FINAL

OU-B 31677

LONG-TERM GROUNDWATER MONITORING

NOVEMBER 1997 SAMPLING

OPERABLE UNIT B POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

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SECTIONONE Introduction

Woodward-Clyde (WC) was contracted by the United States Army Corps of Engineers (USACE) on behalf of the United States Army, Public Works (Army) to conduct long-term groundwater monitoring at Operable Unit B (OUB), the Poleline Road Disposal Area, at Fort Richardson, Alaska. OUB is a former Army disposal area for chemical warfare training materials and has been the subject of several environmental investigations, a feasibility study, and a treatability study.

The objective of long-term groundwater monitoring is twofold: to collect data on groundwater contaminant trends, and to devise an appropriate long-term monitoring plan for the site. According to the *Long-Term Groundwater Monitoring Workplan, Operable Unit B, Poleline Road Disposal Area, Forth Richardson, Alaska* (WC, September 1997), eight rounds of sampling will be performed initially to evaluate groundwater contaminant trends. This report summarizes data collected during the first round of groundwater monitoring which was conducted in November 1997.

SECTIONTWO Scope Of Work

The tasks to be completed under the *Long-Term Groundwater Monitoring Workplan, Operable Unit B, Poleline Road Disposal Area, Forth Richardson, Alaska* (WC, September 1997) include the following:

- Conduct eight rounds of groundwater sampling for volatile organic compounds (VOCs) in 20 monitoring wells at OUB. Also conduct sampling for natural attenuation parameters during the first two rounds.
- Set up and maintain a database of VOC groundwater data from OUB using Microsoft Access. Structure the database to accommodate additional data from future long-term monitoring. Enter existing VOC data and update the database after each sampling event.
- Prepare a technical memorandum after each round of sampling that includes the results of the sampling event, a description of changes in contaminant concentrations since the previous sampling event, and recommendations for the next round of sampling.
- Evaluate natural attenuation data after the first two rounds of sampling and revise sampling plan based on the evaluation.
- Evaluate data after the eight rounds of sampling are complete and provide recommendations for the wells to be used for long-term monitoring.

3.1 LOCATION

OUB is located on the Fort Richardson Army Post, approximately 10 miles northeast of Anchorage. Alaska. The site is approximately 1 mile south of the Eagle River and 0.6 miles north of the Anchorage Regional Landfill. Access to the area is by Poleline Road, a major gravel road that runs northeast-southwest along a power line route and the Eklutna Water Line. The site is bisected by Barrs Boulevard, a gravel road extending from the Glenn Highway to Poleline Road.

3.2 SITE DESCRIPTION

The OUB site is a low-lying, relatively flat area which is bordered by wooded hills to the northwest and southeast. The site encompasses four disposal areas, Areas A-1 through A-4 (Figure 3-1). The area was cleared of vegetation during a removal action in 1994. Wetlands are located directly south and southwest of the disposal areas. The remaining area bordering the site is relatively flat and wooded.

3.3 GEOLOGY

Regional surficial deposits are fluvially reworked glacial sediments and glacial tills. These deposits appear to be up to 30 feet thick at the site and consist of unstratified to poorly stratified clays, silts, sands, gravels, and boulders. A basal till lies below the surficial deposits and overlies an advance moraine/till complex. Underlying the glacial sediments is bedrock composed of a hard black fissile claystone.

The subsurface soils are dense glacial tills and generally silty sands with some gravel. Thin, discontinuous clay lenses were observed rarely. Observations during drilling confirm a typical fluvio-glacial setting; a heterogeneous system of discontinuous, relatively permeable channels with intervening denser, less permeable sediments.

3.4 HYDROGEOLOGY

Four water bearing intervals have been identified at OUB: a perched interval, a shallow interval, an intermediate interval, and a deep aquifer. The detection of contaminants in all four intervals suggests that they are interconnected to some degree. Observations made while drilling indicate that the saturated intervals are separated by zones of very dense, low porosity, compact tills. The compact tills are dry or slightly moist.

The perched interval was observed in borings drilled between Area A-2 and the wetlands, and in Area A-3. The top of the perched interval was encountered at 4 to 10 feet below ground surface (bgs), and the bottom was found at 6 to 12 feet bgs. The average thickness of the perched interval is approximately 5 feet. The perched interval is recharged mainly by surface water from the wetlands, although some recharge also occurs from precipitation. The only well installed in the perched interval is MW-14.

The shallow saturated interval is an average of 10 feet thick; the top was encountered at 20 to 25 feet bgs, and the bottom was found at 28 to 36 feet bgs. Groundwater elevations indicate that

shallow groundwater is flowing in a north-northeast direction. Because of the localized nature of water-bearing zones at this site, it is difficult to tell whether the water-bearing units are hydraulically connected between wells. The shallow interval is recharged by water from the perched interval and by infiltration of precipitation.

The intermediate interval was observed while drilling deep monitoring well MW-16. The saturated portion of the intermediate interval was encountered at approximately 65 to 95 feet bgs in MW-16. The intermediate saturated interval does not correlate with the other deep wells on site, suggesting that it is an isolated lens with limited continuity. There may be several isolated lenses of saturated material within the intermediate interval.

Five monitoring wells at OUB penetrate the deep aquifer, the top of which was encountered from approximately 80 to 125 feet bgs. The deep aquifer is an advance moraine/till complex with a thickness of between 3 and 40 feet. Groundwater elevations indicate that the flow direction in the deep aquifer is locally to the northeast and regionally to the northwest. Available data indicate that the deep aquifer below the site is not connected with the aquifers used for drinking water in the community of Eagle River (over one mile to the northeast).

The deep aquifer overlies a claystone bedrock unit with unknown thickness. Four of the five deep wells at OUB penetrate the bedrock unit and the well screens extend slightly into the bedrock. The top of bedrock was encountered from 120 to 170 feet beneath the site.

The ultimate discharge area of the water-bearing intervals at OUB is probably the Eagle River, approximately 1 mile north of the site. The Eagle River flows into the Knik Arm of Cook Inlet approximately 5 miles northwest of OUB. The river is not used as a drinking water supply.

3.5 LAND USE

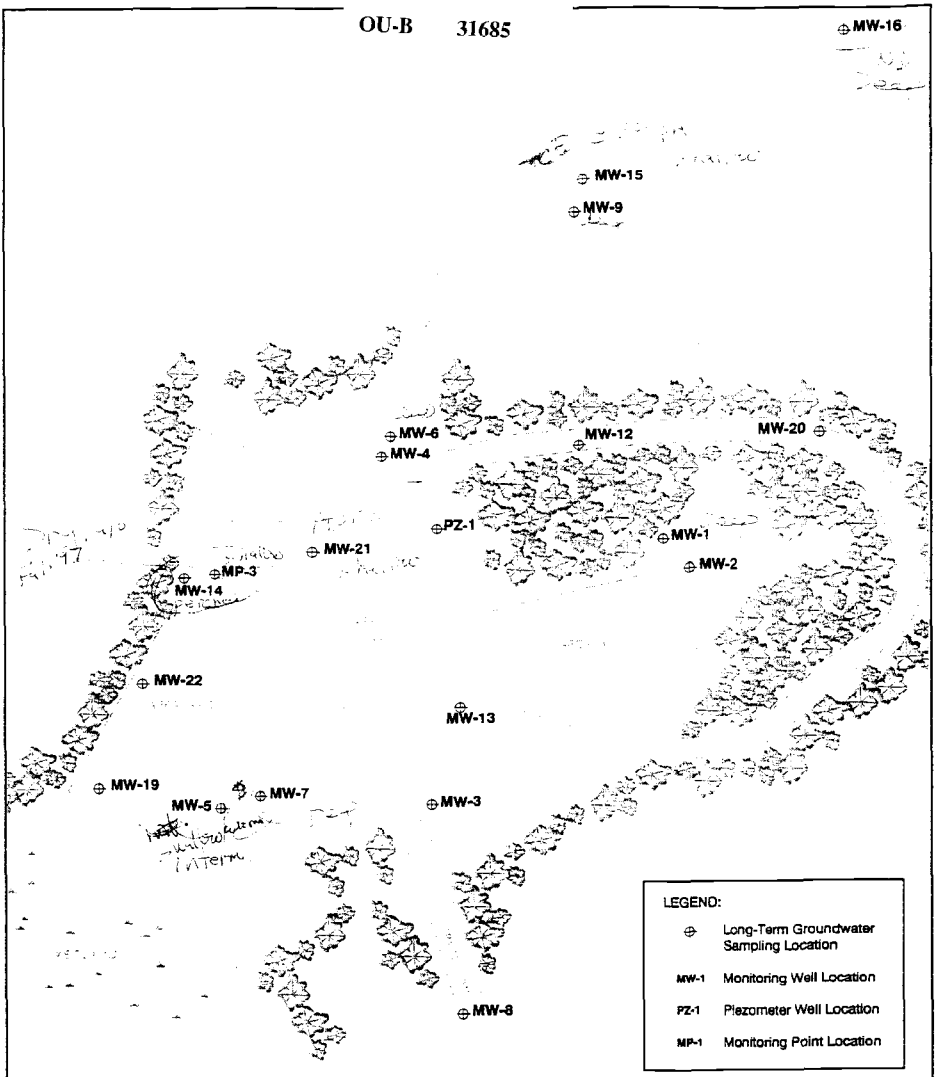
The land surrounding OUB currently is used for Army training activities and for recreational purposes. It is unlikely that groundwater beneath the site ever would be used for a drinking water supply. Yield from the intermediate, shallow, and perched saturated intervals may be too low to supply an average household, and the installation of septic systems would preclude use of the shallow or perched intervals for drinking water. The deep aquifer may provide sufficient yield but the installation of drinking water wells in the deep aquifer is unlikely. The Eklutna Water Line, a pipeline which supplies Anchorage and the community of Eagle River with drinking water from Eklutna Lake (over 15 miles from the site), runs immediately west of the site and would provide a relatively inexpensive and reliable source of drinking water.

3.6 CURRENT SITE CONDITIONS

A design verification study (DVS) was underway during the November 1997 round of groundwater sampling. The primary objective of the DVS is to evaluate the applicability of six-phase soil heating (SPSH) as an applicable *in-situ* technology for remediating solvent contaminated soils. SPSH uses common low frequency electricity to heat soil as an enhancement to soil vapor extraction (SVE).

The DVS used an array of electrodes connected to transformers that provided electricity to heat the subsurface to approximately 100 degrees Celsius. Each electrode was installed in a well that

served as a soil vapor extraction vent. Extracted vapors flowed through a condenser and the condensed liquids were treated in an air stripper and discharged on site.



SITE MAP
20 GROUNDWATER MONITORING WELLS
POLELINE ROAD DISPOSAL AREA
OUB, FORT RICHARDSON, ALASKA

Woodward-Clyde

Dwg: 97GW3_1.DWG	*By:* AR	*Figure:* 3-1
Project: E9408U	*Date:* 7-18-97	

The wells selected for sampling during the initial eight rounds of the long-term groundwater monitoring program are shown on the site map (Figure 3-1). The rationale for sampling each well is presented in Table 3-1 of the *Long-Term Groundwater Monitoring Workplan, Operable Unit B, Poleline Road Disposal Area, Forth Richardson, Alaska* (WC, September 1997). Field tasks for the first round of groundwater monitoring included the following:

- collect headspace readings of the vapors in each well
- measure static water levels
- purge and sample up to 20 wells for analysis of volatile organic compounds (VOCs) and selected natural attenuation parameters

The parameters selected for measurement of natural attenuation are listed in Table 4-2 of the *Long-Term Groundwater Monitoring Workplan, Operable Unit B, Poleline Road Disposal Area, Forth Richardson, Alaska* (WC, September 1997).

Groundwater monitoring was conducted in accordance with procedures and protocols presented in Sections 4 through 7 of the *Long-Term Groundwater Monitoring Workplan, and Addendum No. 1 to the Long-Term Groundwater Monitoring Work Plan.* Section 4 covers the groundwater monitoring field procedures, Section 5 is the Quality Assurance Project Plan (QAPP), Section 6 and *Addendum No. 1* describe the management of investigation -derived waste, and Section 7 covers health and safety requirements.

Headspace measurements and groundwater levels were measured in 21 monitoring wells. Three of these wells, MP-3, MW-4, and MW-14 were dry. An array of electrodes was heating subsurface soils to approximately 100 degrees Celsius as part of a design verification study that was underway during the November 1997 round of groundwater sampling. The proximity of wells MP-3 and MW-14 to the array is the likely reason that they were dry. Measurements using a photoionization detector (PID) showed no volatile organic vapors in the headspace of most of the wells. The only wells where PID values were above 0.0 ppm were MW-6 (1.0 ppm), MW-9 (3.0 ppm), MW-14 (13.9 ppm), and MW-22 (11.0 ppm). Groundwater samples were collected from 18 wells for analysis of volatile organic compounds (VOCs) and selected natural attenuation parameters.

5.1 VOLATILE ORGANIC COMPOUNDS

Table 5-1 summarizes analytical results for the VOCs detected in groundwater samples collected during 1995, 1996, and 1997. Ten of the thirteen VOCs detected in the November 1997 groundwater samples were chlorinated compounds. VOCs were not detected in groundwater from the shallow (background) well MW-17, or in groundwater from the deep monitoring wells MW-9, and MW-16. The distribution of VOCs detected is discussed below.

5.1.1 Non-Chlorinated VOCs

Acetone, benzene, and toluene are the three non-chlorinated VOCs detected in groundwater collected during the November 1997 round of sampling. Acetone and benzene were identified in samples from the shallow aquifer. Acetone was detected at a concentration of 0.059 ppm in groundwater collected from monitoring well MW-22. Benzene was detected in samples from monitoring wells MW-21, MW-22, and PZ-1 at concentrations of 0.094 ppm, 0.009 ppm, and 0.022 ppm, respectively.

A trace amount of toluene (0.001 ppm) was detected in one sample collected from the deep-aquifer monitoring well MW-6. The detection limit for toluene using EPA Method 8260A is 0.001 ppm.

5.1.2 Chlorinated VOCs

Chlorinated VOCs were detected in most of the November 1997 groundwater samples. Two compounds, 1,1,2,2-tetrachloroethane and trichloroethene (TCE), were found at concentrations significantly higher than other chemicals detected at the site. These two contaminants were also detected over the largest area. The compounds, 1,1,2-trichloroethene, and 1,2-dichloroethene (total cis- and trans-) were also widespread in their occurrence. Highest VOC concentrations occurred in samples from the shallow aquifer. Samples from monitoring wells MW-21 and MW-22 were the most contaminated.

Table 5-1 is organized so that changes in contaminant concentrations over time can be identified. A review of Table 5-1 does not show any clear trends currently. Not consistently sampling the existing wells and installling new wells leaves few instances where three years of data are available.

The concentration of several chlorinated daughter products (breakdown products from 1,1,2,2-tetrachloroethane) may be increasing. The concentration of 1,1,2,2-tetrachloroethane may also be decreasing. These trends are based on very few data points and may not be accurate. Additional rounds of sampling will help identify trends.

5.1.3 Maximum Contaminant Levels

Groundwater from 13 wells contained one or more compounds that exceeded Alaska maximum contaminant levels (MCLs). Table 5-2 summarizes compounds detected in concentrations that exceeded MCLs in groundwater samples collected in November 1997.

5.2 NATURAL ATTENUATION PARAMETERS

The behavior of organic and inorganic contaminants, inorganic minerals, and microbial populations is affected by the geochemistry of the subsurface environment. Primary geochemical parameters that characterize the subsurface include:

- alkalinity
- temperature
- pH
- redox potential
- dissolved constituents (including electron acceptors)
- the physical and chemical characterization of the solids
- microbial processes

The most important of these in relation to biological processes are:

- alkalinity
- redox potential
- the concentration of electron acceptors
- the chemical nature of the solids

Selected parameters were measured to help identify what types of natural processes may be degrading contaminants at the site. Laboratory results for analysis of selected natural attenuation parameters are summarized in Table 5-3, and field measurements are summarized in Table 5-4. These tables include data from analysis of samples collected in November 1996 and November 1997.

Alkalinity

Carbon dioxide generated during biodegradation causes an increase in alkalinity. Thus, biologically active portions of a plume may be identified in the field by their increased alkalinity (compared with background wells), and alkalinity can be one of the parameters used to identify where to collect biologically active core material.

The alkalinity of water sampled from the background well (MW-17) was 110 ppm. Alkalinity values for samples collected from the shallow aquifer ranged from 68 ppm to 190 ppm. Alkalinity in water from monitoring well MW-5 (shallow-intermediate aquifers) was 56 ppm. Water sampled from the deep aquifer had alkalinity values of 110 ppm to 280 ppm.

Oxidation/Reduction Potential

The oxidation/reduction (redox) potential of ground water is a measure of electron activity that indicates the relative ability of a solution to accept or transfer electrons. Most redox reactions in the subsurface are microbially catalyzed during metabolism of native organic matter or contaminants. According to Wilson, et al. (1996), when the redox potential is less than 50 mV against Ag/AgCl, a reductive pathway is possible. Redox data from the November 1997 sampling is limited due to problems encountered with the instrumentation. However, the data suggest that conditions are not favorable for reductive pathways.

5.2.1 Electron Acceptors

In order to identifying the predominant microbial and geochemical processes occurring *in situ* at the time of sample collection, it is critical to measure the available electron acceptors. Nitrate and sulfate are found naturally in most groundwater and will subsequently be used as electron acceptors once oxygen is consumed. Oxidized forms of iron and manganese can be used as electron acceptors before sulfate reduction, and their reduced forms scavenge oxygen to the extent that strict anaerobes (some sulfate reducers and all methanogens) can develop. Sulfate is found in many depositional environments, and sulfate reduction may be very common in contaminated groundwater. In environments where sulfate is depleted, carbonate becomes the electron acceptor, with methane gas produced as an end product.

Dissolved Oxygen

According to Wilson et al. (1996) the reductive pathways necessary for bioremediation require dissolved oxygen concentrations of less than 0.05 ppm At higher concentrations, dissolved oxygen is toxic to the reductive pathway (vinyl chloride, for example, is oxidized when the oxygen concentration is greater than 1 ppm). The dissolved oxygen concentration in water from three of the shallow monitoring wells (MW-3, MW-19, and MW-20) measured zero ppm, suggesting appropriate conditions necessary for reductive pathways. Dissolved oxygen measurements in water from the other 15 wells, however, were erratic or unusually high. It is suspected that ambient air temperatures were too cold for proper operation of the dissolved oxygen meter.

Nitrate and Nitrite

Nitrate reducing conditions are indicated when nitrate and nitrite occur together. Also, for reductive pathways, the optimum concentration of nitrate should be less than 1 ppm.

The concentration of nitrate/nitrite as nitrogen was less than 1 ppm in all samples except those from the shallow monitoring wells MW-12 (2 ppm) and MW-13 (2 ppm), and shallow-intermediate well MW-5 (5.6 ppm). The range of concentrations of nitrate/nitrite as nitrogen in samples from the shallow aquifer does not appear significantly different from the range of values in samples from the deep aquifer.

Sulfate

For reductive pathways, the optimum concentration for sulfate is less than 20 ppm. Sulfate concentrations in samples from the shallow and shallow-intermediate aquifers ranged from 3.7 ppm to 78 ppm, and ranged from 5.3 ppm to 17 ppm in samples from the deep aquifers. The samples from the shallow and shallow-intermediate aquifers with relatively high sulfate concentrations are from wells with relatively high VOC concentrations.

Ferrous Iron

Reductive pathways are possible when the concentration of iron (II) is greater than about 1 to 1.5 ppm. Ferrous iron concentrations in samples from two of the shallow wells (MW-19 and MW-21) were above 1.5 ppm. Ferrous iron in these wells measures 5.5 ppm, and 4.0 ppm. respectively.

Temperature, Specific Conductance, and pH

Temperature and pH affect biodegradation of contaminants. Although biological growth can occur over a wide range of temperatures, most microorganisms are active primarily between 50°F and 95°F. Measured groundwater temperatures during the November 1997 round of sampling ranged from 34.0°F to 70.9°F with all but one of the measurements below 50°F. Some of the temperature values were elevated above normal values due to the heating subsurface soils during design verification study that was underway during the November 1997 round of groundwater sampling.

An optimum pH range for most microorganisms is between 6.0 and 8.0. Many microorganisms, however, can tolerate a pH range of 5.0 to 9.0. Most groundwater in uncontaminated aquifers has a pH in the 5.0 to 9.0 range. Active oxidation of sulfides may cause pH levels to be as low as 4.0. In carbonate-buffered groundwater, pH values may be as high as 9.0. Measured pH during the November 1997 round of groundwater sampling ranged from 5.89 to 8.38 with water from the shallow aquifer being slightly lower (5.89 to 7.65) than water from the deep aquifer (6.15 to 8.38).

Chloride

Inorganic chloride accumulates as a result of reductive dechlorination. In aquifers with a low background of inorganic chloride, the concentration of inorganic chloride should increase as the chlorinated solvents degrade. The sum of the inorganic chloride plus the contaminant being degraded should remain relatively consistent along the groundwater flow path.

The concentration of chloride in groundwater from the background well (MW-17) was 3.6 ppm. Chloride concentrations in samples from the shallow and shallow-intermediate aquifers ranged from 1.6 ppm to 42 ppm with the higher concentrations occurring in wells which also had high concentrations of VOCs. Chloride concentrations in samples from the deep aquifer ranged from 2.4 ppm to 22 ppm. The relatively high value of 22 ppm occurred in the sample from monitoring well MW-16, and appears anomalous.

Ammonia

Ammonia as nitrogen was found in seven of the groundwater samples collected from the shallow aquifer (0.085 ppm to 1.2 ppm), the shallow-intermediate aquifer (0.51 ppm), and the deep aquifer (0.41 ppm to 0.74 ppm).

Sulfide

A reductive pathway is possible when the concentration for sulfide is greater than 1 ppm. Sulfide was not detected in any of the 1996 and 1997 groundwater samples. The analytical detection limit for the November 1997 samples was 0.05ppm to 0.1ppm.

Total Organic Carbon

Total organic carbon (TOC) represents a source of carbon and energy that drive dechlorination and influences contaminant migration. Optimum values for TOC are greater than 20 ppm. Although TOC was present in all of the November 1997 samples, the concentration was never greater than 9.6 ppm. TOC concentrations in samples from the shallow aquifer ranged from 0.85 ppm to 9.6 ppm. The TOC concentration for the sample from the shallow-intermediate aquifer was 5.9 ppm. TOC concentrations in samples from the deep aquifer ranged from 0.39 ppm to 3.8 ppm.

5.3 NATURAL ATTENUATION AT OUB

Analytical results for the 18 groundwater samples collected in November 1997 indicate that there is little or no natural attenuation of contaminants occurring at OUB. The technical protocol for evaluating the natural attenuation of chlorinated solvents in groundwater developed by T.H. Wiedemeier, et al. (1996) for the U.S. Air Force Center for Environmental Excellence was used to evaluate results of the November 1997 groundwater sampling at OUB.

The protocol uses a scoring system to rate the potential for natural attenuation at a site. The score is based on the results of measurement of several chemical and physical parameters for groundwater sampled from the area with the highest concentration of contaminants. The higher the score, the higher the likelihood that natural attenuation is occurring at the site. A score of 0 to 5 indicates inadequate evidence for biodegradation of chlorinated organics, 6 to 14 indicates limited evidence, 15 to 20 indicates adequate evidence, and a score of greater than 20 indicates strong evidence of biodegradation. The score using results from analysis of November 1997 groundwater samples collected from monitoring wells MW-21, MW-22, PZ-1, and MW-5 indicates that there is inadequate to limited evidence for biodegradation of chlorinated solvents at OUB.

TABLE 5-1

SUMMARY OF ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS (VOCS) FOR 1995, 1996, AND 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Volatile Organic Compounds Detected (mg/L) in Groundwater Samples Using EPA Method 8260A								
Monitoring Well ID	1997 Sample ID	Acetone			Benzene			Toluene		
		1995	1996	1997	1995	1996	1997	1995	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER										
MP-3	No Sample: Well Dry	--	--	--	--	--	--	--	--	--
MW-2	97PRDA-004-GW	NA	NA	ND (0.010)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)
MW-3	97PRDA-019-GW	NA	NA	ND (0.010)	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)
MW-8	97PRDA-005-GW	NA	NA	ND (0.010)	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)
MW-12	97PRDA-006-GW	NA	NA	ND (0.010)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)
MW-13	97PRDA-009-GW	NA	NA	ND (0.010)	0.00034	ND (0.0010)	ND (0.001)	0.00032	ND (0.0010)	ND (0.001)
MW-15	97PRDA-008-GW	NA	NA	ND (0.010)	ND (0.0002)	--	ND (0.001)	0.00018	--	ND (0.001)
MW-17	97PRDA-010-GW	--	--	ND (0.010)	--	--	ND (0.001)	--	--	ND (0.001)
MW-19	97PRDA-016-GW	--	--	ND (0.010)	--	--	ND (0.001)	--	--	ND (0.001)
MW-19	97PRDA-017-GW*	--	--	ND (0.010)	--	--	ND (0.001)	--	--	ND (0.001)
MW-20	97PRDA-022-GW	--	--	ND (0.010)	--	--	ND (0.001)	--	--	ND (0.001)
MW-21	97PRDA-023-GW	--	--	ND (0.200)	--	--	**0.094**	--	--	ND (0.020)
MW-22	97PRDA-011-GW	--	--	**0.059**	--	--	**0.009**	--	--	ND (0.001)
MW-22	97PRDA-012-GW*	--	--	**0.058**	--	--	**0.009**	--	--	ND (0.001)
PZ-1	97PRDA-024-GW	--	--	ND (0.200)	--	ND (0.10)	**0.022**	--	ND (0.10)	ND (0.020)
WELL SCREENED IN PERCHED AQUIFER										
MW-14	No Sample: Well Dry	NA	NA	--	2.9	3.3	--	ND (0.5)	ND (1.0)	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER										
MW-5	97PRDA-001-GW	NA	NA	ND (0.010)	ND (0.2)	0.0013	**0.004**	ND (0.2)	ND (0.0010)	ND (0.001)
WELL SCREENED IN INTERMEDIATE AQUIFER										
MW-4	No Sample: Well Dry	NA	NA	--	ND (0.2)	--	--	ND (0.2)	--	--
WELL SCREENED IN DEEP AQUIFER										
MW-1	97PRDA-003-GW	NA	NA	ND (0.010)	ND (0.002)	--	ND (0.001)	ND (0.002)	--	ND (0.001)
MW-6	97PRDA-020-GW	NA	NA	ND (0.010)	ND (0.002)	--	ND (0.001)	ND (0.002)	--	**0.001**
MW-7	97PRDA-002-GW	NA	NA	ND (0.010)	ND (0.02)	--	ND (0.001)	ND (0.02)	--	ND (0.001)
MW-9	97PRDA-021-GW	NA	NA	ND (0.010)	0.00073	--	ND (0.001)	0.00073	--	ND (0.001)
MW-16	97PRDA-007-GW	NA	NA	ND (0.010)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)

NOTES:

-- = Not Sampled
NA = Not Analyzed
ND = Analyte Not Detected (Detection Limit in Parentheses)
* = Duplicate Sample for Quality Assurance (QA)

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TABLE 5-1 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS (VOCS) FOR
1995, 1996, AND 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Volatile Organic Compounds Detected (mg/L) in GroundWater Samples Using EPA Method 8260A											
Monitoring Well ID	1997 Sample ID	Bromodichloromethane			Carbon Tetrachloride			Chlorobenzene			Chloroform		
		1995	1996	1997	1995	1996	1997	1995	1996	1997	1995	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER													
MP-3	No Sample: Well Dry	--	--	--	--	--	--	--	--	--	--	--	--
MW-2	97PRDA-004-GW	ND (0.0005)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)
MW-3	97PRDA-019-GW	ND (0.0005)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	0.00053	--	ND (0.001)
MW-8	97PRDA-005-GW	ND (0.0005)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)
MW-12	97PRDA-006-GW	ND (0.0005)	ND (0.0010)	**0.002**	0.022	**0.0011**	**0.002**	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	**0.002**
MW-13	97PRDA-009-GW	ND (0.0005)	ND (0.0010)	ND (0.001)	0.00038	ND (0.0010)	**0.003**	0.00038	ND (0.0010)	ND (0.001)	0.0011	ND (0.0010)	ND (0.001)
MW-15	97PRDA-008-GW	ND (0.0005)	--	ND (0.001)	0.0014	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	0.0016	--	**0.002**
MW-17	97PRDA-010-GW	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)
MW-19	97PRDA-016-GW	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)	--	--	**0.001**
MW-19	97PRDA-017-GW*	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)	--	--	**0.001**
MW-20	97PRDA-022-GW	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)
MW-21	97PRDA-023-GW	--	--	ND (0.020)	--	--	ND (0.020)	--	--	ND (0.020)	--	--	**0.078**
MW-22	97PRDA-011-GW	--	--	ND (0.001)	--	--	**0.011**	--	--	**0.001**	--	--	**0.012**
MW-22	97PRDA-012-GW*	--	--	ND (0.001)	--	--	**0.013**	--	--	**0.001**	--	--	**0.012**
PZ-1	97PRDA-024-GW	--	ND (0.10)	ND (0.020)	--	ND (0.10)	ND (0.020)	--	ND (0.10)	ND (0.020)	--	ND (0.10)	ND (0.020)
WELL SCREENED IN PERCHED AQUIFER													
MW-14	No Sample: Well Dry	ND (1.3)	ND (1.0)	--	2.6	2.7	--	ND (0.5)	ND (1.0)	--	1.4	ND (1.0)	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER													
MW-5	97PRDA-001-GW	ND (0.50)	ND (0.0010)	ND (0.001)	ND (0.2)	ND (0.0010)	ND (0.001)	ND (0.2)	ND (0.0010)	ND (0.001)	ND (0.2)	**0.0059**	**0.010**
WELL SCREENED IN INTERMEDIATE AQUIFER													
MW-4	No Sample: Well Dry	ND (0.50)	--	--	ND (0.2)	--	--	ND (0.2)	--	--	ND (0.2)	--	--
WELL SCREENED IN DEEP AQUIFER													
MW-1	97PRDA-003-GW	ND (0.005)	--	ND (0.001)	ND (0.002)	--	ND (0.001)	ND (0.002)	--	ND (0.001)	ND (0.002)	--	ND (0.001)
MW-6	97PRDA-020-GW	ND (0.005)	--	ND (0.001)	ND (0.002)	--	**0.001**	ND (0.002)	--	ND (0.001)	ND (0.002)	--	ND (0.001)
MW-7	97PRDA-002-GW	ND (0.05)	--	ND (0.001)	ND (0.02)	--	ND (0.001)	ND (0.02)	--	ND (0.001)	ND (0.02)	--	**0.001**
MW-9	97PRDA-021-GW	ND (0.0005)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	0.00055	--	ND (0.001)	ND (0.0002)	--	ND (0.001)
MW-16	97PRDA-007-GW	ND (0.0005)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND(0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)

NOTES:

-- = Not Sampled
NA = Not Analyzed
ND = Analyte Not Detected (Detection Limit in Parentheses)
* = Duplicate Sample for Quality Assurance (QA)

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TABLE 5-1 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS (VOCS) FOR 1995, 1996, AND 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Volatile Organic Compounds Detected (mg/L) in Groundwater Samples Using EPA Method 8260A								
Monitoring Well ID	1997 Sample ID	1,1-Dichloroethene			1,2-Dichloroethene (Total)			Trichloroethene		
		1995	1996	1997	1995	1996	1997	1995	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER										
MP-3	No Sample: Well Dry	--	--	--	--	--	--	--	--	--
MW-2	97PRDA-004-GW	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	0.001
MW-3	97PRDA-019-GW	ND (0.00019)	--	ND (0.001)	0.012	--	**0.046**	0.26	--	**0.270**
MW-8	97PRDA-005-GW	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	ND (0.0002)	--	ND (0.001)
MW-12	97PRDA-006-GW	0.00014	ND (0.0010)	ND (0.001)	0.001	**0.0029**	**0.015**	0.16	**0.070**	**0.190**
MW-13	97PRDA-009-GW	0.00026	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	**0.001**	0.0067	**0.0041**	**0.018**
MW-15	97PRDA-008-GW	0.00071	--	ND (0.001)	0.019	--	**0.028**	0.27	--	**0.320**
MW-17	97PRDA-010-GW	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)
MW-19	97PRDA-016-GW	--	--	**0.002**	--	--	**0.076**	--	--	0.960
MW-19	97PRDA-017-GW*	--	--	**0.002**	--	--	**0.075**	--	--	**0.950**
MW-20	97PRDA-022-GW	--	--	ND (0.001)	--	--	ND (0.001)	--	--	**0.012**
MW-21	97PRDA-023-GW	--	--	**0.032**	--	--	**5.100**	--	--	**22.000**
MW-22	97PRDA-011-GW	--	--	**0.010**	--	--	**0.710**	--	--	**8.700**
MW-22	97PRDA-012-GW*	--	--	**0.005**	--	--	**0.730**	--	--	**9.000**
PZ-1	97PRDA-024-GW	--	ND (0.10)	ND (0.020)	--	**.17**	**1.100**	--	**.94**	**5.400**
WELL SCREENED IN PERCHED AQUIFER										
MW-14	No Sample: Well Dry	ND (0.5)	ND (1.0)	--	**49**	**5.9**	--	220	186	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER										
MW-5	97PRDA-001-GW	ND (0.2)	ND (0.0010)	**0.010**	ND (0.2)	**.33**	**0.650**	4.8	**3.1**	**8.000**
WELL SCREENED IN INTERMEDIATE AQUIFER										
MW-4	No Sample: Well Dry	ND (0.2)	--	--	2	--	--	14	--	--
WELL SCREENED IN DEEP AQUIFER										
MW-1	97PRDA-003-GW	ND (0.002)	--	ND (0.001)	0.0053	--	**0.004**	0.043	--	**0.030**
MW-6	97PRDA-020-GW	ND (0.002)	--	ND (0.001)	0.0035	--	**0.004**	0.13	--	**0.086**
MW-7	97PRDA-002-GW	ND (0.02)	--	**0.004**	0.34	--	**0.380**	1	--	**1.300**
MW-9	97PRDA-021-GW	0.0012	--	ND (0.001)	ND (0.0002)	--	ND (0.001)	0.00091	--	ND (0.001)
MW-16	97PRDA-007-GW	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.0002)	ND (0.0010)	ND (0.001)	0.00031	ND (0.0010)	ND (0.001)

NOTES:

-- = Not Sampled
NA = Not Analyzed
ND = Analyte Not Detected (Detection Limit in Parentheses)
* = Duplicate Sample for Quality Assurance (QA)

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TABLE 5-1 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS (VOCS) FOR 1995, 1996, AND 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Volatile Organic Compounds Detected (mg/L) in Groundwater Samples Using EPA Method 8260A								
Monitoring Well ID	1997 Sample ID	Tetrachloroethene			1,1,2,2-Tetrachloroethane			1,1,2-Trichloroethane		
		1995	1996	1997	1995	1996	1997	1995	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER										
MP-3	No Sample: Well Dry	--	--	--	--	--	--	--	--	--
MW-2	97PRDA-004-GW	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.50)	ND (0.0010)	**0.003**	ND (0.50)	ND (0.0010)	ND (0.001)
MW-3	97PRDA-019-GW	ND (0.0002)	--	ND (0.001)	0.54	--	**0.450**	0.0023	--	**0.004**
MW-8	97PRDA-005-GW	ND (0.0002)	--	ND (0.001)	ND (0.50)	--	ND (0.001)	ND (0.50)	--	ND (0.001)
MW-12	97PRDA-006-GW	0.00035	ND (0.0010)	ND (0.001)	0.49	**0.024**	**0.065**	0.00078	ND (0.0010)	**0.002**
MW-13	97PRDA-009-GW	ND (0.0002)	ND (0.0010)	ND (0.001)	0.0011	**0.0011**	**0.009**	ND (0.50)	ND (0.0010)	ND (0.001)
MW-15	97PRDA-008-GW	0.0021	--	**0.002**	0.0063	--	**0.004**	0.0013	--	**0.003**
MW-17	97PRDA-010-GW	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.001)
MW-19	97PRDA-016-GW	--	--	**0.018**	--	--	**1.600**	--	--	**0.014**
MW-19	97PRDA-017-GW*	--	--	**0.018**	--	--	**1.400**	--	--	**0.014**
MW-20	97PRDA-022-GW	--	--	ND (0.001)	--	--	**0.010**	--	--	ND (0.001)
MW-21	97PRDA-023-GW	--	--	**0.390**	--	--	**62.000**	--	--	**0.420**
MW-22	97PRDA-011-GW	--	--	**0.300**	--	--	**11.000**	--	--	**0.043**
MW-22	97PRDA-012-GW*	--	--	**0.320**	--	--	**11.000**	--	--	**0.043**
PZ-1	97PRDA-024-GW	--	ND (0.10)	**0.073**	--	**1.4**	**19.000**	--	ND (0.10)	**0.120**
WELL SCREENED IN PERCHED AQUIFER										
MW-14	No Sample: Well Dry	11	12.3	--	1900	1000	--	ND (1.3)	1	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER										
MW-5	97PRDA-001-GW	ND (0.2)	**0.067**	**0.130**	21	**9.1**	**19.000**	ND (0.50)	0.45	**0.100**
WELL SCREENED IN INTERMEDIATE AQUIFER										
MW-4	No Sample: Well Dry	0.31	--	--	71	--	--	ND (0.50)	--	--
WELL SCREENED IN DEEP AQUIFER										
MW-1	97PRDA-003-GW	ND (0.002)	--	ND (0.001)	0.082	--	**0.047**	ND (0.005)	--	ND (0.001)
MW-6	97PRDA-020-GW	ND (0.002)	--	ND (0.001)	0.52	--	**0.006**	ND (0.005)	--	ND (0.001)
MW-7	97PRDA-002-GW	ND (0.02)	--	**0.004**	3.1	--	**1.500**	ND (0.05)	--	**0.024**
MW-9	97PRDA-021-GW	ND (0.0002)	--	ND (0.001)	ND (0.50)	--	ND (0.001)	ND (0.50)	--	ND (0.001)
MW-16	97PRDA-007-GW	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.002)	ND (0.0010)	ND (0.001)	ND (0.50)	ND (0.0010)	ND (0.001)

NOTES:

-- = Not Sampled
NA = Not Analyzed
ND = Analyte Not Detected (Detection Limit in Parentheses)
* = Duplicate Sample for Quality Assurance (QA)

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TABLE 5-2

VOLATILE ORGANIC COMPOUNDS THAT EXCEEDED MCLS NOVEMBER 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA, FORT RICHARDSON, ALASKA			
Compound	**MCL (ppm)**	**Monitoring Well ID**	**Concentration (ppm)**
benzene	0.005	MW- 21	0.094
		MW- 22	0.009
		PZ-1	0.022
carbon tetrachloride	0.005	MW-22	0.013
1,2-dichloroethene (total cis- and trans-)	**	MW-5	0.650
		MW-7	0.380
		MW-19	0.076
		MW-21	5.100
		MW-22	0.730
		PZ-1	1.100
tetrachloroethene (PCE)	0.005	MW-5	0.130
		MW-19	0.018
		MW-21	0.390
		MW-22	0.320
		PZ-1	0.073
trichloroethene (TCE)	0.005	MW-1	0.030
		MW-3	0.270
		MW-5	8.000
		MW-6	0.086
		MW-7	1.300
		MW-12	0.190
		MW-13	0.018
		MW-15	0.320
		MW-19	0.960
		MW-20	0.012
		MW-21	22.000
		MW-22	9.000
		PZ-1	5.400

NOTES:

ppm = parts per million

* Only those concentrations that exceed Maximum Contaminant Levels (MCLs) are shown

** Analysis did not separate cis- and trans-dichloroethene which have MCLs of 0.07 and 0.1 ppm , respectively

TABLE 5-3

SUMMARY OF ANALYTICAL RESULTS FOR NATURAL ATTENUATION PARAMETERS FOF NOVEMBER 1996 AND NOVEMBER 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Natural Attenuation Parameters Detected (ppm) in Groundwater Samples (Nutrients and Electron Acceptors)						
Well ID	1997 Sample ID	Ammonia as Nitrogen		Total Kjedahl Nitrogen		Nitrate as Nitrogen	Nitrite as Nitrogen	Nitrate/Nitrite as Nitrogen
		1996	1997	1996	1997	1996	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER								
MW-2	97PRDA-004-GW	0.144	ND (0.050)	0.271	--	2.1	ND (0.1)	0.64
MW-3	97PRDA-019-GW	--	ND (0.050)	--	--	--	--	0.36
MW-8	97PRDA-005-GW	--	0.085	--	--	--	--	0.75
MW-12	97PRDA-006-GW	0.157	ND (0.050)	0.452	--	0.24	ND (0.1)	2.0
MW-13	97PRDA-009-GW	0.37	ND (0.050)	0.242	--	0.32	ND (0.1)	2.0
MW-15	97PRDA-008-GW	--	ND (0.050)	--	--	--	--	0.90
MW-17	97PRDA-010-GW	--	ND (0.050)	--	--	--	--	0.74
MW-19	97PRDA-016-GW	--	1.2	--	--	--	--	0.16
MW-20	97PRDA-022-GW	--	ND (0.050)	--	--	--	--	0.37
MW-21	97PRDA-023-GW	--	0.91	--	--	--	--	ND (0.025)
MW-22	97PRDA-011-GW	--	0.30	--	--	--	--	0.49
PZ-1	97PRDA-024-GW	0.232	0.43	0.76	--	ND (0.1)	ND (0.1)	ND (0.025)
WELL SCREENED IN PERCHED AQUIFER								
MW-14	No Sample: Well Dry	0.122	--	0.365	--	ND (2.0)	0.71	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER								
MW-5	97PRDA-001-GW	0.633	0.51	0.82	--	2.1	ND (0.1)	5.6
WELL SCREENED IN DEEP AQUIFER								
MW-1	97PRDA-003-GW	--	ND (0.050)	--	--	--	--	0.54
MW-6	97PRDA-020-GW	--	0.74	--	--	--	--	ND (0.025)
MW-7	97PRDA-002-GW	--	0.41	--	--	--	--	0.13
MW-9	97PRDA-021-GW	--	ND (0.050)	--	--	--	--	0.30
MW-16	97PRDA-007-GW	0.129	ND (0.050)	ND (0.2)	--	0.57	ND (0.1)	0.75

NOTES:

-- Indicates that well was not sampled

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TABLE 5-3 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR NATURAL ATTENUATION PARAMETERS FOF NOVEMBER 1996 AND NOVEMBER 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Natural Attenuation Parameters Detected (ppm) in Groundwater Samples (Nutrients and Electron Acceptors Continued)											
Well ID	1997 Sample ID	Chloride		Ferrous Iron		Manganese		Phosphorous (Total)		Residue (Total)		Sulfate	
		1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER													
MW-2	97PRDA-004-GW	1.6	1.6	0.864	ND (0.200)	0.111	--	0.749	--	2400	--	17.3	11
MW-3	97PRDA-019-GW	--	3.7	--	ND (0.200)	--	--	--	--	--	--	--	14
MW-8	97PRDA-005-GW	--	1.6	--	0.200	--	--	--	--	--	--	--	25
MW-12	97PRDA-006-GW	1.67	3.2	0.246	ND (0.200)	1.84	--	0.421	--	1030	--	17	15
MW-13	97PRDA-009-GW	1.74	2.4	0.218	ND (0.200)	0.0304	--	0.047	--	186	--	17	14
MW-15	97PRDA-008-GW	--	6.3	--	ND (0.200)	--	--	--	--	--	--	--	11
MW-17	97PRDA-010-GW	--	3.6	--	ND (0.200)	--	--	--	--	--	--	--	28
MW-19	97PRDA-016-GW	--	2.1	--	5.5	--	--	--	--	--	--	--	3.7
MW-20	97PRDA-022-GW	--	1.7	--	ND (0.200)	--	--	--	--	--	--	--	8.4
MW-21	97PRDA-023-GW	--	42	--	4	--	--	--	--	--	--	--	78
MW-22	97PRDA-011-GW	--	33	--	0.500	--	--	--	--	--	--	--	20
PZ-1	97PRDA-024-GW	2.13	16	0.0937	1.4	0.815	--	0.059	--	237	--	26.9	65
WELL SCREENED IN PERCHED AQUIFER													
MW-14	No Sample: Well Dry	127	--	ND (0.05)	--	0.511	--	0.342	--	996	--	44	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER													
MW-5	97PRDA-001-GW	7.33	12	0.595	0.400	0.537	--	0.029	--	294	--	82.3	79
WELL SCREENED IN DEEP AQUIFER													
MW-1	97PRDA-003-GW	--	2.4	--	ND (0.200)	--	--	--	--	--	--	--	13
MW-6	97PRDA-020-GW	--	14	--	ND (0.200)	--	--	--	--	--	--	--	5.3
MW-7	97PRDA-002-GW	--	4.3	--	ND (0.200)	--	--	--	--	--	--	--	15
MW-9	97PRDA-021-GW	--	3.0	--	ND (0.200)	--	--	--	--	--	--	--	12
MW-16	97PRDA-007-GW	23.2	22	0.761	0.200	ND (0.02)	--	0.028	--	576	--	16.8	17

NOTES:

-- Indicates that well was not sampled

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TABLE 5-3 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR NATURAL ATTENUATION PARAMETERS FOR NOVEMBER 1996 AND NOVEMBER 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Natural Attenuation Parameters Detected (ppm) in Groundwater Samples (Metabolic End Products)							
Well ID	1997 Sample ID	Ethane		Ethene		Methane		Sulfide	
		1996	1997	1996	1997	1996	1997	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER									
MW-2	97PRDA-004-GW	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	ND (0.0500)
MW-3	97PRDA-019-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-8	97PRDA-005-GW	--	--	--	--	--	--	--	ND (0.100)
MW-12	97PRDA-006-GW	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	ND (0.0500)
MW-13	97PRDA-009-GW	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	ND (0.0500)
MW-15	97PRDA-008-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-17	97PRDA-010-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-19	97PRDA-016-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-20	97PRDA-022-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-21	97PRDA-023-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-22	97PRDA-011-GW	--	--	--	--	--	--	--	ND (0.0500)
PZ-1	97PRDA-024-GW	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	ND (0.0500)
WELL SCREENED IN PERCHED AQUIFER									
MW-14	No Sample: Well Dry	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER									
MW-5	97PRDA-001-GW	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	ND (0.0500)
WELL SCREENED IN DEEP AQUIFER									
MW-1	97PRDA-003-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-6	97PRDA-020-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-7	97PRDA-002-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-9	97PRDA-021-GW	--	--	--	--	--	--	--	ND (0.0500)
MW-16	97PRDA-007-GW	ND (0.02)	--	ND (0.06)	--	ND (0.02)	--	ND (0.0500)	ND (0.0500)

NOTES:

-- Indicates that well was not sampled

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TABLE 5-3 (CONTINUED)

SUMMARY OF ANALYTICAL RESULTS FOR NATURAL ATTENUATION PARAMETERS FOR NOVEMBER 1996 AND NOVEMBER 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B POLINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA		Natural Attenuation Parameters Detected in Groundwater Samples (Substrates and Others)									
		Substrates (ppm)		Others							
Well ID	1997 Sample ID	Total Organic Carbon		Alkalinity (ppm)		Heterotrophic Plate Count (col/L)		Oil Degrading Bacteria (col/L)		Sulfate Reducing Bacteria (col/L)	
		1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
WELLS SCREENED IN SHALLOW AQUIFER											
MW-2	97PRDA-004-GW	1.3	1.1	--	130	1300	--	ND (20)	--	Negative	--
MW-3	97PRDA-019-GW	--	1.2	--	160	--	--	--	--	--	--
MW-8	97PRDA-005-GW	--	1.5	--	120	--	--	--	--	--	--
MW-12	97PRDA-006-GW	1.4	0.90	--	68	72	--	ND (20)	--	Negative	--
MW-13	97PRDA-009-GW	1.2	1.1	--	160	200	--	ND (20)	--	Negative	--
MW-15	97PRDA-008-GW	--	0.85	--	98	--	--	--	--	--	--
MW-17	97PRDA-010-GW	--	1.5	--	110	--	--	--	--	--	--
MW-19	97PRDA-016-GW	--	8.6	--	190	--	--	--	--	--	--
MW-20	97PRDA-022-GW	--	1.1	--	94	--	--	--	--	--	--
MW-21	97PRDA-023-GW	--	9.6	--	160	--	--	--	--	--	--
MW-22	97PRDA-011-GW	--	3.4	--	130	--	--	--	--	--	--
PZ-1	97PRDA-024-GW	2.6	3.7	--	160	490	--	ND (20)	--	Negative	--
WELL SCREENED IN PERCHED AQUIFER											
MW-14	No Sample: Well Dry	5.2	--	--	--	2	--	ND (20)	--	Negative	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER											
MW-5	97PRDA-001-GW	4.4	5.9	--	56	201	--	ND (20)	--	Negative	--
WELL SCREENED IN DEEP AQUIFER											
MW-1	97PRDA-003-GW	--	1.8	--	150	--	--	--	--	--	--
MW-6	97PRDA-020-GW	--	0.80	--	280	--	--	--	--	--	--
MW-7	97PRDA-002-GW	--	3.8	--	220	--	--	--	--	--	--
MW-9	97PRDA-021-GW	--	0.59	--	110	--	--	--	--	--	--
MW-16	97PRDA-007-GW	ND (0.05)	0.39	--	110	204	--	ND (20)	--	Negative	--

NOTES:

-- Indicates that well was not sampled

OU-B 31700

TABLE 5-4

SUMMARY OF FIELD MEASUREMENTS FOR NOVEMBER 1996 AND NOVEMBER 1997 GROUNDWATER SAMPLES

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA, FORT RICHARDSON, ALASKA											
Aquifer(s) Screened	Well Identification	Dissolved Oxygen (ppm)		Oxidation Reduction Potential (mV)		pH		Specific Conductance (µS/cm)		Temperature (°F)	
		1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
Shallow	MW-2	9.63	20.44*	63.3	46**	7.49	6.17	163	261	41.1	43.7
Shallow	MW-3	--	0.00	--	370/136	--	7.71	--	237	--	38.3
Shallow	MW-8	--	***	--	43**	--	6.22	--	265	--	39.0
Shallow	MW-12	3.9	24.01*	94.2	48**	7.48	6.13	194	182	40.3	39.0
Shallow	MW-13	8.3	***	81.9	53**	7.50	6.00	228	344	43.5	41.7
Shallow	MW-15	--	***	--	43**	--	6.23	--	203	--	40.6
Shallow	MW-17	--	***	--	57**	--	5.89	--	295	--	39.7
Shallow	MW-19	--	0.00	--	***	--	***	--	358	--	41.2
Shallow	MW-20	--	0.0	--	207/115	--	7.65	--	150	--	36.1
Shallow	MW-21	--	22.5*	--	55/79	--	6.4	--	475	--	39.6
Shallow	MW-22	--	3.87	--	***	--	***	--	413	--	70.9
Shallow	PZ-1	3.65	19*	-75.5	148/110	7.04	6.9	229	395	41.0	37.6
Perched	MW-14	4.38	well dry	112.8	well dry	7.22	well dry	638	well dry	44.9	well dry
Shallow-Intermediate	MW-5	4.33	17.78*	5.4	42**	6.67	6.22	233	350	42.6	34.0
Deep	MW-1	--	20.64*	--	44**	--	6.19	--	308	--	43.7
Deep	MW-6	--	17.37*	--	312/74	--	8.38	--	471	--	41.4
Deep	MW-7	--	19.54*	--	43**	--	6.25	--	427	--	45.7
Deep	MW-9	--	47.2*	--	284/155	--	7.68	--	174	--	37.4
Deep	MW-16	8.77	***	-10.2	49**	7.22	6.15	225	308	41.1	49.5

NOTES:

Where two values are recorded for Oxidation Reduction Potential, two instruments were used for the measurement

-- Indicates that well was not sampled

* Indicates values higher than expected (suspect ambient temperature too cold for proper operation of instrument)

** Indicates values lower than expected (instrument not reading oxidation reduction potential)

*** Indicates erratic readings (suspect ambient temperature too cold for proper operation of instrument)

6.1 CONCLUSIONS

Round one of the long-term groundwater monitoring program for OUB was conducted in November 1997. Headspace measurements and groundwater levels were measured in 21 monitoring wells. Three of these wells, MP-3, MW-4, and MW-14 were dry. An array of electrodes was heating subsurface soils as part of a design verification study that was underway during the November 1997 round of groundwater sampling. The proximity of wells MP-3 and MW-14 to thc array is the likely reason that they were dry. Groundwater samples were collected from 18 wells for analysis of volatile organic compounds (VOCs) and selected natural attenuation parameters. Thirteen VOCs were detected and ten of these were chlorinated compounds. VOCs were not detected in groundwater from the shallow (background) well MW-17, or in groundwater from the deep monitoring wells MW-9, and MW-16. Measurement and analysis of natural attenuation parameters indicates that there is inadequate to limited evidence for biodegradation of chlorinated solvents at OUB.

6.2 RECOMMENDATIONS

The following recommendations are based upon the results of the first round of long-term groundwater monitoring at OUB:

- Include measurement (field and laboratory) of the selected natural attenuation parameters for one more round of monitoring. The reason for this recommendation is twofold: (1) An array of electrodes was heating subsurface soils to approximately 100 degrees Celsius as part of a design verification study that was underway during the November 1997 round of groundwater sampling. Heated soil and groundwater proximate to several of the wells likely affected the chemical processes controlling some or all of the natural attenuation parameters; (2) cold winter temperatures are suspected to have caused erratic readings during collection of some of the field measurements. More complete data would be generated if natural attenuation measurements collected during late Spring to early Fall.
- Measure ferrous iron in the field using a Hach ferrous iron test kit. Discussion with Dr. Molly TeVracht, a chemist with the USACE, indicates that more representative ferrous iron values would be generated by measuring this parameter in the field rather than having it analyzed at a laboratory.
- Use a discharge hose dedicated to each well when extending the discharge line so it will reach the vehicle containing the drums being used for temporary storage of purge water. This will prevent the need to decontaminate a small-diameter hose.
- To identify if nitrate reducing conditions exist, analyze for nitrate and nitrite separately (nitrate reducing conditions exist when both occur together).

Wiedemeier, T.H., M.A. Swanson, D.E. Moutoux, K, Gordon, J.T., Wilson, B.H. Wilson, D.H. Kampbell, J.E. Hansen, P. Haas, and F.H. Chapelle. 1996. "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. U.S. Air Force Center for Environmental Excellence, San Antonio.

Wilson, B.H., J.T. Wilson, and D. Luce. 1996 "Design and Interpretation of Microcosm Studies for Chlorinated Compounds" in U. S. Environmental Protection Agency. 1996. "Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, September 11-13, Dallas, Texas.

Woodward-Clyde, *Long-Term Groundwater Monitoring Workplan, Operable Unit B, Poleline Road Disposal Area, Forth Richardson, Alaska* (September 1997).

ATTACHMENT 1

Laboratory Reports from CT&E Environmental Services, Inc.

CT&E Environmental Services Inc.

CT&E Ref.#	976994001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/11/97 14:45
Client Sample ID	97PRDA-001-GW	**Received Date/Time**	11/12/97 08:30
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/14/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.400	0.200	mg/L	Hach Method			11/12/97	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	977008001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring E94084-5700	**Collected Date/Time**	11/12/97 13:05
Client Sample ID	97PRDA-002-GW	**Received Date/Time**	11/13/97 08:34
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/14/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/13/97	JRJ

CT&E Environmental Services Inc.

CT&E Ref.#	977008002	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring E94084-5700	**Collected Date/Time**	11/12/97 14:30
Client Sample ID	97PRDA-003-GW	**Received Date/Time**	11/13/97 08:34
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/14/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/13/97	JRJ

CT&E Environmental Services Inc.

CT&E Ref.#	977008003	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring E94084-5700	**Collected Date/Time**	11/12/97 15:20
Client Sample ID	97PRDA-004-GW	**Received Date/Time**	11/13/97 08:34
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/14/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/13/97	JRJ

CT&E Environmental Services Inc.

CT&E Ref.#	977037001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/13/97 14:25
Client Sample ID	97PRDA-005-GW	**Received Date/Time**	11/14/97 08:25
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.100 U	0.100	mg/L	EPA 376.2			11/17/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200	0.200	mg/L	Hach Method			11/14/97	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	977102001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/17/97 13:20
Client Sample ID	97PRDA-006-GW	**Received Date/Time**	11/18/97 08:25
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/18/97	RMV
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/18/97	RMV

CT&E Environmental Services Inc.

OU-B 31711

CT&E Ref.#	977102002	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/17/97 14:45
Client Sample ID	97PRDA-007-GW	**Received Date/Time**	11/18/97 08:25
Matrix	Water (Surface, Eff., Ground)	**Technical Director:**	**Stephen C. Ede**
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/18/97	RMV
Waters Analysis								
Ferrous Iron Screen	0.200	0.200	mg/L	Hach Method			11/18/97	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	977102003	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/17/97 15:50
Client Sample ID	97PRDA-008-GW	**Received Date/Time**	11/18/97 08:25
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/18/97	RMV
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/18/97	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	977102004	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/17/97 16:30
Client Sample ID	97PRDA-009-GW	**Received Date/Time**	11/18/97 08:25
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/18/97	RMV
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/18/97	RMV

CT&E Ref.#	977102005	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/17/97 17:15
Client Sample ID	97PRDA-010-GW	**Received Date/Time**	11/18/97 08:25
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/18/97	RMV
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/18/97	RMV

CT&E Environmental Services Inc.

CT&E Ref.#	977127001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E94084-5700	**Collected Date/Time**	11/18/97 14:45
Client Sample ID	97PRDA-011-GW	**Received Date/Time**	11/19/97 08:30
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/19/97	RMV
Waters Analysis								
Ferrous Iron Screen	0.500	0.200	mg/L	Hach Method			11/19/97	RMV

CT&E Environmental Services Inc.

OU-B 31716

CT&E Ref.#	977127002	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E94084-5700	**Collected Date/Time**	11/18/97 16:30
Client Sample ID	97PRDA-016-GW	**Received Date/Time**	11/19/97 08:30
Matrix	Water (Surface, Eff., Ground)	**Technical Director:**	**Stephen C. Ede**
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/19/97	RMV
Waters Analysis								
Ferrous Iron Screen	5.50	0.200	mg/L	Hach Method			11/19/97	RMV

CT&E Environmental Services Inc.

OU-B 31717

CT&E Ref.#	977203001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring Fort Rich	**Collected Date/Time**	11/23/97 12:30
Client Sample ID	97-PRDA-019-GW	**Received Date/Time**	11/24/97 08:15
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/25/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/24/97	JRJ

CT&E Environmental Services Inc.

CT&E Ref.#	977203002	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 14:24
Project Name/#	OUB GW Monitoring Fort Rich	**Collected Date/Time**	11/23/97 15:00
Client Sample ID	97-PRDA-020-GW	**Received Date/Time**	11/24/97 08:15
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/25/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/24/97	JRJ

CT&E Ref.#	977225001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	**Collected Date/Time**	11/24/97 12:30
Client Sample ID	97-PRDA-021-GW	**Received Date/Time**	11/24/97 16:45
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/25/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/25/97	JRJ

CT&E Ref.#	977225002	Client PO#	
Client Name	Woodward-Clyde Consultants	Printed Date/Time	11/26/97 09:44
Project Name/#	OUB GW Monitoring E9408U/5700	Collected Date/Time	11/24/97 14:00
Client Sample ID	97-PRDA-022-GW	Received Date/Time	11/24/97 16:45
Matrix	Water (Surface, Eff., Ground)	Technical Director: Stephen C. Ede	
Ordered By			
PWSID		Released By	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/25/97	JRJ
Waters Analysis								
Ferrous Iron Screen	0.200 U	0.200	mg/L	Hach Method			11/25/97	JRJ

CT&E Environmental Services Inc.

CT&E Ref.#	977251001	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 16:23
Project Name/#	OUB GW Monitoring E9408U/7400	**Collected Date/Time**	11/25/97 10:45
Client Sample ID	97-PRDA-023-GW	**Received Date/Time**	11/25/97 16:30
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/26/97	JRJ
Waters Analysis								
Ferrous Iron Screen	4.00	0.200	mg/L	Hach Method			11/25/97	JRJ

CT&E Ref.#	977251002	**Client PO#**	
Client Name	Woodward-Clyde Consultants	**Printed Date/Time**	11/26/97 16:23
Project Name/#	OUB GW Monitoring E9408U/7400	**Collected Date/Time**	11/25/97 12:30
Client Sample ID	97-PRDA-024-GW	**Received Date/Time**	11/25/97 16:30
Matrix	Water (Surface, Eff., Ground)	**Technical Director: Stephen C. Ede**	
Ordered By			
PWSID		**Released By**	Stephen C Ede

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Sulfide	0.0500 U	0.0500	mg/L	EPA 376.2			11/26/97	JRJ
Waters Analysis								
Ferrous Iron Screen	1.40	0.200	mg/L	Hach Method			11/25/97	JRJ

ATTACHMENT 2

Laboratory Reports from MultiChem Environmental Services

MAS I.D. # 821285-1 **OU-B** **31724**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/11/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/13/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-001-GW	DATE ANALYZED	: 11/17/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	<10	
1,1-DICHLOROETHENE	10	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	10	
1,2-DICHLOROETHENE (TOTAL)	650	D6
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	<1	
BENZENE	4	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	8000	D6
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	100	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	130	
CHLOROBENZENE	<1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	19000	D9

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	90	64 - 145
TOLUENE-D8	95	89 - 110
BROMOFLUOROBENZENE	102	82 - 112

D6 = Value from a 50 fold diluted analysis.
D9 = Value from a 500 fold diluted analysis.

MAS I.D. # 821287-1 **OU-B** **31725**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/12/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/14/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-002-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	<10	
1,1-DICHLOROETHENE	4	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	1	
1,2-DICHLOROETHENE (TOTAL)	380	D7
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	<1	
BENZENE	<1	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	1300	D7
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	24	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	4	
CHLOROBENZENE	<1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	1500	D7

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	99	64 - 145
TOLUENE-D8	105	89 - 110
BROMOFLUOROBENZENE	101	82 - 112

D7 = Value from a 100 fold diluted analysis.

MAS I.D. # 821287-2

OU-B 31726

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/12/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/14/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-003-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLORCETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	4
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLORCETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	30
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	47

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	98	64 - 145
TOLUENE-D8	102	89 - 110
BROMOFLUOROBENZENE	100	82 - 112

MAS I.D. # 821287-3

OU-B 31727

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/12/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/14/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-004-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	<1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	1
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	3

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	98	64 - 145
TOLUENE-D8	104	89 - 110
BROMOFLUOROBENZENE	96	82 - 112

OU-B 31728

MAS I.D. # 821289-1

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/13/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/14/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-005-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	<1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	<1
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	2

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	111	64 - 145
TOLUENE-D8	100	89 - 110
BROMOFLUOROBENZENE	102	82 - 112

MAS I.D. # 821297-1

OU-B 31729

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/17/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/19/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-006-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	2
1,2-DICHLOROETHENE (TOTAL)	15
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	2
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	190
BROMODICHLOROMETHANE	2
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	2
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	65

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	111	64 - 145
TOLUENE-D8	100	89 - 110
BROMOFLUOROBENZENE	101	82 - 112

MAS I.D. # 821297-2

OU-B **31730**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/17/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/19/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-007-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	<1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	<1
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	<1

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	112	64 - 145
TOLUENE-D8	100	89 - 110
BROMOFLUOROBENZENE	100	82 - 112

MAS I.D. # 821297-5

OU-B 31731

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/17/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/19/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-008-GW	DATE ANALYZED	: 11/22/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	<10	
1,1-DICHLOROETHENE	<1	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	2	
1,2-DICHLOROETHENE (TOTAL)	28	
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	<1	
BENZENE	<1	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	320	D7
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	3	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	2	
CHLOROBENZENE	<1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	4	

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	119	64 - 145
TOLUENE-D8	102	89 - 110
BROMOFLUOROBENZENE	100	82 - 112

D7 = Value from a 100 fold diluted analysis.

MAS I.D. # 821297-6

VOLATILE ORGANICS ANALYSIS **OU-B** **31732**
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/17/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/19/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-009-GW	DATE ANALYZED	: 11/22/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	3
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	18
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	9

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	119	64 - 145
TOLUENE-D8	103	89 - 110
BROMOFLUOROBENZENE	100	82 - 112

MAS I.D. # 821297-3 **OU-B 31733**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/17/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/19/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-010-GW	DATE ANALYZED	: 11/21/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	<1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	<1
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	<1

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	113	64 - 145
TOLUENE-D8	101	89 - 110
BROMOFLUOROBENZENE	100	82 - 112

MAS I.D. # 821300-1 **OU-B 31734**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/18/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/20/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-011-GW	DATE ANALYZED	: 11/25/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	59	
1,1-DICHLOROETHENE	10	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	12	
1,2-DICHLOROETHENE (TOTAL)	710	D7
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	11	
BENZENE	9	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	8700	D7
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	43	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	300	D7
CHLOROBENZENE	1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	11000	D7

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	109	64 - 145
TOLUENE-D8	101	89 - 110
BROMOFLUOROBENZENE	104	82 - 112

D7 = Value from a 100 fold diluted analysis.

MAS I.D. # 821300-2 **OU-B** **31735**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/18/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/20/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-012-GW	DATE ANALYZED	: 11/24/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	58	
1,1-DICHLOROETHENE	5	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	12	
1,2-DICHLOROETHENE (TOTAL)	730	D7
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	13	
BENZENE	9	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	9000	D7
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	43	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	320	D7
CHLOROBENZENE	1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	11000	D7

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	107	64 - 145
TOLUENE-D8	95	89 - 110
BROMOFLUOROBENZENE	109	82 - 112

D7 = Value from a 100 fold diluted analysis.

MAS I.D. # 821300-4

OU-B **31736**

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/18/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/20/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-016-GW	DATE ANALYZED	: 11/24/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	<10	
1,1-DICHLOROETHENE	2	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	1	
1,2-DICHLOROETHENE (TOTAL)	76	
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	<1	
BENZENE	<1	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	960	D5
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	14	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	18	
CHLOROBENZENE	<1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	1600	D5

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	117	64 - 145
TOLUENE-D8	101	89 - 110
BROMOFLUOROBENZENE	106	82 - 112

D5 = Value from a twenty fold diluted analysis.

MAS I.D. # 821300-5

OU-B 31737

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/18/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/20/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97PRDA-017-GW	DATE ANALYZED	: 11/24/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	<10	
1,1-DICHLOROETHENE	2	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	1	
1,2-DICHLOROETHENE (TOTAL)	75	
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	<1	
BENZENE	<1	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	950	D5
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	14	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	18	
CHLOROBENZENE	<1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	1400	D5

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	119	64 - 145
TOLUENE-D8	101	89 - 110
BROMOFLUOROBENZENE	107	82 - 112

D5 = Value from a twenty fold diluted analysis.

MAS I.D. # 821302-1

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/23/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/25/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97-PRDA-019-GW	DATE ANALYZED	: 11/26/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
CHLOROMETHANE	<10	
VINYL CHLORIDE	<1	
BROMOMETHANE	<10	
CHLOROETHANE	<1	
ACETONE	<10	
1,1-DICHLOROETHENE	<1	
METHYLENE CHLORIDE	<5	
CARBON DISULFIDE	<10	
1,1-DICHLOROETHANE	<1	
VINYL ACETATE	<10	
2-BUTANONE (MEK)	<10	
CHLOROFORM	<1	
1,2-DICHLOROETHENE (TOTAL)	46	
1,1,1-TRICHLOROETHANE	<1	
1,2-DICHLOROETHANE	<1	
CARBON TETRACHLORIDE	<1	
BENZENE	<1	
1,2-DICHLOROPROPANE	<1	
TRICHLOROETHENE	270	D4
BROMODICHLOROMETHANE	<1	
CIS-1,3-DICHLOROPROPENE	<1	
4-METHYL-2-PENTANONE (MIBK)	<10	
TRANS-1,3-DICHLOROPROPENE	<1	
1,1,2-TRICHLOROETHANE	4	
TOLUENE	<1	
DIBROMOCHLOROMETHANE	<1	
2-HEXANONE (MBK)	<10	
TETRACHLOROETHENE	<1	
CHLOROBENZENE	<1	
ETHYLBENZENE	<1	
BROMOFORM	<5	
STYRENE	<1	
TOTAL XYLENES	<1	
1,1,2,2-TETRACHLOROETHANE	450	D4

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	107	64 - 145
TOLUENE-D8	105	89 - 110
BROMOFLUOROBENZENE	98	82 - 112

D4 = Value from a ten fold diluted analysis.

MAS I.D. # 821302-2

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/23/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/25/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97-PRDA-020-GW	DATE ANALYZED	: 12/01/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	4
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	86
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	6

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	105	64 - 145
TOLUENE-D8	99	89 - 110
BROMOFLUOROBENZENE	97	82 - 112

OU-B 31740

MAS I.D. # 821307-1

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/24/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/26/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97-PRDA-021-GW	DATE ANALYZED	: 12/08/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	<1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	<1
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	<1

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	106	64 - 145
TOLUENE-D8	103	89 - 110
BROMOFLUOROBENZENE	98	82 - 112

MAS I.D. # 821307-2

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/24/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/26/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97-PRDA-022-GW	DATE ANALYZED	: 12/05/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<10
VINYL CHLORIDE	<1
BROMOMETHANE	<10
CHLOROETHANE	<1
ACETONE	<10
1,1-DICHLOROETHENE	<1
METHYLENE CHLORIDE	<5
CARBON DISULFIDE	<10
1,1-DICHLOROETHANE	<1
VINYL ACETATE	<10
2-BUTANONE (MEK)	<10
CHLOROFORM	<1
1,2-DICHLOROETHENE (TOTAL)	<1
1,1,1-TRICHLOROETHANE	<1
1,2-DICHLOROETHANE	<1
CARBON TETRACHLORIDE	<1
BENZENE	<1
1,2-DICHLOROPROPANE	<1
TRICHLOROETHENE	12
BROMODICHLOROMETHANE	<1
CIS-1,3-DICHLOROPROPENE	<1
4-METHYL-2-PENTANONE (MIBK)	<10
TRANS-1,3-DICHLOROPROPENE	<1
1,1,2-TRICHLOROETHANE	<1
TOLUENE	<1
DIBROMOCHLOROMETHANE	<1
2-HEXANONE (MBK)	<10
TETRACHLOROETHENE	<1
CHLOROBENZENE	<1
ETHYLBENZENE	<1
BROMOFORM	<5
STYRENE	<1
TOTAL XYLENES	<1
1,1,2,2-TETRACHLOROETHANE	10

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	109	64 - 145
TOLUENE-D8	98	89 - 110
BROMOFLUOROBENZENE	98	82 - 112

MAS I.D. # 821307-3

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/25/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/26/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97-PRDA-023-GW	DATE ANALYZED	: 12/05/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 20

COMPOUNDS	RESULTS	
CHLOROMETHANE	<200	
VINYL CHLORIDE	<20	
BROMOMETHANE	<200	
CHLOROETHANE	<20	
ACETONE	<200	
1,1-DICHLOROETHENE	32	
METHYLENE CHLORIDE	<100	
CARBON DISULFIDE	<200	
1,1-DICHLOROETHANE	<20	
VINYL ACETATE	<200	
2-BUTANONE (MEK)	<200	
CHLOROFORM	78	
1,2-DICHLOROETHENE (TOTAL)	5100	
1,1,1-TRICHLOROETHANE	<20	
1,2-DICHLOROETHANE	<20	
CARBON TETRACHLORIDE	<20	
BENZENE	94	
1,2-DICHLOROPROPANE	<20	
TRICHLOROETHENE	22000	D9
BROMODICHLOROMETHANE	<20	
CIS-1,3-DICHLOROPROPENE	<20	
4-METHYL-2-PENTANONE (MIBK)	<200	
TRANS-1,3-DICHLOROPROPENE	<20	
1,1,2-TRICHLOROETHANE	420	
TOLUENE	<20	
DIBROMOCHLOROMETHANE	<20	
2-HEXANONE (MBK)	<200	
TETRACHLOROETHENE	390	
CHLOROBENZENE	<20	
ETHYLBENZENE	<20	
BROMOFORM	<100	
STYRENE	<20	
TOTAL XYLENES	<20	
1,1,2,2-TETRACHLOROETHANE	62000	D9

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	111	64 - 145
TOLUENE-D8	106	89 - 110
BROMOFLUOROBENZENE	96	82 - 112

D9 = Value from a 500 fold diluted analysis.

MAS I.D. # 821307-4

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: WOODWARD-CLYDE CONSULTANTS	DATE SAMPLED	: 11/25/97
PROJECT #	: E9408U/5700	DATE RECEIVED	: 11/26/97
PROJECT NAME	: FT. RICHARDSON-OUB	DATE EXTRACTED	: N/A
CLIENT I.D.	: 97-PRDA-024-GW	DATE ANALYZED	: 12/05/97
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 624	DILUTION FACTOR	: 20

COMPOUNDS	RESULTS	
CHLOROMETHANE	<200	
VINYL CHLORIDE	<20	
BROMOMETHANE	<200	
CHLOROETHANE	<20	
ACETONE	<200	
1,1-DICHLOROETHENE	<20	
METHYLENE CHLORIDE	<100	
CARBON DISULFIDE	<200	
1,1-DICHLOROETHANE	<20	
VINYL ACETATE	<200	
2-BUTANONE (MEK)	<200	
CHLOROFORM	<20	
1,2-DICHLOROETHENE (TOTAL)	1100	
1,1,1-TRICHLOROETHANE	<20	
1,2-DICHLOROETHANE	<20	
CARBON TETRACHLORIDE	<20	
BENZENE	22	
1,2-DICHLOROPROPANE	<20	
TRICHLOROETHENE	5400	D0
BROMODICHLOROMETHANE	<20	
CIS-1,3-DICHLOROPROPENE	<20	
4-METHYL-2-PENTANONE (MIBK)	<200	
TRANS-1,3-DICHLOROPROPENE	<20	
1,1,2-TRICHLOROETHANE	120	
TOLUENE	<20	
DIBROMOCHLOROMETHANE	<20	
2-HEXANONE (MBK)	<200	
TETRACHLOROETHENE	73	
CHLOROBENZENE	<20	
ETHYLBENZENE	<20	
BROMOFORM	<100	
STYRENE	<20	
TOTAL XYLENES	<20	
1,1,2,2-TETRACHLOROETHANE	19000	D0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	109	64 - 145
TOLUENE-D8	104	89 - 110
BROMOFLUOROBENZENE	97	82 - 112

D0 = Value from a 200 fold diluted analysis.