.

For reporting purposes, the EPA-CLP detection limits were used providing that the calculated detection limit values were lower. In addition, and following a letter from Geraghty & Miller sent by K. Duchac, C.W. Ankenberg, and E.R. Rothschild, dated 1 February 1988 the following limits have been reported:

Cyanide, free and total	LOQ = 0.010 mg/L	IDL = 0.0026 mg/L
Fluoride,	LOQ = 0.15 mg/L	

June 1988

QUANTITATION LIMITS

Water Samples

Parameter	IDL (a)	Lowest Calibration Standard	Quantitation Limit
Cyanide (free)	0.0026 mg/L	0.010 mg/L	0.010 mg/L
Cyanide (total)	0.0026 mg/L	0.010 mg/L	0.010 mg/L

Methods of Analysis

Parameter	Method	Reference
Cyanide (free)	412.H	Standard Methods, 16th Ed.
Cyanide (total)	335.2	EPA-600/4-79-20, Rev. 3/83

June 1988

DETECTION LIMIT DISCUSSION

Summary of Detection Limit Determinations

Cyanide - total and free

Cyanide detection limits for water samples were determined using the procedures in the EPA-CLP SOW 7/85 for Inorganics. Briefly, 7 replicate measurements were performed on three non-consecutive days and the LOD or IDL calculated as 3 times the average standard deviation.

In order to attain lower detection limits for water samples analyzed for cyanide 500 ml rather than 250 ml of sample was distilled.

DETECTION LIMITS DISCUSSION

Summary discussion

The detection limits reported by Versar ESM Operation Laboratory were determined and calculated in accordance with EPA-CLP protocols for cyanide.

For reporting purposes, the EPA-CLP detection limits were used providing that the calculated detection limit values were lower. In addition, and following a letter from Geraghty & Miller sent by K. Duchac, C.W. Ankenberg, and E.R. Rothschild, dated 1 February 1988 the following limits have been reported:

Cyanide, free and total LOQ = 0.010 mg/L IDL = 0.0026 mg/L

VALIDATION SUMMARY FORMS AND QC SUPPORT DATA

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

HOLDING TIMES

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**P/A**	SULFATE:	**A**
FREE CYANIDE:	**P/A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All QAPP and 40 CFR 136 specified holding times met.

P - Provisional: Some QAPP and 40 CFR 136 specified holding times are met.

U - Unacceptable: All holding time exceeded.

N - Not Applicable

REMARKS:

Several holding times were exceeded for free and total cyanide samples collected in April -- All samples were recollected in June

GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

QA DATA SUMMARY FOR: HOLDING TIMES

		JUNE 1988				APRIL 1988							
WELL NUMBER	DESCRIPTION	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE
MWR-2B		880606-018	03-Jun-88	X	X	880426-001	23-Apr-88	X	X	X	X	X	X
MW-5S		880606-023	03-Jun-88	X	X	880425-009	21-Apr-88	X	X	X	X	X	X
MW-7B		880606-010	02-Jun-88	X	X	880422-002	20-Apr-88	X	X	X	X	X	X
MW-8S		880606-007	02-Jun-88	X	X	880421-015	19-Apr-88	X	EXCEEDED	X	X	X	X
MWR-8A		880606-011	02-Jun-88	X	X	880422-008	20-Apr-88	X	X	X	X	X	X
MWR-8B		880606-012	02-Jun-88	X	X	880422-005	20-Apr-88	X	X	X	X	X	X
REP1	REP OF MW-8B	880606-001	02-Jun-88	X	X	880422-004	20-Apr-88	X	X	X	X	X	X
MW-9S		880606-006	02-Jun-88	X	X	880421-016	20-Apr-88	X	X	X	X	X	X
MWR-9A		880606-005	02-Jun-88	X	X	880422-001	20-Apr-88	X	X	X	X	X	X
MW-9B		880606-002	02-Jun-88	X	X	880422-006	20-Apr-88	X	X	X	X	X	X
MW-14B		880606-009	02-Jun-88	X	X	880422-003	20-Apr-88	X	X	X	X	X	X
MW-17S		880606-017	03-Jun-88	X	X	880425-008	21-Apr-88	X	X	X	X	X	X
MW-18S		880606-019	04-Jun-88	X	X	880426-002	23-Apr-88	X	X	X	X	X	X
MW-19S		880606-008	03-Jun-88	X	X	880426-005	22-Apr-88	X	X	X	X	X	X
MW-21S		880606-021	03-Jun-88	X	X	880426-006	22-Apr-88	EXCEEDED	X	X	X	X	X
REP2	REP OF MW-21S	880606-022	03-Jun-88	X	X	880426-007	22-Apr-88	X	X	X	X	X	X
MW-29S		880606-004	03-Jun-88	X	X	880426-008	22-Apr-88	X	EXCEEDED	X	X	X	X
MW-33B		880603-002	01-Jun-88	X	X	880426-003	22-Apr-88	X	EXCEEDED	X	X	X	X
MW-34B		880603-003	01-Jun-88	X	X	880425-011	22-Apr-88	EXCEEDED	X	X	X	X	X
CHENOWETH #1		880603-006	01-Jun-88	X	X	880420-027	19-Apr-88	X	X	X	X	X	X
CHENOWETH #2		-	-	N	N	880420-028	19-Apr-88	X	X	X	X	X	X
CHENOWETH #3		880603-007	01-Jun-88	X	X	880429-005	27-Apr-88	X	X	X	X	X	X
ANIMAL SHELTER		880603-005	01-Jun-88	X	X	880420-029	19-Apr-88	X	EXCEEDED	X	X	X	X
RESIDENTIAL WELL		880603-001	01-Jun-88	X	X	880429-004	27-Apr-88	X	X	X	X	X	X
SA-D	TEST PIT SUMP	880606-013	04-Jun-88	X	X	880429-007	27-Apr-88	X	X	X	X	X	X
OCWP-B	TEST PIT SUMP	880606-014	04-Jun-88	X	X	880429-008	27-Apr-88	X	X	X	X	X	X
OCWP-D	TEST PIT SUMP	880606-015	04-Jun-88	X	X	880429-009	27-Apr-88	X	X	X	X	X	X
MW-5FB	FIELD BLANK	880606-024	03-Jun-88	X	X	880425-010	21-Apr-88	EXCEEDED	X	X	X	X	X
MWR-9FB	FIELD BLANK	880606-003	02-Jun-88	X	X	880422-007	20-Apr-88	X	X	X	X	X	X
MW9-SR2	SAMPLER RINSATE	-	-	N	N	880421-014	19-Apr-88	X	X	X	X	X	X
OCWP-SR1	SAMPLER RINSATE	880606-016	04-Jun-88	X	X	880429-010	27-Apr-88	X	X	X	X	X	X
TRIP BLANK #1		880603-004	27-May-88	X	X	880420-030	15-Apr-88	EXCEEDED	X	X	X	X	X
TRIP BLANK		-	-	N	N	880426-004	15-Apr-88	EXCEEDED	X	X	X	X	X
TRIP BLANK #1		880606-020	31-May-88	X	X	880429-006	20-Apr-88	X	EXCEEDED	X	X	X	X

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME: MET	ALLOWED
Arsenic	880420-027-029	Water	19-Apr-88	20-Apr-88	29-Apr-88	03-May-88	14 days	6 months
Arsenic	880420-030	Water	15-Apr-88	20-Apr-88	29-Apr-88	03-May-88	18 days	6 months
Arsenic	880421-014-016	Water	19-Apr-88	21-Apr-88	29-Apr-88	03-May-88	14 days	6 months
Arsenic	880422-001-008	Water	20-Apr-88	22-Apr-88	29-Apr-88	03-May-88	13 days	6 months
Arsenic	880425-008-010	Water	21-Apr-88	23-Apr-88	19-May-88	25-May-88	34 days	6 months
Arsenic	880425-011	Water	22-Apr-88	23-Apr-88	19-May-88	25-May-88	33 days	6 months
Arsenic	880426-001-002	Water	23-Apr-88	25-Apr-88	19-May-88	25-May-88	32 days	6 months
Arsenic	880426-003, 880426-005-008	Water	22-Apr-88	25-Apr-88	19-May-88	25-May-88	33 days	6 months
Arsenic	880426-004	Water	15-Apr-88	25-Apr-88	19-May-88	25-May-88	40 days	6 months
Arsenic	880429-004-005, 880429-007-010	Water	27-Apr-88	29-Apr-88	23-May-88	25-May-88	28 days	6 months
Arsenic	880429-006	Water	20-Apr-88	29-Apr-88	23-May-88	25-May-88	35 days	6 months
Sodium	880420-027-029	Water	19-Apr-88	20-Apr-88	29-Apr-88	03-May-88	14 days	6 months
Sodium	880420-030	Water	15-Apr-88	20-Apr-88	29-Apr-88	03-May-88	18 days	6 months
Sodium	880421-014-016	Water	19-Apr-88	21-Apr-88	29-Apr-88	03-May-88	14 days	6 months
Sodium	880422-001-008	Water	20-Apr-88	22-Apr-88	29-Apr-88	03-May-88	13 days	6 months
Sodium	880425-008-010	Water	21-Apr-88	23-Apr-88	19-May-88	26-May-88	35 days	6 months
Sodium	880425-011	Water	22-Apr-88	23-Apr-88	19-May-88	26-May-88	34 days	6 months
Sodium	880426-001-002	Water	23-Apr-88	25-Apr-88	19-May-88	26-May-88	33 days	6 months
Sodium	880426-003, 880426-005-008	Water	22-Apr-88	25-Apr-88	19-May-88	26-May-88	34 days	6 months
Sodium	880426-004	Water	15-Apr-88	25-Apr-88	19-May-88	26-May-88	41 days	6 months
Sodium	880429-004-005, 880429-007-010	Water	27-Apr-88	29-Apr-88	23-May-88	26-May-88	29 days	6 months
Sodium	880429-006	Water	20-Apr-88	29-Apr-88	23-May-88	26-May-88	36 days	6 months

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	ALLOWED
Fluoride	880420-027-029	Water	19-Apr-88	20-Apr-88		02-May-88	13 days	28 Days
Fluoride	880420-030	Water	15-Apr-88	20-Apr-88		02-May-88	17 days	28 Days
Fluoride	880421-014-016	Water	19-Apr-88	21-Apr-88		02-May-88	13 days	28 Days
Fluoride	880422-001-008	Water	20-Apr-88	22-Apr-88		02-May-88	12 days	28 Days
Fluoride	880425-008-010	Water	21-Apr-88	23-Apr-88		02-May-88	11 days	28 Days
Fluoride	880425-011	Water	22-Apr-88	23-Apr-88		02-May-88	10 days	28 Days
Fluoride	880426-001-002	Water	23-Apr-88	25-Apr-88		03-May-88	10 days	28 Days
Fluoride	880426-003, 880426-005-008	Water	22-Apr-88	25-Apr-88		03-May-88	11 days	28 Days
Fluoride	880426-004	Water	15-Apr-88	25-Apr-88		03-May-88	18 days	28 Days
Fluoride	880429-004-005, 880429-007-010	Water	27-Apr-88	29-Apr-88		03-May-88	6 days	28 Days
Fluoride	880429-006	Water	20-Apr-88	29-Apr-88		03-May-88	13 days	28 Days
Sulfate	880420-027-029	Water	19-Apr-88	20-Apr-88		11-May-88	22 days	28 Days
Sulfate	880420-030	Water	15-Apr-88	20-Apr-88		11-May-88	26 days	28 Days
Sulfate	880421-014-016	Water	19-Apr-88	21-Apr-88		11-May-88	22 days	28 Days
Sulfate	880422-001-008	Water	20-Apr-88	22-Apr-88		11-May-88	21 days	28 Days
Sulfate	880425-008-010	Water	21-Apr-88	23-Apr-88		11-May-88	20 days	28 Days
Sulfate	880425-011	Water	22-Apr-88	23-Apr-88		11-May-88	19 days	28 Days
Sulfate	880426-001-002	Water	23-Apr-88	25-Apr-88		11-May-88	18 days	28 Days
Sulfate	880426-003, 880426-005-008	Water	22-Apr-88	25-Apr-88		11-May-88	19 days	28 Days
Sulfate	880426-004	Water	15-Apr-88	25-Apr-88		11-May-88	26 days	28 Days
Sulfate	880429-004-005, 880429-007-010	Water	27-Apr-88	29-Apr-88		11-May-88	14 days	28 Days
Sulfate	880429-006	Water	20-Apr-88	29-Apr-88		11-May-88	21 days	28 Days

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	ALLOWED
Free Cyanide	880420-027-029	Water	19-Apr-88	20-Apr-88	27-Apr-88	03-May-88	14 days	14 Days
Free Cyanide *	880420-030	Water	15-Apr-88	20-Apr-88	27-Apr-88	03-May-88	18 days	14 Days
Free Cyanide	880421-014-016	Water	19-Apr-88	21-Apr-88	28-Apr-88	03-May-88	14 days	14 Days
Free Cyanide	880422-001-006	Water	20-Apr-88	22-Apr-88	28-Apr-88	03-May-88	13 days	14 Days
Free Cyanide	880422-007-008	Water	20-Apr-88	22-Apr-88	02-May-88	03-May-88	13 days	14 Days
Free Cyanide	880425-008-009	Water	21-Apr-88	23-Apr-88	02-May-88	03-May-88	12 days	14 Days
Free Cyanide *	880425-010	Water	21-Apr-88	23-Apr-88	04-May-88	06-May-88	15 days	14 Days
Free Cyanide *	880425-011	Water	22-Apr-88	23-Apr-88	04-May-88	26-May-88	34 days	14 Days
Free Cyanide	880426-001-002	Water	23-Apr-88	25-Apr-88	04-May-88	06-May-88	13 days	14 Days
Free Cyanide	880426-003, 880426-005-008	Water	22-Apr-88	25-Apr-88	05-May-88	05-May-88	13 days	14 Days
Free Cyanide *	880426-004	Water	15-Apr-88	25-Apr-88	28-Apr-88	03-May-88	18 days	14 Days
Free Cyanide	880429-004-005	Water	27-Apr-88	29-Apr-88	05-May-88	05-May-88	8 days	14 Days
Free Cyanide *	880429-006	Water	20-Apr-88	29-Apr-88	05-May-88	06-May-88	16 days	14 Days
Free Cyanide	880429-007	Water	27-Apr-88	29-Apr-88	05-May-88	10-May-88	13 days	14 Days
Free Cyanide	880429-008	Water	27-Apr-88	29-Apr-88	10-May-88	10-May-88	13 days	14 Days
Free Cyanide	880429-009	Water	27-Apr-88	29-Apr-88	05-May-88	06-May-88	9 days	14 Days
Free Cyanide	880429-010	Water	27-Apr-88	29-Apr-88	05-May-88	09-May-88	12 days	14 Days

* Holding time exceeded for 880420-030,880425-010-011,880426-004 and 880429-006. Samples 880420-030,880426-004 and 880429-006 are trip blanks.

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	ALLOWED
Total Cyanide	880420-027-028	Water	19-Apr-88	20-Apr-88	25-Apr-88	29-Apr-88	10 days	14 Days
Total Cyanide *	880420-029	Water	19-Apr-88	20-Apr-88	26-Apr-88	04-May-88	15 days	14 Days
Total Cyanide	880420-030	Water	15-Apr-88	20-Apr-88	25-Apr-88	29-Apr-88	14 days	14 Days
Total Cyanide	880421-014	Water	19-Apr-88	21-Apr-88	25-Apr-88	29-Apr-88	10 days	14 Days
Total Cyanide *	880421-015	Water	19-Apr-88	21-Apr-88	25-Apr-88	04-May-88	15 days	14 Days
Total Cyanide	880421-016	Water	19-Apr-88	21-Apr-88	26-Apr-88	29-Apr-88	10 days	14 Days
Total Cyanide	880422-001-002,006	Water	20-Apr-88	22-Apr-88	26-Apr-88	04-May-88	14 days	14 Days
Total Cyanide	880422-004-005	Water	20-Apr-88	22-Apr-88	26-Apr-88	29-Apr-88	9 days	14 Days
Total Cyanide	880422-007	Water	20-Apr-88	22-Apr-88	27-Apr-88	29-Apr-88	9 days	14 Days
Total Cyanide	880422-008	Water	20-Apr-88	22-Apr-88	27-Apr-88	04-May-88	14 days	14 Days
Total Cyanide	880422-003	Water	20-Apr-88	22-Apr-88	03-May-88	04-May-88	14 days	14 Days
Total Cyanide	880425-008-010	Water	21-Apr-88	23-Apr-88	03-May-88	04-May-88	13 days	14 Days
Total Cyanide	880425-011	Water	22-Apr-88	23-Apr-88	03-May-88	04-May-88	12 days	14 Days
Total Cyanide	880426-001-002	Water	23-Apr-88	25-Apr-88	04-May-88	06-May-88	13 days	14 Days
Total Cyanide *	880426-003,	Water	22-Apr-88	25-Apr-88	04-May-88	09-May-88	17 days	14 Days
Total Cyanide	880426-005-008	Water	22-Apr-88	25-Apr-88	04-May-88	06-May-88	14 days	14 Days
Total Cyanide *	880426-004	Water	15-Apr-88	25-Apr-88	04-May-88	06-May-88	21 days	14 Days
Total Cyanide	880429-004-005	Water	27-Apr-88	29-Apr-88	06-May-88	06-May-88	9 days	14 Days
Total Cyanide	880429-007	Water	27-Apr-88	29-Apr-88	06-May-88	09-May-88	12 days	14 Days
Total Cyanide	880429-008-010	Water	27-Apr-88	29-Apr-88	06-May-88	10-May-88	13 days	14 Days
Total Cyanide *	880429-006	Water	20-Apr-88	29-Apr-88	06-May-88	10-May-88	20 days	14 Days

* Holding time exceeded for 880420-029,880421-015,880426-003,880426-004 and 880429-006 . Samples 880426-004 and 880429-006 are trip blanks.

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	ALLOWED
Total Cyanide	880603-001,003, 005-007	Water	1-Jun-88	3-Jun-88	6-Jun-88	8-Jun-88	7 days	14 Days
Total Cyanide	880603-002	Water	1-Jun-88	3-Jun-88	7-Jun-88	8-Jun-88	7 days	14 Days
Total Cyanide	880603-004	Water	27-May-88	3-Jun-88	6-Jun-88	8-Jun-88	12 days	14 Days
Total Cyanide	880606-001-003, 005-006	Water	2-Jun-88	4-Jun-88	7-Jun-88	8-Jun-88	6 days	14 Days
Total Cyanide	880606-004	Water	3-Jun-88	4-Jun-88	8-Jun-88	9-Jun-88	6 days	14 Days
Total Cyanide	880606-007,009-012	Water	2-Jun-88	4-Jun-88	8-Jun-88	9-Jun-88	7 days	14 Days
Total Cyanide	880606-008	Water	3-Jun-88	4-Jun-88	10-Jun-88	13-Jun-88	10 days	14 Days
Total Cyanide	880606-013-014,016	Water	4-Jun-88	6-Jun-88	10-Jun-88	13-Jun-88	9 days	14 Days
Total Cyanide	880606-015,019	Water	4-Jun-88	6-Jun-88	13-Jun-88	14-Jun-88	10 days	14 Days
Total Cyanide	880606-017	Water	3-Jun-88	6-Jun-88	10-Jun-88	13-Jun-88	10 days	14 Days
Total Cyanide	880606-018,021-022	Water	3-Jun-88	6-Jun-88	13-Jun-88	14-Jun-88	11 days	14 Days
Total Cyanide	880606-020	Water	31-May-88	6-Jun-88	13-Jun-88	14-Jun-88	14 days	14 Days
Total Cyanide	880606-023-024	Water	3-Jun-88	6-Jun-88	14-Jun-88	15-Jun-88	12 days	14 Days
Free Cyanide	880603-001,003, 005-007	Water	1-Jun-88	3-Jun-88	6-Jun-88	8-Jun-88	7 days	14 Days
Free Cyanide	880603-002	Water	1-Jun-88	3-Jun-88	8-Jun-88	8-Jun-88	7 days	14 Days
Free Cyanide	880603-004	Water	27-May-88	3-Jun-88	6-Jun-88	8-Jun-88	12 days	14 Days
Free Cyanide	880606-001	Water	2-Jun-88	4-Jun-88	6-Jun-88	8-Jun-88	6 days	14 Days
Free Cyanide	880606-002-003, 005-006	Water	2-Jun-88	4-Jun-88	8-Jun-88	8-Jun-88	6 days	14 Days
Free Cyanide	880606-004	Water	3-Jun-88	4-Jun-88	9-Jun-88	9-Jun-88	6 days	14 Days
Free Cyanide	880606-007	Water	2-Jun-88	4-Jun-88	15-Jun-88	15-Jun-88	13 days	14 Days

VERSAR INC., ESM OPERATIONS
SAMPLE HOLDING TIME SUMMARY

PARAMETER	SAMPLE ESM ID	SAMPLE MATRIX	SAMPLE DATES: COLLECTION	LAB RECEIPT	PREPARATION EXTRACTION	ANALYSIS	HOLDING TIME MET	ALLOWED
Free Cyanide	880606-008	Water	3-Jun-88	4-Jun-88	13-Jun-88	13-Jun-88	10 days	14 Days
Free Cyanide	880606-009-012	Water	2-Jun-88	4-Jun-88	9-Jun-88	9-Jun-88	7 days	14 Days
Free Cyanide	880606-013-014, 016,019	Water	4-Jun-88	6-Jun-88	13-Jun-88	13-Jun-88	9 days	14 Days
Free Cyanide	880606-015	Water	4-Jun-88	6-Jun-88	14-Jun-88	14-Jun-88	10 days	14 Days
Free Cyanide	880606-017	Water	3-Jun-88	6-Jun-88	13-Jun-88	13-Jun-88	10 days	14 Days
Free Cyanide	880606-018,022	Water	3-Jun-88	6-Jun-88	14-Jun-88	14-Jun-88	11 days	14 Days
Free Cyanide	880606-020	Water	31-May-88	6-Jun-88	13-Jun-88	13-Jun-88	13 days	14 Days
Free Cyanide	880606-021	Water	3-Jun-88	6-Jun-88	13-Jun-88	14-Jun-88	11 days	14 Days
Free Cyanide	880606-023-024	Water	3-Jun-88	6-Jun-88	14-Jun-88	15-Jun-88	12 days	14 Days

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY BLANKS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**A/A**	SULFATE:	**A**
FREE CYANIDE:	**P/A**	SODIUM:	**P**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: No contaminants above minimum detection limit, no interference with sample results, appropriate blank used for each GC/MS system, extraction method, and inorganic analytical system.

P - Provisional: Contaminants present but minimal interference with sample results.

U - Unacceptable: Gross contamination, too much interference to use data for certain compounds or for the entire fraction; appropriate blanks not analyzed.

N - Not Applicable

REMARKS:

All total sodium results were greater than IDL, but less than quantitation limit -- No samples biased
Total cyanide and free cyanide detected in one blank greater than IDL, but less than LOQ -- All samples were recollected in June

GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

QA DATA SUMMARY FOR: LABORATORY BLANKS

		JUNE 1988				APRIL 1988							
WELL NUMBER	DESCRIPTION	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE
MWR-2B		880606-018	03-Jun-88	X	X	880426-001	23-Apr-88	X	X	X	X	- 1 -	X
MW-5S		880606-023	03-Jun-88	X	X	880425-009	21-Apr-88	X	X	X	X	- 1 -	X
MW-7B		880606-010	02-Jun-88	X	X	880422-002	20-Apr-88	X	X	X	X	- 1 -	X
MW-8S		880606-007	02-Jun-88	X	X	880421-015	19-Apr-88	X	X	X	X	- 1 -	X
MWR-8A		880606-011	02-Jun-88	X	X	880422-008	20-Apr-88	X	X	X	X	- 1 -	X
MWR-8B		880606-012	02-Jun-88	X	X	880422-005	20-Apr-88	X	X	X	X	- 1 -	X
REP1	REP OF MW-8B	880606-001	02-Jun-88	X	X	880422-004	20-Apr-88	X	X	X	X	- 1 -	X
MW-9S		880606-006	02-Jun-88	X	X	880421-016	20-Apr-88	X	X	X	X	- 1 -	X
MWR-9A		880606-005	02-Jun-88	X	X	880422-001	20-Apr-88	X	X	X	X	- 1 -	X
MW-9B		880606-002	02-Jun-88	X	X	880422-006	20-Apr-88	X	X	X	X	- 1 -	X
MW-14B		880606-009	02-Jun-88	X	X	880422-003	20-Apr-88	X	X	X	X	- 1 -	X
MW-17S		880606-017	03-Jun-88	X	X	880425-008	21-Apr-88	X	X	X	X	- 1 -	X
MW-18S		880606-019	04-Jun-88	X	X	880426-002	23-Apr-88	X	X	X	X	- 1 -	X
MW-19S		880606-008	03-Jun-88	X	X	880426-005	22-Apr-88	X	X	X	X	- 1 -	X
MW-21S		880606-021	03-Jun-88	X	X	880426-006	22-Apr-88	X	X	X	X	- 1 -	X
REP2	REP OF MW-21S	880606-022	03-Jun-88	X	X	880426-007	22-Apr-88	X	X	X	X	- 1 -	X
MW-29S		880606-004	03-Jun-88	X	X	880426-008	22-Apr-88	X	X	X	X	- 1 -	X
MW-33B		880603-002	01-Jun-88	X	X	880426-003	22-Apr-88	X	X	X	X	- 1 -	X
MW-34B		880603-003	01-Jun-88	X	X	880425-011	22-Apr-88	X	X	X	X	- 1 -	X
CHENOWETH #1		880603-006	01-Jun-88	X	X	880420-027	19-Apr-88	X	X	X	X	- 1 -	X
CHENOWETH #2		-	-	N	N	880420-028	19-Apr-88	X	X	X	X	- 1 -	X
CHENOWETH #3		880603-007	01-Jun-88	X	X	880429-005	27-Apr-88	X	X	X	X	- 1 -	X
ANIMAL SHELTER		880603-005	01-Jun-88	X	X	880420-029	19-Apr-88	X	X	X	X	- 1 -	X
RESIDENTIAL WELL		880603-001	01-Jun-88	X	X	880429-004	27-Apr-88	X	X	X	X	- 1 -	X
SA-D	TEST PIT SUMP	880606-013	04-Jun-88	X	X	880429-007	27-Apr-88	X	- 2 -	X	X	- 1 -	X
OCWP-B	TEST PIT SUMP	880606-014	04-Jun-88	X	X	880429-008	27-Apr-88	- 2 -	- 2 -	X	X	- 1 -	X
OCWP-D	TEST PIT SUMP	880606-015	04-Jun-88	X	X	880429-009	27-Apr-88	X	- 2 -	X	X	- 1 -	X
MW-5FB	FIELD BLANK	880606-024	03-Jun-88	X	X	880425-010	21-Apr-88	X	X	X	X	- 1 -	X
MWR-9FB	FIELD BLANK	880606-003	02-Jun-88	X	X	880422-007	20-Apr-88	X	X	X	X	- 1 -	X
MW9-SR2	SAMPLER RINSATE	-	-	N	N	880421-014	19-Apr-88	X	X	X	X	- 1 -	X
OCWP-SR1	SAMPLER RINSATE	880606-016	04-Jun-88	X	X	880429-010	27-Apr-88	X	- 2 -	X	X	- 1 -	X
TRIP BLANK #1		880603-004	27-May-88	X	X	880420-030	15-Apr-88	X	X	X	X	- 1 -	X
TRIP BLANK		-	-	N	N	880426-004	15-Apr-88	X	X	X	X	- 1 -	X
TRIP BLANK #1		880606-020	31-May-88	X	X	880429-006	20-Apr-88	X	X	X	X	- 1 -	X

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = SODIUM DETECTED IN BLANK GREATER THAN IDL, BUT LESS THAN QUANTITATIVE LIMIT
2 = FREE OR TOTAL CYANIDE DETECTED IN BLANK GREATER THAN IDL, BUT LESS THAN LOQ

Metals QC Summary -- Laboratory Blanks

Matrix: Water Analysis Type: Total Units: µg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank* Result	Method
Arsenic	880420-027-030, 880421-014-016, 880422-001-008	10	3.0U	Furnace
Arsenic	880425-008-011, 880426-001-008,	10	3.0U	Furnace
Arsenic	880429-004-010	10	3.0U	Furnace
Sodium	880420-027-030, 880421-014-016, 880422-001-008	500	[201]	ICP
Sodium	880425-008-011, 880426-001-008,	1000	[287]	ICP
Sodium	880429-004-010	1000	[596]	ICP

* Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Laboratory Blanks

Matrix: Water Analysis Type: Units: mg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Fluoride	880420-027-030, 880421-014-016,	0.15	0.048U	340.2
Fluoride	880422-001-007	0.15	0.048U	340.2
Fluoride	880422-008,880425-008-011	0.15	0.048U	340.2
Fluoride	880426-001-008	0.15	0.048U	340.2
Fluoride	880429-004-010	0.15	0.048U	340.2
Sulfate	880420-027-030, 880421-014-016	5.0	1.0U	375.4
Sulfate	880422-001-008	5.0	1.0U	375.4
Sulfate	880425-008-011, 880426-001-003	5.0	1.0U	375.4
Sulfate	880426-004-008, 880429-004-006	5.0	1.0U	375.4
Sulfate	880429-007-010	5.0	1.0U	375.4
Free Cyanide	880420-027-030	0.01	0.0026U	412.H
Free Cyanide	880421-014-016, 880422-001-002	0.01	0.0026U	412.H
Free Cyanide	880422-003-006, 880426-004	0.01	0.0026U	412.H
Free Cyanide	880422-007-008, 880425-008-009	0.01	0.0026U	412.H
Free Cyanide	880425-010-011, 880426-001-003	0.01	0.0026U	412.H
Free Cyanide	880426-003,005-008, 880429-004-005	0.01	0.0026U	412.H
Free Cyanide	880429-006-010	0.01	0.0026U	412.H

Non-Metals QC Summary -- Laboratory Blanks (Continued)

Matrix: Water Analysis Type: Units: mg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Free Cyanide	880429-008	0.01	[0.0034]	412.H
Total Cyanide	880420-027-028,030, 880421-014-015	0.01	0.0026U	335.2
Total Cyanide	880420-029,880421-016, 880422-001-002	0.01	0.0026U	335.2
Total Cyanide	880422-003-006	0.01	0.0026U	335.2
Total Cyanide	880422-007-008	0.01	0.0026U	335.2
Total Cyanide	880420-027-028,030, 880421-014-015	0.01	0.0026U	335.2
Total Cyanide	880422-003, 880425-008-011	0.01	0.019	335.2
Total Cyanide	880426-001-006	0.01	0.0026U	335.2
Total Cyanide	880426-007-008, 880429-004-006	0.01	0.0026U	335.2
Total Cyanide	880429-007-010	0.01	[0.0035]	335.2

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Laboratory Blanks

Matrix: Water Analysis Type: Units: mg/L

Parameter Method	Associated Samples (ESM ID RANGE)	Quantitation Limit	Blank Result	Method
Free Cyanide	880603-001,003-007, 880606-001	0.01	0.0026U	412.H
Free Cyanide	880603-002, 880606-002-003,005-006	0.01	0.0026U	412.H
Free Cyanide	880606-007	0.01	0.0026U	412.H
Free Cyanide	880606-004,009-012	0.01	0.0026U	412.H
Free Cyanide	880606-008,013-014, 016-017,020	0.01	0.0026U	412.H
Free Cyanide	880606-015,018-019, 880606-021-022	0.01	0.0026U	412.H
Free Cyanide	880606-023-024	0.01	0.0026U	412.H
Total Cyanide	880603-001,003-007	0.01	0.0026U	335.2
Total Cyanide	880603-002, 880606-001-003,005-006	0.01	0.0026U	335.2
Total Cyanide	880606-004,007,009-012	0.01	0.0026U	335.2
Total Cyanide	880606-008,013-014, 016-017	0.01	0.0026U	335.2
Total Cyanide	880606-015,018-022	0.01	0.0026U	335.2
Total Cyanide	880606-023-024	0.01	0.0026U	335.2

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW

RI SUPPLEMENT

MMRF, THE DALLES

LABORATORY DUPLICATES

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**P/A**	SULFATE:	**A**
FREE CYANIDE:	**P/A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All relative percent differences (RPDs) are within QC limits.

P - Provisional: Some RPDs outside of QC limits.

U - Unacceptable: All RPDs outside QC limits.

REMARKS:

One laboratory duplicate for free cyanide and one laboratory duplicate for total cyanide was outside QC limits for samples collected in April -- All samples recollected in June

GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

QA DATA SUMMARY FOR: LABORATORY DUPLICATES

		JUNE 1988				APRIL 1988							
WELL NUMBER	DESCRIPTION	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE
MWR-2B		880606-018	03-Jun-88	X	X	880426-001	23-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-5S		880606-023	03-Jun-88	X	X	880425-009	21-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-7B		880606-010	02-Jun-88	X	X	880422-002	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-8S		880606-007	02-Jun-88	X	X	880421-015	19-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-8A		880606-011	02-Jun-88	X	X	880422-008	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-8B		880606-012	02-Jun-88	X	X	880422-005	20-Apr-88	- 1 -	- 2 -	X	X	X	X
REP1	REP OF MW-8B	880606-001	02-Jun-88	X	X	880422-004	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-9S		880606-006	02-Jun-88	X	X	880421-016	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-9A		880606-005	02-Jun-88	X	X	880422-001	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-9B		880606-002	02-Jun-88	X	X	880422-006	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-14B		880606-009	02-Jun-88	X	X	880422-003	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-17S		880606-017	03-Jun-88	X	X	880425-008	21-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-18S		880606-019	04-Jun-88	X	X	880426-002	23-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-19S		880606-008	03-Jun-88	X	X	880426-005	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-21S		880606-021	03-Jun-88	X	X	880426-006	22-Apr-88	- 1 -	- 2 -	X	X	X	X
REP2	REP OF MW-21S	880606-022	03-Jun-88	X	X	880426-007	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-29S		880606-004	03-Jun-88	X	X	880426-008	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-33B		880603-002	01-Jun-88	X	X	880426-003	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-34B		880603-003	01-Jun-88	X	X	880425-011	22-Apr-88	- 1 -	- 2 -	X	X	X	X
CHENOWETH #1		880603-006	01-Jun-88	X	X	880420-027	19-Apr-88	- 1 -	- 2 -	X	X	X	X
CHENOWETH #2		-	-	N	N	880420-028	19-Apr-88	- 1 -	- 2 -	X	X	X	X
CHENOWETH #3		880603-007	01-Jun-88	X	X	880429-005	27-Apr-88	- 1 -	- 2 -	X	X	X	X
ANIMAL SHELTER		880603-005	01-Jun-88	X	X	880420-029	19-Apr-88	- 1 -	- 2 -	X	X	X	X
RESIDENTIAL WELL		880603-001	01-Jun-88	X	X	880429-004	27-Apr-88	- 1 -	- 2 -	X	X	X	X
SA-D	TEST PIT SUMP	880606-013	04-Jun-88	X	X	880429-007	27-Apr-88	- 1 -	- 2 -	X	X	X	X
OCWP-B	TEST PIT SUMP	880606-014	04-Jun-88	X	X	880429-008	27-Apr-88	- 1 -	- 2 -	X	X	X	X
OCWP-D	TEST PIT SUMP	880606-015	04-Jun-88	X	X	880429-009	27-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-5FB	FIELD BLANK	880606-024	03-Jun-88	X	X	880425-010	21-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-9FB	FIELD BLANK	880606-003	02-Jun-88	X	X	880422-007	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW9-SR2	SAMPLER RINSATE	-	-	N	N	880421-014	19-Apr-88	- 1 -	- 2 -	X	X	X	X
OCWP-SR1	SAMPLER RINSATE	880606-016	04-Jun-88	X	X	880429-010	27-Apr-88	- 1 -	- 2 -	X	X	X	X
TRIP BLANK #1		880603-004	27-May-88	X	X	880420-030	15-Apr-88	- 1 -	- 2 -	X	X	X	X
TRIP BLANK		-	-	N	N	880426-004	15-Apr-88	- 1 -	- 2 -	X	X	X	X
TRIP BLANK #1		880606-020	31-May-88	X	X	880429-006	20-Apr-88	- 1 -	- 2 -	X	X	X	X

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = FIVE FREE CYANIDE DUPLICATE ANALYSES WERE RUN; ONE SAMPLE OUTSIDE QC LIMITS
2 = FIVE TOTAL CYANIDE DUPLICATE ANALYSES WERE RUN; ONE SAMPLE OUTSIDE QC LIMITS

Metals QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) : Units: µg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)(a)	Duplicate Result (DR)(a)(b)	Calc RPD (c)
Arsenic (d)	0420-027	10	3.0U	3.0U	NC(e)
Arsenic (d)	0422-001	10	3.0U	3.0U	NC
Arsenic (f)	0425-008	10	3.0U	3.0U	NC
Arsenic (f)	0426-001	10	3.0U	3.0U	NC
Arsenic (g)	0429-004	10	3.0U	3.0U	NC
Sodium (d)	0420-027	500	45300	47100	3.9
Sodium (d)	0422-001	500	73800	70700	4.3
Sodium (f)	0425-008	1000	28300	28000	1.1
Sodium (f)	0426-001	1000	46700	48700	4.2
Sodium (g)	0429-004	1000	172000	169000	1.8

(a) Results reported as total metals
(b) Duplicate samples are digestion duplicates
(c) RPD = (SR-DR)/[(SR+DR)/2] X 100
(d) Associated with samples 880420-027-030,880421-014-016, 880422-001-008
(e) RPD not calculated (NC), result <QL
(f) Associated with samples 880425-008-011,880426-001-008
(g) Associated with samples 880429-004-010

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 5/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) : Units: mg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Fluoride (c)	0420-027	0.15	0.96	0.95	1.0
Fluoride (c)	0422-001	0.15	5.8	5.9	1.7
Fluoride (c)	0425-008	0.15	0.51	0.50	2.0
Fluoride (d)	0426-001	0.15	0.84	0.76	10
Fluoride (d)	0429-004	0.15	4.2	4.3	2.4
Sulfate (e)	0420-027	5.0	48	51	6.1
Sulfate (e)	0422-001	5.0	57	59	3.4
Sulfate (e)	0425-008	5.0	76	82	7.6
Sulfate (e)	0426-001	5.0	82	87	5.9
Sulfate (e)	0429-004	5.0	987	933	5.6
Free Cyanide (e)	0420-028	0.01	0.0026U	0.0026U	NC(f)
Free Cyanide (e)	0422-003	0.01	0.035	0.062	(g)(h)
Free Cyanide (e)	0422-008	0.01	0.011	[0.0050]	(g)
Free Cyanide (e)	0426-002	0.01	0.011	0.012	(g)
Free Cyanide (e)	0429-010	0.01	0.0026U	0.0026U	NC

Non-Metals QC Summary -- Duplicate Analysis (Continued)

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Total Cyanide (e)	0420-027	0.01	0.0026U	0.0026U	NC
Total Cyanide (e)	0422-002	0.01	1.10	0.84	27(h)
Total Cyanide (e)	0422-007	0.01	0.0026U	0.0026U	NC
Total Cyanide (e)	0426-001	0.01	1.35	1.36	0.74
Total Cyanide (e)	0429-007	0.01	46	48	4.3

(a) Duplicate samples are digestion duplicates
(b) RPD = (SR-DR)/[(SR+DR)/2] X 100
(c) Associated with samples 880420-027-030,880421-014-016, 880422-001-008,880425-008-011
(d) Associated with samples 880426-001-008,880429-004-010
(e) Associated with samples from (c) & (d)
(f) RPD not calculated (NC), result <QL
(g) For results < 5 x QL, values must agree within ± QL
(h) Duplicate analysis is not within control limits

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Duplicate Analysis

One sample per batch received was analyzed as a laboratory duplicate. The Relative Percent Difference (RPD) was calculated and interpreted according to the Contract Laboratory Program (CLP) Statement of Work 7/87 (see clarifications below the table) where applicable or according to data quality objectives in ESM Standard Operating Procedures. Sample result (SR), duplicate result (DR) and calculated RPDs are listed in the table. Required RPD control limits are ± 20%.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) : Units: mg/L

Parameter	Lab ID	Quantitation Limit (QL)	Sample Result (SR)	Duplicate Result (DR) (a)	Calc RPD (b)
Free Cyanide (c)	0603-002	0.01	0.102	0.101	1.0
Free Cyanide (d)	0606-002	0.01	0.063	0.054	17
Free Cyanide (e)	0606-007	0.01	0.152	0.138	9.7
Free Cyanide (f)	0606-017	0.01	0.022	0.024	(g)
Free Cyanide (h)	0606-021	0.01	0.015	0.017	(g)
Total Cyanide (c)	0603-002	0.01	2.17	2.11	2.8
Total Cyanide (d)	0606-002	0.01	3.01	3.05	1.3
Total Cyanide (e)	0606-007	0.01	8.22	8.18	0.49
Total Cyanide (f)	0606-017	0.01	0.394	0.376	4.7
Total Cyanide (h)	0606-021	0.01	0.022	0.021	(g)

(a) Duplicate samples are distilled duplicates
(b) RPD = (SR-DR)/[(SR+DR)/2] X 100

Non-Metals QC Summary -- Duplicate Analysis (Continued)

(c) Associated with samples 880603-001-007
(d) Associated with samples 880606-001-006
(e) Associated with samples 880606-007-012
(f) Associated with samples 880606-013-019
(g) For results < 5 x QL, values must agree within ± QL
(h) Associated with samples 880606-020-024

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

MATRIX SPIKE RECOVERY - INORGANICS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**P_1 & P_2/A**	SULFATE:	**A**
FREE CYANIDE:	**U/A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits (75-125%) or meet CLP criteria or >125%R and reported sample result is <IDL.
P_1 - Provisional:	Some %R not within QC limits but are between 30% to 74%; or are >125% and analyte was reported <IDL--Flag UJ.
P_2 - Provisional:	Some %R not within QC limits but are between 30% to 74% and analyte was reported at >LOQ/IDL--Flag J.
P_3 - Provisional:	%R are less than 30% or greater than 125% and analyte was detected at >LOQ/IDL--Flag J.
U - Unacceptable:	%R <30% and sample results are reported as <IDL - Flag R.

REMARKS:

Low matrix spike recovery for free and total cyanide analyses for samples collected in April -- All samples recollected in June

GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

QA DATA SUMMARY FOR: MATRIX SPIKE RECOVERY

		JUNE 1988				APRIL 1988							
WELL NUMBER	DESCRIPTION	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE
MWR-2B		880606-018	03-Jun-88	X	X	880426-001	23-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-5S		880606-023	03-Jun-88	X	X	880425-009	21-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-7B		880606-010	02-Jun-88	X	X	880422-002	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-8S		880606-007	02-Jun-88	X	X	880421-015	19-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-8A		880606-011	02-Jun-88	X	X	880422-008	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-8B		880606-012	02-Jun-88	X	X	880422-005	20-Apr-88	- 1 -	- 2 -	X	X	X	X
REP1	REP OF MW-8B	880606-001	02-Jun-88	X	X	880422-004	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-9S		880606-006	02-Jun-88	X	X	880421-016	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-9A		880606-005	02-Jun-88	X	X	880422-001	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-9B		880606-002	02-Jun-88	X	X	880422-006	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-14B		880606-009	02-Jun-88	X	X	880422-003	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-17S		880606-017	03-Jun-88	X	X	880425-008	21-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-18S		880606-019	04-Jun-88	X	X	880426-002	23-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-19S		880606-008	03-Jun-88	X	X	880426-005	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-21S		880606-021	03-Jun-88	X	X	880426-006	22-Apr-88	- 1 -	- 2 -	X	X	X	X
REP2	REP OF MW-21S	880606-022	03-Jun-88	X	X	880426-007	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-29S		880606-004	03-Jun-88	X	X	880426-008	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-33B		880603-002	01-Jun-88	X	X	880426-003	22-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-34B		880603-003	01-Jun-88	X	X	880425-011	22-Apr-88	- 1 -	- 2 -	X	X	X	X
CHENOWETH #1		880603-006	01-Jun-88	X	X	880420-027	19-Apr-88	- 1 -	- 2 -	X	X	X	X
CHENOWETH #2		-	-	N	N	880420-028	19-Apr-88	- 1 -	- 2 -	X	X	X	X
CHENOWETH #3		880603-007	01-Jun-88	X	X	880429-005	27-Apr-88	- 1 -	- 2 -	X	X	X	X
ANIMAL SHELTER		880603-005	01-Jun-88	X	X	880420-029	19-Apr-88	- 1 -	- 2 -	X	X	X	X
RESIDENTIAL WELL		880603-001	01-Jun-88	X	X	880429-004	27-Apr-88	- 1 -	- 2 -	X	X	X	X
SA-D	TEST PIT SUMP	880606-013	04-Jun-88	X	X	880429-007	27-Apr-88	- 1 -	- 2 -	X	X	X	X
OCWP-B	TEST PIT SUMP	880606-014	04-Jun-88	X	X	880429-008	27-Apr-88	- 1 -	- 2 -	X	X	X	X
OCWP-D	TEST PIT SUMP	880606-015	04-Jun-88	X	X	880429-009	27-Apr-88	- 1 -	- 2 -	X	X	X	X
MW-5FB	FIELD BLANK	880606-024	03-Jun-88	X	X	880425-010	21-Apr-88	- 1 -	- 2 -	X	X	X	X
MWR-9FB	FIELD BLANK	880606-003	02-Jun-88	X	X	880422-007	20-Apr-88	- 1 -	- 2 -	X	X	X	X
MW9-SR2	SAMPLER RINSATE	-	-	N	N	880421-014	19-Apr-88	- 1 -	- 2 -	X	X	X	X
OCWP-SR1	SAMPLER RINSATE	880606-016	04-Jun-88	X	X	880429-010	27-Apr-88	- 1 -	- 2 -	X	X	X	X
TRIP BLANK #1		880603-004	27-May-88	X	X	880420-030	15-Apr-88	- 1 -	- 2 -	X	X	X	X
TRIP BLANK		-	-	N	N	880426-004	15-Apr-88	- 1 -	- 2 -	X	X	X	X
TRIP BLANK #1		880606-020	31-May-88	X	X	880429-006	20-Apr-88	- 1 -	- 2 -	X	X	X	X

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = SIX MATRIX SPIKE SAMPLES ANALYZED; THREE SAMPLE RECOVERIES WERE NOT WITHIN CONTROL LIMITS (LOW RECOVERY 12-65%)
2 = SEVEN MATRIX SPIKE SAMPLES ANALYZED; ONE SAMPLE RECOVERY WAS NOT WITHIN CONTROL LIMITS (LOW RECOVERY 34%)

Metals QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) : Units: µg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result(a)	Sample Result(a)	Spike Added	%R (b)
Arsenic(c)	-027	75 - 125	21	3.0U	20	105
Arsenic(c)	-001	75 - 125	21	3.0U	20	105
Arsenic(d)	-008	75 - 125	21	3.0U	20	105
Arsenic(d)	-001	75 - 125	17	3.0U	20	85
Arsenic(e)	-004	75 - 125	15	3.0U	20	75
Sodium (c)	-027	75 - 125	61000	45300	10000	(f)
Sodium (c)	-001	75 - 125	79100	73800	10000	(f)
Sodium (d)	-008	75 - 125	36700	28300	10000	84
Sodium (d)	-001	75 - 125	59100	46700	10000	(f)
Sodium (e)	-004	75 - 125	176000	172000	10000	(f)

(a) Results reported as total metals
(b) %R = [(SSR-SR)/SA] x 100
(c) Associated with samples 880420-027-030,880421-014-016, 880422-001-008. Samples 880420-027 & 880422-001 were spiked
(d) Associated with samples 880425-008-011,880426-001-008. Samples 880425-008 & 880426-001 were spiked
(e) Associated with samples 880429-004-010
(f) %R not calculated (NC), Sample concentration > 4 x SA

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) : Units: mg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Fluoride(b)	-027	75 - 125	11	0.77(c)	10	102
Fluoride(b)	-001	75 - 125	14	4.6 (c)	10	94
Fluoride(b)	-008	75 - 125	10	0.41(c)	10	96
Fluoride(d)	-001	75 - 125	4.8	0.67(c)	5.0	83
Fluoride(d)	-004	75 - 125	7.8	3.4 (c)	5.0	88
Sulfate (e)	-027	75 - 125	169	48	100	121
Sulfate (e)	-001	75 - 125	141	57	100	84
Sulfate (e)	-008	75 - 125	188	76	100	112
Sulfate (e)	-001	75 - 125	184	82	100	102
Sulfate (e)	-004	75 - 125	1870	987	100	88
Free Cyanide (f)	0420-030	75 - 125	0.13	0.0026U	0.20	65(g)
Free Cyanide (f)	0421-015	75 - 125	0.25	0.096	0.20	77
Free Cyanide (f)	0422-007	75 - 125	0.025	0.0026U	0.20	12(g)
Free Cyanide (f)	0425-010	75 - 125	0.16	0.0026U	0.20	80
Free Cyanide (f)	0429-004	75 - 125	0.19	[0.0091]	0.20	90
Free Cyanide (f)	0429-008	75 - 125	7.3	1.9	10 (h)	54(g)

Non-Metals QC Summary -- Spike Recoveries (Continued)

Parameter	Lab ID	Control Limits	Spiked Sample Result (a)	Sample Result(a)	Spike Added	%R (b)
Total Cyanide (f)	0421-015	75 - 125	7.7	7.2	0.20	(i)
Total Cyanide (f)	0422-001	75 - 125	2.8	3.7	0.20	(i)
Total Cyanide (f)	0422-004	75 - 125	0.55	0.38	0.20	85
Total Cyanide (f)	0422-008	75 - 125	0.96	0.76	0.20	100
Total Cyanide (f)	0425-008	75 - 125	0.19	0.0026U	0.20	95
Total Cyanide (f)	0426-005	75 - 125	0.16	[0.0054]	0.20	77
Total Cyanide (f)	0429-004	75 - 125	0.085	0.017	0.20	34(g)

(a) %R = [(SSR-SR)/SA] x 100
(b) Associated with samples 880420-027-030,880421-014-016, 880423-001-008,880425-008-011
(c) Results corrected for volume of spike added
(d) Associated with samples 880426-001-008,880429-004-010. Samples 880426-001 and 880429-004 were spiked
(e) Associated with samples from (b) & (d), samples 880420-027, 880422-001,880425-008,880426-001 and 880429-004 were spiked
(f) Associated with samples 880420-027-030,880421-014-016, 880423-001-008,880425-008-011,880426-001-008,880429-004-010
(g) Spike recovery is not within the control limits
(h) Sample diluted 50 X before spiking
(i) %R not calculated (NC), sample concentration > 4 x SA

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Non-Metals QC Summary -- Spike Recoveries

One sample per batch was spiked and analyzed for the parameters listed in the table below. Spiked sample result (SSR), sample result (SR), spike added (SA), percent recovery (%R), and control limits are also listed.

Matrix: Water Associated Samples: see footnotes (ESM ID RANGE) Units: mg/L

Parameter	Lab ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Free Cyanide (b)	0603-003	75 - 125	0.203	[0.0037]	0.20	100
Free Cyanide (c)	0606-004	75 - 125	0.191	0.0026U	0.20	96
Free Cyanide (d)	0606-008	75 - 125	0.211	0.010	0.20	101
Free Cyanide (e)	0606-019	75 - 125	0.170	[0.0058]	0.20	82
Free Cyanide (f)	0606-023	75 - 125	0.460	0.304	0.20	78
Total Cyanide (b)	0603-003	75 - 125	0.208	0.012	0.20	98
Total Cyanide (c)	0606-004	75 - 125	0.198	0.007	0.20	96
Total Cyanide (d)	0606-008	75 - 125	0.226	0.034	0.20	96
Total Cyanide (e)	0606-019	75 - 125	0.211	0.040	0.20	86
Total Cyanide (f)	0606-023	75 - 125	18.3	18.2	0.20	(g)

(a) %R = [(SSR-SR)/SA] x 100
(b) Associated with samples 880603-001-007
(c) Associated with samples 880606-001-006
(d) Associated with samples 880606-007-012
(e) Associated with samples 880606-013-019
(f) Associated with samples 880606-020-024
(g) %R not calculated (NC), sample concentration > 4 x SA

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

CALIBRATION CURVE STANDARDS - INORGANICS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**A/A**	SULFATE:	**A**
FREE CYANIDE:	**A/A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All curves three- to five-point curves with lowest standard at the LOQ; ICP - one point.

U - Unacceptable: Less than three-point curve and/or lowest standard not at the LOQ; no one-point verification for ICP.

REMARKS:

None

April 1988 Analyses

Analytical QC Data -- Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Arsenic	206.2	10	µg/L
Arsenic	206.2	25	µg/L
Arsenic	206.2	50	µg/L
Sodium	200.7	50000	µg/L

April 1988 Analyses
Analytical QC Data -- Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Cyanide (free) Cyanide(total)	412.H 335.2	0.010	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.050	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.200	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.400	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.800	mg/L
Fluoride	340.2	0.1	mg/L
Fluoride	340.2	1.0	mg/L
Fluoride	340.2	5.0	mg/L
Fluoride	340.2	10	mg/L
Fluoride	340.2	50	mg/L
Fluoride	340.2	100	mg/L
Sulfate	375.4	5.0	mg/L
Sulfate	375.4	10	mg/L
Sulfate	375.4	20	mg/L
Sulfate	375.4	30	mg/L
Sulfate	375.4	40	mg/L

June 1988 Analyses

Analytical QC Data -- Concentration of Calibration Curve Standards

Parameter	Method	Standard Concentration	Units
Cyanide (free) Cyanide(total)	412.H 335.2	0.010	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.060	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.200	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.400	mg/L
Cyanide (free) Cyanide(total)	412.H 335.2	0.800	mg/L

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

INITIAL AND CONTINUING CALIBRATION VERIFICATION - INORGANICS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**P/A**	SULFATE:	**A**
FREE CYANIDE:	**A/A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: %R of ICVS and CCVS inside of QC limits (± 10% R).

P - Provisional: %R of ICVS or CCVS outside of QC limits, but not less than 50% or greater than 150%.

U - Unacceptable: %R of ICVS or CCVS outside QC limits but less than 50% or greater than 150%.

N - Not Applicable

REMARKS:

Continuing calibration standards were outside control limits for total cyanide analyses in April -- All samples recollected in June

GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

QA DATA SUMMARY FOR: INITIAL AND CONTINUING CALIBRATION VERIFICATION

		JUNE 1988				APRIL 1988							
WELL NUMBER	DESCRIPTION	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE
MWR-2B		880606-018	03-Jun-88	X	X	880426-001	23-Apr-88	X	- 2 -	X	X	X	X
MW-5S		880606-023	03-Jun-88	X	X	880425-009	21-Apr-88	X	- 1 -	X	X	X	X
MW-7B		880606-010	02-Jun-88	X	X	880422-002	20-Apr-88	X	- 1 -	X	X	X	X
MW-8S		880606-007	02-Jun-88	X	X	880421-015	19-Apr-88	X	- 1 -	X	X	X	X
MWR-8A		880606-011	02-Jun-88	X	X	880422-008	20-Apr-88	X	- 1 -	X	X	X	X
MWR-8B		880606-012	02-Jun-88	X	X	880422-005	20-Apr-88	X	X	X	X	X	X
REP1	REP OF MW-8B	880606-001	02-Jun-88	X	X	880422-004	20-Apr-88	X	X	X	X	X	X
MW-9S		880606-006	02-Jun-88	X	X	880421-016	20-Apr-88	X	X	X	X	X	X
MWR-9A		880606-005	02-Jun-88	X	X	880422-001	20-Apr-88	X	- 1 -	X	X	X	X
MW-9B		880606-002	02-Jun-88	X	X	880422-006	20-Apr-88	X	- 1 -	X	X	X	X
MW-14B		880606-009	02-Jun-88	X	X	880422-003	20-Apr-88	X	- 1 -	X	X	X	X
MW-17S		880606-017	03-Jun-88	X	X	880425-008	21-Apr-88	X	- 1 -	X	X	X	X
MW-18S		880606-019	04-Jun-88	X	X	880426-002	23-Apr-88	X	- 2 -	X	X	X	X
MW-19S		880606-008	03-Jun-88	X	X	880426-005	22-Apr-88	X	- 2 -	X	X	X	X
MW-21S		880606-021	03-Jun-88	X	X	880426-006	22-Apr-88	X	- 2 -	X	X	X	X
REP2	REP OF MW-21S	880606-022	03-Jun-88	X	X	880426-007	22-Apr-88	X	- 2 -	X	X	X	X
MW-29S		880606-004	03-Jun-88	X	X	880426-008	22-Apr-88	X	- 2 -	X	X	X	X
MW-33B		880603-002	01-Jun-88	X	X	880426-003	22-Apr-88	X	X	X	X	X	X
MW-34B		880603-003	01-Jun-88	X	X	880425-011	22-Apr-88	X	- 1 -	X	X	X	X
CHENOWETH #1		880603-006	01-Jun-88	X	X	880420-027	19-Apr-88	X	X	X	X	X	X
CHENOWETH #2		-	-	N	N	880420-028	19-Apr-88	X	X	X	X	X	X
CHENOWETH #3		880603-007	01-Jun-88	X	X	880429-005	27-Apr-88	X	- 2 -	X	X	X	X
ANIMAL SHELTER		880603-005	01-Jun-88	X	X	880420-029	19-Apr-88	X	- 1 -	X	X	X	X
RESIDENTIAL WELL		880603-001	01-Jun-88	X	X	880429-004	27-Apr-88	X	- 2 -	X	X	X	X
SA-D	TEST PIT SUMP	880606-013	04-Jun-88	X	X	880429-007	27-Apr-88	X	X	X	X	X	X
OCWP-B	TEST PIT SUMP	880606-014	04-Jun-88	X	X	880429-008	27-Apr-88	X	X	X	X	X	X
OCWP-D	TEST PIT SUMP	880606-015	04-Jun-88	X	X	880429-009	27-Apr-88	X	X	X	X	X	X
MW-5FB	FIELD BLANK	880606-024	03-Jun-88	X	X	880425-010	21-Apr-88	X	- 1 -	X	X	X	X
MWR-9FB	FIELD BLANK	880606-003	02-Jun-88	X	X	880422-007	20-Apr-88	X	X	X	X	X	X
MW9-SR2	SAMPLER RINSATE	-	-	N	N	880421-014	19-Apr-88	X	X	X	X	X	X
OCWP-SR1	SAMPLER RINSATE	880606-016	04-Jun-88	X	X	880429-010	27-Apr-88	X	X	X	X	X	X
TRIP BLANK #1		880603-004	27-May-88	X	X	880420-030	15-Apr-88	X	X	X	X	X	X
TRIP BLANK		-	-	N	N	880426-004	15-Apr-88	X	- 2 -	X	X	X	X
TRIP BLANK #1		880606-020	31-May-88	X	X	880429-006	20-Apr-88	X	X	X	X	X	X

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = FOUR CONTINUING CALIBRATION STANDARDS ANALYZED; ALL FOUR WERE OUTSIDE QC LIMITS (77-78%)
2 = THREE CONTINUING CALIBRATIONS STANDARDS ANALYZED; ONE WAS OUTSIDE QC LIMITS (113%)

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: µg/L

Parameter	Initial Calibration			Continuing Calibration					
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)		Amount Found	%R (a)
Arsenic(b)	24	24	100	24	24	100		25	104
Arsenic				24	25	104			
Arsenic(b)	24	25	104	24	25	104		24	100
Arsenic				24	24	100		24	100
Arsenic(c)	30	32	107	30	33	110		32	107
Arsenic				30	31	103		33	110
Arsenic				30	33	110			
Arsenic(d)	30	32	107	30	33	110		31	103
Arsenic				30	31	103		32	107
Arsenic(d)	30	31	103	30	29	97		33	110
Sodium (b)	25400	26100	103	25400	26500	104		26600	105
Sodium				25400	27000	106		27400	108
Sodium (c)	25400	25300	100	25400	24800	98		25200	99
Sodium				25400	25600	101			
Sodium (c)	25400	24000	94	25400	24200	95		24400	96
Sodium (d)	25400	24000	94	25400	24400	96		24100	95
Sodium				25400	24400	96		24100	95

(a) %R = (Amount Found / True Value) x 100 Control Limits=90-110%

Analytical QC Data - Initial and Continuing Calibration Verification (Continued)

(b) Associated with samples 880420-027-030,88041-014-016, 880422-001-008
(c) Associated with samples 880425-008-011,880426-001-008
(d) Associated with samples 880429-004-010

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
Fluoride (b)	5.0	5.4	108	5.0	5.0	100	4.8	96
Fluoride (b)				5.0	5.0	100	4.9	98
Fluoride (c)	5.0	5.2	104	5.0	5.1	102	5.2	104
Fluoride (c)				5.0	4.8	96		
Sulfate (d)	20	18.7	94	20	19.1	96	19.3	96
Sulfate (d)				20	18.5	92	18.2	91
Sulfate (d)				20	18.9	94	18.5	92

(a) %R = (Amount Found / True Value) x 100
Control Limits = 90-110%
(b) Associated with samples 880420-027-030,880421-014-016, 880422-001-008,880425-008-011
(c) Associated with samples 880426-001-008,880429-004-010
(d) Associated with samples 880420-027-030,880421-014-016, 880422-001-008,880425-008-011,880426-001-008,880429-004-010

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
CN (free)(b)	0.200	0.214	107	0.200	0.213	106	0.216	108
CN (free)(b)				0.200	0.208	104		
CN (free)(b)				0.400	0.362	90		
CN (free)(c)	0.400	0.419	105	0.400	0.422	106	0.432	108
CN (free)(d)	0.400	0.435	109	0.400	0.432	108	0.429	107
CN (free)(e)	0.400	0.419	105	0.400	0.410	103	0.435	109
CN (free)(f)	0.200	0.190	95	0.200	0.208	104	0.206	103
CN (free)(g)	0.400	0.428	107	0.400	0.431	108	0.404	101

(a) %R = (Amount Found / True Value) x 100
Control Limits=90-110%
(b) Associated with samples 880420-027-030,880421-014-016, 880422-001-008,880425-008-009,880426-004
(c) Associated with samples 880425-010-011,880426-001-002
(d) Associated with samples 880426-003-008,880429-004-005
(e) Associated with samples 880429-006-007,009
(f) Associated with samples 880429-010
(g) Associated with samples 880429-008

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration				
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)	Amount Found	%R (a)
CN(total)(b)	0.400	0.402	101	0.400	0.402	101	0.389	97
CN(total)(b)				0.400	0.380	95		
CN(total)(c)	0.200	0.191	95	0.200	0.168	84(d)	0.154	77(d)
CN(total)(c)				0.200	0.150	75(d)	0.157	78(d)
CN(total)(e)	0.400	0.419	105	0.400	0.435	109	0.453	113(d)
CN(total)(e)				0.400	0.388	97		
CN(total)(f)	0.200	0.190	95	0.200	0.215	108	0.214	107
CN(total)(g)	0.400	0.428	107	0.400	0.430	108	0.431	108

(a) %R = (Amount Found / True Value) x 100
Control Limits=90-110%
(b) Associated with samples 880420-027-028,030,880421-014,016, 880422-004-005,007
(c) Associated with samples 880420-029,880421-015,880422-001-003, 880422-006,008,880425-008-011
(d) %R not within control limits
(e) Associated with samples 880426-001-002,004-008,880429-004-005
(f) Associated with samples 880426-003,880429-007
(g) Associated with samples 880429-006,008-010

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration					
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)		Amount Found	%R (a)
CN (free)(b)	0.200	0.198	99	0.200	0.197	98		0.193	96
CN (free)(b)				0.200	0.200	100		0.197	98
CN (free)(c)	0.200	0.200	100	0.200	0.200	100		0.196	98
CN (free)(d)	0.200	0.201	100	0.200	0.203	102		0.200	100
CN (free)(e)	0.200	0.204	102	0.200	0.193	96		0.191	96
CN (free)(e)				0.200	0.191	96		0.189	94
CN (free)(f)	0.200	0.200	100	0.200	0.204	102		0.201	100
CN (free)(f)				0.200	0.196	98		0.190	95

(a) %R = (Amount Found / True Value) x 100
Control Limits=90-110%
(b) Associated with samples 880603-001-007,880606-001-003,005-006
(c) Associated with samples 880606-004,009-012
(d) Associated with samples 880606-008,013-014,016-017,020
(e) Associated with samples 880606-015,018-019,021-022
(f) Associated with samples 880606-007,023-024

Analytical QC Data - Initial and Continuing Calibration Verification

Note: The table contains two "Continuing Calibration " columns. The column to the left will contain values for the first continuing calibration verification standard, and the column to the right and below will contain values for the second, third and etc. continuing calibration verification standards. The column to the right and/or below will be empty if no second continuing calibration verification standard was performed. Each subsequent initial calibration is listed in the Initial Calibration column.

Associated Samples: see footnotes
(ESM ID RANGE) :

Units: mg/L

Parameter	Initial Calibration			Continuing Calibration					
	True Value	Amount Found	%R (a)	True Value	Amount Found	%R (a)		Amount Found	%R (a)
CN(total)(b)	0.200	0.198	99	0.200	0.184	92		0.190	95
CN(total)(b)				0.200	0.196	98		0.192	96
CN(total)(c)	0.200	0.200	100	0.200	0.192	96		0.189	94
CN(total)(d)	0.200	0.201	100	0.200	0.194	97		0.191	96
CN(total)(e)	0.200	0.204	102	0.200	0.196	98		0.193	96
CN(total)(e)				0.200	0.191	96		0.189	94
CN(total)(f)	0.200	0.200	100	0.200	0.204	102		0.200	100
CN(total)(f)				0.200	0.193	96		0.190	95

(a) %R = (Amount Found / True Value) x 100
Control Limits=90-110%
(b) Associated with samples 880603-001-007,880606-001-003,005-006
(c) Associated with samples 880606-004,007,009-012
(d) Associated with samples 880606-008,013-017
(e) Associated with samples 880606-015,018-022
(f) Associated with samples 880606-023-024

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

LABORATORY CONTROL SAMPLES (LCS) - INORGANICS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**U/A**	SULFATE:	**N**
FREE CYANIDE:	**U/A**	SODIUM:	**A**
FLUORIDE:	**N**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits or CLP criteria (± 20% R).
P - Provisional:	%R outside QC limits but not <30% or >120%. Flag all data associated as J.
U - Unacceptable:	If LCS falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable -Flag R.
N - Not Applicable:	LCS are not required; LCS are used to evaluate method/sample preparation; analysis does not require preparation.

REMARKS:

Free and total cyanide laboratory control samples were outside control limits for samples collected in April -- All samples recollected in June

GROUND-WATER SAMPLING
MMRF, THE DALLES
JUNE AND APRIL 1988

QA DATA SUMMARY FOR: LABORATORY CONTROL SAMPLES

		JUNE 1988				APRIL 1988							
WELL NUMBER	DESCRIPTION	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	LAB ID	DATE COLLECTED	FREE CYANIDE	TOTAL CYANIDE	FLUORIDE (BY ISE)	TOTAL ARSENIC	TOTAL SODIUM	SULFATE
MWR-2B		880606-018	03-Jun-88	X	X	880426-001	23-Apr-88	X	- 2 -	N	X	X	N
MW-5S		880606-023	03-Jun-88	X	X	880425-009	21-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-7B		880606-010	02-Jun-88	X	X	880422-002	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-8S		880606-007	02-Jun-88	X	X	880421-015	19-Apr-88	- 1 -	X	N	X	X	N
MWR-8A		880606-011	02-Jun-88	X	X	880422-008	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MWR-8B		880606-012	02-Jun-88	X	X	880422-005	20-Apr-88	- 1 -	- 2 -	N	X	X	N
REP1	REP OF MW-8B	880606-001	02-Jun-88	X	X	880422-004	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-9S		880606-006	02-Jun-88	X	X	880421-016	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MWR-9A		880606-005	02-Jun-88	X	X	880422-001	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-9B		880606-002	02-Jun-88	X	X	880422-006	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-14B		880606-009	02-Jun-88	X	X	880422-003	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-17S		880606-017	03-Jun-88	X	X	880425-008	21-Apr-88	- 1 -	- 2 -	N	X	X	N
MW-18S		880606-019	04-Jun-88	X	X	880426-002	23-Apr-88	X	- 2 -	N	X	X	N
MW-19S		880606-008	03-Jun-88	X	X	880426-005	22-Apr-88	X	- 2 -	N	X	X	N
MW-21S		880606-021	03-Jun-88	X	X	880426-006	22-Apr-88	X	- 2 -	N	X	X	N
REP2	REP OF MW-21S	880606-022	03-Jun-88	X	X	880426-007	22-Apr-88	X	- 2 -	N	X	X	N
MW-29S		880606-004	03-Jun-88	X	X	880426-008	22-Apr-88	X	- 2 -	N	X	X	N
MW-33B		880603-002	01-Jun-88	X	X	880426-003	22-Apr-88	X	- 2 -	N	X	X	N
MW-34B		880603-003	01-Jun-88	X	X	880425-011	22-Apr-88	X	- 2 -	N	X	X	N
CHENOWETH #1		880603-006	01-Jun-88	X	X	880420-027	19-Apr-88	X	X	N	X	X	N
CHENOWETH #2		-	-	N	N	880420-028	19-Apr-88	X	X	N	X	X	N
CHENOWETH #3		880603-007	01-Jun-88	X	X	880429-005	27-Apr-88	X	- 2 -	N	X	X	N
ANIMAL SHELTER		880603-005	01-Jun-88	X	X	880420-029	19-Apr-88	X	- 2 -	N	X	X	N
RESIDENTIAL WELL		880603-001	01-Jun-88	X	X	880429-004	27-Apr-88	X	- 2 -	N	X	X	N
SA-D		880606-013	04-Jun-88	X	X	880429-007	27-Apr-88	X	X	N	X	X	N
OCWP-B		880606-014	04-Jun-88	X	X	880429-008	27-Apr-88	- 1 -	X	N	X	X	N
OCWP-D		880606-015	04-Jun-88	X	X	880429-009	27-Apr-88	X	X	N	X	X	N
MW-5FB	FIELD BLANK	880606-024	03-Jun-88	X	X	880425-010	21-Apr-88	X	- 2 -	N	X	X	N
MWR-9FB	FIELD BLANK	880606-003	02-Jun-88	X	X	880422-007	20-Apr-88	- 1 -	- 2 -	N	X	X	N
MW9-SR2	SAMPLER RINSATE	-	-	X	X	880421-014	19-Apr-88	- 1 -	X	N	X	X	N
OCWP-SR1	SAMPLER RINSATE	880606-016	04-Jun-88	X	X	880429-010	27-Apr-88	X	X	N	X	X	N
TRIP BLANK #1		880603-004	27-May-88	X	X	880420-030	15-Apr-88	X	X	N	X	X	N
TRIP BLANK		-	-	X	X	880426-004	15-Apr-88	- 1 -	- 2 -	N	X	X	N
TRIP BLANK #1		880606-020	31-May-88	X	X	880429-006	20-Apr-88	X	- 2 -	N	X	X	N

NOTES: X = ANALYSIS PASSES QA PROTOCOL
N = NOT REQUIRED/NOT ANALYZED
1 = LABORATORY CONTROL SAMPLES OUTSIDE QC LIMITS (10-70%R)
2 = LABORATORY CONTROL SAMPLES OUTSIDE QC LIMITS (27-78%R)

Analytical QC Data -- Laboratory Control Sample

Matrix: Water Units: mg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
CN (free)	80-120	880420-027-030	0.200	0.199	100
CN (free)	80-120	880421-014-016, 880422-001-002	0.200	0.110	55(b)
CN (free)	80-120	880422-003-006, 880426-004	0.200	0.140	70(b)
CN (free)	80-120	880422-007-008 880425-008-009	0.200	0.021	10(b)
CN (free)	80-120	880425-010-011, 880426-001-002	0.200	0.176	88
CN (free)	80-120	880426-003,005-008, 880429-004-005	0.200	0.198	99
CN (free)	80-120	880429-006-007,009-010	0.200	0.193	96
CN (free)	80-120	880429-008	0.200	0.130	65(b)
CN (total)	80-120	880420-027-028,030, 880421-014-015	0.200	0.162	81
CN (total)	80-120	880420-029,880421-016, 880422-001-002	0.200	0.110	55(b)
CN (total)	80-120	880422-004-006	0.200	0.155	78(b)
CN (total)	80-120	880422-007-008	0.200	0.054	27(b)
CN (total)	80-120	880422-003, 880425-008-011	0.200	0.075	38(b)
CN (total)	80-120	880426-001-006	0.200	0.098	49(b)
CN (total)	80-120	880426-007-008, 880429-004-006	0.200	0.124	62(b)
CN (total)	80-120	880429-007-010	0.200	0.218	109

(a) %R = (Amount Found / True Value) x 100
(b) %R not within control limits

Analytical QC Data -- Laboratory Control Sample

Matrix: Water Units: µg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
Arsenic	80-120	880420-027-030, 880421-014-016, 880422-001-008	30	28	93
Arsenic	80-120	880425-008-011, 880426-001-008	30	28	93
Arsenic	80-120	880429-004-010	30	28	93
Sodium	80-120	880420-027-030, 880421-014-016, 880422-001-008	10000	9520	95
Sodium	80-120	880425-008-011, 880426-001-08	10000	10400	104
Sodium	80-120	880429-004-010	10000	9950	100

(a) %R = (Amount Found / True Value) x 100

Analytical QC Data -- Laboratory Control Sample

Matrix: Water Units: mg/L

Parameter	Control Limits	Associated Samples (ESM ID RANGE)	True Value	Amount Found	%R (a)
CN (free)	80-120	880603-001,003-007 880606-001	0.400	0.405	101
CN (free)	80-120	880603-002, 880606-002-003,005-006	0.400	0.356	89
CN (free)	80-120	880606-007	0.400	0.137	93
CN (free)	80-120	880606-004,009-012	0.400	0.382	96
CN (free)	80-120	880606-008,013-014, 880606-016-017,020	0.400	0.388	97
CN (free)	80-120	880606-015,018-019, 880606-021-022	0.400	0.347	87
CN (free)	80-120	880606-023-024	0.400	0.376	94
CN (total)	80-120	880603-001,003-007	0.400	0.385	96
CN (total)	80-120	880603-002, 880606-001-003,005-006	0.400	0.373	93
CN (total)	80-120	880606-004,007,009-012	0.400	0.364	91
CN (total)	80-120	880606-008,013-014, 880606-016-017	0.400	0.382	96
CN (total)	80-120	880606-015,018-022	0.400	0.360	90
CN (total)	80-120	880606-023-024	0.400	0.357	89

(a) %R = (Amount Found / True Value) x 100

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

ICP SERIAL DILUTIONS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**N**	SULFATE:	**N**
FREE CYANIDE:	**N**	SODIUM:	**A**
FLUORIDE:	**N**	ARSENIC:	**N**

CRITERIA:

A - Acceptable: All %D within QC limits or CLP criteria (± 10% D).

P - Provisional: %D outside QC limits but not <30% or >120%. Flag all data associated as J.

U - Unacceptable: If %D falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable - Flag R.

N - Not Applicable: Serial dilutions are not required.

REMARKS:

None

Analytical QC Data -- ICP Serial Dilutions

Matrix: Water Units: µg/L

Parameter	Control Limits	ESM Sample ID	Initial Sample Result(I)	Serial Dilution Result(S)	%D*
Sodium	± 10%	880422-001	73800	70200	4.9
Sodium	± 10%	880426-001	46700	48400	3.6
Sodium	± 10%	880429-005	41100	45100	9.7

* Percent Difference (%D) = [(I - S) / I] x 100

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

AA - POST DIGESTION SPIKE RECOVERY

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**

PARAMETERS:

TOTAL CYANIDE:	**N**	SULFATE:	**N**
FREE CYANIDE:	**N**	SODIUM:	**N**
FLUORIDE:	**N**	ARSENIC:	**A**

CRITERIA:

A - Acceptable:	All %R within QC limits or CLP criteria (± 15% R).
P - Provisional:	%R outside QC limits but not <30% or >120%. Flag all data associated as J.
U - Unacceptable:	If %R falls less than 30%, this is indicative of several laboratory or method deficiencies and the data should be reported as unusable - Flag R.
N - Not Applicable:	Post digestion spike recovery analyses are not required.

REMARKS:

None

Analytical QC Data -- Post Digested (Analytical) Spike Recoveries

Matrix: Water Units: µg/L

Parameter	ESM ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Arsenic	880420-027	85-115	17.8	3.0U	20	89(b)
Arsenic	880420-028	85-115	22.3	[4.5]	20	89
Arsenic	880420-029	85-115	23.0	[3.3]	20	98
Arsenic	880420-030	85-115	23.6	3.0U	20	118(b)
Arsenic	880421-014	85-115	22.1	3.0U	20	110(b)
Arsenic	880421-015	85-115	22.9	3.0U	20	114(b)
Arsenic	880421-016	85-115	20.4	3.0U	20	102(b)
Arsenic	880422-001	85-115	21.9	3.0U	20	110(b)
Arsenic	880422-002	85-115	18.8	3.0U	20	94(b)
Arsenic	880422-003	85-115	19.5	3.0U	20	98(b)
Arsenic	880422-004	85-115	19.1	3.0U	20	96(b)
Arsenic	880422-005	85-115	21.6	3.0U	20	108(b)
Arsenic	880422-006	85-115	23.0	[4.7]	20	92
Arsenic	880422-007	85-115	20.7	3.0U	20	104(b)
Arsenic	880422-008	85-115	21.2	3.0U	20	106(b)
Arsenic	880425-008	85-115	20.8	3.0U	20	104(b)
Arsenic	880425-009	85-115	18.4	3.0U	20	92(b)
Arsenic	880425-010	85-115	20.1	3.0U	20	100(b)
Arsenic	880425-011	85-115	17.9	3.0U	20	89(b)
Arsenic	880426-001	85-115	17.6	3.0U	20	88(b)
Arsenic	880426-002	85-115	14.0	3.0U	20	70(b)
Arsenic	880426-003	85-115	18.4	3.0U	20	92(b)
Arsenic	880426-004	85-115	19.9	3.0U	20	100(b)
Arsenic	880426-005	85-115	17.3	3.0U	20	86(b)

Analytical QC Data -- Post Digested (Analytical) Spike Recoveries (Continued)

Matrix: Water Units: µg/L

Parameter	ESM ID	Control Limits	Spiked Sample Result	Sample Result	Spike Added	%R (a)
Arsenic	880426-006	85-115	17.2	3.0U	20	86(b)
Arsenic	880426-007	85-115	17.3	3.0U	20	86(b)
Arsenic	880426-008	85-115	18.5	3.0U	20	92(b)
Arsenic	880429-004	85-115	19.0	3.0U	20	95(b)
Arsenic	880429-005	85-115	17.7	3.0U	20	88(b)
Arsenic	880429-006	85-115	22.0	3.0U	20	110(b)
Arsenic (c)	880429-007	85-115	41.7	24.6	20	86
Arsenic (d)	880429-008	85-115	45.1	24.4	20	104
Arsenic (e)	880429-009	85-115	29.9	8.6	20	106
Arsenic	880429-010	85-115	21.6	[4.3]	20	86

(a) %R =[(Spiked Sample Result - Sample Result)/Spike Added] x 100
(b) %R > 40% and sample absorbance < 50% of the spike absorbance. By EPA/CLP SOW 7/87, samples are reported to IDL, 85-115 %R control limits do not apply.
(c) Sample diluted 5 X
(d) Sample diluted 25 X
(e) Result determined by Method of Standard Addition, sample diluted 100 X

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

TRIP BLANKS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**
(excluding April Free and Total Cyanide analyses)

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**P**
FREE CYANIDE:	**A**	SODIUM:	**P**
FLUORIDE:	**P**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: No evidence of contamination above minimum detection limits.

P - Provisional: Contaminants present but minimal or no evidence of interference with sample results.

U - Unacceptable: Gross contamination resulting in definite compromise to the sample data integrity.

REMARKS:

Trace amount of total cyanide, flouride, sodium and sulfate between IDC and LOQ found in Trip Blanks -- No samples biased

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

FIELD BLANKS

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**
(excluding April Free and Total Cyanide analyses)

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**P**
FREE CYANIDE:	**P**	SODIUM:	**P**
FLUORIDE:	**P**	ARSENIC:	**P**

CRITERIA:

A - Acceptable: No contamination in any blank;

P - Provisional: Some blanks contaminated, no apparent interference with any sample results;

U - Unacceptable: Gross contamination in blanks indicating poor sampling technique, bottle contamination, airborne contamination, preservative contamination, or improper handling. Data for batch invalid or suspect.

REMARKS:

Sampler rinsate blank (880606-016) had trace amounts of free cyanide; field blank (880422-007) had trace amounts of Fluoride; field blanks (880422-007) and (880425-010) had trace amounts of sodium -- No samples biased

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

FIELD REPLICATES

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**
(excluding April Free and Total Cyanide analyses)

PARAMETERS:

TOTAL CYANIDE:	**P**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All RPDs are within QC limits (± 30% RPD);

P - Provisional: Some RPDs are outside QC limits;

U - Unacceptable: All RPDs are outside QC limits.

REMARKS:

MW-21S field replicate had 56% RPD for total cyanide -- No samples biased

LABORATORY DATA VALIDATION
QUALITY ASSURANCE REVIEW
RI SUPPLEMENT
MMRF, THE DALLES

SPLIT SAMPLES

SAMPLING EVENT: **Ground Water**

DATE: **April/June 1988**
(excluding April Free and Total Cyanide analyses)

PARAMETERS:

TOTAL CYANIDE:	**A**	SULFATE:	**A**
FREE CYANIDE:	**A**	SODIUM:	**A**
FLUORIDE:	**A**	ARSENIC:	**A**

CRITERIA:

A - Acceptable: All RPDs are within QC limits (± 30% RPD);

P - Provisional: Some RPDs are outside QC limits;

U - Unacceptable: All RPDs are outside QC limits.

REMARKS:

None

SPLIT SAMPLE ANALYSES
GROUND WATER
MMRF, THE DALLES, OR
APRIL/JUNE 1988

SPLIT SAMPLE MW-8S		VERSAR 880606-007 880421-015	ECOVA 840-01 758-01	RPD
TOTAL CN	MG/L	8.2	7.3	11.6
FREE CN	MG/L	0.15	0.116	25.6
FLUORIDE	MG/L	0.68	0.84	21.1
SULFATE	MG/L	152	170	11.2
SODIUM	MG/L	57.5	59.5	3.4
ARSENIC	MG/L	0.003 U	0.005 U	NC

SPLIT SAMPLE MW-9S		VERSAR 880606-006 880421-016	ECOVA 840-02 758-02	RPD
TOTAL CN	MG/L	0.8	0.70	13.3
FREE CN	MG/L	0.043	0.051	17.0
FLUORIDE	MG/L	1.5	1.47	2.0
SULFATE	MG/L	25	19.4	25.2
SODIUM	MG/L	48.5	55.9	14.2
ARSENIC	MG/L	0.003 U	0.005 U	NC

SPLIT SAMPLE MWR-9A		VERSAR 880606-005 880422-001	ECOVA 840-03 759-01	RPD
TOTAL CN	MG/L	3.4	3.60	5.7
FREE CN	MG/L	0.065	0.077	16.9
FLUORIDE	MG/L	5.8	6.33	8.7
SULFATE	MG/L	57	60.4	5.8
SODIUM	MG/L	73.8	74.4	0.8
ARSENIC	MG/L	0.003 U	0.005 U	NC

NOTES: NC - NOT CALCULATED
RPD - RELATIVE PERCENT DIFFERENCE

021DAL4:JUNSPLIT.WK1

APPENDIX D

APPENDIX D

SPRING 1988 ANALYTICAL RESULTS

APPENDIX D

SPRING 1988 ANALYTICAL RESULTS

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D-1

ANALYTICAL RESULTS FOR SAMPLES COLLECTED JANUARY 29 TO FEBRUARY 11, 1988 (VERSAR)

RESULTS OF ANALYSES OF SOIL AND WATER SAMPLES COLLECTED DURING 29 JANUARY AND 11 FEBRUARY 1988 FROM MARTIN MARIETTA ALUMINUM THE DALLES REDUCTION PLANT

TASK ORDER NO. 901-000-TD4
G&M Project Number TF0487P004

Prepared for

Martin Marietta Aluminum
3313 W. Second Street
The Dalles, Oregon 97058

Prepared by

VERSAR, Inc., ESM Operations
Analytical Chemistry Services
9200 Rumsey Road
Columbia MD, 21045

Versar Report Number 80

30 March 1988
Revised 17 June 1988

CASE NARRATIVE

During 8 February and 16 February 1988, Versar Inc., ESM Operations received 19 water samples, 7 soil samples, and 3 water blanks collected during 29 January to 11 February 1988 from Martin Marietta Aluminum, The Dalles Reduction Plant. A list of samples received and corresponding laboratory tracking numbers is presented in Table 1. Additional sample information can be found on the Chain-of-Custody forms included as Appendix D.

Results of analysis are presented in Tables 2 and 3, with quality control data presented in Appendices A, B, and C. A holding time summary has been included as Appendix E, and a quantitation limits summary has been included as Appendix F.

Non-Metals Analysis

Cyanide (free and total)

All holding times for water and soil field samples were met, but two trip blanks, Versar ID 880208-052 and 054, exceeded holding times by four days. These trip blanks were distilled within allowed holding times, but were not colorized until the field samples were analyzed. The trip blanks contained no cyanide (free or total).

Sulfide scrubbers containing lead acetate solution were used for both water and soil sample distillations. None of the scrubbers were discolored during the distillations, indicating no bound sulfide in any of the samples.

With the exception of sample 880216-006, all of the spike recoveries were within control limits. Sample 880216-006 was within allowable limits for total cyanide, but was low for free cyanide. The free cyanide spike was not re-run because all of the sample volume was used during analysis.

Fluoride

All holding times were met for fluoride analysis. Samples for fluoride were analyzed using an ion specific electrode. The quality control for these analyses were all within acceptable ranges.

CASE NARRATIVE (continued)

Non-Metals Analysis (continued)

Sulfate

All holding times for water and soil field samples for sulfate analysis were met, but two trip blanks, Versar ID 880208-052 and 880208-054, exceeded holding times by three days. The trip blanks contained no sulfate.

Sulfate was analyzed using the turbidimetric method. Quality control results were all within acceptable ranges.

Metals Analysis

All holding times for water and soil samples were met for the analyses of arsenic and sodium. All quality control results are within acceptable ranges.

Arsenic was analyzed by graphite furnace. It was necessary to dilute sample 880212-018 because of matrix interferences. The value obtained before multiplying by the dilution factor was between our Instrument Detection Level (IDL) and our Level of Quantitation (LOQ), therefore the result of [15] µg/L is in brackets.

All samples for sodium were analyzed by inductively coupled plasma (ICP). An Interference Check Sample (ICS) for sodium was not run since it is not one of the EPA/CLP SOW 787 ICS parameters.

RELEASE OF THE DATA CONTAINED IN THIS REPORT HAS BEEN AUTHORIZED BY THE LABORATORY MANAGER OR A DESIGNEE, AS VERIFIED BY THE FOLLOWING SIGNATURE:

Douglas J. McInnes
Project Manager

DATE: 30 March 88
30 March 1988

Table 1. Sample Identification Cross Reference

G & M, Inc. Sample Number	Versar, Inc., ESM Operations Laboratory Sample Number
CCSWG - 3R	880208-043
CCSWG - 7R	880208-044
CCSWG - 8R-	880208-045
CCSWG - 5R-	880208-046
CCSWG - 6R	880208-047
CCSDG - 7R	880208-048
CCSDG - 9R	880208-049
CCSWG - 1R	880208-050
CCSWG - 2R	880208-051
Trip Blank #1	880208-052
CCSWG - 4R	880208-053
Trip Blank #6	880208-054
CCSDG - 1R	880208-055
CCSDG - 2R	880208-056
CCSDG - 3R	880208-057
CCSDG - 4R	880208-058
CCSDG - 5R	880208-059
CCSDG - 6R	880208-060
CCSDG - 8R	880208-061
BRTPW - 1G	880212-011
BRTPW - 2G	880212-012
Trip Blank #8	880212-013
RRTPW - 5G -	880212-014
OCTPW - 12G	880212-015
SATPW - 3G	880212-016
OCTPW - 10G	880212-017
OCTPW - 11G -	880212-018
RRTPW - 110G	880216-005
RRTPW - 111G	880216-006

Table 2. Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	CCSWG-3R	CCSWG-7R	CCSWG-8R	
Sample Number:	880208-043	880208-044	880208-045	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
arsenic	[3.6]	3.0U	3.0U	µg/L
sodium	5940	1440	5720	µg/L

* - Results reported as Total Metals
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	CCSWG-5R	CCSWG-6R	CCSWG-1R	
Sample Number:	880208-046	880208-047	880208-050	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	5550	6160	5960	µg/L

* - Result reported as Total Metals
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater taht IDL but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	CCSWG-2R	TRIP BLANK #1	CCSWG-4R	
Sample Number:	880208-051	880208-052	880208-053	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	29-JAN-1988	4-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	5600	[289]	5850	µg/L

* - Results reported as Total Metals
U - Result less than Instrument Detection Limit
[] - Result greater than IDL but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	BRTPW-1G	BRTPW-2G	TRIP BLANK #8	
Sample Number:	880212-011	880212-012	880212-013	
Date Received:	12-FEB-1988	12-FEB-1988	12-FEB-1988	
Date Sampled:	10-FEB-1988	10-FEB-1988	9-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	[3.9]	[3.6]	µg/L
sodium	91500	251000	[558]	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	RRTPW-5G	OCTPW-12G	SATPW-3G	
Sample Number:	880212-014	880212-015	882012-016	
Date Received:	12-FEB-1988	12-FEB-1988	12-FEB-1988	
Date Sampled:	10-FEB-1988	10-FEB-1988	10-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	9.9	3.0U	51	µg/L
sodium	15000	[628]	810000	µg/L

* - Results reported as Total Metals
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	OCTPW-10G	OCTPW-11G	
Sample Number:	880212-017	880212-018	
Date Received:	12-FEB-1988	12-FEB-1988	
Date Sampled:	10-FEB-1988	10-FEB-1988	
Matrix:	WATER	WATER	
Compounds	Results(a)		Units
arsenic	[3.2]	[15](b)	µg/L
sodium	1000	16000	µg/L

(a) - Results reported as Total Metals
(b) - Sample diluted 3x due to matrix interference, thus 15 µg/L is below the adjusted quantitation limit and is reported in brackets

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	RRTPW-110G	RRTPW-111G	
Sample Number:	880216-005	880216-006	
Date Received:	16-FEB-1988	16-FEB-1988	
Date Sampled:	11-FEB-1988	11-FEB-1988	
Matrix:	WATER	WATER	
Compounds	Results*		Units
arsenic	480	568	µg/L
sodium	620000	949000	µg/L

* - Result reported as Total Metals
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-1.

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-1R	CCSDG-2R	CCSDG-3R	
Sample Number:	880208-055	880208-056	880208-057	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988	
Matrix:	SOIL	SOIL	SOIL	
Compounds	Results *			Units
cyanide, free	0.033U	0.037U	0.036U	mg/kg
cyanide, total	0.033U	0.037U	0.036U	mg/kg
fluoride by ISE	[1.2]	2.4	[1.4]	mg/kg
percent solids	80	70	73	%

* - Results reported as dry weight covered for percent solids
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-1. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-4R	CCSDG-5R	CCSDG-6R	
Sample Number:	880208-058	880208-059	880208-060	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988	
Matrix:	SOIL	SOIL	SOIL	
Compounds	Results*			Units
cyanide, free	0.035U	0.030U	0.035U	mg/kg
cyanide, total	0.035U	0.59	0.035U	mg/kg
fluoride by ISE	[0.96]	[0.97]	[1.6]	mg/kg
percent solids	74	86	74	%

* - Results reported as dry weight, corrected for percent solids
U - Results less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-1. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-8R
Sample Number:	880208-061
Date Received:	6-FEB-1988
Date Sampled:	4-FEB-1988
Matrix:	SOIL

Compounds	Results*	Units
cyanide, free	0.031U	mg/kg
cyanide, total	0.031U	mg/kg
fluoride by ISE	[1.2]	mg/kg
percent solids	85	%

* - Result reported as dry weight, corrected for percent solids
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantittion Limit

Table 3-2.

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSWG-3R	CCSWG-7R	CCSWG-8R
Sample Number:	880208-043	880208-044	880208-045
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988
Matrix:	WATER	WATER	WATER

Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0026U	0.0026U	mg/L
fluoride by ISE	[0.12]	0.048U	[0.093]	mg/L
sulfate, turbidimetric	7.4	1.0U	7.2	mg/L

U - Result less that Instrument Detection Limit (IDL)
[] - Result greater that IDL but less than Quantitaion Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSWG-5R	CCSWG-6R	CCSDG-7R	
Sample Number:	880208-046	880208-047	880208-048	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0039U	0.0026U	mg/L
fluoride by ISE	[0.10]	[0.10]	0.048U	mg/L
sulfate, turbidimetric	6.7	6.5	NR	mg/L

NR - Not required
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-9R	CCSWG-1R	CCSWG-2R	
Sample Number:	880208-049	880208-050	880208-051	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	4-FEB-1988	4-FEB-1988	4-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0026U	0.0026U	mg/L
fluoride by ISE	0.048U	[0.084]	[0.13]	mg/L
sulfate	NR	7.4	6.9	mg/L

NR - Not required
U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	TRIP BLANK #1	CCSWG-4R	TRIP BLANK #6	
Sample Number:	880208-052	880208-053	880208-054	
Date Received:	6-FEB-1988	6-FEB-1988	6-FEB-1988	
Date Sampled:	29-JAN-1988	4-FEB-1988	29-JAN-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0026U	0.0026U	mg/L
fluoride by ISE	0.048U	[0.11]	0.048U	mg/L
sulfate, turbidimetric	1.0U	7.4	1.0U	mg/L

U - Result less than Instrument Detection Limit
[] - Result greater than IDL but less than Quantitation Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	BRTPW-1G	BRTPW-2G	
Sample Number:	880212-011	880212-012	
Date Received:	12-FEB-1988	12-FEB-1988	
Date Sampled:	10-FEB-1988	10-FEB-1988	
Matrix:	WATER	WATER	
Compounds	Results		Units
cyanide, free	0.028	3.6	mg/L
cyanide, total	18	26	mg/L
fluoride by ISE	34	11	mg/L
sulfate, turbidimetric	30	490	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	TRIP BLANK #8	RRTPW-5G	OCTPW-12G	
Sample Number:	880212-013	880212-014	880212-015	
Date Received:	12-FEB-1988	12-FEB-1988	12-FEB-1988	
Date Sampled:	9-FEB-1988	10-FEB-1988	10-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.48	[0.0073]	mg/L
cyanide, total	0.0026U	1.2	0.0026U	mg/L
fluoride by ISE	0.048U	0.52	[0.050]	mg/L
sulfate, turbidimetric	1.0U	47	1.0U	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL but less than Quantitation Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	SATPW-3G	OCTPW-10G	OCTPW-11G	
Sample Number:	880212-016	880212-017	880212-018	
Date Received:	12-FEB-1988	12-FEB-1988	12-FEB-1988	
Date Sampled:	10-FEB-1988	10-FEB-1988	10-FEB-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	33	[0.0045]	0.36	mg/L
cyanide, total	190	0.0026U	1.2	mg/L
fluoride by ISE	288	[0.057]	0.39	mg/L
sulfate, turbidimetric	131	[1.1]	42	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] - Results greater than IDL but less than Quantitation Limit

Table 3-2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	RRTPW-110G	RRTPW-111G
Sample Number:	880216-005	880216-006
Date Received:	16-FEB-1988	16-FEB-1988
Date Sampled:	11-FEB-1988	11-FEB-1988
Matrix:	WATER	WATER

Compounds	Results		Units
cyanide, free	0.13	0.30	mg/L
cyanide, total	24	27	mg/L
fluoride by ISE	73	78	mg/L
sulfate, turbidimetric	78	116	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] _ Result greater than IDL but less than Quantitation Limit

D-2

ANALYTICAL RESULTS FOR SAMPLES COLLECTED MARCH 3 TO 7, 1988 (VERSAR)

RESULTS OF ANALYSES OF SOIL AND WATER SAMPLES COLLECTED DURING 3 MARCH AND 7 MARCH 1988 FROM MARTIN MARIETTA ALUMINUM THE DALLES REDUCTION PLANT

TASK ORDER NO. 901-000-TD4
G&M Project Number TF0487P004

Prepared for

Martin Marietta Aluminum
3313 W. Second Street
The Dalles, Oregon 97058

Prepared by

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Columbia, MD 21045

Versar Report Number 88

22 April 1988

QUALITY GUARANTEE

The Environmental Chemistry Laboratory of Versar Inc., ESM Operations pledges that the work for this report was performed according to the terms and conditions mutually agreed upon. To that extent, the data presented are complete, precise, and accurate.

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CASE NARRATIVE

On 9 March 1988 Versar Inc., ESM Operations received 7 soil samples, 11 water samples, and 4 water blanks collected during 3 March and 7 March 1988 from Martin Marietta Aluminum, The Dalles Reduction Plant. A list of samples received and corresponding laboratory tracking numbers is presented in Table 1. Additional sample information can be found on the Chain-of-Custody forms included as Appendix D.

Results of analysis are presented in Tables 2 through 4, with quality control data presented in Appendices A, B, and C. A holding time summary has been included as Appendix E, and a summary of quantitation limits and methods of analysis has been included as Appendix F. For samples that had no recorded sampling date on the Chain-of-Custody forms the date noted on the sample bottle label was used to calculate holding times.

Non-Metals Analysis

Cyanide (free and total)

Sulfide scrubbers containing lead acetate solution were used for both water and soil sample distillations. None of the scrubbers were discolored during the distillations, indicating no bound sulfide in any of the samples.

Soil Samples

All soil field samples met the EPA approved water sample holding time. Spike recoveries, duplicate analyses and laboratory blanks were all within acceptable limits. Results are reported on a dry weight basis in mg/kg.

Water Samples

All holding times for water field samples were met, but two trip blanks, Versar ID 880309-031 and 040, exceeded the two week holding time by one day. These trip blanks were distilled within allowed holding times, but were not colorized until the field samples were analyzed.

All of the field samples contained no detectable free or total cyanide, but Trip Blank #6, Versar ID 880309-031, was positive for total cyanide. The trip blank could not be reanalyzed because all sample volume was distilled during the first analysis. Ms. K. Duchac and Mr. C.W. Ankerberg were informed about the positive trip blank result by telephone on 31 March 1988. After checking the analysis results of the associated field blank and rinseate, both of which contained no cyanide, Mr. Ankenberg stated that the positive trip blank result would not invalidate the field sample data.

Trip Blank #5, Versar ID 880309-030, had a sampling date of January 29, 1988, but was not received by Versar until forty days later. The sample value for total cyanide was 0.0027 mg/kg which is below the quantitation limit (0.010 mg/kg), but slightly above the instrument detection limit (0.0026 mg/kg)

Fluoride

Soil Samples

All soil field samples met the EPA approved holding time for water samples. EPA has not established a holding time for this parameter in soil samples. Spike recoveries, duplicate analyses and laboratory blanks were all within acceptable limits.

Soil samples were leached in de-ionized water for 24 hours. The leachate was then analyzed, and the results calculated back to the dry weight of sample used.

Water Samples

All holding times were met for water samples analyzed for fluoride. The quality control for these analyses were all within control limits.

Sulfate

Water Samples

All holding times for sulfate analysis were met. Samples were analyzed for sulfate using the turbidimetric method. Quality control results were all within acceptable ranges.

Metals Analysis

Water Samples

All holding times were met for the analysis of arsenic, sodium and cadmium. All quality control results are within acceptable ranges.

An Interference Check Sample (ICS) for sodium was not run since it is not one of the EPA/CLP SOW 787 ICS QC parameters.

Table 1. List of samples received on 9 March 1988 and corresponding laboratory tracking numbers

The Dalles Sample ID	Versar Inc. ESM Operations Sample ID
CCSDG-5R2	880309-025
CCSDG-6R2	880309-026
CCSDG-7R2	880309-027
CCSDG-8R2	880309-028
CCSDG-9R2	880309-029
TRIP BLANK #5	880309-030
TRIP BLANK #6	880309-031
TRIP BLANK #4	880309-032
CCSWG-4R2	880309-033
CCSWG-5R2	880309-034
CCSWG-6R2	880309-035
CCSWG-8R2	880309-036
CCSWG-1R2	880309-037
CCSWG-2R2	880309-038
CCSWG-3R2	880309-039
TRIP BLANK #1	880309-040
CCSDG-1R2	880309-041
CCSDG-2R2	880309-042
CCSDG-3R2	880309-043
CCSDG-4R2	880309-044
CCSDG-7R2	880309-045
MMSTWG-1	880309-046

Table 2. Versar Inc., ESM Operations Analytical Laboratory Results of Metals Analysis

Cust Samp No.:	CCSWG-4R2
Sample Number:	880309-033
Date Received:	9-MAR-1988
Date Sampled:	7-MAR-1988
Matrix:	WATER

Compounds	Results *	Units
arsenic	3.0U	ug/l
sodium	7740	ug/l

* - Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	CCSWG-5R2	CCSWG-6R2	CCSWG-8R2	
Sample Number:	880309-034	880309-035	880309-036	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:	7-MAR-1988	7-MAR-1988	7-MAR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results *			Units
arsenic	[4.2]	[3.9]	3.0U	ug/l
sodium	8120	8270	[211]	ug/l

* Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	CCSWG-1R2	CCSWG-2R2	CCSWG-3R2	
Sample Number:	880309-037	880309-038	880309-039	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:	7-MAR-1988	7-MAR-1988	7-MAR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results *			Units
arsenic	[3.6]	[3.1]	[3.4]	ug/l
sodium	7900	7630	7920	ug/l

* - Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	CCSWG-7R2	MMSTWG-1	
Sample Number:	880309-045	880309-046	
Date Received:	9-MAR-1988	9-MAR-1988	
Date Sampled:	7-MAR-1988	7-MAR-1988	
Matrix:	WATER	WATER	
Compounds	Results (a)		Units
arsenic	[3.6]	NR (b)	ug/l
cadmium	NR	238000	ug/l
sodium	7720	NR	ug/l

(a) - Results reported as total metals
(b) - NR - Not Required

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table 2. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Analysis

Cust Samp No.:	TRIP BLANK #1	
Sample Number:	880309-040	
Date Received:	9-MAR-1988	
Date Sampled:	3-MAR-1988	
Matrix:	WATER	
Compounds	Results *	Units
arsenic	3.0U	ug/l
sodium	[309]	ug/l

* - Results reported as total metals

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

Table 3.

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-5R2	CCSDG-6R2	CCSDG-7R2	
Sample Number:	880309-025	880309-026	880309-027	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:				
Matrix:	SOIL	SOIL	SOIL	
Compounds	Results*			Units
cyanide, free	0.033U	0.030U	0.032U	mg/kg
cyanide, total	0.033U	0.030U	0.032U	mg/kg
fluoride by ISE	[1.0]	[0.77]	[0.82]	mg/kg
percent solids	78	86	81	%

* - Results reported as dry weight

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less thant Quantitation Limit

Table 3. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-1R2	CCSDG-2R2	CCSDG-3R2	
Sample Number:	880309-041	880309-042	880309-043	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:	7-MAR-1988	7-MAR-1988	7-MAR-1988	
Matrix:	SOIL	SOIL	SOIL	
Compounds	Results *			Units
cyanide, free	0.035U	0.038U	0.033U	mg/kg
cyanide, total	0.035U	0.038U	0.033U	mg/kg
fluoride by ISE	[1.5]	[1.2]	[1.1]	mg/kg
percent solids	74	69	79	%

* - Results reported as dry weight

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 3. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-4R2	
Sample Number:	880309-044	
Date Received:	9-MAR-1988	
Date Sampled:	7-MAR-1988	
Matrix:	SOIL	
Compounds	Results *	Units
cyanide, free	0.032U	mg/kg
cyanide, total	0.032U	mg/kg
fluoride by ISE	[1.5]	mg/kg
percent solids	82	%

* - Results reported as dry weight

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 4.

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSDG-8R2	CCSDG-9R2	CCSWG-4R2	
Sample Number:	880309-028	880309-029	880309-033	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:			7-MAR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0026U	0.0026U	mg/L
fluoride by ISE	0.048U	0.048U	[0.12]	mg/L
sulfate, turbidimetric	NR *	NR	9.7	mg/L

* - NR - Not Required

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 4. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSWG-5R2	CCSWG-6R2	CCSWG-8R2	
Sample Number:	880309-034	880309-035	880309-036	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:	7-MAR-1988	7-MAR-1988	7-MAR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0026U	0.0026U	mg/L
fluoride by ISE	0.15	[0.13]	0.048U	mg/L
sulfate, turbidimetric	10	9.4	1.0U	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 4. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSWG-1R2	CCSWG-2R2	CCSWG-3R2	
Sample Number:	880309-037	880309-038	880309-039	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:	7-MAR-1988	7-MAR-1988	7-MAR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	0.0026U	0.0026U	mg/L
cyanide, total	0.0026U	0.0026U	0.0026U	mg/L
fluoride by ISE	[0.12]	[0.13]	[0.13]	mg/L
sulfate, turbidimetric	6.7	6.7	9.2	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 4. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	CCSWG-7R2
Sample Number:	880309-045
Date Received:	9-MAR-1988
Date Sampled:	7-MAR-1988
Matrix:	WATER

Compounds	Results	Units
cyanide, free	0.0026U	mg/L
cyanide, total	0.0026U	mg/L
fluoride by ISE	[0.10]	mg/L
sulfate, turbidimetric	7.7	mg/L

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 4. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	TRIP BLANK #5	TRIP BLANK #6	TRIP BLANK #4	
Sample Number:	880309-030	880309-031	880309-032	
Date Received:	9-MAR-1988	9-MAR-1988	9-MAR-1988	
Date Sampled:	29-JAN-1988	3-MAR-1988	3-MAR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide, free	0.0026U	NR *	NR	mg/L
cyanide, total	[0.0027]	0.032	NR	mg/L
fluoride, by ISE	NR	NR	[0.13]	mg/L

* - NR - Not Required

U - Result less than Instrument Detection Limit (IDL)
[] - Result greater than IDL, but less than Quantitation Limit

Table 4. continued

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Analysis

Cust Samp No.:	TRIP BLANK #1
Sample Number:	880309-040
Date Received:	9-MAR-1988
Date Sampled:	3-MAR-1988
Matrix:	WATER

Compounds	Results	Units
cyanide, free	0.0026U	mg/L
cyanide, total	0.0026U	mg/L
fluoride by ISE	0.048U	mg/L
sulfate, turbidimetric	1.0U	mg/L

U - Result less than Instrument Detection Limit (IDL)
[ ] - Result greater than IDL, but less than Quantitation Limit

D-3

ANALYTICAL RESULTS FOR SAMPLES COLLECTED APRIL 19 TO 27, 1988 AND JUNE 1-4, 1988 (VERSAR)

RESULTS OF ANALYSIS OF WATER SAMPLES COLLECTED DURING 19 APRIL AND 27 APRIL 1988 FROM MARTIN MARIETTA ALUMINUM THE DALLES REDUCTION PLANT PROJECT NO. TF0487P003

REPORT NO. 98

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24 June 1988

REPORT SUMMARY

During 20 April and 29 April 1988 Versar Inc., ESM Operations received 31 water samples, and 3 water blanks collected during 19 April and 27 April 1988 from Martin Marietta Aluminum, The Dalles Reduction Plant. A list of samples received and corresponding laboratory tracking numbers is presented in Table 1. Additional sample information can be found on the Chain-of-Custody forms included as Appendix C.

Results of analysis are presented following Table 1, with quality control sample data presented in Appendix A, and analytical quality control data presented in Appendix B. A sample holding time summary has been included as Appendix D, and a quantitation limits summary has been included as Appendix E.

Quality control limits referred to in the metals and non-metals narratives refers to the limits presented in Task Order for Laboratory Services 901-999-TD1, Attachment A.

METALS ANALYSIS

All holding times were met for the analysis of arsenic and sodium. All quality control results were within control limits.

An Interference Check Sample (ICS) for sodium was not run since it is not one of the EPA/CLP SOW 787 ICS QC parameters.

Cyanide (free and total) Analysis

Sulfide scrubbers containing lead acetate solution were used for all distillations. None of the scrubbers were discolored during the distillations, indicating no bound sulfide in any of the samples.

Free Cyanide

Holding times for all samples were met with the following exceptions:

Samples 880425-010 and 880425-011 were not analyzed until 1 and 20 days, respectively, past holding time.

Samples 880420-030, 880426-004, and 880429-006 (trip blanks) were not analyzed until 4, 4, and 2 days, respectively, past holding time. No cyanide was present in these trip blanks.

All seven preparation blanks were less that the quantitation limit of 0.010 mg/L. One preparation blank was measured between the quantitation limit and the instrument detection limit of 0.0026 mg/L ([0.0034] mg/L). According to EPA CLP procedures, preparation blanks below the quantitation limit are acceptable. Of the five duplicates run, four were within control limits. Of the six matrix spikes, three were within control limits. According to EPA CLP procedures no re-analysis is required for these samples.

All six Initial Calibration Verification Standards (ICVS) were within control limits. All fourteen Continuing Calibration Verification Standards (CCVS) were within control limits. Of the eight Laboratory Control Standards (LCS), four were within control limits. According to EPA CLP procedures, when an LCS fails the analysis must be stopped and the problem resolved. The previous samples associated with the failed LCS must then be re-distilled and re-analyzed. Due to the limited holding time (14 days) for cyanide's, the samples associated with the failed LCS's were not re-run once the problem had been resolved.

Total Cyanide

Holding times for all samples were met with the following exceptions:

Samples 880420-029, 880421-015, and 880426-003 were not analyzed until 1, 1, and 3 days, respectively, past holding time.

Samples 880426-004 and 880429-006 (trip blanks) were not analyzed until 7 and 6 days,respectively, past holding time. No cyanide was present in sample 880426-004, and sample 880429-006 contained 0.010 mg/L cyanide.

Of the nine preparation blanks one was above the quantitation limit of 0.010 mg/L (0.010 mg/L), and one was measured between the quantitation limit and the instrument detection limit of 0.0026 mg/L ([0.0035] mg/L). According to EPA CLP procedures, if a preparation blank contains an analyte at a concentration greater than the quantitation limit the associated samples must be re-distilled and re-analyzed. Due to the limited holding time (14 days) for cyanide's, the samples associated with the high preparation blank were not re-run once the problem had been resolved.

Of the five duplicates run, four were within control limits. Of the seven matrix spikes, six were within control limits. According to EPA CLP procedures no re-analysis is required for these samples.

All five Initial Calibration Verification Standards (ICVS) were within control limits. Of the fourteen Continuing Calibration Verification Standards (CCVS), nine were within control limits. According to EPA CLP procedures, if a CCVS is out of control limits the analysis must be stopped, the problem resolved, and the group of samples associated with the out of control CCVS re-analyzed. These samples exceeded holding times before the problem was resolved and the samples re-analyzed.

Of the eight Laboratory Control Standards (LCS), one was within control limits. According to EPA CLP procedures, when an LCS fails, the analysis must be stopped and the problem resolved. The previous samples associated with the failed LCS must then be re-distilled and re-analyzed. Due to the limited holding time (14 days) for cyanide's the samples associated with the failed LCS's were not re-run once the problem had been resolved.

Fluoride Analysis

All holding times were met for samples analyzed for fluoride. The quality control results were all within control limits.

Sulfate Analysis

All holding times for sulfate analysis were met. Samples were analyzed for sulfate using the turbidimetric method. Quality control results were all within control limits.

Table 1. List of samples received between 20 and 29 April 1988 and their corresponding laboratory tracking numbers

The Dalles Sample ID	Versar Inc., ESM Operations Sample ID
MMRF-CHEN1	880420-027
MMRF-CHEN2	880420-028
MMRF-SHELTER	880420-029
TRIP BLANK #1	880420-030
MMRF-MW9-SR2 *	880421-014
MMRF-MW-8S	880421-015
MMRF-MW-9S	880421-016
MMRF-MWR-9A	880422-001
MMRF-MWR-7B	880422-002
MMRF-MW-14B	880422-003
MMRF-REP1	880422-004
MMRF-MWR-8B	880422-005
MMRF-MWR-9B	880422-006
MMRF-MWR-9FB	880422-007
MMRF-MWR-8A	880422-008
MMRF-MW-17S	880425-008
MMRF-MW-5S	880425-009
MMRF-MW-5FB	880425-010
MMRF-MW-34B	880425-011
MMRF-MWR-2B	880426-001
MMRF-MW-18S	880426-002
MMRF-MW-33B	880426-003
TRIP BLANK #2	880426-004
MMRF-MW-19S	880426-005
MMRF-MW-21S	880426-006
MMRF-REP2	880426-007
MMRF-MW-29S	880426-008

* - Sample ID on the chain-of-custody form was changed from MMRF-MW9-SR1 to MMRF-MW9-SR2 by telephone on 21 April 1988 by K. Duchac. The sample bottles were correctly labeled.

Table 1. continued

The Dalles Sample ID	Versar Inc., ESM Operations Sample ID
MMRF-RESWELL	880429-004
MMRF-CHEN3	880429-005
TRIP BLANK #1	880429-006
MMRF-SA-D	880429-007
MMRF-OCWP-B	880429-008
MMRF-OCWP-D	880429-009
MMRF-OCWP-SR1	880429-010

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-CHEN1	MMRF-CHEN2	MMRF-SHELTER	
Sample Number:	880420-027	880420-028	880420-029	
Date Received:	20-APR-1988	20-APR-1988	20-APR-1988	
Date Sampled:	19-APR-1988	19-APR-1988	19-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	[4.5]	[3.3]	µg/L
sodium	45300	49400	5080	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	TRIP BLANK #1	MMRF-MW9-SR2	MMRF-MW-8S	
Sample Number:	880420-030	880421-014	880421-015	
Date Received:	20-APR-1988	21-APR-1988	21-APR-1988	
Date Sampled:	15-APR-1988	19-APR-1988	19-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	[166]	534	57500	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MW-9S	MMRF-MWR-9A	MMRF-MWR-7B	
Sample Number:	880421-016	880422-001	880422-002	
Date Received:	21-APR-1988	22-APR-1988	22-APR-1988	
Date Sampled:	19-APR-1988	20-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	48500	73800	24700	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MW-14B	MMRF-REP1	MMRF-MWR-8B	
Sample Number:	880422-003	880422-004	880422-005	
Date Received:	22-APR-1988	22-APR-1988	22-APR-1988	
Date Sampled:	20-APR-1988	20-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	20600	17100	17200	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MWR-9B	MMRF-MWR-9FB	MMRF-MWR-8A	
Sample Number:	880422-006	880422-007	880422-008	
Date Received:	22-APR-1988	22-APR-1988	22-APR-1988	
Date Sampled:	20-APR-1988	20-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	[4.7]	3.0U	3.0U	µg/L
sodium	109000	[209]	35200	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MW-17S	MMRF-MW-5S	MMRF-MW-5FB	
Sample Number:	880425-008	880425-009	880425-010	
Date Received:	23-APR-1988	23-APR-1988	23-APR-1988	
Date Sampled:	21-APR-1988	21-APR-1988	21-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	28300	547000	[269]	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MW-34B	MMRF-MWR-2B	MMRF-MW-18S	
Sample Number:	880425-011	880426-001	880426-002	
Date Received:	23-APR-1988	25-APR-1988	25-APR-1988	
Date Sampled:	22-APR-1988	23-APR-1988	23-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	33100	46700	244000	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MW-33B	TRIP BLANK #2	MMRF-MW-19S	
Sample Number:	880426-003	880426-004	880426-005	
Date Received:	25-APR-1988	25-APR-1988	25-APR-1988	
Date Sampled:	22-APR-1988	15-APR-1988	22-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	19100	17U	168000	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-MW-21S	MMRF-REP2	MMRF-MW-29S	
Sample Number:	880426-006	880426-007	880426-008	
Date Received:	25-APR-1988	25-APR-1988	25-APR-1988	
Date Sampled:	22-APR-1988	22-APR-1988	22-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	224000	230000	61900	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-RESWELL	MMRF-CHEN3	TRIP BLANK #1	
Sample Number:	880429-004	880429-005	880429-006	
Date Received:	29-APR-1988	29-APR-1988	29-APR-1988	
Date Sampled:	27-APR-1988	27-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	3.0U	3.0U	3.0U	µg/L
sodium	172000	41100	[280]	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MMRF-SA-D	MMRF-OCWP-B	MMRF-OCWP-D	
Sample Number:	880429-007	880429-008	880429-009	
Date Received:	29-APR-1988	29-APR-1988	29-APR-1988	
Date Sampled:	27-APR-1988	27-APR-1988	27-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results*			Units
arsenic	123	610	860	µg/L
sodium	2090000	7400000	6290000	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Metals Lab

Cust Samp No.:	MRF-OCWP-SR1	
Sample Number:	880429-010	
Date Received:	29-APR-1988	
Date Sampled:	27-APR-1988	
Matrix:	WATER	
Compounds	Results*	Units
arsenic	[4.3]	µg/L
sodium	1380	µg/L

* - Results reported as Total Metals
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-CHEN1	MMRF-CHEN2	MMRF-SHELTER	
Sample Number:	880420-027	880420-028	880420-029	
Date Received:	20-APR-1988	20-APR-1988	20-APR-1988	
Date Sampled:	19-APR-1988	19-APR-1988	19-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.0026U	0.0026U	[0.0035]	mg/L
cyanide (total) *	0.0026U	0.0026U	0.065U	mg/L
fluoride by ISE	0.96	0.98	0.25	mg/L
sulfate, turbidimetric	48	47	14	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	TRIP BLANK #1	MMRF-MW9-SR2	MMRF-MW-8S	
Sample Number:	880420-030	880421-014	880421-015	
Date Received:	20-APR-1988	21-APR-1988	21-APR-1988	
Date Sampled:	15-APR-1988	19-APR-1988	19-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.0026U	0.0026U	0.096	mg/L
cyanide (total) *	0.0026U	0.0026U	7.2	mg/L
fluoride by ISE	0.048U	0.048U	0.68	mg/L
sulfate, turbidimetric	1.0U	[1.0]	152	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MW-9S	MMRF-MWR-9A	MMRF-MWR-7B	
Sample Number:	880421-016	880422-001	880422-002	
Date Received:	21-APR-1988	22-APR-1988	22-APR-1988	
Date Sampled:	19-APR-1988	20-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.068	0.027	0.026	mg/L
cyanide (total) *	0.19	3.7	1.1	mg/L
fluoride by ISE	1.5	5.8	0.48	mg/L
sulfate, turbidimetric	25	57	85	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MW-14B	MMRF-REP1	MMRF-MWR-8B	
Sample Number:	880422-003	880422-004	880422-005	
Date Received:	22-APR-1988	22-APR-1988	22-APR-1988	
Date Sampled:	20-APR-1988	20-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.035	0.034	0.032	mg/L
cyanide (total) *	0.44	0.38	0.31	mg/L
fluoride by ISE	0.56	0.60	0.71	mg/L
sulfate, turbidimetric	64	47	38	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MWR-9B	MMRF-MWR-9FB	MMRF-MWR-8A	
Sample Number:	880422-006	880422-007	880422-008	
Date Received:	22-APR-1988	22-APR-1988	22-APR-1988	
Date Sampled:	20-APR-1988	20-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free)	0.047	0.0026U	0.011	mg/L
cyanide (total)	2.8	0.0026U	0.76	mg/L
fluoride by ISE	9.7	0.22	0.67	mg/L
sulfate, turbidimetric	53	[1.3]	86	mg/L

U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MW-17S	MMRF-MW-5S	MMRF-MW-5FB	
Sample Number:	880425-008	880425-009	880425-010	
Date Received:	23-APR-1988	23-APR-1988	23-APR-1988	
Date Sampled:	21-APR-1988	21-APR-1988	21-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.0026U	0.069	0.0026U	mg/L
cyanide (total) *	0.0026U	011.4	[0.0032]	mg/L
fluoride by ISE	0.51	28	0.18	mg/L
sulfate, turbidimetric	76	85	1.0U	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MW-34B	MMRF-MWR-2B	MMRF-MW-18S	
Sample Number:	880425-011	880426-001	880426-002	
Date Received:	23-APR-1988	25-APR-1988	25-APR-1988	
Date Sampled:	22-APR-1988	23-APR-1988	23-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.0026U	0.035	0.011	mg/L
cyanide (total) *	[0.0070]	1.4	0.033	mg/L
fluoride by ISE	0.73	0.84	3.7	mg/L
sulfate, turbidimetric	12	82	1480	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MW-33B	TRIP BLANK #2	MMRF-MW-19S	
Sample Number:	880426-003	880426-004	880426-005	
Date Received:	25-APR-1988	25-APR-1988	25-APR-1988	
Date Sampled:	22-APR-1988	15-APR-1988	22-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free) *	0.097	0.0026U	0.0026U	mg/L
cyanide (total) *	1.8	0.0026U	[0.0054]	mg/L
fluoride by ISE	0.28	[0.050]	4.2	mg/L
sulfate, turbidimetric	191	1.0U	3.9	mg/L

* - Associated QC out of control, see Report Summry and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-MW-21S	MMRF-REP2	MMRF-MW-29S	
Sample Number:	880426-006	880426-007	880426-008	
Date Received:	25-APR-1988	25-APR-1988	25-APR-1988	
Date Sampled:	22-APR-1988	22-APR-1988	22-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free) *	0.024	0.015	[0.0052]	mg/L
cyanide (total) *	0.013	0.028	0.010	mg/L
fluoride by ISE	5.3	5.4	2.3	mg/L
sulfate, turbidimetric	1680	1550	844	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-RESWELL	MMRF-CHEN3	TRIP BLANK #1	
Sample Number:	880429-004	880429-005	880429-006	
Date Received:	29-APR-1988	29-APR-1988	29-APR-1988	
Date Sampled:	27-APR-1988	27-APR-1988	20-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free) *	[0.0091]	[0.0028]	0.0026U	mg/L
cyanide (total) *	0.017	0.0026U	0.010	mg/L
fluoride by ISE	4.2	0.84	0.048U	mg/L
sulfate, turbidimetric	987	34	[1.0]	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MMRF-SA-D	MMRF-OCWP-B	MMRF-OCWP-D	
Sample Number:	880429-007	880429-008	880429-009	
Date Received:	29-APR-1988	29-APR-1988	29-APR-1988	
Date Sampled:	27-APR-1988	27-APR-1988	27-APR-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free) *	0.38	1.9	0.055	mg/L
cyanide (total) *	47	1.8	1.8	mg/L
fluoride by ISE	288	513	1300	mg/L
sulfate, turbidimetric	571	1430	863	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	MRF-OCWP-SR1	
Sample Number:	880429-010	
Date Received:	29-APR-1988	
Date Sampled:	27-APR-1988	
Matrix:	WATER	
Compounds	Results	Units
cyanide (free) *	0.0026U	mg/L
cyanide (total) *	[0.0031]	mg/L
fluoride by ISE	0.048U	mg/L
sulfate, turbidimetric	1.0U	mg/L

* - Associated QC out of control, see Report Summary and Appendix A
U - Results less than Instrument Detection Limit (IDL)
[] - Results greater than IDL, but less than Quantitation Limit

RESULTS OF ANALYSES OF WATER SAMPLES COLLECTED DURING 1 JUNE AND 4 JUNE 1988 FROM MARTIN MARIETTA ALUMINUM THE DALLES REDUCTION PLANT

TASK ORDER NO. 88-02
G&M Project Number WA0487VE01

Prepared for

Martin Marietta Aluminum
3313 W. Second Street
The Dalles, Oregon 97058

Prepared by

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Versar Report Number 107

1 July 1988

REPORT SUMMARY

During 3 June and 6 June 1988 Versar Inc., ESM Operations received 29 water samples, and 2 water blanks collected during 1 June and 4 June 1988 from Martin Marietta Aluminum, The Dalles Reduction Plant. A list of samples received and corresponding laboratory tracking numbers is presented in Table 1. Additional sample information can be found on the Chain-of-Custody forms included as Appendix C.

Results of analysis are presented following Table 1, with quality control sample data presented in Appendix A, and analytical quality control data presented in Appendix B. A sample holding time summary has been included as Appendix D, and a quantitation limits summary has been included as Appendix E.

Quality control limits referred to in the narrative refers to the limits presented in Task Order for Laboratory Services 901-999-TD1, Attachment A.

Free Cyanide

Holding times for all samples were met.
All seven preparation blanks were less that the instrument detection limit of 0.0026 mg/L.
All five duplicate analyses were within control limits.
All five matrix spikes were within control limits.

All five Initial Calibration Verification Standards (ICVS) were within control limits. All eighteen Continuing Calibration Verification Standards (CCVS) were within control limits. All seven Laboratory Control Standards (LCS) were within control limits.

Total Cyanide

Holding times for all samples were met.
All six preparation blanks were less that the instrument detection limit of 0.0026 mg/L.
All five duplicate analyses were within control limits.
All five matrix spikes were within control limits.

All five Initial Calibration Verification Standards (ICVS) were within control limits. All sixteen Continuing Calibration Verification Standards (CCVS) were within control limits. All six Laboratory Control Standards (LCS) were within control limits.

Table 1. Sample Identification Cross Reference

Geraghty & Miller, Inc. Sample Number	Versar Inc.ESM Operation Laboratory Sample Number
VER-RESWELL	880603-001
VER-MW-33B	880603-002
VER-MW-34B	880603-003
TRIPBLANK 1	880603-004
VER-SHELTER	880603-005
VER-CHEN1	880603-006
VER-CHEN3 *	880603-007
VER-REP1	880606-001
VER-MW-9B	880606-002
VER-MW-9FB	880606-003
VER-MW-29S	880606-004
VER-MWR-9A	880606-005
VER-MW-9S	880606-006
VER-MW-8S	880606-007
VER-MW-19S	880606-008
VER-MW-14B	880606-009
VER-MW-7B	880606-010
VER-MWR-8A	880606-011
VER-MWR-8B	880606-012
VER-SA-D	880606-013
VER-OCWP-B	880606-014
VER-OCWP-D	880606-015
VER-OCWP-SR1	880606-016
VER-MW-17S	880606-017
VER-MWR-2B	880606-018
VER-MW-18S	880606-019
TRIPBLANK #1	880606-020
VER-MW-21S	880606-021
VER-REP2	880606-022
VER-MW-5S	880606-023
VER-MW-5FB	880606-024

* On the original chain-of-custody form this sample was identified as VER-CHEN2. The sample ID was changed following a telephone call from Ms. Kathleen Duchac, requesting that this sample be identifed as "VER-CHEN3". The sample bottles were correctly labeled "VER-CHEN3" upon receipt.

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-RESWELL	VER-MW-33B	VER-MW-34B	
Sample Number:	880603-001	880603-002	880603-003	
Date Received:	3-JUN-1988	3-JUN-1988	3-JUN-1988	
Date Sampled:	1-JUN-1988	1-JUN-1988	1-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free)	[0.0085]	0.10	[0.0037]	mg/L
cyanide (total)	0.017	2.2	0.012	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	TRIP BLANK #1	VER-SHELTER	VER-CHEN1	
Sample Number:	880603-004	880603-005	880603-006	
Date Received:	3-JUN-1988	3-JUN-1988	3-JUN-1988	
Date Sampled:	27-MAY-1988	1-JUN-1988	1-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free)	0.0026U	[0.0045]	0.0026U	mg/L
cyanide (total)	0.0026U	0.023	0.0026U	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-CHEN3	VER-REP1	VER-MW-9B	
Sample Number:	880603-007	880606-001	880606-002	
Date Received:	3-JUN-1988	4-JUN-1988	4-JUN-1988	
Date Sampled:	1-JUN-1988	2-JUN-1988	2-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free)	0.0026U	0.042	0.063	mg/L
cyanide (total)	0.0026U	0.53	3.0	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MW-9FB	VER-MW-29S	VER-MWR-9A	
Sample Number:	880606-003	880606-004	880606-005	
Date Received:	4-JUN-1988	4-JUN-1988	4-JUN-1988	
Date Sampled:	2-JUN-1988	3-JUN-1988	2-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free)	0.0026U	0.0026U	0.065	mg/L
cyanide (total)	0.0026U	[0.0068]	3.4	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MW-9S	VER-MW-8S	VER-MW-19S	
Sample Number:	880606-006	880606-007	880606-008	
Date Received:	4-JUN-1988	4-JUN-1988	4-JUN-1988	
Date Sampled:	2-JUN-1988	2-JUN-1988	3-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free)	0.043	0.15	0.010	mg/L
cyanide (total)	0.80	8.2	0.034	mg/L

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MW-14B	VER-MW-7B	VER-MWR-8A	
Sample Number:	880606-009	880606-010	880606-011	
Date Received:	4-JUN-1988	4-JUN-1988	4-JUN-1988	
Date Sampled:	2-JUN-1988	2-JUN-1988	2-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free)	0.11	0.075	0.064	mg/L
cyanide (total)	0.72	1.0	1.1	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MWR-8B	VER-SA-D	VER-OCWP-B	
Sample Number:	880606-012	880606-013	880606-014	
Date Received:	4-JUN-1988	6-JUN-1988	6-JUN-1988	
Date Sampled:	2-JUN-1988	4-JUN-1988	4-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free)	0.048	0.50	0.65	mg/L
cyanide (total)	0.50	76	260	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-OCWP-D	VER-OCWP-SR1	VER-MW-17S	
Sample Number:	880606-015	880606-016	880606-017	
Date Received:	6-JUN-1988	6-JUN-1988	6-JUN-1988	
Date Sampled:	4-JUN-1988	4-JUN-1988	3-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free)	0.39	0.012	0.022	mg/L
cyanide (total)	106	[0.0038]	0.39	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MWR-2B	VER-MW-18S	TRIP BLANK #1	
Sample Number:	880606-018	880606-019	880606-020	
Date Received:	6-JUN-1988	6-JUN-1988	6-JUN-1988	
Date Sampled:	3-JUN-1988	4-JUN-1988	31-MAY-1988	
Matrix:	WATER	WATER	WATER	
Compounds	Results			Units
cyanide (free)	0.051	[0.0058]	0.0026U	mg/L
cyanide (total)	0.21	0.040	[0.0034]	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MW-21S	VER-REP2	VER-MW-5S	
Sample Number:	880606-021	880606-022	880606-023	
Date Received:	6-JUN-1988	6-JUN-1988	6-JUN-1988	
Date Sampled:	3-JUN-1988	3-JUN-1988	3-JUN-1988	
Matrix:	WATER	WATER	WATER	
Compounds		Results		Units
cyanide (free)	0.015	0.012	0.30	mg/L
cyanide (total)	0.022	0.039	18	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less tha Quantitation Limit

Versar Inc., ESM Operations
Analytical Laboratory
Results of Non-Metals Lab

Cust Samp No.:	VER-MW-5FB	
Sample Number:	880606-024	
Date Received:	6-JUN-1988	
Date Sampled:	3-JUN-1988	
Matrix:	WATER	
Compounds	Results	Units
cyanide (free)	0.0026U	mg/L
cyanide (total)	0.0026U	mg/L

U - Results less than Instrument Detection Limit
[] - Results greater than IDL but less than Quantitation Limit

D-4

SPLIT SAMPLE ANALYTICAL RESULTS FOR SAMPLES COLLECTED JANUARY 29 TO FEBRUARY 11, 1988 (COMPUCHEM)

COMPUCHEM LABORATORIES

April 29, 1988

Mr. Jerry Kubal
Geraghty & Miller, Inc.
3820 Northdale Blvd.
Suite 2008
Tampa, FL 33524

Dear Mr. Kubal:

Enclosed is the complete report for the eight samples received by Compuchem on February 6 and 13, 1988. A summary report was sent to you April 16. Due to typographical errors in that report, the detection limits for fluoride were incorrectly listed as 0.10(mg/kg-mg/l). Also incorrect, TRIP BLANK #3 had a fluoride value of 0.10mg/kg. They have been corrected in the enclosed report.

I apologized for the delay and any inconvenience you may have experienced.

Sincerely,

Diana A. Scammell

Diana A. Scammell
Environmental Project Manager

RECEIVED
MAY 2 1988
GERAGHTY & MILLER, INC.
Seattle, Washington

CC:
Kathy Duchac
Geraghty & Miller
14655 Bill-Red Rd.
Suite 202
Belleview, WA 98007

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

INTRODUCTION

On February 6, 1988, a water sample, a water trip blank, a sediment sample, and three water (to be treated as sediment) trip blanks were received by Compuchem Laboratories. The chain-of-custody documents indicated that total and "free" cyanide, fluoride, sulfate, sodium, and arsenic were to be determined in the following samples: CCSWG-3R-SPLIT, and the associated TRIP BLANK #2. Fluoride, total and "free" cyanide were to be determined in the sediment sample CCSDG-3R-SPLIT; fluoride in TRIP BLANK #3; total cyanide in TRIP BLANK #4; and "free" cyanide in TRIP BLANK #6.

On February 13, 1988, two water samples, RRTPW5G-SPLIT and TRIP BLANK #7, were received by Compuchem Laboratories for the determination of total and "free" cyanide, fluoride, sulfate, sodium, and arsenic as indicated by the chain-of-custody document.

This report contains the data results for these samples in a summary table. The Sampling and Analysis Chronicle details dates of the sampling event and the dates of analysis for each parameter. The Notes and Observations section provides for the documentation of any analytical anomalies that occur. The associated quality control data is presented by parameter and includes initial calibration concentrations, initial continuing calibration, continuing calibration verification, blank calibration, spike recovery, and duplicate relative percent difference where appropriate.

NOTES AND OBSERVATIONS

Sample Description: The trip blanks were clear and colorless. RRTPW-5G-SPLIT was a brown, cloudy liquid. CCSWG-3R-SPLIT was a clear and colorless liquid. CCSDG-3R-SPLIT was a dark brown, wet sediment with varying particle sizes.

"Free" Cyanide: Sample RRTPW-5G-SPLIT/180408 was the only sample that contained "free" cyanide. All others were below the instrument detection limit of 10ug/l. The associated quality control and check samples for the soil and water matrices met all acceptance criteria.

Total Cyanide: Sample RRTPW-5G-SPLIT/180408 was the only sample that contained total cyanide. All others were below the instrument detection limit of 10ug/l. The associated quality control for the solid matrix and for the water matrix met all acceptance criteria with two exceptions. The spike and duplicate for the water matrix exhibited unacceptable results. The original sample used was 180408 and an initital analysis of the sample yielded a result of 200ug/l. The duplicate and spike values were off scale. They were reanalyzed at a 10:1 dilution. The duplicate was at 762ug/l and the spike was at 743ug/l. The original was reanalyzed neat and it was at 76ug/l. The results failed qc criteria and the original values from both analyses are inconsistent. The differences in results for this sample may be due to a native interferent, since the associated quality control calibration ressults demonstrated system control. There was insufficient sample remaining to redigest and reanalyze the sample.

Fluoride: Three samples had fluoride present: CCSWG-3R-SPLIT/180395, RRTPW-5G-SPLIT/180408, and CCSDG-3R-SPLIT/180407. All trip blanks were below the instrument detection limit of 0.010mg/l or mg/kg. The associated quality control and check samples for the water matrix and the check samples for the solid matrix met all acceptance criteria. A spike and duplicate were not generated for the solid matrix. They were inadvertently omitted by the analyst.

Sulfate: All samples requiring this analysis contained sulfate. The concentration of sulfate in the associated trip blanks was slightly above the instrument detection limit of 1.0mg/l. The associated quality control and check samples met all quality control criteria.

Arsenic: Arsenic was not detected in any samples below the instrument detection limit(IDL) of 1.5 ug/l. The quality control and check samples met all acceptance criteria. The duplicate Relative Percent Difference(RPD) could not be calculated because the original sample concentration was below the IDL and the duplicate concentration, ([1.6]ug/l), was above it.

Sodium: Two samples, CSWG-3R-SPLIT/180395 and RRTPW-5G-SPLIT/180408, contained sodium above the instrument detection limit of 500ug/l. All quality control and check samples met acceptance criteria.

- GERAGHTY & MILLER -

SAMPLE AND ANALYSIS CHRONICLE

G & M SAMPLE I.D.	1. CCSWG-3R SPLIT	2. CCSDG-3R SPLIT	3. TRIP BLANK#2	4. TRIP BLANK#3
CC. I.D.	180395	180407	180401	180402
DATE SAMPLED:	2/4/88	2/4/88	1/29/88	1/29/88
ANALYSIS DATE:				
1. Total Cyanide	2/16/88	2/16/88	2/16/88	NA
2. Free Cyanide	2/16/88	2/16/88	2/16/88	NA
3. Fluoride	2/15/88	2/15/88	2/15/88	2/15/88
4. Sulfate	2/15/88	NA	2/15/88	NA
5. Sodium	03/8/88	NA	03/8/88	NA
6. Arsenic	03/8/88	NA	03/8/88	NA

- GERAGHTY & MILLER -

SAMPLE AND ANALYSIS CHRONICLE

G & M SAMPLE I.D.	5. TRIP BLANK#4	6. TRIP BLANK#6	7. RRTPW5G SPLIT	8. TRIP BLANK#7
CC. I.D.	180402	180402	180408	180409
DATE SAMPLED:	1/29/88	1/29/88	2/10/88	2/2/88
ANALYSIS DATE:				
1. Total Cyanide	2/16/88	NA	2/16/88	2/16/88
2. Free Cyanide	NA	2/16/88	2/16/88	2/16/88
3. Fluoride	NA	NA	2/15/88	2/15/88
4. Sulfate	NA	NA	2/15/88	2/15/88
5. Sodium	NA	NA	03/8/88	03/8/88
6. Arsenic	NA	NA	03/8/88	03/8/88

- GERAGHTY & MILLER -

DATA RESULTS

LIQUID SAMPLES

G.M. I.D./C.C.	1. CCSWG-3R SPLIT/ 180395	2. TRIP BLANK#2/ 180401	3. RRTPW5G SPLIT/ 180408	4. TRIP BLANK#7/ 180409	DETECTION LIMITS
1. Total Cyanide (UG/L)	10U	10U	200 *	10U	10
2. Free Cyanide (UG/L)	10U	10U	68	10U	10
3. Fluoride (MG/L)	0.095	0.010U	0.046	0.010U	0.01
4. Sulfate (MG/L)	6.3	1.5	42	1.5	1.0
5. Sodium (UG/L)	5230	500U	15300	500U	500
6. Arsenic (UG/L)	1.5U	1.5U	[1.6]	1.5U	1.5

NA - Not Applicable

U - Indicates parameter was analyzed for but not detected. Value is reported with the instrument detection limit value (e.g., 10U).

* - See Notes and Observations

- GERAGHTY & MILLER -

DATA RESULTS

SOLID SAMPLES

G.M. I.D./C.C.	1. CCSDG-3R SPLIT/ 180407	2. TRIP BLANK#3/ 180402	3. TRIP BLANK#4/ 180402	4. TRIP BLANK#6/ 180402	DETECTION LIMITS
1. Total Cyanide (MG/KG)	10U	NA	10U	NA	10
2. Free Cyanide (MG/KG)	10U	NA	NA	10U	10
3. Fluoride (MG/KG)	1.15	0.010U	NA	NA	0.010U

NA - Not Applicable

U - Indicates parameter was analyzed for but not detected. Value is reported with the instrument detection limit value (e.g., 10U).

QUALITY CONTROL DATA
FOR
TOTAL AND FREE CYANIDES

"Free" Cyanides:	Actual Value (mg/kg)	True Or Original Value (mg/kg)	Percent Recovery
Initial Calibration Blank (ICB)	10u	NA	NA
Initial Calibration Verification (ICV)	194	200	97
Preparation Blank (Soils)	10u	NA	NA
Spike (180407)	29	10u	29
Duplicate (180407)	10u	10u	RPD = 0
	(ug/l)		
Preparation Blank (Water)	10u	NA	NA
Continuing Calibration Blank (CCB)	10u	10u	NA
Continuing Calibration Verification (CCV)	203	200	102
Spike (180408)	159	68	91
Duplicate (180408)	60	67	RPD = 9

Total Cyanides:			
	(mg/kg)		
Preparation Blank (Soils)	10u	NA	NA
Sample Spike (180407)	94	10u	94
Duplicate (180407)	10u	10u	RPD = 0
	(ug/l)		
Preparation Blank (Water)	10u	NA	NA
Continuing Calibration Blank (CCB)	10u	NA	NA
Continuing Calibration Verification (CCV)	198	200	99
Laboratory Control Sample (LCS)	100	150	67
Spike (180408)	*	200	*
Duplicate (180408)	*	200	*
Continuing Calibration Blank (CCB)	10u	NA	NA
Continuing Calibration Verification (CCV)	210	200	101
Laboratory Control Sample (LCS)	167	150	111

Initial Calibration Standards

	Concentration (ug/l)
1.	300
2.	200
3.	100
4.	50
5.	10

All standards, blanks, and quality control samples were distilled on February 16, 1988. The spiking concentration is 100 mg/kg or ug/l. NA indicates value or recovery is not applicable.

* - See Notes and Observations

QUALITY CONTROL DATA
FOR
ARSENIC ANALYSIS BY FURNACE AA

	Actual Value (ug/l)	True Or Original Value (ug/l)	Percent Recovery
Initial Calibration Verification (ICV)	19.89	19.76	101
Initial Calibration Blank (ICB)	1.5u	NA	NA
Preparation Blank (Water)	1.5u	NA	NA
Continuing Calibration Blank (CCB)	1.5u	NA	NA
Continuing Calibration Verification (CCV)	21.9	20	109
Spike (180395/CCSWG-3R-SPLIT)	20.70	1.5u	104
Duplicate (180408/RRTPWSG-SPLIT)	1.5u	[1.6]	*

Initial Calibration Standards

	Concentration (ug/l)
1.	30
2.	20
3.	10
4.	50

All standards, blanks, and quality control samples were analyzed on March 9, 1988. The spiking concentration is 20 ug/l. NA indicates value or recovery is not applicable.

* Relative Percent Difference (RPD) can not be calculated.

QUALITY CONTROL DATA FOR FLUORIDES

	Actual Value (mg/kg)	True Or Original Value (mg/kg)	Percent Recovery
Initial Calibration Blank (ICB)	10u	NA	NA
Initial Calibration Verification (ICV)	194	200	97
Preparation Blank (Soils)	10u	NA	NA
	(mg/l)	(mg/l)	
Preparation Blank (Water)	0.010U	NA	NA
Continuing Calibration Verification (CCV)	0.87	0.87	100
Spike (RRTPW-5G-SPLIT/180408)	1.30	0.46	84
Duplicate (CCSWG-3R-SPLIT/180395)	0.105	0.095	RPD = 2

Initial Calibration Standards

	Concentration (mg/l)
1.	0.01
2.	0.05
3.	0.10
4.	1.00
5.	5.00
6.	10.0

All standards, blanks, and quality control samples were analyzed February 15, 1988. The spiking concentration is 1.00 mg/l. NA indicates value or recovery is not applicable.

QUALITY CONTROL DATA FOR SODIUM ANALYSIS BY FLAME AA

	Actual Value (ug/l)	True Or Original Value (ug/l)	Percent Recovery
Initial Calibration Blank (ICB)	500u	NA	NA
Initial Calibration Verification (ICV)	9380	10000	94
Preparation Blank (Water)	500u	NA	NA
Continuing Calibration Blank (CCB)	500u	NA	NA
Continuing Calibration Verification (CCV)	9440	10000	94
Spike (180395/CCSWG-3R-SPLIT)	20700	20000	104
Duplicate (180408/RRTPW5G-SPLIT)	15580	15300	RPD = 1.8

Initial Calibration Standards

	Concentration (ug/l)
1.	15000
2.	10000
3.	5000
4.	20000
5.	40000

All standards, blanks, and quality control samples were analyzed on March 9, 1988. The spiking concentration is 10000 ug/l. NA indicates value or recovery is not applicable.

QUALITY CONTROL DATA FOR SULFATE ANALYSIS

	Actual Value (mg/l)	True Or Original Value (mg/l)	Percent Recovery
Initial Calibration Blank (ICB)	1.0u	NA	NA
Initial Calibration Verification (ICV)	19.9	20	100
Preparation Blank (Water)	1.0u	NA	NA
Continuing Calibration Blank (CCB)	1.0u	NA	NA
Continuing Calibration Verification (CCV)	21.9	20	109
Spike (180395/CCSWG-3R-SPLIT)	14.96	3.15*	118
Duplicate (180395/CCSWG-3R-SPLIT)	5.04	6.3	RPD = 22

Initial Calibration Standards

	Concentration (mg/l)
1.	5
2.	10
3.	20
4.	30
5.	40

All standards, blanks, and quality control samples were analyzed on March 9, 1988. The spiking concentration is 10 mg/l. NA indicates value or recovery is not applicable.

* The sample spike was prepared using half the normal volume of the original sample. As a result, the original value is halved.

METHOD REFERENCES

	Parameter	Method Reference
1.	Total Cyanide	EPA Method 335.2
2.	Weak and Dissociable (Free) Cyanide	Standard Methods 16th Edition 412.H
3.	Fluoride (water)	Standard Methods 16th Edition 413.B
4.	Fluoride (soil)	Preparation Procedure as written by Versar followed by Standard Methods 16th Edition 413.B
5.	Total Sodium	EPA Method 200.7
6.	Total Arsenic	EPA Method 206.2
7.	Sulfate Sample Pretest	EPA Method 370.1 (Silica)
8.	Sulfate (Water)	EPA Method 375.4 Turbidimetric

D-5

SPLIT SAMPLE ANALYTICAL RESULTS FOR SAMPLES COLLECTED MARCH 3 TO 7, 1988 (ECOVA)

May 10, 1988
Revised Report

Mr. Edward R. Rothschild
Geraghty and Miller, Inc.
14655 Bel-Red Road, Suite 202
Bellevue, WA 98007

Dear Mr. Rothschild:

This revised report reflects the change in the cyanide detection limit from 10 ppb to 5 ppb. This change was made at the request of Charles Ankerberg, and also meets criteria set forth in the Hood River Basin Study. The original report was dated March 31, 1988, and is superseded in its entirety by this report.

Eight samples were received March 9, 1988, and logged in under the following numbers:

G & M Sample ID	EAS Lab ID	Matrix
CCSWG-4R2 (Split)	704-01	Water
Trip Blank #2	704-02	Water
CCSDG-4R2 (Split)	704-03	Sediment
Trip Blank #3	704-04	Water
Trip Blank #5	704-05	Water
Trip Blank #5	704-06	Water
Trip Blank #6	704-07	Water
MMSTWG-2	704-08	Water

As requested, samples 704-05, 704-06, and 704-07, were given "On Hold" status. Pursuant to a phone conversation with Kathy Duchac and Charles Ankerberg of March 14, 1988, the request for analysis of analytes listed for 704-04 (Trip Blank #3) was cancelled. Further, sample 704-08 was identified as a non-field sample and the request for analysis will be addressed under a separate letter.

Analysis for total cyanide was performed in accordance with EPA Method 335.2 (to include a sulfide scrubber) for samples 704-01, 704-02, and 704-03. A non-detectable level of 5 ppb for a water matrix and 0.5 mg/Kg for sediment, is reported for the three samples. Further, the raw data absorbance values were examined for estimate of detectable analyte between the method IDL of 2 ppb and the G&M MDL of 5 ppb. Zero analyte was detectable between these levels. The following four calibration standards were measured and recorded for a four-point cyanide curve: 20 ug/L, 50 ug/L, 150 ug/L, and 250 ug/L.

Corporate Office
8820 159th Avenue NE
Redmond, WA 98052
(206) 883-1900
(206) 867-2210 FAX

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MAY 11 1988
GERAGHTY & MILLER, INC.
Seattle, Washington

Both a duplicate and a matrix spike analysis for total cyanide was performed for each matrix. The matrix spike recovery for 704-01 was 42% and out of established control limits of 75-125%. At the time of analysis, no analytical spike of the distillate extract was performed. Further, there was an inadequate sample volume reserved for total cyanide to allow for re-analysis. A check of the distillate apparatus to include the sulfide scrubber was performed by analyzing DI water spiked at 200 ug/L. Recovery was 83.5%.

In a phone conversation with Charles Ankerberg on March 29, 1988, G&M was advised of QC problems associated with the water matrix and a decision by Ecova not to perform the requested analysis for Free Cyanide or "Weak and Dissociable Cyanide" by Standard Method 412.H. This decision was based on non-detectable levels for total cyanide analysis. Ecova does plan to analyze the sample reserved for free cyanide (now out of the 14 day holding time) for total cyanide and will include analysis of both a matrix spike and analytical spike of the distillate extract. These results will be forthcoming under a different cover letter.

Further sample analyses performed were for fluoride and sulfate. Fluoride analysis was performed in accordance with EPA Method 340.2 with a modification to allow for extraction of soil and sediment matrices in D.I. water for 24 hours and subsequent analysis of the extract. Potentiometric standardization was performed with 1.0 mg/L and a 10.0 mg/L standards. Sulfate analysis was performed by the turbidimetric EPA Method 375.4. A three-point sulfate calibration curve consisted of 5.0 mg/L, 10.0 mg/L, and 25.0 mg/L standards.

Requests for analysis of metals were for sodium and arsenic. Samples 704-01 and 704-02 were analyzed by EPA Method 206.2 CLP-M, "Arsenic Analysis by Atomic Absorption, Furnace Technique". The three-point AAS calibration curve consisted of 20 ug/L, 50 ug/L, and 100 ug/L standards. Sodium was analyzed in accordance with EPA Method 200.7 CLP-M, "Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Waters and Wastes". The five-point ICP calibration curve consisted of 0.5 mg/L, 1.0 mg/L, 5.0 mg/L, 50 mg/L, and 100 mg/L standards.

Instrument detection limits for all inorganic analyses performed are summarized in Attachment I. IDLs were determined in accordance with procedures described in the 7/85 Revision of the Statement of Work of the EPA Contract Laboratory Program (CLP). Specifically, the average of the standard deviations obtained on three non-consecutive days from the analysis of a standard solution at a concentration 3X - 5X IDL, with seven consecutive measurements per day was multiplied by three for the IDL. The Contract Required Quantitation Levels (CRQL) were found to be 5 - 10X the IDLs measured. Note that IDLs are based on analysis of the analyte in deionized water.

In accordance with the contract requirements for Laboratory Reportables - Level III, a CLP documentation package comprised of Forms 1-11 is provided. These forms provide complete documentation of QA/QC to include blanks, calibration standard checks, and interference check standards. Please note that the source of initial calibration check standards is the EPA Wastewater Study QC samples from Study WP019 and EPA QC Standards for Statement of Work No. 787 for Inorganic Analysis under the Contract Lab Program. See Attachment II for an explanation of Data Qualifiers used on the supplied forms.

Please review the submitted data package and feel free to call should you have any questions or need further clarification of the final results.

Sincerely,

Donald Sitkei
Inorganic Chemist
Data Revision

63/GMI-TRAN.LT
Attachments

cc: Kathleen Duchac - G&M Project Field Manager
Charles Ankerberg - G&M Project QA
Jose Bou, Vice President - Martin Marietta Aluminum Properties
Loretta Grabowski, Project Site Manager - Martin Marietta

ATTACHMENT I

Inorganic Instrument Detection Limits

Analysis	Date IDL Determined	Analyte Conc. (ppb)	IDL (Avg Std) (Dev x 3)	CRQL(1) (ppb)
Arsenic	2-22-88	25	1.93	5.0
Fluoride	3-26-88	200	9.1	100
Sodium	8-10-87	100	17.5	100
Sulfate	3-28-88	5000	1100	5000
Total Cyanide	3-28-88	10	2.2	10, 5(2)

(1) Contract Required Quantitation Level

(2) Per G&M requirements

ATTACHMENT II

Form I-IN includes fields for three types of result qualifirers. These qualifiers must be completed as follows:

Under the columns labeled "C", "Q", and "M", enter result qualifiers as identified below.

- o C (Concentration) qualifier -- Enter "B" if the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" must be entered.

- o Q qualifier -- Specified entries and their meanings are as follows:

  - D - Reported analyte concentration is based on a dilution.

  - N - Spiked sample recovery not within control limits.

  - W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

  - * - Duplicate analysis not within control limits.

- o M (Method) qualifier -- Enter:

  - "P" for ICP
  - "F" for Furnace AA
  - 340.2 for Fluoride
  - 412.H for Free Cyanide
  - 335.2 for Total Cyanide
  - 375.4 for Sulfate

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 704-01
Sample Matrix: Water
Date Sample Collected: 3-07-88
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: CCSWG-4R2
Sample Description: Split

Analyte	(mg/L) Concentration		M	Date of Analysis	
Arsenic (As)	0.005	U	F	3-17-88	
Fluoride (F)	0.11		340.2	3-16-88	
Sodium (Na)	9.91		P	3-21-88	
Sulfate (SO_4)	12		375.4	3-15-88	
Total Cyanide (CN)	0.005	U	335.2	3-15-88	Note 1

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Note 1: Examination of the sample results indicate Q amount of cyanide analyte between the established IDL of 2 ppb and the G&M MDL of 5 ppb. All data reported between these levels is considered qualitative.

Method Qualifiers:

P - ICP
F - FURNACE AA
340.2 - FLUORIDE
375.4 - SULFATE
335.2 - TOTAL CYANIDE

Data Revision Authorized:

63/7104-IAD.704

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 704-02
Sample Matrix: Water
Date Sample Collected: 3-07-88
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: Trip Blank #2
Sample Description: None

Analyte	(mg/L) Concentration		M	Date of Analysis	
Arsenic (As)	0.005	U	F	3-17-88	
Fluoride (F)	0.10	U	340.2	3-16-88	
Sodium (Na)	0.70	B	P	3-21-88	
Sulfate (SO_4)	5.0	U	375.4	3-15-88	
Total Cyanide (CN)	0.005	U	335.2	3-15-88	Note 1

Data Report Qualifiers:

B - Indicates that analyte is found in the associated blank as well as the sample.

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Note 1: Examination of the sample results indicate Q amount of cyanide analyte between the established IDL of 2 ppb and the G&M MDL of 5 ppb. All data reported between these levels is considered qualitative.

Method Qualifiers:

P - ICP
F - FURNACE AA
340.2 - FLUORIDE
375.4 - SULFATE
335.2 - TOTAL CYANIDE

Data Revision Authorized:

63/7104-IAD.704

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 704-03
Sample Matrix: Sediment
Date Sample Collected: 3-07-88
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: CCSDG-4R2
Sample Description: Split

Analyte	(mg/Kg) Concentration		M	Date of Analysis	
Fluoride (F)	1.4	U	340.2	3-16-88	Note 1
Total Cyanide (CN)	0.5	U	335.2	3-15-88	Note 2
Total Solids	71.1%		209F	3-25-88	

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Note 1 - Fluoride concentration is based on analysis of an extract prepared by mixing 10 gms sediment with 100 ml DI water for 24 hours. A non-detectable level of 0.1 mg/L-F in the extract is reported in mg/Kg on a dry weight basis of the sediment.

Note 2 - Examination of the sample results indicates Q amount of cyanide analyte between the established IDL of 2 ppb and the G&M MDL of 5 ppb for the cyanide extract. A minimum detection limit of 1 mg/Kg is based on a sample dry weight of 5 grams.

Method Qualifiers:

340.2 - FLUORIDE
335.2 - TOTAL CYANIDE
209 - TOTAL SOLIDS

Data Revision Authorized:

63/7104-IAD.704

General Chemistry Duplicate Analysis Data Sheet

Laboratory Name: Ecova Analytical Services
Lab Sample No: EAS 704-01 DUP
Sample Matrix: Water
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: CCSWG-4R2
Sample Description: Split

Data Revision Authorized:

Analyte		(mg/L) Duplicate Sample Conc.		(mg/L) Original Sample Conc.		Relative Percent Difference	
Arsenic	(As)	0.005	U	0.005	U	NA	
Fluoride	(F)	0.12		0.11		8.7	
Sodium	(Na)	10.0		9.91		1.1	
Sulfate	(SO_4)	13.5		12.0		11.8	
Total Cyanide	(CN)	0.009	U	0.005	U	NA	Note 1

DATA REPORT QUALIFIERS:

U - Indicates compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

NA - Relative percent difference calculation is not applicable to analytes when not detected.

Note 1 - Different Non-Detectable quantitative levels for the cyanide analyte are based on different sample volumes for analysis.

63/7104-MS.704

General Chemistry Duplicate Analysis Data Sheet

Laboratory Name: Ecova Analytical Services
Lab Sample No: EAS 704-03 DUP
Sample Matrix: Sediment
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: CCSDG-4R2
Sample Description: Split

Data Revision Authorized:
Donald Litter

Analyte		(mg/Kg) Duplicate Sample Conc.	(mg/Kg) Original Sample Conc.	Relative Percent Difference
Fluoride	(F)	1.4 U	1.4 U	NA
Total Cyanide	(CN)	0.5 U	0.5 U	NA

DATA REPORT QUALIFIERS:

U - Indicates compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

NA - Relative percent difference calculation is not applicable to analytes when not detected.

63/7104-MS.704

General Chemistry Matrix Spike Analysis Data Sheet

Laboratory Name: Ecova Analytical Services
Lab Sample No: EAS 704-01 MS
Sample Matrix: Water
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: CCSWG-4R2
Sample Description: Split
Data Revision Authorized:
Donald Litter

Analyte		(mg/L) Spike Sample Concentration	(mg/L) Original Sample Conc.	(mg/L) Spike Level	Percent Recovery
Arsenic	(As)	0.043	0.005 U	0.040	107
Fluoride	(F)	1.07	0.11	1.0	96
Sodium	(Na)	12.45	9.91	2.5	102
Sulfate	(SO_4)	19	12	10	70 N
Total Cyanide	(CN)	0.084	0.005 U	0.20	42 N

DATA REPORTING QUALIFIERS:

U - Indicates compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

N - Spiked sample recovery not within established control limits of 125%.

63/7104-MS.704

General Chemistry Matrix Spike Analysis Data Sheet

Laboratory Name: Ecova Analytical Services
Lab Sample No: EAS 704-03 MS
Sample Matrix: Sediment
Date Sample Received: 3-09-88

Project No: 807104
Customer Sample No: CCSDG-4R2
Sample Description: Split
Data Revision Authorized:
Donald [illegible]

Analyte		(mg/Kg) Spike Sample Concentration	(mg/Kg) Original Sample Conc.	(mg/Kg) Spike Level	Percent Recovery
Fluoride	(F)	11.2	1.4 U	10	112
Total Cyanide	(CN)	9.9	0.5 U	10	99

DATA REPORTING QUALIFIERS:

U - Indicates compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

63/7104-MS.704

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COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ECOVA Analytical Services Contract: G+M 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

SOW No.: ____

G+M Sample No.	Lab Sample ID.
CCSWG-4R2	704-01
Trip Blank #3	704-02
CCSDG-4R2 (Split)	704-03

Were ICP interelement corrections applied? Yes/No yes

Were ICP background corrections applied? Yes/No no

If yes-were raw data generated before application of background corrections? Yes/No ___

Comments:
See narrative for Summary of Analytical methods, method detection limits and QA/QC explanations. this is a revision of data package from 03/31/88

Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Inorganic Chemist Lab Manager: [signature]

Revised Date: 5-10-88

COVER PAGE - IN 7/87

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1

INORGANIC ANALYSIS DATA SHEET

G+M SAMPLE NO. CCSWG-4R2

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 704-01

Level (low/med): low Date Received: 03-09-88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum					
7440-36-0	Antimony					
7440-38-2	Arsenic	5	U		E	
7440-39-3	Barium					
7440-41-7	Beryllium					
7440-43-9	Cadmium					
7440-70-2	Calcium					
7440-47-3	Chromium					
7440-48-4	Cobalt					
7440-50-8	Copper					
7439-89-6	Iron					
7439-92-1	Lead					
7439-95-4	Magnesium					
7439-96-5	Manganese					
7439-97-6	Mercury					
7440-02-0	Nickel					
7440-09-7	Potassium					
7782-49-2	Selenium					
7440-22-4	Silver					
7440-23-5	Sodium	9910			P	
7440-28-0	Thallium					
7440-62-2	Vanadium					
Free	Cyanide	—				412.H
TOTAL	Cyanide	5	U	N	✓	335.2
	Fluoride	110			✓	340.2
	Sulfate	12000			✓	375.4

Color Before: colorless Clarity Before: clear Texture: ____

Color After: colorless Clarity After: clear Artifacts: ____

Comments:

FORM I - IN 7/87

U.S. EPA - CLP

1

INORGANIC ANALYSIS DATA SHEET

G+M SAMPLE NO.

Trip Blank #2

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 704-02

Level (low/med): low Date Received: 03-09-88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum					
7440-36-0	Antimony					
7440-38-2	Arsenic	5	U	W	E	
7440-39-3	Barium					
7440-41-7	Beryllium					
7440-43-9	Cadmium					
7440-70-2	Calcium					
7440-47-3	Chromium					
7440-48-4	Cobalt					
7440-50-8	Copper					
7439-89-6	Iron					
7439-92-1	Lead					
7439-95-4	Magnesium					
7439-96-5	Manganese					
7439-97-6	Mercury					
7440-02-0	Nickel					
7440-09-7	Potassium					
7782-49-2	Selenium					
7440-22-4	Silver					
7440-23-5	Sodium	700	B		P	
7440-28-0	Thallium					
7440-62-2	Vanadium					
Free	Cyanide	—				412.H
TOTAL	Cyanide	5	U		V	335.2
	Fluoride	100			V	340.2
	Sulfate	5000	U		V	375.4

Color Before: colorless Clarity Before: clear Texture: ____

Color After: colorless Clarity After: clear Artifacts: ____

Comments:

FORM I - IN 7/87

U.S. EPA - CLP

1

INORGANIC ANALYSIS DATA SHEET

G+M SAMPLE NO.

CCSDG-4R2

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): sediment Lab Sample ID: 704-03

Level (low/med): ____ Date Received: 03-09-88

% Solids: 71.1

Concentration Units (ug/L or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum					
7440-36-0	Antimony					
7440-38-2	Arsenic					
7440-39-3	Barium					
7440-41-7	Beryllium					
7440-43-9	Cadmium					
7440-70-2	Calcium					
7440-47-3	Chromium					
7440-48-4	Cobalt					
7440-50-8	Copper					
7439-89-6	Iron					
7439-92-1	Lead					
7439-95-4	Magnesium					
7439-96-5	Manganese					
7439-97-6	Mercury					
7440-02-0	Nickel					
7440-09-7	Potassium					
7782-49-2	Selenium					
7440-22-4	Silver					
7440-23-5	Sodium					
7440-28-0	Thallium					
7440-62-2	Vanadium					
Free	Cyanide	—				412.H
TOTAL	Cyanide	0.5	U		V	335.2
	Fluoride	1.4	U		V	340.2

Color Before: ____ Clarity Before: ____ Texture: ____

Color After: ____ Clarity After: ____ Artifacts: ____

Comments:

Fluoride concentration based on analysis of extract prepared by mixing 10gm sediment with 100ml DI water for 24 hours. Final concentration reported on dry weight basis

FORM I - IN 7/87

U.S. EPA - CLP

2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Initial Calibration Source: Plasma - EPA-LV; Furnace - Inorganic Ventures Inc

Continuing Calibration Source: Plasma - Inorganic Ventures Inc; Furnace - VHG Labs Inc.

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	M
Aluminum									
Antimony									
Arsenic	80	80.1	100.1	50	51.1	102	49.6	99.2	F
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium	50700	54,400	108.8	1000	1090	109	10,000 10,400	104	P
Thallium									
Vanadium									
Zinc									
Cyanide	124	126	101.6	50	42.8	85.6			
Fluoride	2010	1930	95.5	10000	10300	103	10300	103	
Sulfate	14000	13000	93.3						

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

FORM II (PART 1) - IN 7/87

U.S. EPA - CLP

3

BLANKS

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Preparation Blank Matrix (soil/water): water

Preparation Blank Concentration Units (ug/L or mg/kg): ug/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											
Antimony											
Arsenic	-0.3	U	0.0	U	-1.7	U			-0.5	U	F
Barium											
Beryllium											
Cadmium											
Calcium											
Chromium											
Cobalt											
Copper											
Iron											
Lead											
Magnesium											
Manganese											
Mercury											
Nickel											
Potassium											
Selenium											
Silver											
Sodium	0	U	12	U					413	U	P
Thallium											
Vanadium											
Zinc											
Cyanide	5	U	5	U					5	U	
Fluoride	NA		—		—		—		—		—
Sulfate	NA		—		—		—		—		—

NA - not Applicable

FORM III - IN 7/87

U.S. EPA - CLP

4

ICP INTERFERENCE CHECK SAMPLE

Lab Name: ECOVA Analytical Services Contract: 80704

Lab Code: 704 Case No: ____ SAS No.: ____ SDG No.: ____

ICP ID Number: Baird Spectrovac ICS Source: EPA-IV 0387

Concentration Units: ug/L

Analyte	True Sol. A	True Sol. AB	Initial Found Sol. A	Initial Found Sol. AB	%R	Final Found Sol. A	Final Found Sol. AB	%R
Aluminum	502000	508000	546999	523938	103.1	508479	511446	100.7
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium	506000	516000	582427	559847	108.5	536598	542992	105.2
Chromium								
Cobalt								
Copper								
Iron	196000	203000	203681	195120	96.1	187275	188191	92.7
Lead								
Magnesium	498000	509000	433408	419134	82.3	407632	412564	81.1
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium	Not Required		Not Required			Not Required		
Thallium								
Vanadium								
Zinc								

FORM IV - IN 7/87

U.S. EPA - CLP

5A

SPIKE SAMPLE RECOVERY

G+M SAMPLE NO. CCSW8-4R2

Lab Name: ECOVA Analytical Services Contract: 80704

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Lab Sample ID: 704-01

Matrix (soil/water): water Level (low/med): ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	75-125	43		5	U	40	107.5		E
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium	75-125	12452		9910		2500	101.7		P
Thallium									
Vanadium									
Zinc									
T. Cyanide	75-125	41.8		5	U	100	41.8	N	
Fluoride	75-125	1070		110		1000	96		
Sulfate	75-125	19000		10000		10000	90		

Comments:

FORM V (PART 1) - IN 7/87

U.S. EPA - CLP

5A
SPIKE SAMPLE RECOVERY

G+M SAMPLE NO. CC506-4R2

Lab Name: ECOVA Analytical Services Contract: 8071104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): Sediment Level (low/med): ____

Concentration Units (ug/L or mg/kg dry weight): mg/kg

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
T Cyanide	75-125	9.9		0.5	U	10	99		
Fluoride	75-125	11.2		1.4	U	10	11.2		

Comments:

FORM V (PART 1) - IN 7/87

U.S. EPA - CLP

5B
POST DIGEST SPIKE SAMPLE RECOVERY

G+M SAMPLE NO. CC5WJ-4R2

Lab Name: ECOVA Analytical Services Contract: 8071104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 704-01 Level (low/med): ____

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	85-115	21		5	U	20	105		E
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide	85-115	.014		5	U	.013	128		

Comments:

FORM V (PART 2) - IN 7/87

U.S. EPA - CLP

5B
POST DIGEST SPIKE SAMPLE RECOVERY

G+M SAMPLE NO.: Trip Blank #2

Lab Name: Ecan Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Lab Sample ID: 704-03

Matrix (soil/water): water Level (low/med): ____

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	85-115	25		5	U	20	125	W	E
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide									

Comments:

FORM V (PART 2) - IN 7/87

U.S. EPA - CLP

6
DUPLICATES

G+M SAMPLE NO.: CCSWG-4R2

Lab Name: Ecan Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Lab Sample ID: 704-01

Matrix (soil/water): water Level (low/med): ____

% Solids for Sample: ____ % Solids for Duplicate: ____

Concentration Units (ug/L or mg/kg dry weight): mg/L

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								
Antimony								
Arsenic	±10 ppb	5	U	5	U			E
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium	±5000 ppb	9910		10016		1.1		P
Thallium								
Vanadium								
Zinc								
T Cyanide	±5	5	U	9	U	—		
Fluoride	±10	110		120		—		
Sulfate	±20%	12000		13500		11.3		

COMMENT: Difference in nondetect level for total cyanide is based on less sample volume for analysis.

FORM VI - IN 7/87

U.S. EPA - CLP

6
DUPLICATES

GTM SAMPLE NO.
CCSDG-4R2

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Lab Sample ID: 704-03

Matrix (soil/water): sediment Level (low/med): ____

Solids for Sample: 71.1 % Solids for Duplicate: ____

Concentration Units (ug/L or mg/kg dry weight): mg/kg

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								
T Cyanide	± 0.5	0.5	U	0.5	U	—		
Fluoride	± 1.0	1.4	U	1.4	U	—		

FORM VI - IN 7/87

U.S. EPA - CLP

7
LABORATORY CONTROL SAMPLE

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 704 Case No.: ____ SAS No.: ____ SDG No.: ____

Solid LCS Source: ____

Aqueous LCS Source: Plasma - EPA-LV Furnace - VHG Labs Inc

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Aluminum									
Antimony									
Arsenic	10	11	110						
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium	50000	58626	115.6						
Thallium									
Vanadium									
Zinc									
Cyanide									

FORM VII - IN 7/87

U.S. EPA - CLP

9

ICP SERIAL DILUTIONS

G&M SAMPLE NO.

CCSWG-4R2

704-01

Lab Name: ECOVA Analytical Services Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix (soil/water): Water Level (low/med): _____

Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	M
Aluminum							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Calcium							
Chromium							
Cobalt							
Copper							
Iron							
Lead							
Magnesium							
Manganese							
Mercury							
Nickel							
Potassium							
Selenium							
Silver							
Sodium	9910		9219		69		P
Thallium							
Vanadium							
Zinc							

FORM IX - IN 7/87

U.S. EPA - CLP

10

HOLDING TIMES

Lab Name: ECOVA ANALYTICAL SERVICES Contract: 8C7104

Lab Code: 704 Case No.: _____ SAS No.: _____ SDG No.: _____

EAS No.	G&M Sample No.	Matrix	Date Received	Metals Prep Date	Metals Holding Time	Cyanide Prep Date	Cyanide Holding Time
704-01	CCSWG-4R2	WATER	3-9-88	3-10-88	180 DAY	3-15-88	14 DAY
704-02	TRIPBLANK3	WATER	3-9-88	3-10-88	180 DAY	3-15-88	14 DAY
704-03	CCSDW-4R3	SEDIMENT	3-9-88	—	—	3-15-88	14 DAY
704-04	TRIPBLANK5	WATER	3-9-88				
704-05	TRIPBLANK5	WATER	3-9-88				
704-06	TRIPBLANK5	WATER	3-9-88				
704-07	TRIPBLANK6	WATER	3-9-88				

FORM X - IN 7/87

U.S. EPA - CLP

11

INSTRUMENT DETECTION LIMITS (QUARTERLY)

Lab Name: ECOVA Analytical Services Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

ICP ID Number: Baird Spectrovac Date: 3-23-88

Flame AA ID Number: _____

Furnace AA ID Number: Perkin-Elmer 3030 Zeeman

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum			200		
Antimony			60		
Arsenic	1939		10	5	E
Barium			200		
Beryllium			5		
Cadmium			5		
Calcium			5000		
Chromium			10		
Cobalt			50		
Copper			25		
Iron			100		
Lead			5		
Magnesium			5000		
Manganese			15		
Mercury			0.2		
Nickel			40		
Potassium			5000		
Selenium			5		
Silver			10		
Sodium	5890		5000	500	P
Thallium			10		
Vanadium			50		
Zinc			20		

Comments:

FORM XI - IN 7/87

D-6

SPLIT SAMPLE ANALYTICAL RESULTS FOR SAMPLES COLLECTED APRIL 19 TO 27, 1988 AND JUNE 1-4, 1988 (ECOVA)

May 24, 1988

Mr. Edward R. Rothschild
Geraghty and Miller, Inc.
14655 Bel-Red Road, Suite 202
Bellevue, Washington 98007

Dear Mr. Rothschild:

Enclosed are data summary sheets and QA/QC documentation for samples comprising EAS Sample Batches 758 and 759. Three samples were received April 21, 1988, and one sample was received April 22, 1988. They were logged in under the following numbers:

G&M Sample ID	EAS Lab ID	Matrix	Date Received
MMRF-MW85-Split	758-01 (A,B,C,D)	Water	04/21/88
MMRF-MW95-Split	758-02 (A,B,C,D)	Water	04/21/88
Trip Blank #3	758-03 (A,B,C,D)	Water	04/21/88
MMRF-MWR-9A-Split	759-01 (A,B,C,D)	Water	04/22/88

The laboratory assigned a unique identifier (A,B,C, or D) to each sample bottle relative to the test to be run from that bottle. Sample bottles for free Cyanide were labelled with an A, sample bottles for total cyanide were labelled with a B, bottles for trace metals were labelled with a C, and bottles for fluoride/sulfate analysis were labelled with a D.

Analysis for total cyanide was performed in accordance with EPA Method 335.2 (to include a sulfide scrubber) for samples 758-01 to 758-03 and 759-01. Analysis for free cyanide was performed in accordance with Standard Methods 16th Ed., 412.H.

Further sample analysis performed were for fluoride and sulfate. Fluoride analysis was performed in accordance with EPA Method 340.2. Potentiometric standardization was performed with 1.0 mg/L and a 10.0 mg/L standards. Sulfate analysis was performed by the turbidimetric EPA Method 375.4. A three-point sulfate calibration curve consisted of 5.0 mg/L, 10.0 mg/L, and 25.0 mg/L standards.

Corporate Office
3820 159th Avenue NE
Redmond, WA 98052
(206) 883-1900
(206) 867-2210 FAX

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MAY 25 1988
GERAGHTY & MILLER, INC.
Seattle, Washington

QC parameters for cyanides were shown to be out of compliance:

1. Free Cyanide on 758-02 - The Relative Percent Difference is 24.8% (20% maximum). At this low level, .060 and .077 mg/L CN, this RPD is not atypical.

2. Total Cyanide on 758-02 - The matrix spike is 60.0% (acceptable is 75-125%). The CLP established guidelines do not account for a sulfide scrubber to be placed in the distillation train. Percent recoveries need to be compiled for such a modification. A post-distillation spike recovery of 108% indicates loss upon distillation and not a colorimetric matrix interference.

Requests for analysis of metals were for sodium and arsenic. Samples 758-01, 758-02, 758-03, and 759-01 were analyzed by EPA Contract Laboratory Program (CLP), Method 206.2 CLP-M, "Arsenic Analysis by Atomic Absorption, Furnace Technique." The three-point AAS calibration curve consisted of 20 ug/L, 50 ug/L, and 100 ug/L standards. Sodium was analyzed in accordance with EPA Method 200.7 CLP-M, "Inductively Coupled Plasma-Atomic Emission Spectrometric method for Trace Element Analysis of Waters and Wastes." The five-point ICP calibration curve consisted of 0.5 mg/L, 1.0 mg/L, 5.0 mg/L, 50 mg/L, and 100 mg/L standards.

Instrument detection limits for all inorganic analyses performed are summarized in Attachment I. IDLs were determined in accordance with procedures described in 07/85 Revision of the Statement of Work of the EPA CLP. Specifically, the average of the standard deviations obtained on three nonconsecutive days from the analysis of a standard solution at a concentration 3X - 5X IDL, with seven consecutive measurements per day was multiplied by three for the IDL. The Contract Required Quantitation Levels (CRQL) were found to be 5 - 10X the IDLs measured. Note that IDLs are based on analysis of the analyte in deionized water. The MDL for cyanide is 5 ppb in water as per Geraghty & Miller's request.

In accordance with the contract requirements for Laboratory Reportables - Level III, a CLP documentation package comprised of Forms I-XI is provided. These forms provide complete documentation of QA/QC to include blanks, calibration standard checks, and interference check standards. Please note that the source of initial calibration check standards is the EPA Wastewater Study QC samples from Study WP019 and EPA QC Standards for Statement of Work No. 787 for Inorganic Analysis under the CLP. See Attachment II for an explanation of Data Qualifiers used on the supplied forms.

Please review the submitted data package and feel free to call should you have any questions or need further clarification of the final results.

Sincerely,

David A. Wunderlich

David A. Wunderlich

64/7104-RPT.758

cc: Kathleen Duchac - G&M, Bellevue, WA
Charles W. Ankerberg - G&M, Tampa, FL
Jose Bou - Martin Marietta, Bethesda, MD
Loretta Grabowski - Martin Marietta, The Dalles, OR

ATTACHMENT I

Inorganic Instrument Detection Limits

Analysis	Date IDL Determined	Analyte Conc. (ppb)	IDL (Avg Std) (Dev X 3)	CRQL(1) (ppb)
Arsenic	02/22/88	25	1.93	10
Fluoride	03/26/88	200	9.1	100
Sodium	08/10/87	100	17.5	5000
Sulfate	03/28/88	5000	1100	5000
Total Cyanide	03/28/88	10	2.2	10 5(2)

(1) Contract Required Quantitation Level

(2) Per Geraghty and Miller request

ATTACHMENT II

Form I-IN includes field for three types of result qualifiers. These qualifiers must be completed as follows:

Under the columns labeled "C," "Q," and "M," enter result qualifiers as identified below.

- C (Concentration) qualifier – Enter "B" if the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL). If the analyte was analyzed for but no detected, a "U" must be entered.

- Q qualifier -- Specified entries and their meanings are as follows:

  D - Reported analyte concentration be based on a dilution.

  N - Spiked sample recovery not within control limits.

  W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

  * - Duplicate analysis not within control limits.

- M (Method) qualifier -- Enter:

  - "P" for ICP
  - "F" for Furnace AA
  - 340.2 for Fluoride
  - 412.H for Free Cyanide
  - 335.2 for Total Cyanide
  - 375.4 for Sulfate

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 758-01
Sample Matrix: Water
Data Sample Collected: 04/19/88
Data Sample Received: 04/21/88

Project No.: 807104
Customer Sample No: MMRF-MW-85
Sample Description: Split

Analyte	(mg/L) Concentration		M	Date of Analysis
Arsenic (As)	0.005	U	F	04/25/88
Fluoride (F)	0.84		340.2	05/10/88
Sodium (Na)	59.5		P	04/25/88
Sulfate (SO4)	170.0		375.4	05/09/88
Total Cyanide (CN)	8.2		335.2	05/02/88
Free Cyanide (CN)	0.119		412.H	05/03/88

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Method Qualifiers:

P - ICP
F - FURNACE AA
340.2- FLUORIDE
375.4- SULFATE
335.2- TOTAL CYANIDE
412.H- FREE CYANIDE

David A Wunderlich
Data Release Authorized:

64/7104-758/59

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 758-02
Sample Matrix: Water
Data Sample Collected: 04/19/88
Data Sample Received: 04/21/88

Project No.: 807104
Customer Sample No: MMRF-MW-95
Sample Description: Split

Analyte	(mg/L) Concentration		M	Date of Analysis
Arsenic (As)	0.005	U	F	04/25/88
Fluoride (F)	1.47		340.2	05/10/88
Sodium (Na)	55.9		P	04/25/88
Sulfate (SO4)	19.4		375.4	05/09/88
Total Cyanide (CN)	0.40		335.2	05/02/88
Free Cyanide (CN)	0.077		412.H	05/03/88

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Method Qualifiers:

P - ICP
F - FURNACE AA
340.2- FLUORIDE
375.4- SULFATE
335.2- TOTAL CYANIDE
412.H- FREE CYANIDE

David A Wunderlich
Data Release Authorized:

64/7104-758/59

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 758-03
Sample Matrix: Water
Data Sample Collected: 04/15/88
Data Sample Received: 04/21/88

Project No.: 807104
Customer Sample No: TRIP BLANK #3
Sample Description: None

Analyte	(mg/L) Concentration		M	Date of Analysis
Arsenic (As)	0.005	U	F	04/25/88
Fluoride (F)	<0.10		340.2	05/10/88
Sodium (Na)	0.5	U	P	04/25/88
Sulfate (SO4)	<1.0		375.4	05/09/88
Total Cyanide (CN)	<0.005		335.2	05/02/88
Free Cyanide (CN)	0.014		412.H	05/03/88

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Note 1: Examination of the sample results indicate 0 amount of cyanide analyte between the established IDL of 2 ppb and the Geraghty and Miller MDL of 5 ppb. All data reported between these levels is considered qualitative.

Method Qualifiers:

P - ICP
F - FURNACE AA
340.2- FLUORIDE
375.4- SULFATE
335.2- TOTAL CYANIDE
412.H- FREE CYANIDE

David A. Wunderlich
Data Release Authorized:

64/7104-758/59

INORGANIC ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 759-01
Sample Matrix: Water
Data Sample Collected: 04/20/88
Data Sample Received: 04/22/88

Project No. 807104
Customer Sample No: MMRF-MWR-9A
Sample Description: Split

Analyte	(mg/L) Concentration		M	Date of Analysis
Arsenic (As)	0.005	U	F	04/25/88
Fluoride (F)	6.33		340.2	05/10/88
Sodium (Na)	74.4		P	04/25/88
Sulfate (SO4)	60.4		375.4	05/09/88
Total Cyanide (CN)	4.2		335.2	05/02/88
Free Cyanide (CN)	0.070		412.H	05/03/88

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

Method Qualifiers:

P - ICP
F - FURNACE AA
340.2- FLUORIDE
375.4- SULFATE
335.2- TOTAL CYANIDE
412.H- FREE CYANIDE

David A. Wunderlich
Data Release Authorized:

64/7104-758/59

GENERAL CHEMISTRY DUPLICATE ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 758-01 Duplicate
Sample Matrix: Water
Data Sample Received: 04/21/88

Project No. 807104
Customer Sample No: MMRF-MW-85
Sample Description: Split
Data Release Authorized:

Analyte	(mg/L) Duplicate Sample Concentration	(mg/L) Original Sample Concentration	Relative Percent Difference
Cyanide (CN)	8.4	8.2	2.4

64/7104-758/59

GENERAL CHEMISTRY DUPLICATE ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 758-02 Duplicate
Sample Matrix: Water
Data Sample Received: 04/21/88

Project No. 807104
Customer Sample No: MMRF-MW-95
Sample Description: Split
Data Release Authorized:

Analyte	(mg/L) Duplicate Sample Concentration	(mg/L) Original Sample Concentration	Relative Percent Difference	Q
Arsenic (As)	0.005 U	0.005 U	NA	
Sodium (Na)	56.3	55.9	0.7	
Free Cyanide (CN)	0.060	0.077	24.8	N

Data Report Qualifiers:

U - Indicates compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

NA - Relative percent difference calculation is not applicable to analytes when not detected.

N - RPD not within established control limits of ±20%.

64/7104-758/59

GENERAL CHEMISTRY DUPLICATE ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 759-01 Duplicate
Sample Matrix: Water
Data Sample Received: 04/22/88

Project No. 807104
Customer Sample No: MMRF-MWR-9A
Sample Description: Split
Data Release Authorized:

Analyte	(mg/L) Duplicate Sample Concentration	(mg/L) Original Sample Concentration	Relative Percent Difference
Fluoride (F)	6.38	6.33	0.8
Sulfate (SO_4)	56.4	60.4	6.8

64/7104-758/59

GENERAL CHEMISTRY MATRIX SPIKE ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 758-02MS
Sample Matrix: Water
Data Sample Received: 04/22/88

Project No. 807104
Customer Sample No: MMRF-MW-95
Sample Description: Split
Data Release Authorized:

Analyte	(mg/L) Spike Sample Concentration	(mg/L) Original Sample Analysis		(mg/L) Spike Level	Percent Recovery	Q
Arsenic (As)	0.036	0.005	U	0.040	90.0	
Sodium (Na)	60.3	55.9		4.0	110.0	
Total Cyanide (CN)	0.46	0.40		0.10	60.0	N

Data Report Qualifiers:

U - Indicates that analyte was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

N - Spiked sample recovery not within established control limits of 75-125%.

64/7104-758/59

GENERAL CHEMISTRY MATRIX SPIKE ANALYSIS DATA SHEET

Laboratory Name: Ecova Analytical Services
Lab Sample ID: EAS 759-01
Sample Matrix: Water
Data Sample Received: 04/22/88

Project No. 807104
Customer Sample No: MMRF-MWR-9A
Sample Description: Split
Data Release Authorized:
Donald Fisher

Analyte	(mg/L) Spike Sample Concentration	(mg/L) Original Sample Analysis	(mg/L) Spike Level	Percent Recovery
Fluoride (F)	8.69	6.17*	2.50	100.8
Sulfate (SO_4)	76.0	60.4	20.0	78.0

Data Report Qualifiers:

* Value adjusted to accommodate dilution due to spike addition.

64/7104-758/59

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COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: Ecova Analytical Services Contract: G&M 807104
Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____
SOW No.: ____

G&M Sample No.	Lab Sample ID.
MMRF-MW-85-Split	758-01
MMRF-MW-95-Split	758-02
Trip Blank #3	758-03
MMRF-MWR-9A Split	759-01

Were ICP interelement corrections applied? Yes/No Yes

Were ICP background corrections applied? Yes/No No
If yes-were raw data generated before application of background corrections? Yes/No ____

Comments:

Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Lab Manager: ____

Date: ____

COVER PAGE - IN 7/87

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1
INORGANIC ANALYSIS DATA SHEET

G&M SAMPLE NO.
MMRF-MW-85 split

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 758-01

Level (low/med): low Date Received: 4-21-88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic	5	U		F
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium	59500			P
7440-28-0	Thallium				
7440-62-2	Vanadium				
	Free Cyanide	119			[illegible]
	Cyanide	8100			[illegible]
	Fluoride	890			[illegible]
	Sulfate	170000			375.4

Color Before: Blue for metals split, colorless for other split Clarity Before: opaque Texture: ____

Color After: Colorless Clarity After: clear Artifacts: ____

Comments:

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1
INORGANIC ANALYSIS DATA SHEET

G&M SAMPLE NO.
MMRF-MW-95 split

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 758-02

Level (low/med): low Date Received: 4-21-88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic	5	U		F
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium	55900			P
7440-28-0	Thallium				
7440-62-2	Vanadium				
	Free Cyanide	77			[illegible]
	Cyanide	402			[illegible]
	Fluoride	1470			[illegible]
	Sulfate	18400			375.4

Color Before: Colorless Clarity Before: Clear Texture: ____

Color After: Colorless Clarity After: Clear Artifacts: ____

Comments:

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1
INORGANIC ANALYSIS DATA SHEET

G&M SAMPLE NO.: Trip Blank #3

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 758-030

Level (low/med): low Date Received: 4-21-88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic	5	U		F
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium	500	U		P
7440-28-0	Thallium				
7440-62-2	Vanadium				
	Free Cyanide	14			AUTH
	Cyanide	5	U		335.2
	Fluoride	100	U		340.2
	Sulfate	1000	U		375.4

Color Before: Colorless Clarity Before: Clear Texture: ____

Color After: Colorless Clarity After: Clear Artifacts: ____

Comments:

FORM I - IN 7/87
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1
INORGANIC ANALYSIS DATA SHEET

G&M SAMPLE NO.: MMRF-MWR-9A SPLIT

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 759-010

Level (low/med): low Date Received: 4-22-88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic	5	U		F
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium	74,400			P
7440-28-0	Thallium				
7440-62-2	Vanadium				
	Free Cyanide	70			AUTH
	Cyanide	4100			335.2
	Fluoride	1170			340.2
	Sulfate	60400			375.4

Color Before: Blue formaldehyde (colorless for others) Clarity Before: cloudy Texture: ____

Color After: Colorless Clarity After: Clear Artifacts: ____

Comments:

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2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Initial Calibration Source: Plasma - EPA(LV) Furnace - Inorganic Ventures Inc

Continuing Calibration Source: Plasma - Inorganic Ventures Inc Furnace - VHG Labs Inc.

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	M
Aluminum									
Antimony									
Arsenic	40	40.3	100.8	50	49.4	98.8	49.8	99.6	F
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium	50700	54000	106.5	5000	5250	105	5030	100.6	P
Thallium									
Vanadium									
Free Cyanide	141	101	71.6	141	98	69.5			
Cyanide	141	101	71.6	141	96	68.1			
Fluoride	2010	2120	106.0	10000	10250	102.5			
Sulfate	74030	77200	104.3	10000	10400	104.0			115.4

(1) Control Limits: Mercury 80-120; Other Metals 90-110; CLP Cyanide 85-115

EPA WP214 conc. was used for ICV for free and total Cyanide, Fluoride, and Sulfate
The acceptable limits on the WP214 conc. studies were 61 - 126% for Cyanide
87 - 110% for Fluoride
91 - 116% for Sulfate

CLP standard WP214 conc.
F : 10 mg/L
SO4 : 10 mg/L

FORM II (PART 1) - IN 7/87

U.S. EPA - CLP

2B
CRDL STANDARD FOR AA AND ICP

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

AA CRDL Standard Source: VHG Labs Inc

ICP CRDL Standard Source: ____

Concentration Units: ug/L

Analyte	CRDL Standard for AA True	CRDL Standard for AA Found	CRDL Standard for AA %R	CRDL Standard for ICP True	CRDL Standard for ICP Initial Found	CRDL Standard for ICP Initial %R	CRDL Standard for ICP Final Found	CRDL Standard for ICP Final %R
Aluminum								
Antimony								
Arsenic	10	10.2	102					
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium				Not Required		Not Required		
Thallium								
Vanadium								
Zinc								

FORM II (PART 2) - IN 7/87

U.S. EPA - CLP

3
BLANKS

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Preparation Blank Matrix (soil/water): water

Preparation Blank Concentration Units (ug/L or mg/kg): ug/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											
Antimony											
Arsenic	-0.4	U	-0.9	U	0.6		0.2	U	-0.6	U	F
Barium											
Beryllium											
Cadmium											
Calcium											
Chromium											
Cobalt											
Copper											
Iron											
Lead											
Magnesium											
Manganese											
Mercury											
Nickel											
Potassium											
Selenium											
Silver											
Sodium	43	U	39	U					225	U	P
Thallium											
Vanadium											
Free Cyanide	5	U							5	U	AI2.M
Cyanide	5	U							5	U	AI52
Phenols	NA										-
Sulfate	1000	U									DIM

*NA - Not Analyzed

FORM III - IN 7/87

U.S. EPA - CLP

5A
SPIKE SAMPLE RECOVERY

EPA SAMPLE NO.
MWRF MW-8S SPLT 75301

Lab Name: Ecova Analytical Services Contract: ____

Lab Code: 759/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Level (low/med): low

Concentration Units (ug/L or mg/kg dry weight): ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Free Cyanide	75-125	4.42		2.23		2.00	122.0	N	AI.M

Comments:
Retract values were used to accomodate different sample volumes.

FORM V (PART 1) - IN 7/87

U.S. EPA - CLP

5A
SPIKE SAMPLE RECOVERY

G & M SAMPLE NO.

MMRF-MW-95 split 758-C2A

Lab Name: Ecova Analytical Services Contract: 807164

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): Water Level (low/med): low

Concentration Units (ug/L or mg/kg dry weight): ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	75-125	36.3		5	U	40	90.8		E
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium	75-125	60300		55900		4000	110		P
Thallium									
Vanadium									
Zinc									
Cyanide	75-125	460		400		100	60	N	[illegible]

Comments:

FORM V (PART 1) - IN 7/87

U.S. EPA - CLP

5A
SPIKE SAMPLE RECOVERY

EPA SAMPLE NO.

MMRF-MWR-9A split 759-01

Lab Name: Ecova Analytical Services Contract: ____

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Level (low/med): med

Concentration Units (ug/L or mg/kg dry weight): µg/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide									
Fluoride	75-125	8690		6170		2500	130.8		[illegible]
Sulfate	75-125	70000		60400		10000	750		[illegible]

Comments:
Fluoride sample result was adjusted for accumulate dilution due to spike addition

FORM V (PART 1) - IN 7/87

U.S. EPA - CLP

5B
POST DIGEST SPIKE SAMPLE RECOVERY

G&M SAMPLE NO.
MMRF-MW-85 SPLIT 758-018

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Level (low/med): low

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	85-115	18.9		5	U	20	94.5		E
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide									
Free Cyanide		3.36		1.19		2.50	136.8		N/A

Comments:

FORM V (PART 2) - IN 7/87

U.S. EPA - CLP

5B
POST DIGEST SPIKE SAMPLE RECOVERY

G&M SAMPLE NO.
MMRF-MW-95 SPLIT 758-02A

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Level (low/med): low

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	85-115	17.9		5	U	20	89.5		E
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide		1050		400		6.25	1033		N/A

Comments:

FORM V (PART 2) - IN 7/87

U.S. EPA - CLP

5B
POST DIGEST SPIKE SAMPLE RECOVERY

G&M SAMPLE NO.: Trip Blank #3 (758-C34)

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): Water Level (low/med): low

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	85-115	17.2		5	U	20	86.0		F
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide									

Comments:

FORM V (PART 2) - IN 7/87

U.S. EPA - CLP

5B
POST DIGEST SPIKE SAMPLE RECOVERY

G&M SAMPLE NO.: MMRF-MWR-9A split (759-01)

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): Water Level (low/med): low

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic	85-115	17.3		5	U	20	86.5		F
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide									

Comments:

FORM V (PART 2) - IN 7/87

U.S. EPA - CLP

6
DUPLICATES

EPA SAMPLE NO.

MMRF-MW85 Split 758 01

Lab Name: Ecova Analytical Services Contract: _____

Lab Code: 758/759 Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix (soil/water): water Level (low/med): low

% Solids for Sample: _____ % Solids for Duplicate: _____

Concentration Units (ug/L or mg/kg dry weight): µg/L

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								
Cyanide	20%	8100		8430		2.4		RS.1

FORM VI - IN 7/87

U.S. EPA - CLP

6
DUPLICATES

G&M SAMPLE NO.

MMRF-MW-95 Split 758-020

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix (soil/water): Water Level (low/med): low

% Solids for Sample: _____ % Solids for Duplicate: _____

Concentration Units (ug/L or mg/kg dry weight): µg/L

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								
Antimony								
Arsenic	±10 ppb	5	U	5	U			E
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium	20%	55900		56300		0.7		P
Thallium								
Vanadium								
Zinc								
Cyanide	20%	77		60		24.3	*	MRA

FORM VI - IN 7/87

U.S. EPA - CLP

6
DUPLICATES

EPA SAMPLE NO.

MMRF-MWR-9A
759-01

Lab Name: Ecova Analytical Services Contract: _____

Lab Code: 758/759 Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix (soil/water): _____ Level (low/med): low

% Solids for Sample: _____ % Solids for Duplicate: _____

Concentration Units (ug/L or mg/kg dry weight): _____

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								
Cyanide								
Fluoride	20%	6120		6730		0.3		NR
Sulfate	20%	66450		56400		1.8		275.4

FORM VI - IN 7/87

U.S. EPA - CLP

7
LABORATORY CONTROL SAMPLE

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: _____ SAS No.: _____ SDG No.: _____

Solid LCS Source: _____

Aqueous LCS Source: VHG Labs Inc

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Aluminum									
Antimony									
Arsenic	100	100	100						
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium	10000	10200	102						
Thallium									
Vanadium									
Zinc									
Cyanide									

FORM VII - IN 7/87

9

ICP SERIAL DILUTIONS

G&M SAMPLE NO.

MMRF-MW-85 Split 758-01C

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Level (low/med): low

Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	M
Aluminum							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Calcium							
Chromium							
Cobalt							
Copper							
Iron							
Lead							
Magnesium							
Manganese							
Mercury							
Nickel							
Potassium							
Selenium							
Silver							
Sodium	59500		59000		0.8		P
Thallium							
Vanadium							
Zinc							

FORM IX - IN 7/87

9

ICP SERIAL DILUTIONS

G&M SAMPLE NO.

MMRF-MWR-9A Split 759-01C

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Level (low/med): low

Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	M
Aluminum							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Calcium							
Chromium							
Cobalt							
Copper							
Iron							
Lead							
Magnesium							
Manganese							
Mercury							
Nickel							
Potassium							
Selenium							
Silver							
Sodium	74400		72000		3.2		P
Thallium							
Vanadium							
Zinc							

FORM IX - IN 7/87

10
HOLDING TIMES

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 758/759 Case No.: _____ SAS No.: _____ SDG No.: _____

AS No.	G&M EPA Sample No.	Matrix	Date Received	Metals Prep Date	Metals Holding Time	Cyanide Prep Date	FREE Cyanide Prep Date	Sulfate Prep Date	Fluoride Prep Date
58-01C	MMRF-MW-8S	water	4-21-88	4-22-88	180 days	5-2-88	5-2-88	5-9-88	5-[illegible]-88
58-02C	MMRF-MW-9S	water	4-21-88	4-22-88	180 days	5-2-88	5-2-88	5-9-88	5-[illegible]-88
58-03C	Trip Blank #3	water	4-21-88	4-22-88	180 days	5-2-88	5-2-88	5-9-88	5-[illegible]-88
59-01C	MMRF-MWR-9A	water	4-22-88	4-22-88	180 days	5-2-88	5-2-88	5-9-88	5-[illegible]-88

Total and Free Cyanide Holding Times: 14 days
Sulfate and Fluoride Holding Times: 28 days

FORM X - IN 7/87

INSTRUMENT DETECTION LIMITS (QUARTERLY)

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

ICP ID Number: Baird Spectrovac Date: 4-23-88

Flame AA ID Number: _____

Furnace AA ID Number: Perkin-Elmer 3030 Zeeman

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum			200		
Antimony			60		
Arsenic	1937		10	5	E
Barium			200		
Beryllium			5		
Cadmium			5		
Calcium			5000		
Chromium			10		
Cobalt			50		
Copper			25		
Iron			100		
Lead			5		
Magnesium			5000		
Manganese			15		
Mercury			0.2		
Nickel			40		
Potassium			5000		
Selenium			5		
Silver			10		
Sodium	5890		5000	500	P
Thallium			10		
Vanadium			50		
Zinc			20		

Comments:

FORM XI - IN 7/87

ECOVA

June 23, 1988

Mr. Edward R. Rothschild
Geraghty and Miller, Inc.
14655 Bel-Red Road, Suite 202
Bellevue, Washington 98007

Dear Mr. Rothschild:

GERAGHTY AND MILLER - 807104

Enclosed are the data sheets and the QA/QC documentation for samples comprising EAS Sample Batch 840. The samples were received June 4, 1988, and logged in under the following numbers:

EAS LAB ID	FIELD ID	MATRIX
840-01 (A,B)	VER-MW8S-Split	Water
840-02 (A,B)	VER-MW9S-Split	Water
840-03 (A,B)	VER-MWR-9A-Split	Water
840-04 (A,B)	Trip Blank	Water

The laboratory assigned a unique identifier (A or B) to each sample bottle relative to the test to be run from that bottle. Sample bottles for free cyanide were labelled with an A, and sample bottles for total cyanide were labelled with a B.

Analysis for total cyanide was performed in accordance with EPA Method 335.2 (to include a sulfide scrubber). Analysis for free cyanide was performed in accordance with Standard Methods, 16th Edition, Section 412.H.

The QA parameters for cyanides were shown to be out of compliance:

- Total cyanide on ICV - The ICV recovery is 137% (acceptable is 85-115%). The CLP established guidelines do not account for a sulfide scrubber to be placed in the distillation train. Ranges need to be compiled for such a modification. However, the ICV used (WP018 #1) fell within the acceptable range established by the study.

Corporate Office
3820 159th Avenue NE
Redmond, WA 98052
(206) 883-1900
(206) 867-2210 FAX

Gulf Coast Region
12790 Merit Drive #220
Lock Box 145
Dallas, TX 75251
(214) 404-7540
(214) 404-7545 FAX

Eastern Region
500 Fifth Avenue
Suite 935
New York, NY 10110
(212) 840-1042
(212) 840-1663 FAX

RECEIVED
JUN 29 1988
GERAGHTY & MILLER, INC
Seattle, Washington

- Free cyanide on ICV - The ICV recovery is 131% (acceptable is 85-115%). The CLP established guidelines do not account for a sulfide scrubber to be placed in the distillation train. Ranges need to be compiled for such a modification. Furthermore, there is no established reference standard specifically for free cyanide. However, the ICV used (WP018 #1) fell within the acceptable range established by the study.

Instrument detection limits for all inorganic analyses performed are summarized in Attachment I. The IDLs were determined in accordance with procedures described in the July 1985 revision of the Statement of Work of the EPA CLP. Specifically, the average of the standard deviations obtained on the three nonconsecutive days from the analysis of a standard solution at a concentration 3X - 5X IDL, with seven consecutive measurements per day was multiplied by 3 for the IDL. Note that IDLs are based on analysis of the analyte in deionized water. The MDL for total and free cyanide is 5 ppb in water as per Geraghty and Miller's request.

In accordance with the contract requirements for Laboratory Reportables, Level III, a CLP documentation package comprised of Forms I-XI is provided. These forms provide complete documentation of QA/QC to include blanks, calibration standard checks, and interference check standards. Please note that the source of initial calibration check standards is the EPA Wastewater Study QA samples from Study WP019. Attachment II contains an explanation of data qualifiers used in the supplied forms.

Please review the submitted data package and contact us should you have any questions or need further clarification of the final results.

Sincerely,

David A. Wunderlich (for D. Aitkei)

David A. Wunderlich,
Group Leader, Trace Metals

cc: C. Ankerberg - G&M, Tampa, FL
J. Bou - Martin Marietta, Bethesda, MD
[redacted] - G&M, Bellevue, WA
L. Grabowski - Martin Marietta, The Dalles, OR

65/7104-LET.840
Enclosures

ECOVA
ANALYTICAL
SERVICES

ATTACHMENT I

Inorganic Instrument Detection Limits

Analysis	Date IDL Determined	Analyte Concentration (ppb)	IDL (Avg Std) (Dev X 3)	CROL(1) (ppb)
Total Cyanide	03/28/88	10	2.2	10 5(2)
Free Cyanide	05/02/88	10	2.6	10 5(2)

(1) Contract Required Quantitation Level
(2) Per Geraghty and Miller request

65/7104-IID.840

ECOVA
ANALYTICAL
SERVICES

INORGANIC ANALYSIS DATA SHEET

Lab Sample ID: EAS 840-01
Sample Matrix: Water
Date Sample Received: 06/04/88

Project No: 807104
Customer Sample No: VER-MW-8S
Sample Description: Split

Analyte	Concentration (mg/L)	M	Date of Analysis
Total Cyanide (CN)	7.3	335.2	06/13/88
Free Cyanide (CN)	0.116	412.H	06/15/88

Method Qualifiers (M):

335.2- Total Cyanide
412.H- Free Cyanide

David A Wunderlich for D. S.
Data Release Authorized:

65/7104-IAD.840

ECOVA
ANALYTICAL
SERVICES

INORGANIC ANALYSIS DATA SHEET

Lab Sample ID: EAS 840-02
Sample Matrix: Water
Date Sample Received: 06/04/88

Project No: 807104
Customer Sample No: VER-MW-9S
Sample Description: Split

Analyte	Concentration (mg/L)	M	Date of Analysis
Total Cyanide (CN)	0.70	335.2	06/13/88
Free Cyanide (CN)	0.051	412.H	06/15/88

Method Qualifiers (M):

335.2- Total Cyanide
412.H- Free Cyanide

David A Wunderlich for D.L.
Data Release Authorized:

65/7104-IAD.840

ECOVA
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SERVICES

GENERAL CHEMISTRY DUPLICATE ANALYSIS DATA SHEET

Lab Sample ID: EAS 840-02 Duplicate
Sample Matrix: Water
Date Sample Received: 06/02/88

Project No: 807104
Customer Sample No: VER-MW-9S
Sample Description: Split

Analyte	Duplicate Sample Concentration (mg/L)	Original Sample Concentration (mg/L)	Relative Percent Difference
Total Cyanide (CN)	0.74	0.70	5.6
Free Cyanide (CN)	0.055	0.051	7.5

David A Wunderlich for D.L.
Data Release Authorized:

65/7104-IAD.840

ECOVA
ANALYTICAL
SERVICES

GENERAL CHEMISTRY MATRIX SPIKE ANALYSIS DATA SHEET

Lab Sample ID: EAS 840-02MS
Sample Matrix: Water
Date Sample Received: 06/04/88

Project No: 807104
Customer Sample No: VER-MW-9S
Sample Description: Split

Analyte	Spike Sample Concentration (mg/L)	Original Sample Concentration (mg/L)	Spike Level (mg/L)	Percent Recovery	
Total Cyanide (CN)	0.77	0.70	.100	70	N
Free Cyanide (CN)	.152	0.051	.100	101	

Data Report Qualifiers:

N - Spike recovery not within control limits. However, sample value exceeded the spiked amount by greater than 4X.

David A Wunderlich for D.L.
Data Release Authorized:

65/7104-1AD.840

ECOVA
ANALYTICAL
SERVICES

INORGANIC ANALYSIS DATA SHEET

Lab Sample ID: EAS 840-03
Sample Matrix: Water
Date Sample Received: 06/04/88

Project No: 807104
Customer Sample No: VER-MWR-9A
Sample Description: Split

Analyte	Concentration (mg/L)	M	Date of Analysis
Total Cyanide (CN)	3.6	335.2	06/13/88
Free Cyanide (CN)	0.077	412.H	06/15/88

Method Qualifiers (M):

335.2- Total Cyanide
412.H- Free Cyanide

David A Wunderlich for D.L.
Data Release Authorized:

65/7104-1AD.840

ECOVA
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SERVICES

INORGANIC ANALYSIS DATA SHEET

Lab Sample ID: EAS 840-04
Sample Matrix: Water
Date Sample Received: 06/04/88

Project No: 807104
Customer Sample No: Trip Blank
Sample Description: N/A

Analyte	Concentration (mg/L)	Q	M	Date of Analysis
Total Cyanide (CN)	0.005	U	335.2	06/13/88
Free Cyanide (CN)	0.005	U	412.H	06/15/88

Data Report Qualifiers (Q):

U - Indicates that analyte was analyzed for but not detected at the given detection limit. The sample quantitation limit was corrected for dilution and for percent moisture, when applicable.

Method Qualifiers (M):

335.2- Total Cyanide
412.H- Free Cyanide

Data Release Authorized: David A. Wunderlich for D. L.

65/7104-IAD.840

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: FCOVA Analytical Services Contract: G+M 83/104

Lab Code: 840 Case No.: ____ SAS No.: ____ SDG No.: ____

SOW No.: ____

G+M ~~EPA~~ Sample No.	Lab Sample ID.
VER-MW-33-Split	840-01
VER-MW-9I-Split	840-02
VER-MWR-9A-Split	840-03
Trip Blank	840-04

Were ICP interelement corrections applied? Yes/No ____

Were ICP background corrections applied? Yes/No ____

If yes-were raw data generated before application of background corrections? Yes/No ____

Comments:

Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Lab Manager: David A. Wunderlich for D. Litch

Date: June 24 1988

COVER PAGE - IN 7/87

U.S. EPA - CLP

1

INORGANIC ANALYSIS DATA SHEET

G+M ~~EPA~~ SAMPLE NO.

VER-MW-33 Split

Lab Name: FCOVA Analytical Services Contract: G+M 83/104

Lab Code: 840 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 840-01

Level (low/med): ____ Date Received: 06/04/88

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ug/L

CAS No.	Analyte	Concentration	C	M	Q
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
Total	Cyanide	7300		335.2	
FREE	Cyanide	116		412.H.	

Color Before: Colorless Clarity Before: Turbid/cloudy Texture: ____

Color After: ____ Clarity After: ____ Artifacts: ____

Comments:

FORM I - IN 7/87

U.S. EPA - CLP

1
INORGANIC ANALYSIS DATA SHEET

G+M
EPA SAMPLE NO.
VER-MW-45 split

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 840 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 840-02

Level (low/med): ____ Date Received: 06/04/87

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): µg/L

CAS No.	Analyte	Concentration	C	M	Q
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
Total	Cyanide	700		335.2	
Free	Cyanide	51		412-A	

Color Before: colorless Clarity Before: cloudy Texture: ____

Color After: ____ Clarity After: ____ Artifacts: ____

Comments:

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1
INORGANIC ANALYSIS DATA SHEET

G+M
EPA SAMPLE NO.
VER-MW-46 split

Lab Name: Ecova Analytical Services Contract: 807104

Lab Code: 840 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 840-03

Level (low/med): ____ Date Received: 06/04/87

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): µg/L

CAS No.	Analyte	Concentration	C	M	Q
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
Total	Cyanide	3600		335.2	
Free	Cyanide	77		412-A	

Color Before: colorless Clarity Before: clear Texture: ____

Color After: ____ Clarity After: ____ Artifacts: ____

Comments:

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1

INORGANIC ANALYSIS DATA SHEET

G+M ~~EPA~~ SAMPLE NO.

Trip Blank

Lab Name: ELOVA Analytical Services Contract: 807104

Lab Code: 340 Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix (soil/water): water Lab Sample ID: 340-04

Level (low/med): ____ Date Received: 10/04/86

% Solids: ____

Concentration Units (ug/L or mg/kg dry weight): ____

CAS No.	Analyte	Concentration	C	M	Q
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese				
7439-97-6	Mercury				
7440-02-0	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
Total	Cyanide	5	U	335.2	
Free	Cyanide	5	U	412.1	

Color Before: Colorless Clarity Before: clear Texture: ____

Color After: ____ Clarity After: ____ Artifacts: ____

Comments:

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2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ELOVA Analytical Services Contract: 807104

Lab Code: 340 Case No.: ____ SAS No.: ____ SDG No.: ____

Initial Calibration Source: See below

Continuing Calibration Source: See below

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	M
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide	70	96	137	50	49	98			
Cyanide	70	92	131	50	50	100			

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

EPA WP015*1 was used for ICV in Free CN and Total CN
The acceptable limits in the WP015*1 for Free and Total CN are 40% - 139%

ICV for both Free and Total CN was a standard prepared at mid-range 50.0 µg/L

FORM II (PART 1) - IN 7/87

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6
DUPLICATES

GTM ~~EPA~~ SAMPLE NO.
VER-MW-85 split

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 840 Case No.: _____ SAS No.: _____ SDG No.: 840-02

Matrix (soil/water): water Level (low/med): _____

% Solids for Sample: _____ % Solids for Duplicate: _____

Concentration Units (ug/L or mg/kg dry weight): ug/L

	Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
	Aluminum								
	Antimony								
	Arsenic								
	Barium								
	Beryllium								
	Cadmium								
	Calcium								
	Chromium								
	Cobalt								
	Copper								
	Iron								
	Lead								
	Magnesium								
	Manganese								
	Mercury								
	Nickel								
	Potassium								
	Selenium								
	Silver								
	Sodium								
	Thallium								
	Vanadium								
	Zinc								
Total	Cyanide	20%	790		740		5.6		
Free	Cyanide	20%	~~740~~ 51		55		7.5		

FORM VI - IN 7/87

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10
HOLDING TIMES

Lab Name: ECOVA Analytical Services Contract: 807104

Lab Code: 840 Case No.: _____ SAS No.: _____ SDG No.: _____

SAS No.	GTM ~~EPA~~ Sample No.	Matrix	Date Received	Total Cyanide ~~Mercury~~ Prep Date	Total Cyanide ~~Mercury~~ Holding Time	Free Cyanide Prep Date	Free Cyanide Holding Time
840-01	VER-MW-85-split	water	06/13/88	06/13/88	4 days	06/15/88	11 days
840-02	VER-MW-95-split	water	06/04/88	06/18/88	4 days	06/15/88	11 days
840-03	VER-MUR-MW-85	water	06/04/88	06/13/88	4 days	06/15/88	11 days
840-04	Trip Blank	water	06/07/88	06/13/88	4 days	06/15/88	11 days

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3
BLANKS

Lab Name: ECOVA Analytical Services Contract: 837104

Lab Code: 842 Case No.: ____ SAS No.: ____ SDG No.: ____

Preparation Blank Matrix (soil/water): water

Preparation Blank Concentration Units (ug/L or mg/kg): µg/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Prepa-ration Blank	C	M
Aluminum											
Antimony											
Arsenic											
Barium											
Beryllium											
Cadmium											
Calcium											
Chromium											
Cobalt											
Copper											
Iron											
Lead											
Magnesium											
Manganese											
Mercury											
Nickel											
Potassium											
Selenium											
Silver											
Sodium											
Thallium											
Vanadium											
Zinc											
Cyanide	5	U	5	U							335.2
Cyanide	5	U	5	U							412.1

FORM III - IN 7/87

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5A
SPIKE SAMPLE RECOVERY

G+M ~~EPA~~ SAMPLE NO.
VER-MW-55 split

Lab Name: ECOVA Analytical Services Contract: 837104

Lab Code: 842 Case No.: ____ SAS No.: ____ SDG No.: 842-02

Matrix (soil/water): water Level (low/med): ____

Concentration Units (ug/L or mg/kg dry weight): µg/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Magnesium									
Manganese									
Mercury									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Thallium									
Vanadium									
Zinc									
Cyanide	75-125	770		700		100	70		335.2
Cyanide	75-125	152		51		100	101		412.1

Comments:
Total Cyanide Sample Result exceeds the spike added by greater than 4x.

FORM V (PART 1) - IN 7/87