OPERABLE UNIT B
POLELINE ROAD DISPOSAL AREA
FORT RICHARDSON, ALASKA

FINAL TECHNICAL MEMORANDUM UPDATING LONG-TERM GROUND-WATER MONITORING RESULTS

VOLUME I

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ACRONYMS

Ag/AgCl	silver/silver chloride
Army	United States Army, Public Works
bgs	below ground surface
CRREL	Cold Regions Research and Engineering Laboratory
ESE	Environmental Science & Engineering, Inc.
FS	feasibility study
HHRA	human health risk assessment
HVE	high vacuum extraction
IDW	investigation-derived waste
MCLs	maximum contaminant levels
mg/L	milligrams per liter
mV	millivolts
OHM	OHM Remediation Services Corporation
ORP	oxygen-reduction potential
OUB	Operable Unit B
PCE	tetrachloroethene
RAOs	remedial action objectives
SPH	six-phase heating
SVE	soil vapor extraction
TCE	trichloroethene
URS	URS Corporation
VOCs	volatile organic compounds
WC	Woodward-Clyde

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

Long-term groundwater monitoring has two objectives: (1) to collect data on groundwater contaminant trends, and (2) to provide data for devising an appropriate long-term monitoring plan for the site. In accordance with the *Long-Term Groundwater Monitoring Work Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska* (WC, 1997), eight rounds of groundwater monitoring were performed to evaluate groundwater contaminants over time. The sampling dates were: November 1997, June 1998, October 1998, March 1999, October 1999, April 2000, October 2000, and April 2001. Subsequently, a ninth round of groundwater monitoring was added to the scope of work. This report summarizes the ninth round of sampling conducted in October 2001. Tables and Figures are presented at the end of the sections in which they are referenced and laboratory data reports are provided as a separately bound Appendix A.

The scope of work consisted of conducting a ninth round of groundwater monitoring in accordance with *Long-Term Groundwater Monitoring Work Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska* (WC, 1997). Specific tasks associated with this round of groundwater monitoring include the following:

- sample groundwater from up to 20 monitoring wells at OUB for volatile organic compounds (VOCs) and natural attenuation parameters
- prepare a technical memorandum that presents the results of the sampling event and describes changes in contaminant concentrations since the preceding sampling event
- evaluate natural attenuation data
- provide recommendations for future groundwater monitoring, if needed

3.1 LOCATION

The Fort Richardson Army Post occupies 61,500 acres of land (Figure 3-1). OUB is located on the Fort Richardson Army Post approximately ten miles northeast of Anchorage, Alaska, one mile south of the Eagle River, and 0.6 miles north of the Anchorage Regional Landfill (Figure 3-2). Access to the area is by Poleline Road, a gravel road that runs northeast-southwest along a power line route and the Eklutna Water Line. OUB is bisected by Barrs Boulevard, a gravel road extending from the Glenn Highway to Poleline Road.

3.2 SITE DESCRIPTION

OUB is a low-lying, relatively flat area, bordered by a wooded, 80-foot hill to the west, wetlands directly south and southwest of the main disposal area (Area 3 and Area 4), and low, wooded hills on the remaining borders (Figure 3-3). The area where buried waste was detected by a geophysical survey is approximately 1.5 acres in size. The main disposal area was cleared of vegetation during a 1994 removal action. No significant re-vegetation has occurred.

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 hard, black, fissile claystone.

The subsurface soils are dense glacial tills and generally consisting of 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: (1) a perched interval, (2) a shallow interval, (3) an intermediate interval, and (4) a deep aquifer. The detection of contaminants in all four intervals suggests they are interconnected to some degree. Observations made while drilling indicate that zones of very dense, low porosity, compact tills, separate the saturated intervals. 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 (Figure 3-3). The top of the perched interval was encountered at four to ten feet below ground surface (bgs), and the bottom was at six to 12 feet bgs. The average thickness of the perched interval is approximately five feet. The perched interval is recharged mainly by surface water from the wetlands, although some recharge also occurs from precipitation. The only monitoring well installed in the perched interval is MW-14 (AP-3746).

The shallow, saturated interval is an average of ten feet thick; the top was encountered at 20 to 25 feet bgs, and the bottom was 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 determine whether the water-bearing units are hydraulically connected between wells. The shallow interval is recharged by water from the discontinuous perched interval and by infiltration of precipitation. The hydraulic conductivity was measured between 0.03 and 3.0 ft/day (URS 1996b). The horizontal hydraulic gradient within the shallow zone ranges from a minimum of 0.002 ft/ft to a maximum of 0.026 ft/ft (URS 1996b).

The intermediate interval was observed while drilling monitoring well MW-16 (AP-3748). The saturated portion of the intermediate interval was encountered at approximately 65 to 95 feet bgs in MW-16 (AP-3748). 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 thickness varying from three to 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 deep aquifers used for drinking water wells in the community of Eagle River (over one mile 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 hydraulic conductivity was measured at 139 ft/day (URS 1996b). The horizontal hydraulic gradient within the deep zone ranges from a minimum of 0.026 ft/ft to a maximum of 0.079 ft/ft (URS 1996b).

The ultimate discharge area of the water-bearing intervals at OUB is probably the Eagle River, approximately one mile north of the site (Figure 3-2). The Eagle River flows into the Knik Arm of Cook Inlet approximately five miles northwest of OUB. The river is not used as a drinking water source.

3.5 LAND USE

The land surrounding OUB currently is used for Army training activities and recreational purposes. The Eklutna Water Line, a pipeline that supplies Anchorage and part of the Eagle River community with drinking water from Eklutna Lake (over 15 miles from the site), runs immediately west of the site.

At present, there are no plans for development of OUB. The deep aquifer may provide sufficient yield for drinking water wells; however, future development of the deep aquifer for this purpose is unlikely, due to the proximity of the Eklutna Water Line.

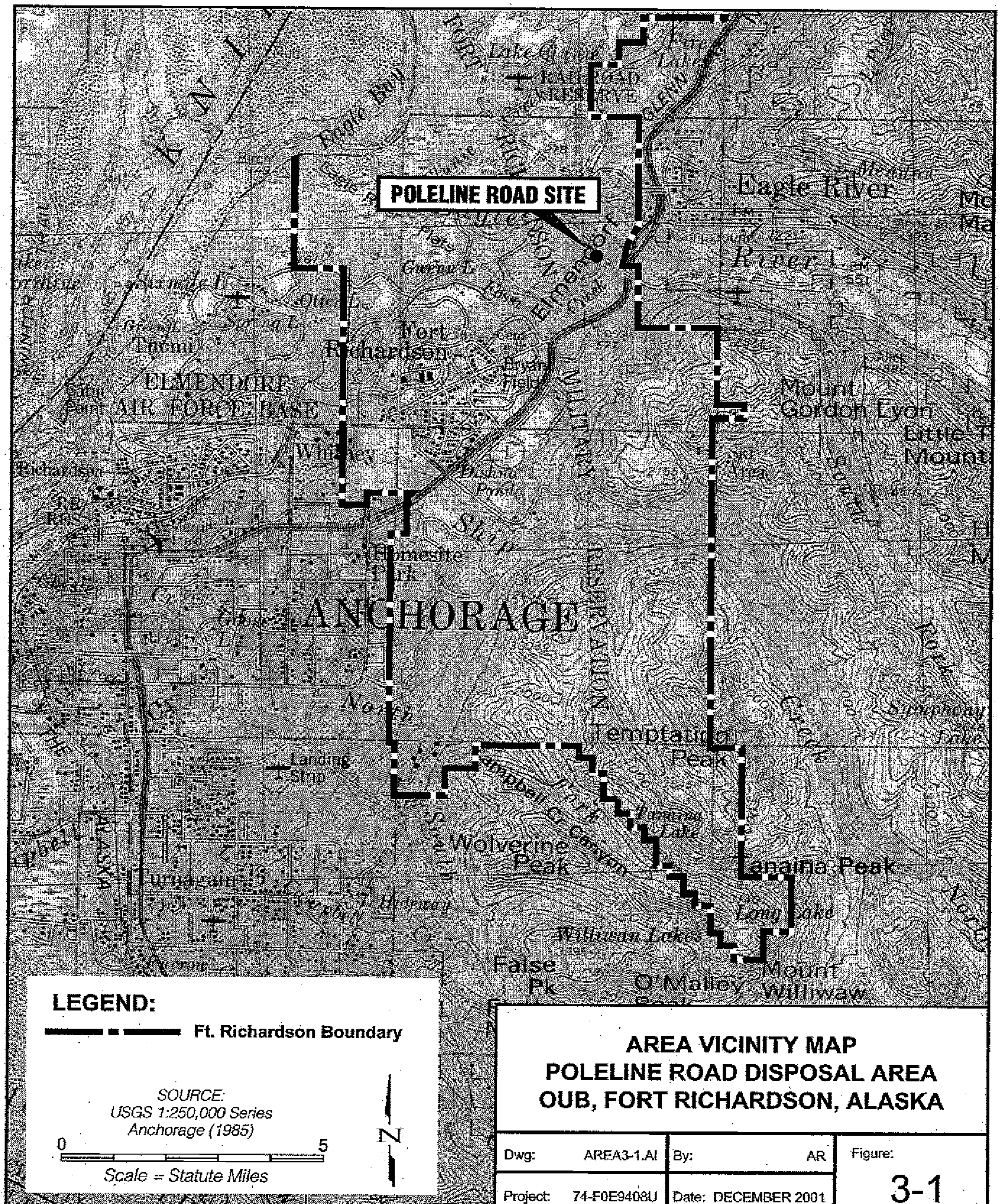
3.6 HISTORY OF INVESTIGATION ACTIVITIES

Several investigations and a removal action have been conducted at OUB since its discovery in 1990. A brief summary of these activities is presented as follows:

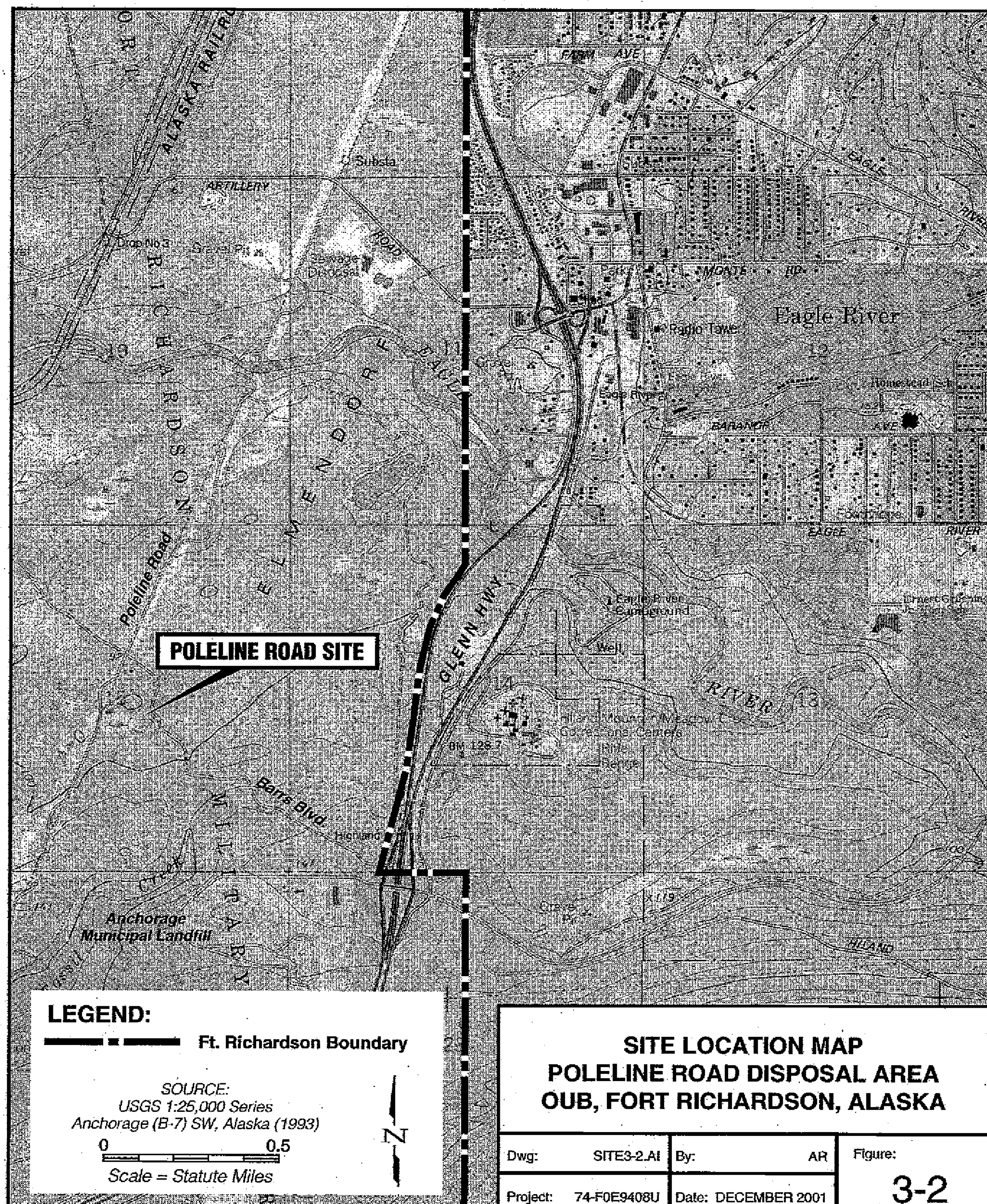
- In 1990 and in 1992, Environmental Science & Engineering, Inc. (ESE) conducted site investigations that included a geophysical survey, soil borings, a soil gas survey, monitoring well installation, groundwater sampling, a water level survey, and aquifer (slug) tests (ESE, 1990, 1991, and 1993).

- In 1993, OHM Remediation Services Corporation (OHM) conducted a rapid response removal action within areas A-3 and A-4 (OHM, 1993).
- In 1994 and in 1995, the Cold Regions Research and Engineering Laboratory (CRREL) conducted geophysical surveys (CRREL, 1994, 1995).
- In 1995, URS (then Woodward-Clyde) performed a Remedial Investigation that consisted of surface and subsurface soil sampling, groundwater sampling, and installation of several new monitoring wells (WC, 1996a).
- In 1995, URS conducted a human health risk assessment (HHRA) that included groundwater sampling and modeling (WC, 1996b).
- In 1996, URS prepared an FS to evaluate remedial alternatives (URS, 1996).
- In 1996, URS performed an ecological risk assessment in conjunction with an HHRA (WC, 1997).
- In 1996, URS conducted a treatability study that provided data concerning soil vapor extraction (SVE) and air sparging. The study also included groundwater sampling and soil borings. (WC, 1997).
- For several days in 1996, URS conducted an SVE evaluation study that included installing additional soil borings and soil/groundwater sampling (WC, 1997).
- In 1997, URS conducted a design verification study to evaluate the applicability of six-phase heating (SPH) as an *in situ* technology for remediating solvent-contaminated soils. The study included soil borings and surface and subsurface soil sampling (WC, 1998).
- In 1998, URS performed a duel-phased, high vacuum extraction (HVE) treatability study that included groundwater sampling, installing additional soil borings and monitoring wells, and subsurface sampling. (WC, 1999).

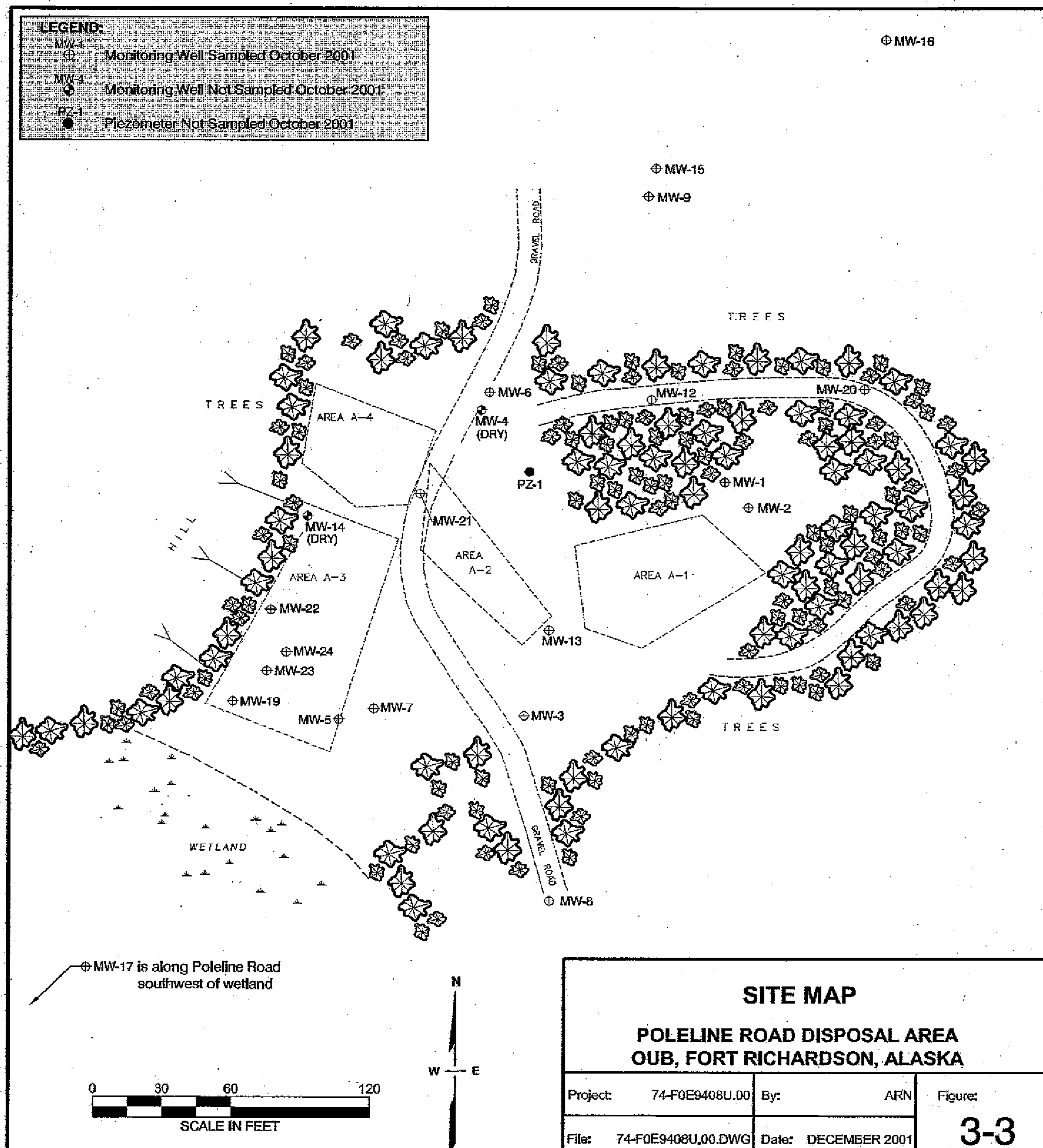
Based on the success of SPH on soils, an additional design verification study was conducted in 1999. This recent design verification study evaluated the applicability of SPH as an *in situ* technology for remediating solvent-contaminated groundwater. New soil borings, surface and subsurface soil samples, and groundwater samples were collected (URS, 2000).



AREA VICINITY MAP POLELINE ROAD DISPOSAL AREA OUB, FORT RICHARDSON, ALASKA		
Dwg: AREA3-1.AI	By: AR	Figure:
Project: 74-F0E9408U	Date: DECEMBER 2001	3-1



SITE LOCATION MAP POLELINE ROAD DISPOSAL AREA OUB, FORT RICHARDSON, ALASKA		
Dwg: SITE3-2.AI	By: AR	Figure:
Project: 74-F0E9408U	Date: DECEMBER 2001	3-2



SITE MAP			
POLELINE ROAD DISPOSAL AREA OUB, FORT RICHARDSON, ALASKA			
Project: 74-F0E9408U.00	By: ARN	Figure:	3-3
File: 74-F0E9408U.00.DWG	Date: DECEMBER 2001		

Monitoring wells selected for sampling during the Long-Term Groundwater Monitoring Program are shown on the site map (Figure 3-3). The rationale for sampling each well is presented in the *Long-Term Groundwater Monitoring Work Plan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska* (WC, 1997). Standard operating procedures were used for sample collection, containerization, labeling, packaging, and sample transport. The procedures follow the guidelines established within the Groundwater Monitoring Plan (WC, 1997).

Field tasks for this round of groundwater monitoring included the following:

(1) measuring static water levels

(2) measuring pH, specific conductivity, turbidity, dissolved oxygen, temperature, oxidation-reduction potential, and ferrous iron

(3) collecting groundwater samples for laboratory analysis of the following constituents using the analytical methods indicated in parentheses:

- VOCs (SW8260B)
- alkalinity (E310.1)
- ammonia (E350.1)
- carbon, total organic (SW9060)
- chloride (E300.0)
- methane (RSK 175)
- nitrate and nitrite (E353.2)
- sulfate (E300.0)
- sulfide (E376.1)

4.1 FIELD MEASUREMENTS

Static water levels were measured in 22 monitoring wells in a single day so that the groundwater levels could be considered synoptic. The pH, specific conductivity, turbidity, dissolved oxygen, temperature, and redox potential of the groundwater were measured while purging each well to monitor stabilization of parameters. Ferrous iron was measured at same time that laboratory samples were being collected. Data are summarized in Section 5 of this report.

4.2 GROUNDWATER SAMPLING

Groundwater samples were collected in accordance with procedures and protocols presented in Sections four through seven of the *Long-Term Groundwater Monitoring Work Plan* (WC, 1997) and *Addendum No. 1* (WC 1997). Samples were collected using dedicated tubing and a submersible pump. Results of the laboratory analyses performed on groundwater are presented in Section 5 of this report. Laboratory reports are provided in the Appendix.

4.3 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during the field investigation (e.g., equipment decontamination fluids and well purge water) was containerized during sampling activities and transported to a U.S. Army Corps of Engineers designated treatment area. Handling and final disposal of all wastes were managed by the contractor under guidance from the U.S. Army Corps of Engineers.

4.4 DEVIATIONS FROM THE LONG-TERM GROUNDWATER MONITORING WORK PLAN

This section lists and describes conditions or actions that resulted in deviations from the work plan. In general, changes and problems encountered during sampling activities include insufficient groundwater for sampling, changes to sampling procedures due to field conditions, and damaged monitoring wells. The following deviations from the work plan occurred during this sampling event:

- No groundwater was encountered in MW-4 (AP-4014); this monitoring well was dry in November 1996 and June 1997, and has been dry or has had insufficient water for sampling since the October 1998 sampling round.
- MW-14 (AP-3746) contained 0.25 feet of water; this is less water than necessary to operate the submersible pump; therefore, it was not sampled. This monitoring well has been dry or has had insufficient water for sampling since the November 1997 sampling round.
- The ferrous iron measurement for MW-7 (AP-4017) was not recorded.
- Monitoring wells MW-6 (AP-4016), MW-15 (AP-3747), and MW-17 (AP-3749) were pumped dry. Groundwater samples were collected when the wells had sufficiently recharged, not after the field parameters had re-stabilized.

Field work for groundwater monitoring Round 9 at OUB was conducted October 9-23, 2001. Static water level measurements were taken at each well on October 9, 2001. Nineteen wells were sampled October 10-23, 2001. MW-4 (AP-4014) was dry and could not be sampled MW-14 (AP-3746) did not have enough water in it to operate the submersible pump for sample collection; therefore this well was not sampled. Two quality control duplicate samples, and one matrix spike/matrix spike duplicate sample were collected. An equipment rinsate sample was not required since sampling materials were dedicated to each well.

Monitoring well and sample identification cross-references are presented in Table 5-1. Analytical laboratory results for VOCs are summarized in Tables 5-2 through 5-12. These tables also provide VOC data from previous sampling events. Table 5-13 lists October 2001 groundwater samples that contain VOCs at concentrations that exceed remedial action objectives (RAOs) and/or maximum contaminant levels (MCLs). Data concerning natural attenuation parameters are provided in Tables 5-14 and 5-15. Laboratory analytical results for natural attenuation parameters are summarized in Table 5-14, and October 2001 field measurements are summarized in Table 5-15. Groundwater elevations acquired periodically from November 1995 through October 2001 are presented in Table 5-16.

5.1 VOLATILE ORGANIC COMPOUNDS

The most prevalent VOCs at OUB are 1,1,2,2-tetrachloroethane, tetrachloroethene (PCE) and trichloroethene (TCE). Figure 5-1 presents the degradation pathways for these chemicals. Isoconcentration maps for 1,1,2,2-tetrachloroethane, PCE, and TCE are presented in Figures 5-2, 5-3, and 5-4, respectively. Figure 5-5 is a spider map that provides historical concentrations for several key contaminants of concern.

Table 5-2 summarizes the analytical results for 1,1,2,2-tetrachloroethane. This compound was detected in samples from 14 of the 19 locations monitored in October 2001. Concentrations of 1,1,2,2-tetrachloroethane ranged from 0.00022 to 2.100 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). A comparison between the April and October 2001 sample results shows no significant change in 1,1,2,2-tetrachloroethane concentrations. The concentration of 1,1,2,2-tetrachloroethane in the samples collected from MW-21 (AP-3983) decreased from 3.400 to 2.100 mg/L. Concentrations of 1,1,2,2-tetrachloroethane exceeded the RAO (0.052 mg/L) in seven of the October 2001 samples.

Table 5-3 summarizes the analytical results for PCE. This compound was detected in samples from ten of the 19 locations monitored in October 2001. Concentrations of PCE ranged from 0.00013 to 0.046 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). A comparison between the April and October 2001 sample results shows no significant change in PCE concentrations. The concentration of PCE in the samples collected from MW-21 (AP-3983) ranged from 0.054 to 0.046 mg/L. Concentrations of PCE exceeded the RAO (0.005 mg/L) in six of the October 2001 samples.

TCE was detected in samples from 13 of the 19 locations monitored in October 2001 (Table 5-4). TCE concentrations ranged from 0.013 to 3.000 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). A comparison between the April and October 2001 sample results shows no significant change in TCE concentrations. The concentration of TCE in the samples collected from MW-21 (AP-3983) ranged from 2.80 to 3.000 mg/L. Concentrations of TCE exceeded the RAO (0.005 mg/L) in 13 of the October 2001 samples.

The compound 1,1,2-trichloroethane was detected in samples from 11 of the 19 locations monitored in October 2001 (Table 5-5). Concentrations of 1,1,2-trichloroethane ranged from 0.00016 to 0.038 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). A comparison between the April and October 2001 sample results shows no significant change in 1,1,2-trichloroethane concentrations. The concentration of 1,1,2-trichloroethane in the samples collected from MW-21 (AP-3983) ranged from 0.0047 to 0.038 mg/L. Concentrations of 1,1,2 trichloroethane exceeded the MCL (0.005 mg/L) in three of the October 2001 samples.

Table 5-6 summarizes the analytical results for cis-1,2-dichloroethene. This compound was detected in samples from 13 of the 19 locations monitored in October 2001. Concentrations of cis-1,2-dichloroethene ranged from 0.00036 to 1.100 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). A comparison between the April and October 2001 sample results shows that cis-1,2-dichloroethene concentrations remained constant at most of the monitoring locations. The concentration of cis-1,2-dichloroethene in the samples collected from MW-21 (AP-3983) ranged from 1.20 to 1.100 mg/L. Concentrations of cis-1,2-dichloroethene exceeded the RAO (0.07 mg/L) in four of the October 2001 samples.

Trans-1,2-dichloroethene was detected in samples from 12 of the 19 locations monitored in October 2001 (Table 5-7). Trans-1,2-dichloroethene concentrations ranged from 0.00022 to 0.170 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). A comparison between the April and October 2001 sample results shows that trans-1,2-dichloroethene concentrations remained constant at most of the monitoring locations. The concentration of trans-1,2-dichloroethene in the samples collected from MW-21 (AP-3983) ranged from 0.180 to 0.170 mg/L. Concentrations of trans-1,2-dichloroethene exceeded the RAO (0.1 mg/L) in two of the October 2001 samples.

Table 5-8 summarizes the analytical results for 1,1-dichloroethene. This compound was detected in samples from nine of the 19 locations monitored in October 2001. Concentrations of 1,1-dichloroethene ranged from 0.00013 to 0.0088 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-7 (AP-4017). A comparison between the April and October 2001 sample results shows no significant change in 1,1-dichloroethene concentrations. The concentration of 1,1-dichloroethene in the samples collected from MW-7 (AP-4017) ranged from 0.0095 to 0.0088 mg/L. The concentration of 1,1-dichloroethene exceeded the MCL (0.007 mg/L) in one of the October 2001 samples.

Vinyl chloride was detected in samples from two of the locations monitored in October 2001 (Table 5-9). Vinyl chloride concentrations were 0.00060 mg/L and 0.0094 mg/L in the samples collected from MW-24 (AP-3986) and MW-21 (AP-3983), respectively. These wells are screened in the shallow aquifer. A comparison between the April and October 2001 sample results shows that the vinyl chloride concentration increased from 0.0047 to 0.0094 mg/L in the samples collected from MW-21 (AP-3983). The concentration of vinyl chloride exceeded the MCL (0.002 mg/L) in one of the October 2001 samples.

Table 5-10 summarizes the analytical results for carbon tetrachloride. This compound was detected in samples from five of the 19 locations monitored in October 2001. Concentrations of carbon tetrachloride ranged from 0.00095 to 0.0030 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-22 (AP-3984). The RAO for carbon tetrachloride is 0.005 mg/L. As shown by the data presented in Table 5-10, only one sample has exceeded the carbon tetrachloride RAO since March 1999.

Chloroform was detected in samples from eight of the 19 locations monitored in October 2001 (Table 5-11). Concentrations of Chloroform ranged from 0.00033 to 0.0038 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-21 (AP-3983). The MCL for chloroform is 0.1 mg/L. As shown by the data presented in Table 5-11, only one sample has exceeded the chloroform MCL since October 1995.

Benzene was detected in the October 2001 sample from monitoring well MW-21 (AP-3983). A comparison between the April and October 2001 sample results (Table 5-12) shows no significant change in the benzene concentration, which ranged from 0.0053 to 0.0038 mg/L in the samples collected from MW-21 (AP-3983). The RAO for benzene is (0.005 mg/L).

Carbon disulfide was detected in samples from eight of the 19 locations monitored in October 2001. Concentrations of carbon disulfide ranged from 0.00017 to 0.0045 mg/L in the October 2001 samples with the highest concentration in the sample collected from MW-23 (AP-3985). The MCL for carbon disulfide (3.65 mg/L) is several orders of magnitude higher than the detected concentrations.

The compounds 1,2-dichloropropane and 1,1,1,2-tetrachloroethane were detected in one groundwater sample collected in October 2001 at concentrations of 0.00090 mg/L and 0.00065 mg/L, respectively. The sample in which these compounds were detected was collected from MW-22 (AP-3984). The MCL for 1,2-dichloropropane is 0.005 mg/L and no MCL has been promulgated for 1,1,1,2-tetrachloroethane.

Methylene chloride was detected in samples from five of the 19 locations monitored in October 2001. Concentrations of methylene chloride were estimated at 0.00052 to 0.0062 mg/L. However, it is likely that detected methylene chloride concentrations are associated with laboratory contamination. The MCL for methylene chloride is 0.005 mg/L.

Toluene was detected in samples from 13 of the 19 locations monitored in October 2001. Concentrations of toluene were estimated at 0.00010 to 0.00034 mg/L. However, toluene was also detected in the associated trip blanks at estimated concentrations of 0.00034 to 0.00044 mg/L. The MCL for toluene is 1 mg/L.

Acetone (0.0033 to 0.0037 mg/L), n-propylbenzene (0.00010 mg/L), and styrene (0.00015 mg/L) were detected in one or more of the trip blanks at estimated concentrations that were less than the method reporting limit but greater than or equal to the method detection limit. These compounds, however, were not detected in samples from the 19 locations monitored in October 2001.

5.2 NATURAL ATTENUATION PARAMETERS

Natural attenuation is the physical, chemical and / or biological processes that unaided by human intervention, reduce the concentration, toxicity or mobility of contaminants in the environment.

Natural attenuation processes include biodegradation, hydrolysis, sorption, dispersion, dilution and volatilization. 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
- oxidation-reduction potential (ORP)
- 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
- ORP
- 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 5-13, and field measurements are summarized in Table 5-14.

Three bacteria count tests (heterotrophic plate count, oil degrading bacteria, and sulfate reducing bacteria) were completed on groundwater samples collected in 1996. The results indicated virtually no bacterial populations in groundwater at the site. Based on these results, no additional tests for bacterial populations have been completed.

Alkalinity

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

The alkalinity is a general water quality parameter used to measure he buffering capacity of the water. Alkalinity can help to maintain groundwater pH because it buffers the groundwater against acids generated through the biodegradation process. However, during aerobic respiration, denitrification, iron III reduction and sulfate the total alkalinity should increase. The alkalinity of water sampled from the background well (MW-17) was 130 mg/L in October 2001. Alkalinity values for samples collected from the shallow aquifer in ranged from 106 to 208 mg/L. Alkalinity in water from monitoring well MW-5 (shallow-intermediate aquifer) was 148 mg/L, and water sampled from the deep aquifer had alkalinity values of 110 to 262 mg/L. The alkalinity of the water where high concentrations of VOCs are found is not significantly higher than the alkalinity of water with no detectable concentrations of VOCs.

Oxidation-Reduction Potential

The ORP of groundwater is a measure of electron activity that indicates the relative ability of a solution to accept or transfer electrons. Most ORP reactions in the subsurface are microbially catalyzed during metabolism of native organic matter or contaminants. According to Wilson, et al. (1996), when the ORP is less than 50 millivolts (mV) against Ag/AgCl, a reductive pathway is possible. The ORP measurements taken in October 2001 were greater than 50 mV, in samples from ten of the 19 locations monitored.

Electron Acceptors

In order to identify 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

If biodegradation occurs in an oxygen rich environment, then aerobic respiration is the primary process. If biodegradation occurs in an oxygen poor environment, then anaerobic degradation is the primary process. Once DO concentrations are less than 0.5 mg/L, anaerobic process begin to dominate the biodegradation processes. In an anaerobic environment, microbes utilize nitrate/nitrite, ferrous/ferric iron and sulfate instead of oxygen in respiration. The dissolved oxygen concentration in water from four of the monitoring wells (MW-6, MW-13, MW-19, and MW-24) measured 0.00 mg/L in October 2001 suggesting appropriate conditions necessary for reductive pathways. Dissolved oxygen measurements in water from the other 15 wells ranged from 1.72 to 15.69 mg/L.

Sulfate

For reductive pathways, the optimum concentration for sulfate is less than 20 mg/L. Sulfate concentrations in samples from the 19 locations monitored in October 2001 ranged from 0.5 to 85.6 mg/L and were less than 20 mg/L at 15 of the locations.

Ferrous Iron

Iron is utilized by the microbes once the dissolved oxygen and nitrate / nitrite compounds have been depleted. Reductive pathways are possible when the concentration of ferrous iron is greater than about 1 to 1.5 mg/L. Ferrous iron was detected in samples from 9 of the locations monitored in October 2001. Concentrations of ferrous iron ranged from 0.8 to 8.0 mg/L and were greater than 1.5 mg/L at seven of the locations.

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. Groundwater temperatures measured during the October 2001 round of sampling ranged from 38.8°F to 53.0°F. Temperatures in the vicinity of MW-22 were elevated above normal values due to the soil-heating project completed in 1999.

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 October 2001 round of groundwater sampling ranged from 6.59 to 9.73 with water from the shallow aquifer being slightly lower (6.62 to 8.19) than water from the deep aquifer (7.26 to 9.73).

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 3.2 mg/L in October 2001. Chloride concentrations in samples from the shallow and shallow-intermediate aquifers ranged from 1.3 to 20.5 mg/L with the higher concentrations occurring in samples from monitoring wells that also had high concentrations of VOCs. Chloride concentrations in samples from the deep aquifer ranged from 1.7 to 37.3 mg/L. The relatively high value of 37.3 mg/L occurred in the sample from monitoring well MW-16, and appears anomalous. However, previous chloride data for samples from this well also were anomalously high.

Ammonia

Ammonia as nitrogen was detected in four of the groundwater samples collected from the shallow aquifer (0.29 to 0.52 mg/L), the shallow-intermediate aquifer (0.49 mg/L), and the deep aquifer (0.24 mg/L).

Sulfide

A reductive pathway is possible when the concentration for sulfide is greater than 1 mg/L. Sulfide was detected in samples collected from 14 locations in October 2001 but concentrations were all less than or equal to 1 mg/L.

Total Organic Carbon

Total organic carbon (TOC) represents a source of carbon and energy that drives dechlorination and influences contaminant migration. Optimum values for TOC are greater than 20 mg/L. TOC was detected in samples collected from 17 locations in October 2001 but the concentration was never greater than 7.8 mg/L. TOC concentrations in samples from the shallow aquifer ranged from 0.7 mg/L to 7.8 mg/L. The TOC concentration for the sample from the shallow-intermediate aquifer was 4.5 mg/L. TOC concentrations in samples from the deep aquifer ranged from 0.6 mg/L to 4.7 mg/L.

Natural Attenuation at OUB

The natural attenuation data presented and discusses above suggest little if any biodegradation is currently occurring at the site. Given that OUB has undergone several rounds of SPH remediation (a process that causes the soil and groundwater to be heated to the boiling point of water) this is not surprising.

5.3 GROUNDWATER ELEVATIONS

The depth to water was measured in 22 monitoring wells on October 9, 2001. These measurements and the elevation of the tops of the well casings were used to calculate the water level elevation at each monitoring location. Table 5-15 summarizes the calculated groundwater elevations for water levels measured in October 2001 and provides a compilation of groundwater elevation data for the period of November 1995 through October 2001.

TABLE 5-1

MONITORING WELL AND SAMPLE ID CROSS-REFERENCES FOR OCTOBER 2001 GROUNDWATER SAMPLES

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA				
Monitoring Well			Laboratory	
Identification	API Number	Sample ID	Sample Code	Sample Type
MW-1	AP-4011	PRDA01-W-1012	K2107860-005	Environmental
MW-2	AP-4012	PRDA02-W-1002	K2107651-005	Environmental
MW-3	AP-4013	PRDA01-W1016	K2107860-011	Environmental
MW-5	AP-4015	PRDA01-W-1017	K2107860-012	Environmental
MW-6	AP-4016	PRDA01-W-1015	K2107860-008	Environmental
MW-7	AP-4017	PRDA01-W-1018	K2107860-013	Environmental
MW-7	AP-4017	PRDA01-W-8001	K2107860-014	Duplicate
MW-8	AP-4018	PRDA01-W-1010	K2107860-003	Environmental
MW-9	AP-4019	PRDA01-W-1001	K2107651-004	Environmental
MW-12	AP-3744	PRDA01-W-1014	K2107860-007	Environmental
MW-13	AP-3745	PRDA01-W-1009	K2107785-009	Environmental
MW-15	AP-3747	PRDA01-W-1011	K2107860-004	Environmental
MW-16	AP-3748	PRDA03-W-1003	K2107651-006	Environmental
MW-17	AP-3749	PRDA01-W-1000	K2107651-003	Environmental
MW-19	AP-3981	PRDA01-W-1004	K2107785-003	Environmental
MW-20	AP-3982	PRDA01-W-1005	K2107785-004	Environmental
MW-21	AP-3983	PRDA01-W-1013	K2107860-006	Environmental
MW-22	AP-3984	PRDA01-W-1006	K2107785-005	Environmental
MW-22	AP-3984	PRDA01-W-8000	K2107785-006	Duplicate
MW-23	AP-3985	PRDA01-W-1008	K2107785-008	Environmental
MW-24	AP-3986	PRDA01-W-1007	K2107785-007	Environmental

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TABLE 5-2

1,1,2,2-TETRACHLOROETHANE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.50)	ND (0.0010)	0.003	0.001	0.004	ND (0.001)	0.0017	ND (0.001)	0.00066	ND (0.0005)	0.00022 J
MW-3	AP-4013	**0.54**	--	**0.45**	0.035	**0.059**	**0.08**	**0.41**	**0.14**	0.048	0.038	**0.060**
MW-8	AP-4018	ND (0.50)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.002	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-12	AP-3744	**0.49**	0.024	**0.065**	0.014	**0.13**	0.019	0.036	0.035	0.029	0.016	0.011
MW-13	AP-3745	0.0011	0.0011	0.009	**0.058**	**0.056**	0.004	**0.13**	0.023	**0.28 D**	0.0063	0.012
MW-15	AP-3747	0.0063	--	0.004	0.002	0.004	0.012	0.013	0.027	0.0057	0.031	0.019 D
MW-17	AP-3749	--	--	ND (0.001)	--	--	0.001	--	--	--	ND (0.0005)	ND (0.00014)
MW-19	AP-3981	--	--	**1.40**	**0.34**	**0.63**	**0.69**	**0.85**	0.04	0.0003 J	ND (0.0005)	0.0048
MW-20	AP-3982	--	--	0.01	**0.15**	**0.12**	**0.059**	0.04	0.024	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-21	AP-3983	--	--	**62.00**	**24.00**	**3.80**	**26.00**	**15.00**	**16.00**	**3.50 D**	**3.400 D**	**2.100 D**
MW-22	AP-3984	--	--	**11.00**	**3.70**	**15.00**	**2.80**	**0.81**	**1.10**	**0.92 D**	**0.260 D**	**0.310 D**
MW-23	AP-3985	--	--	--	**17.00**	**18.00**	**17.00**	**0.10**	**0.32**	**0.42 D**	**0.340 D**	**0.140 D**
MW-24	AP-3986	--	--	--	--	**47.00**	--	0.026	**0.14**	**0.23 D**	**0.200 D**	**0.140 D**
PZ-1	AP-3989	--	**1.40**	**19.00**	**1.00**	**3.30**	**1.80**	**0.83**	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	**1900**	**1000**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	**21**	**9.1**	**19.00**	**15.00**	**6.00**	**10.00**	**14.00**	**2.60**	**3.20 D**	**0.550 D**	**0.360 D**
Intermediate Aquifer												
MW-4**	AP-4014	**71**	--	--	**6.00**	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	**0.082**	--	0.047	**0.054**	0.029	0.018	0.047	**0.071**	0.033	0.018	0.014
MW-6	AP-4016	**0.52**	--	0.006	0.013	0.019	0.005	0.013	0.006	0.0079	0.0031	0.0012
MW-7	AP-4017	**3.10**	--	**1.50**	**1.80**	**1.50**	**0.95**	**1.50**	**0.69**	**1.00 D**	**1.200 D**	**0.980 D**
MW-9	AP-4019	ND (0.50)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-16	AP-3748	ND (0.002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) of 0.052 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-3

TETRACHLOROETHENE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-3	AP-4013	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0003 J	ND (0.0005)	0.00040 J
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-12	AP-3744	0.00035	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0002 J	ND (0.0005)	0.00013 J
MW-13	AP-3745	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0004 J	ND (0.0005)	ND (0.00011)
MW-15	AP-3747	0.0021	--	0.002	0.001	0.003	**0.006**	**0.006**	**0.009**	0.0028	**0.0078**	**0.0070 D**
MW-17	AP-3749	--	--	ND (0.001)	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00011)
MW-19	AP-3981	--	--	**0.018**	0.002	0.005	**0.007**	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	0.00025 J
MW-20	AP-3982	--	--	ND (0.001)	0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-21	AP-3983	--	--	**0.39**	**0.17**	**0.14**	**0.16**	**0.12**	**0.13**	**0.068**	**0.054 D**	**0.046 D**
MW-22	AP-3984	--	--	**0.30**	**0.084**	**0.15**	**0.062**	**0.029**	**0.096**	**0.06**	**0.018 D**	**0.034 D**
MW-23	AP-3985	--	--	--	**0.052**	**0.086**	**0.072**	**0.01**	**0.007**	**0.015**	**0.0052 D**	**0.0064 D**
MW-24	AP-3986	--	--	--	--	**0.15**	--	**0.0092**	**0.013**	**0.013**	**0.0071 D**	**0.013 D**
PZ-1	AP-3989	--	ND (0.10)	**0.073**	**0.01**	**0.01**	**0.013**	0.006	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	**11**	**12.3**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.2)	**0.067**	**0.13**	**0.029**	**0.032**	**0.059**	**0.038**	**0.05**	**0.032**	**0.020 D**	**0.016 D**
Intermediate Aquifer												
MW-4**	AP-4014	**0.31**	--	--	**0.084**	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	ND (0.002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-6	AP-4016	ND (0.002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-7	AP-4017	ND (0.02)	--	0.004	0.005	0.003	0.004	0.002	0.002	0.0021	ND (0.005)	0.0034 J,D
MW-9	AP-4019	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)

NOTES:

Results in **boldface print** exceed the Remedial Action Objective (RAO) and Maximum Contaminant Level (MCL) of 0.005 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-4

TRICHLOROETHENE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-3	AP-4013	0.26	--	0.27	0.037	0.062	0.11	0.24	0.13	0.062	0.061	0.100 D
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-12	AP-3744	0.16	0.07	0.19	0.058	0.063	0.058	0.079	0.058	0.054	0.040	0.038
MW-13	AP-3745	0.0067	0.0041	0.018	0.008	0.01	0.007	0.012	0.008	0.11 D	0.015	0.017
MW-15	AP-3747	0.27	--	0.32	0.14	0.26	0.73	0.87	1.2	0.25 D	0.860 D	0.990 D
MW-17	AP-3749	--	--	ND (0.001)	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00012)
MW-19	AP-3981	--	--	0.95	0.11	0.17	0.28	0.021	0.016	0.0013 B	0.00081	0.013
MW-20	AP-3982	--	--	0.012	0.018	0.012	0.017	0.0012	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-21	AP-3983	--	--	22.00	12.00	1.10	12.00	9.10	11	3.10 D	2.80 D	3.000 D
MW-22	AP-3984	--	--	8.70	2.10	7.800	1.70	1.60	4.6	2.30 D	0.260 D	1.100 D
MW-23	AP-3985	--	--	--	2.20	3.20	3.10	0.97	1.7	0.68 D	0.440 D	0.400 D
MW-24	AP-3986	--	--	--	--	3.70	--	0.97	0.87	0.53 D	0.380 D	0.470 D
PZ-1	AP-3989	--	0.94	5.40	0.93	1.30	0.74	0.68	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	220	186	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	4.8	3.1	8.00	3.00	3.70	5.40	3.40	4.5	2.20 D	1.400 D	1.200 D
Intermediate Aquifer												
MW-4**	AP-4014	14.00	--	--	4.10	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	0.043	--	0.03	0.034	0.029	0.035	0.034	0.038	0.038	0.037	0.038
MW-6	AP-4016	0.13	--	0.086	0.025	0.026	0.073	0.02	0.025	0.013	0.013	0.0062
MW-7	AP-4017	1.00	--	1.30	0.92	0.85	1.10	0.86	0.66	0.73 D	1.300 D	1.400 D
MW-9	AP-4019	0.00091	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0002 J,B	ND (0.0005)	ND (0.00012)
MW-16	AP3748	0.00031	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) and Maximum Contaminant Level (MCL) of 0.005 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

B = Analyte was found in the blank at a level that is significant relative to the sample result

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-5

1,1,2-TRICHLOROETHANE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA												
Well ID	**API No.**	**Oct 1995**	**Nov 1996**	**Nov 1997**	**June 1998**	**Oct 1998**	**Mar 1999**	**Oct 1999**	**April 2000**	**Oct 2000**	**April 2001**	**Oct 2001**
Shallow Aquifer												
MW-2	AP-4012	ND (0.50)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0001)	ND (0.0005)	ND (0.00010)
MW-3	AP-4013	0.0023	--	0.004	ND (0.001)	ND (0.001)	ND (0.001)	0.002	0.001	0.001	0.00066	0.0011
MW-8	AP-4018	ND (0.50)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0001)	ND (0.0005)	ND (0.00010)
MW-12	AP-3744	0.00078	ND (0.0010)	0.002	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0005 J	ND (0.0005)	0.00027 J
MW-13	AP-3745	ND (0.50)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.003	ND (0.0005)	0.00016 J
MW-15	AP-3747	0.0013	--	0.003	ND (0.001)	0.002	0.005	0.004	0.005	0.002	**0.0052 D**	0.0045 D
MW-17	AP-3749	--	--	ND (0.001)	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00010)
MW-19	AP-3981	--	--	**0.014**	ND (0.001)	0.003	0.005	**0.02**	ND (0.001)	ND (0.0001)	ND (0.0005)	ND (0.00010)
MW-20	AP-3982	--	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0001)	ND (0.0005)	ND (0.00010)
MW-21	AP-3983	--	--	**0.42**	**0.19**	**0.20**	**0.18**	**0.12**	**0.12**	**0.04**	0.0047 D	**0.038 D**
MW-22	AP-3984	--	--	**0.043**	**0.011**	**0.41**	ND (0.010)	0.004	**0.007**	**0.007**	**0.0086 D**	0.0019 J,D
MW-23	AP-3985	--	--	--	**0.076**	**0.077**	**0.07**	0.001	**0.011**	0.0048	0.0030 D	0.0020 D
MW-24	AP-3986	--	--	--	--	**0.15**	--	**0.008**	**0.006**	**0.0051**	0.0031 D	0.0030 D
PZ-1	AP-3989	--	ND (0.10)	**0.12**	**0.009**	**0.022**	**0.015**	**0.008**	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	ND (1.3)	**1.0**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.50)	**0.45**	**0.10**	**0.025**	**0.031**	**0.059**	**0.021**	**0.031**	**0.013**	**0.013**	**0.0083 D**
Intermediate Aquifer												
MW-4**	AP-4014	ND (0.50)	--	--	**0.036**	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	ND (0.005)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.001	0.00069	0.00061
MW-6	AP-4016	ND (0.005)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0002 J	ND (0.0005)	ND (0.00010)
MW-7	AP-4017	ND (0.05)	--	**0.024**	**0.028**	**0.02**	**0.021**	**0.021**	**0.012**	**0.018**	**0.027 D**	**0.025 D**
MW-9	AP-4019	ND (0.50)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0001)	ND (0.0005)	ND (0.00010)
MW-16	AP-3748	ND (0.50)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0001)	ND (0.0005)	ND (0.00010)

NOTES:

Results in boldface print exceed the Maximum Contaminant Level (MCL) of 0.005 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-6

CIS-1,2-DICHLOROETHENE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	**0.380*** **	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-3	AP-4013	0.028	--	0.046***	0.005	0.01	0.013	0.034	0.021	0.011	0.0089	0.018
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-12	AP-3744	0.0091	0.0029	0.015***	0.003	0.004	0.002	0.0034	0.003	0.0032	0.0028	0.0019
MW-13	AP-3745	ND (0.0002)	ND (0.0010)	0.001***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.027	0.0020	0.0022
MW-15	AP-3747	0.015	--	0.028***	0.008	0.017	0.034	0.04	0.054	0.016	0.044	0.044 D
MW-17	AP-3749	--	--	ND (0.001)***	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00012)
MW-19	AP-3981	--	--	**0.076*** **	0.014	0.011	0.014	0.01	0.004	0.0014	ND (0.0005)	0.0023
MW-20	AP-3982	--	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-21	AP-3983	--	--	**5.100*** **	**1.50**	**2.20**	**2.40**	**2.50**	**3.10**	**1.40 D**	**1.20 D**	**1.100 D**
MW-22	AP-3984	--	--	**0.730*** **	**0.16**	**0.73**	**0.18**	0.058	**0.16**	**0.079**	**0.260 D**	0.028 D
MW-23	AP-3985	--	--	--	**0.14**	**0.15**	**0.23**	**0.30**	**1.40**	**0.28 D**	**0.092 D**	0.051 D
MW-24	AP-3986	--	--	--	--	**0.22**	--	**0.34**	**0.76**	**0.28 D**	**0.150 D**	**0.130 D**
PZ-1	AP-3989	--	**0.17**	**1.100*** **	**0.097**	**0.25**	**0.16**	**0.098**	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	**37.00**	**4.30**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.2)	**0.26**	**0.650*** **	**0.19**	**0.39**	**0.64**	**1.20**	**2.00**	**0.50 D**	**0.470 D**	**0.300 D**
Intermediate Aquifer												
MW-4**	AP-4014	**1.60**	--	--	**0.33**	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	0.0053	--	ND (0.001)***	0.005	0.006	0.004	0.0041	0.004	0.006	0.0048	0.0050
MW-6	AP-4016	0.0035	--	0.004***	0.002	0.002	0.002	ND (0.001)	0.001	0.0011	0.00086	0.00036 J
MW-7	AP-4017	**0.28**	--	ND (0.001)***	**0.30**	**0.31**	**0.38**	**0.29**	**0.18**	**0.26 D**	**0.390 D**	**0.400 D**
MW-9	AP-4019	ND (0.0002)	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) and Maximum Contaminant Level (MCL) of 0.07 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

*** Sample analyzed for total dichloroethene (includes 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene)

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-7

TRANS-1,2-DICHLOROETHENE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	**0.380*** **	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-3	AP-4013	0.0038	--	0.046***	ND (0.001)	0.01	0.002	0.0042	0.002	0.0013	0.0012	0.0025
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)***	ND (0.001)	0.002	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-12	AP-3744	0.001	ND (0.0010)	0.015***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.00073	0.00054	0.00045 J
MW-13	AP-3745	ND (0.0002)	ND (0.0010)	0.001***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0016	ND (0.0005)	0.00022 J
MW-15	AP-3747	0.0041	--	0.028***	0.002	0.004	0.01	0.0093	0.015	0.0046	0.013	0.012 D
MW-17	AP-3749	--	--	ND (0.001)***	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00014)
MW-19	AP-3981	--	--	0.076***	0.006	0.005	0.006	0.0013	ND (0.001)	ND (0.0002)	ND (0.0005)	0.00038 J
MW-20	AP-3982	--	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-21	AP-3983	--	--	**5.100*** **	**0.47**	**0.72**	**1.10**	**0.48**	**0.51**	**0.22 D**	**0.180 D**	**0.170 D**
MW-22	AP-3984	--	--	**0.730*** **	0.048	**0.19**	0.06	0.015	0.044	0.020	0.022 D	0.0075 D
MW-23	AP-3985	--	--	--	0.053	0.068	0.094	0.036	0.07	0.03	0.012 D	0.0090 D
MW-24	AP-3986	--	--	--	--	0.087	--	0.04	0.064	0.043	0.022 D	0.022 D
PZ-1	AP-3989	--	ND (0.10)	**1.100*** **	0.031	0.065	0.06	0.028	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	**12.00**	**1.60**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.2)	0.067	**0.650*** **	0.066	**0.11**	**0.34**	**0.11**	**0.19**	0.091 D	0.075 D	0.058 D
Intermediate Aquifer												
MW-4**	AP-4014	**0.41**	--	--	0.075	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	ND (0.002)	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.00056	ND (0.0005)	0.00045 J
MW-6	AP-4016	ND (0.002)	--	0.004***	ND (0.001)	ND (0.001)	0.001	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-7	AP-4017	0.058	--	ND (0.001)***	0.082	0.074	0.075	0.059	0.049	0.056	0.100 D	**0.110 D**
MW-9	AP-4019	ND (0.0002)	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00014)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) and Maximum Contaminent Level (MCL) of 0.1 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

*** Sample analyzed for total dichloroethene (includes 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene)

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-8

1,1-DICHLOROETHENE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	**0.380*** **	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-3	AP-4013	ND (0.00019)	--	**0.046*** **	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	0.00029 J
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-12	AP-3744	0.00014	ND (0.0010)	**0.015*** **	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-13	AP-3745	0.00026	ND (0.0010)	0.001***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.00052	ND (0.0005)	ND (0.00012)
MW-15	AP-3747	0.00071	--	**0.028*** **	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.003	0.0006	0.0025	0.0026 D
MW-17	AP-3749	--	--	ND (0.001)***	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00012)
MW-19	AP-3981	--	--	**0.076*** **	ND (0.001)	ND (0.001)	ND (0.001)	0.003	ND (0.001)	ND (0.0002)	ND (0.0005)	0.00013 J
MW-20	AP-3982	--	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-21	AP-3983	--	--	**5.100*** **	**0.014**	**0.019**	**0.018**	**0.033**	**0.038**	**0.018**	**0.011 D**	0.0070 J,D
MW-22	AP-3984	--	--	**0.730*** **	ND (0.001)	0.007	ND (0.010)	ND (0.001)	0.002	0.0019	0.0014 D	0.00060 J,D
MW-23	AP-3985	--	--	--	ND (0.001)	0.004	ND (0.010)	0.001	**0.028**	**0.0095**	0.0039 D	0.0022 D
MW-24	AP-3986	--	--	--	--	0.005	--	**0.014**	**0.02**	**0.0074**	0.0048 D	0.0042 D
PZ-1	AP-3989	--	ND (0.10)	**1.100*** **	ND (0.001)	0.003	0.002	ND (0.001)	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	ND (0.5)	ND (1.0)	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.2)	ND (0.0010)	**0.650*** **	ND (0.001)	0.005	ND (0.010)	**0.01**	**0.021**	0.0057	**0.0081 D**	0.0060 D
Intermediate Aquifer												
MW-4**	AP-4014	ND (0.2)	--	--	0.003	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	ND (0.002)	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-6	AP-4016	ND (0.002)	--	0.004***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-7	AP-4017	ND (0.02)	--	ND (0.001)***	0.003	0.005	0.005	0.003	0.003	0.0035	**0.0095**	**0.0088 D**
MW-9	AP-4019	0.0012	--	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)***	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00012)

NOTES:

Results in boldface print exceed the Maximum Contaminant Level (MCL) of 0.007 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

*** Sample analyzed for total dichloroethene (includes 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene)

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-9

VINYL CHLORIDE (mg/L) IN GROUNDWATER 1998 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA									
Well ID	API No.	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer									
MW-2	AP-4012	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-3	AP-4013	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-8	AP-4018	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-12	AP-3744	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-13	AP-3745	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-15	AP-3747	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.0011)
MW-17	AP-3749	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00022)
MW-19	AP-3981	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-20	AP-3982	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-21	AP-3983	ND (0.001)	**0.009**	0.002	**0.004**	**0.005**	**0.0028**	**0.0047 D**	**0.0094 J,D**
MW-22	AP-3984	ND (0.001)	ND (0.001)	ND (0.010)	ND (0.001)	ND (0.001)	ND (0.0003)	**0.0022 D**	ND (0.0011)
MW-23	AP-3985	ND (0.001)	ND (0.001)	ND (0.010)	**0.003**	**0.005**	0.0017	ND (0.001)	ND (0.00043)
MW-24	AP-3986	ND (0.001)	ND (0.001)	--	0.002	**0.004**	0.0016	ND (0.001)	0.00060 J,D
PZ-1	AP-3989	ND (0.001)	ND (0.100)	ND (0.001)	ND (0.001)	--	--	--	--
Perched Aquifer									
MW-14*	AP-3746	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer									
MW-5	AP-4015	ND (0.001)	ND (0.001)	ND (0.010)	0.001	**0.003**	0.00097	ND (0.005)	ND (0.0022)
Intermediate Aquifer									
MW-4**	AP-4014	ND (0.001)	--	--	--	--	--	--	--
Deep Aquifer									
MW-1	AP-4011	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-6	AP-4016	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-7	AP-4017	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.00089	ND (0.005)	ND (0.0022)
MW-9	AP-4019	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)
MW-16	AP-3748	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0003)	ND (0.0005)	ND (0.00022)

NOTES:

Results in boldface print exceed the Maximum Contaminant Level (MCL) of 0.002 mg/L

* MW-14 was dry or had insufficient water for sampling June 1998 through Oct 2001

** MW-4 was dry or had insufficient water for sampling Oct 1998 through Oct 2001

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-10

CARBON TETRACHLORIDE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-3	AP-4013	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-12	AP-3744	**0.022**	0.0011	0.002	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.00071	ND (0.0005)	0.00048 J
MW-13	AP-3745	0.00038	ND (0.0010)	0.003	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0003 J	ND (0.0005)	0.00015 J
MW-15	AP-3747	0.0014	--	ND (0.001)	ND (0.001)	ND (0.001)	0.003	0.003	0.004	0.001	0.0032	0.0028 D
MW-17	AP-3749	--	--	ND (0.001)	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00013)
MW-19	AP-3981	--	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-20	AP-3982	--	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-21	AP-3983	--	--	ND (0.020)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0025)	ND (0.0025)
MW-22	AP-3984	--	--	**0.011**	**0.01**	**0.006**	ND (0.010)	0.0037	**0.007**	0.005	ND (0.001)	0.0030 D
MW-23	AP-3985	--	--	--	ND (0.001)	ND (0.001)	ND (0.010)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.001)	ND (0.00026)
MW-24	AP-3986	--	--	--	--	ND (0.001)	--	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.001)	ND (0.00025)
PZ-1	AP-3989	--	ND (0.10)	ND (0.020)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	**2.6**	**2.7**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.2)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.010)	ND (0.001)	ND (0.001)	0.0003 J	ND (0.005)	ND (0.0013)
Intermediate Aquifer												
MW-4**	AP-4014	ND (0.2)	--	--	**0.009**	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	ND (0.002)	--	ND (0.001)	0.001	ND (0.001)	ND (0.001)	0.001	0.001	0.0012	0.00085	0.00095
MW-6	AP-4016	ND (0.002)	--	0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-7	AP-4017	ND (0.02)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.005)	ND (0.0013)
MW-9	AP-4019	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00013)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) and Maximum Contaminant Level (MCL) of 0.005 mg/L.

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-11

CHLOROFORM (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2001
WELLS SCREENED IN SHALLOW AQUIFER										
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-3	AP-4013	0.00053	--	ND (0.001)	ND (0.001)	ND (0.001)	0.013	ND (0.001)	ND (0.001)	ND (0.000096)
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-12	AP-3744	ND (0.0002)	ND (0.0010)	0.002	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.00033 J
MW-13	AP-3745	0.0011	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-15	AP-3747	0.0016	--	0.002	ND (0.001)	0.001	0.004	0.009	0.004	0.0036 D
MW-17	AP-3749	--	--	ND (0.001)	--	--	ND (0.001)	--	--	ND (0.000096)
MW-19	AP-3981	--	--	0.001	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-20	AP-3982	--	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-21	AP-3983	--	--	0.078	0.028	0.016	0.023	0.012	0.011	0.0038 J,D
MW-22	AP-3984	--	--	0.012	0.001	0.010	ND (0.010)	0.001	0.005	0.0015 J,D
MW-23	AP-3985	--	--	--	0.003	0.004	ND (0.010)	0.001	ND (0.001)	0.00 34 J,D
MW-24	AP-3986	--	--	--	--	0.006	--	ND (0.001)	ND (0.001)	0.00046 J,D
PZ-1	AP-3989	--	ND (0.10)	ND (0.020)	0.003	0.003	0.003	0.002	--	--
WELL SCREENED IN PERCHED AQUIFER										
MW-14	AP-3746	1.4	ND (1.0)	--	--	--	--	--	--	--
WELL SCREENED IN SHALLOW-INTERMEDIATE AQUIFER										
MW-5	AP-4015	ND (0.2)	0.0059	0.010	0.003	0.003	ND (0.010)	0.002	0.001	0.0010 J,D
WELL SCREENED IN INTERMEDIATE AQUIFER										
MW-4	AP-4014	ND (0.2)	--	--	0.009	--	--	--	--	--
WELL SCREENED IN DEEP AQUIFER										
MW-1	AP-4011	ND (0.002)	--	ND (0.001)	ND (0.001)	0.006	0.004	ND (0.001)	ND (0.001)	ND (0.000096)
MW-6	AP-4016	ND (0.002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-7	AP-4017	ND (0.02)	--	0.001	0.002	0.001	0.002	0.001	ND (0.001)	0.0016 J,D
MW-9	AP-4019	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.000096)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) and Maximum Contaminant Level (MCL) of 0.005 mg/L
* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001
** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001
D = Reported result is from a dilution
J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)
mg/L = milligrams per liter
ND = Analyte Not Detected (detection limit in parentheses)
-- = Not Sampled

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TABLE 5-12

BENZENE (mg/L) IN GROUNDWATER 1995 - 2001

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Oct 1995	Nov 1996	Nov 1997	June 1998	Oct 1998	Mar 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
Shallow Aquifer												
MW-2	AP-4012	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-3	AP-4013	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-8	AP-4018	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-12	AP-3744	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-13	AP-3745	0.00034	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-15	AP-3747	ND (0.0002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00053)
MW-17	AP-3749	--	--	ND (0.001)	--	--	ND (0.001)	--	--	--	ND (0.0005)	ND (0.00011)
MW-19	AP-3981	--	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-20	AP-3982	--	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-21	AP-3983	--	--	**0.094**	**0.021**	**0.021**	**0.033**	**0.012**	**0.017**	**0.0061**	**0.0053 D**	0.0038 J,D
MW-22	AP-3984	--	--	**0.009**	0.004	**0.017**	ND (0.010)	ND (0.001)	0.004	0.002 B	0.0019 D	ND (0.00053)
MW-23	AP-3985	--	--	--	0.001	0.002	ND (0.010)	ND (0.001)	ND (0.001)	0.0003 J,B	ND (0.001)	ND (0.00021)
MW-24	AP-3986	--	--	--	--	0.004	--	ND (0.001)	ND (0.001)	0.0004 J,B	ND (0.001)	ND (0.00021)
PZ-1	AP-3989	--	ND (0.10)	**0.022**	0.002	0.003	0.002	ND (0.001)	--	--	--	--
Perched Aquifer												
MW-14*	AP-3746	**2.9**	**3.3**	--	--	--	--	--	--	--	--	--
Shallow-Intermediate Aquifer												
MW-5	AP-4015	ND (0.2)	0.0013	0.004	ND (0.001)	ND (0.001)	ND (0.010)	ND (0.001)	ND (0.001)	0.00053 B	ND (0.005)	ND (0.0011)
Intermediate Aquifer												
MW-4**	AP-4014	ND (0.2)	--	--	0.002	--	--	--	--	--	--	--
Deep Aquifer												
MW-1	AP-4011	ND (0.002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-6	AP-4016	ND (0.002)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-7	AP-4017	ND (0.02)	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.0003 J,B	ND (0.0050)	ND (0.0011)
MW-9	AP-4019	0.00073	--	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)
MW-16	AP-3748	ND (0.0002)	ND (0.0010)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.0002)	ND (0.0005)	ND (0.00011)

NOTES:

Results in boldface print exceed the Remedial Action Objective (RAO) and Maximum Contaminant Level (MCL) of 0.005 mg/L

* MW-14 was dry or had insufficient water for sampling Nov 1997 through Oct 2001

** MW-4 was dry in Nov 1997 and was dry or had insufficient water for sampling Oct 1998 through Oct 2001

B = Analyte was found in the blank at a level that is significant relative to the sample result

D = Reported result is from a dilution

J = Reported result is an estimated concentration that is less than the Method Reporting Limit (MRL) but greater than or equal to the Method Detection Limit (MDL)

mg/L = milligrams per liter

ND = Analyte Not Detected (detection limit in parentheses)

-- = Not Sampled

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TABLE 5-13

VOLATILE ORGANIC COMPOUNDS THAT EXCEEDED RAOs AND/OR MCLs IN OCTOBER 2001 GROUNDWATER SAMPLES

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA					
Compound	RAO (mg/L)	MCL (mg/L)	Oct 2001 Analytical Result (mg/L)	Monitoring Well Identification	Monitoring Well API Number
Benzene	0.005	0.005	--	--	--
Carbon Tetrachloride	0.005	0.005	--	--	--
1,1-Dichloroethene	--	0.007	0.0088	MW-7	AP-4017
cis-1,2-Dichloroethene	0.07	0.07	0.300	MW-5	AP-4015
			0.400	MW-7	AP-4017
			1.100	MW-21	AP-3983
			0.130	MW-24	AP-3986
trans-1,2-Dichloroethene	0.1	0.1	0.110	MW-7	AP-4017
			0.170	MW-21	AP-3983
1,1,2,2-Tetrachloroethane	0.052	0.004	0.060	MW-3	AP-4013
			0.360	MW-5	AP-4015
			0.980	MW-7	AP-4017
			2.100	MW-21	AP-3983
			0.310	MW-22	AP-3984
			0.140	MW-23	AP-3985
			0.140	MW-24	AP-3986
Tetrachloroethene	0.005	0.005	0.016	MW-5	AP-4015
			0.0070	MW-15	AP-3747
			0.046	MW-21	AP-3983
			0.034	MW-22	AP-3984
			0.0064	MW-23	AP-3985
			0.013	MW-24	AP-3986
1,1,2-Trichloroethane	--	0.005	0.0083	MW-5	AP-4015
			0.025	MW-7	AP-4017
			0.038	MW-21	AP-3983
Trichloroethene	0.005	0.005	0.038	MW-1	AP-4011
			0.100	MW-3	AP-4013
			1.200	MW-5	AP-4015
			0.0062	MW-6	AP-4016
			1.400	MW-7	AP-4017
			0.038	MW-12	AP-3744
			0.017	MW-13	AP-3745
			0.990	MW-15	AP-3747
			0.013	MW-19	AP-3981
			3.000	MW-21	AP-3983
			1.100	MW-22	AP-3984
			0.400	MW-23	AP-3985
			0.470	MW-24	AP-3986
Vinyl Chloride	--	0.002	0.0094	MW-21	AP-3983

NOTES:
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
RAO = Remedial Action Objective

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TABLE 5-14

SUMMARY OF ANALYTICAL RESULTS (mg/L) FOR NATURAL ATTENUATION PARAMETERS FOR OCTOBER 2001 GROUNDWATER SAMPLES

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Alkalinity as $CaCO_3$ (Total)	Ammonia as Nitrogen	Carbon (Total Organic)	Chloride	Methane	Nitrate+Nitrite as Nitrogen	Sulfate	Sulfide
Wells Screened in Shallow Aquifer									
MW-2	AP-4012	132	ND (0.02)	0.8	1.5	ND (0.00030)	0.5	10.7	ND (0.2)
MW-3	AP-4013	140	ND (0.02)	0.9	1.7	0.00049 J	0.4	11.7	0.2 J
MW-8	AP-4018	130	ND (0.02)	1.0	1.4	0.0027	0.2	10.7	0.3 J
MW-12	AP-3744	144	ND (0.02)	0.7	2.3	ND (0.00030)	0.9	17.3	0.4 J
MW-13	AP-3745	150	ND (0.02)	0.8	1.9	ND (0.00030)	1.4	16.5	0.9 J
MW-15	AP-3747	124	ND (0.02)	0.8	2.3	0.00040 J	0.9	10.4	0.2 J
MW-17	AP-3749	130	ND (0.02)	1.2	3.2	ND (0.00030)	0.5	14.1	ND (0.2)
MW-19	AP-3981	202	0.42	7.8	1.6	0.880	0.07 J	0.5	0.5 J
MW-20	AP-3982	106	ND (0.02)	0.8	1.3	0.0011	0.5	9.6	0.7 J
MW-21	AP-3983	146	0.52	5.5	20.5	0.058	ND (0.04)	85.6	0.9 J
MW-22	AP-3984	128	ND (0.02)	1.1	5.8	0.019	0.7	13.0	0.9 J
MW-23	AP-3985	208	0.29	5.5	2.7	0.510	0.08 J	7.5	1.0 J
MW-24	AP-3986	176	0.32	4.3	8.0	0.330	0.07 J	39.9	0.9 J
Wells Screened in Shallow-Intermediate Aquifer									
MW-05	AP-4015	148	0.49	4.5	3.1	0.500	0.06 J	36.6	0.2 J
Wells Screened in Deep Aquifer									
MW-1	AP-4011	152	ND (0.02)	0.6	1.7	0.00040 J	0.4	12.5	0.3 J
MW-6	AP-4016	262	0.24	0.6	8.4	0.550	0.05 J	6.5	0.6 J
MW-7	AP-4017	228	0.24	4.7	4.9	0.230	0.1 J	27.6	ND (0.2)
MW-9	AP-4019	110	ND (0.02)	ND (0.2)	4.7	ND (0.00030)	0.4	11.4	ND (0.2)
MW-16	AP-3748	112	ND (0.02)	ND (0.2)	37.3	0.0044	0.7	17.0	ND (0.2)

mg/L = milligrams per liter
ND = Analyte Not Detected (detection limit in parentheses)

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TABLE 5-15

SUMMARY OF OCTOBER 2001 FIELD MEASUREMENTS

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA

Well ID	API No.	Date Sampled	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (°C)	ORP (mV)	Ferrous Iron (mg/L)
Wells Screened in Shallow Aquifer									
MW-2	AP-4012	10-11-01	7.37	0.245	-1.7	9.60	5.73	278	0.0
MW-3	AP-4013	10-22-01	7.44	0.271	-10	8.80	3.79	160	0.0
MW-8	AP-4018	10-18-01	7.07	0.243	-1.6	7.14	3.89	-3	0.8
MW-12	AP-3744	10-19-01	7.22	0.255	20.4	11.48	5.16	187	0.0
MW-13	AP-3745	10-17-01	7.50	0.296	0.9	8.31	7.11	89	3.0
MW-15*	AP-3747	10-18-01	8.19	0.233	36.7	10.71	5.94	112	0.0
MW-17*	AP-3749	10-10-01	7.58	0.247	239	11.36	6.11	207	0.0
MW-19	AP-3981	10-15-01	6.72	0.340	1.3	0.00	8.84	-66	8.0
MW-20	AP-3982	10-15-01	7.22	0.195	5.7	15.69	5.53	1	0.8
MW-21	AP-3983	10-19-01	7.01	0.002****	210.0	13.20	11.69	-97	3.6
MW-22	AP-3984	10-16-01	6.62	0.266	20.7	8.83	15.43	-42	3.0
MW-23	AP-3985	10-17-01	6.98	0.378	106.0	0.00	13.68	-89	6.0
MW-24	AP-3986	10-16-01	6.83	0.376	9.1	0.00	15.12	-51	3.0
PZ-1	AP-3989	--	--	--	--	--	--	--	--
Well Screened in Perched Aquifer									
MW-14**	AP-3746	--	--	--	--	--	--	--	--
Well Screened in Shallow-Intermediate Aquifer									
MW-5	AP-4015	10-22-01	6.59	0.327	-10	1.72	10.29	-20	4.8
Well Screened in Intermediate Aquifer									
MW-4***	AP-4014	--	--	--	--	--	--	--	--
Wells Screened in Deep Aquifer									
MW-1	AP-4011	10-18-01	8.06	0.275	-0.7	12.58	6.79	92	0.0
MW-6*	AP-4016	10-19-01	9.73	0.474	33.6	0.00	5.70	28	0.0
MW-7	AP-4017	10-23-01	7.26	0.420	-2.5	2.89	8.77	-81	NR
MW-9	AP-4019	10-10-01	7.84	0.212	12.8	9.87	8.04	175	0.0
MW-16	AP-3748	10-11-01	8.02	0.313	-2.9	8.44	7.37	97	0.0

NOTES:
* Well pumped dry and measurements obtained after well recharged sufficiently for sampling
** MW-14 was dry or had insufficient water for sampling June 1998 through Oct 2001
*** MW-4 was dry or had insufficient water for sampling Oct 1998 through Oct 2001
**** Measurement appears to have been recorded incorrectly
mS/cm = milliSiemens/centimeter

mV = millivolts
NTU = nephelometric turbidity units
NR = Not Reported
-- = Not Sampled

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TABLE 5-16

GROUNDWATER ELEVATIONS 1995 - 2001*

OPERABLE UNIT B, POLELINE ROAD DISPOSAL AREA FORT RICHARDSON, ALASKA																							
Well ID	API No.	11/1/95	12/4/95	1/3/96	2/1/96	3/1/96	4/1/96	5/1/96	6/3/96	7/1/96	8/2/96	9/3/96	10/2/96	11/4/96	11/10/97	6/8/98	10/21/98	3/11/99	10/21/99	3/13/00	10/9/00	03/29/01	10/9/01
Shallow Aquifer																							
MW-2	AP-4012	274.11	273.43	272.69	272.30	272.08	271.88	271.62	271.80	271.76	271.61	271.37	271.22	271.01	273.31	275.22	273.97	273.48	272.69	271.85	273.81	271.98	272.20
MW-3	AP-4013	274.01	272.84	271.55	270.78	269.97	269.49	269.33	269.42	269.41	269.38	269.28	269.26	NS	272.56	275.05	274.30	271.06	271.86	270.32	274.12	271.18	271.21
MW-8	AP-4018	276.67	276.04	275.20	274.61	274.15	273.84	273.59	273.65	273.60	273.53	273.45	273.34	NS	275.35	277.16	276.45	273.56	274.59	273.72	276.50	274.04	280.33
MW-12	AP-3744	273.75	273.04	272.24	271.76	271.38	271.10	270.70	270.92	270.82	270.57	270.29	270.13	269.94	272.84	274.62	273.62	271.60	271.98	270.94	273.46	271.21	271.49
MW-13	AP-3745	275.88	275.21	274.46	273.90	273.62	273.22	272.98	273.02	272.99	272.96	272.91	272.83	272.73	274.79	276.27	275.72	272.96	274.09	273.16	276.70	273.42	273.74
MW-15	AP-3747	271.92	270.83	269.83	269.29	268.36	268.22	267.17	267.20	267.03	266.89	266.21	265.74	265.03	271.68	274.67	272.12	268.68	270.00	268.8	271.72	268.83	269.63
MW-17	AP-3749	285.40	284.54	283.69	283.06	282.59	282.28	282.36	282.70	282.64	282.37	282.15	281.97	281.80	284.86	281.08	284.97	282.33	284.28	NS	NS	282.44	282.78
MW-19	AP-3981	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	276.82	276.29	277.48	274.64	275.86	274.84	277.6	274.95	272.91
MW-20	AP-3982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	272.33	274.44	273.31	271.4	271.78	271.04	273.12	271.2	273.74
MW-21	AP-3983	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	274.15	275.40	276.09	272.4	273.45	272.27	276.07	272.72	271.34
MW-22	AP-3984	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	277.27	276.55	277.43	276.51	275.71	274.96	276.94	274.69	273.42
MW-23	AP-3985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	276.05	277.44	274.88	275.68	274.36	277.21	274.66	271.86
MW-24	AP-3986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	276.13	277.27	NS	275.77	274.3	276.99	274.45	271.72
PZ-1	AP-3989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	271.61	273.91	275.07	274.64	272.34	272.79	272.2	274.66	NA	--
Perched Aquifer																							
MW-14	AP-3746	290.93	289.93	289.05	288.37	287.71	287.28	288.80	290.38	289.89	289.37	289.08	288.72	288.91	Dry	Dry	285.07	Dry	Dry	285.28	Dry	Dry	285.20
Shallow-Intermediate Aquifer																							
MW-5	AP-4015	277.44	276.59	275.33	275.15	274.60	274.24	273.85	274.10	274.16	274.00	273.88	273.76	273.64	276.30	276.52	276.93	272.82	275.72	274.06	276.79	274.22	274.72
Intermediate Aquifer																							
MW-4	AP-4014	237.77	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	238.33	NS	Dry	243.26	Dry	Dry	Dry	Dry	236.90	Dry	Dry
Deep Aquifer																							
MW-1	AP-4011	173.27	173.26	173.22	173.28	173.18	173.32	Dry	173.29	173.18	173.24	173.18	173.32	NS	173.39	173.35	173.12	173.43	173.62	173.27	173.01	173.25	173.27
MW-6	AP-4016	177.36	177.24	177.40	177.53	177.32	177.68	177.35	177.63	177.33	177.44	177.42	177.71	NS	177.54	177.64	177.28	177.76	177.92	177.61	177.22	177.55	177.51
MW-7	AP-4017	226.71	226.37	226.30	226.38	226.12	226.40	226.08	226.30	225.97	226.09	226.09	226.33	NS	226.53	226.85	227.09	226.65	227.54	227.61	227.97	228.04	227.90
MW-9	AP-4019	Dry	160.16	160.13	159.94	Dry	159.09	Dry	Dry	158.08	158.10	158.08	158.02	NS	NS	157.82	160.21	159.35	158.37	158.08	159.90	158.99	158.88
MW-16	AP-3748	162.38	162.19	162.11	162.11	161.56	161.39	160.51	160.41	160.00	160.17	160.12	160.30	160.00	159.46	160.02	162.20	161.47	160.54	160.22	161.82	161.17	160.96

NOTES:
* Groundwater elevations are in feet
Dry = Dry well
NA = Not Available
NS = Not Sampled

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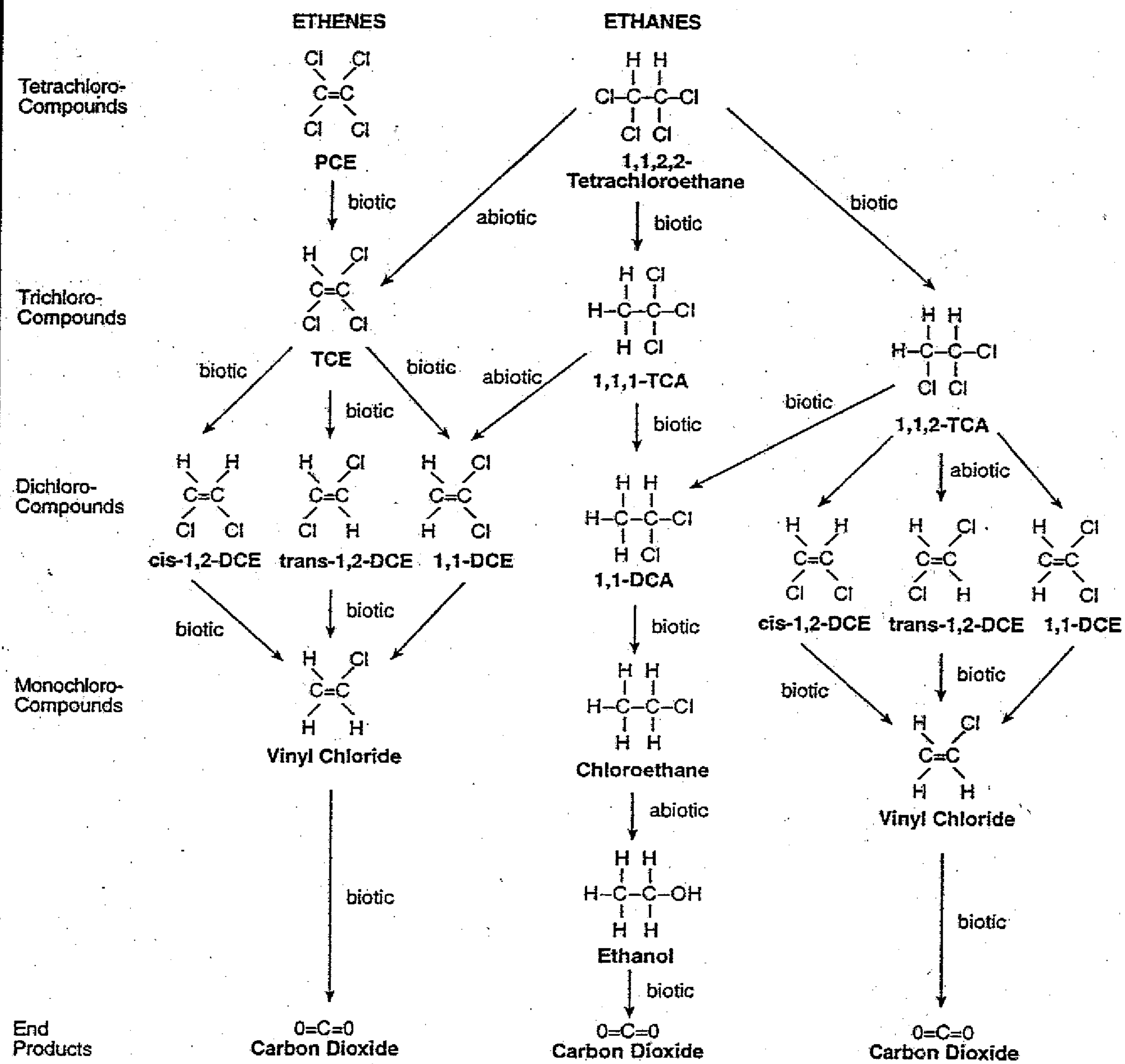
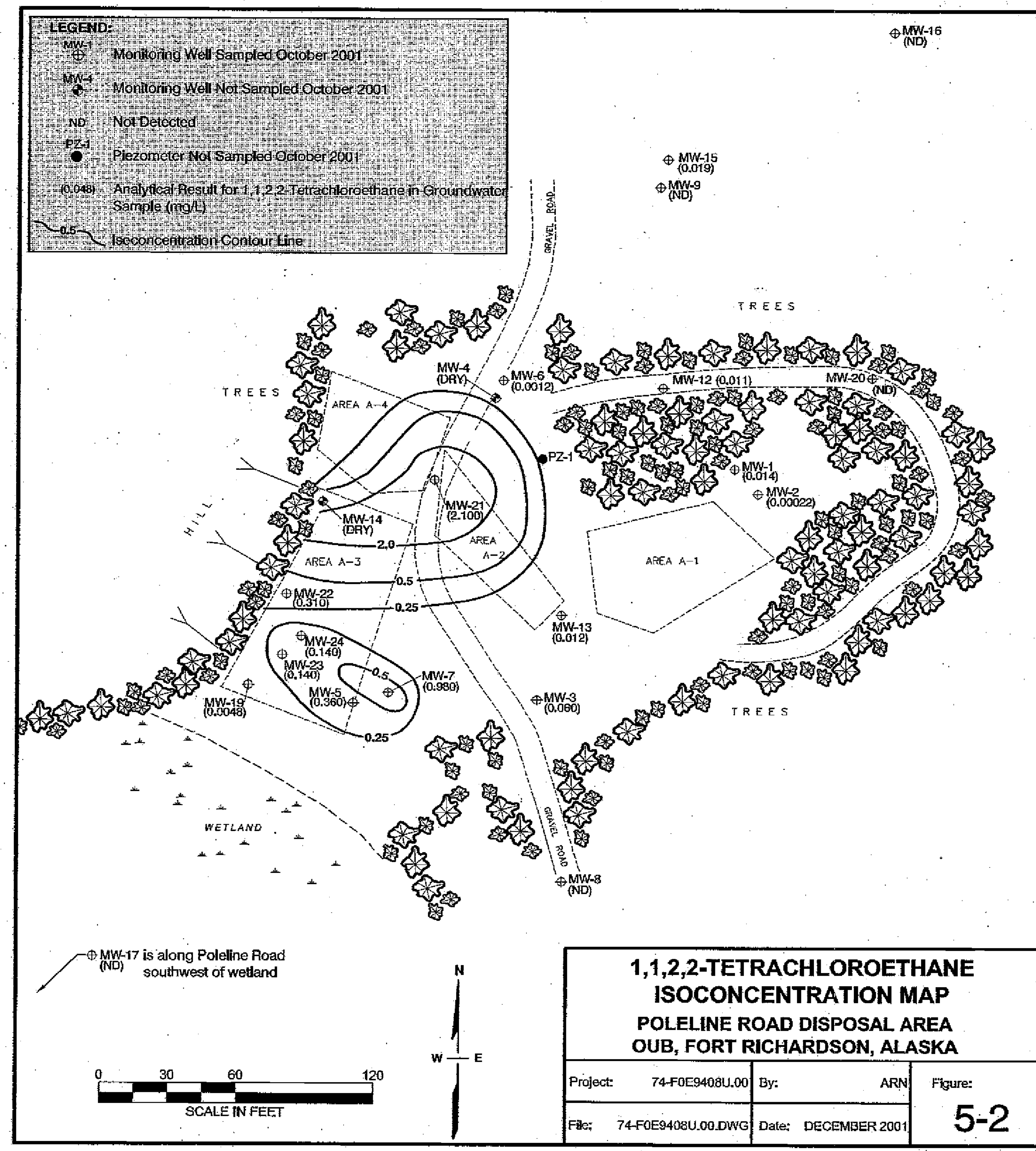


DEGRADATION PATHWAYS OF CHEMICALS OF CONCERN POLELINE ROAD DISPOSAL AREA OUB, FORT RICHARDSON, ALASKA

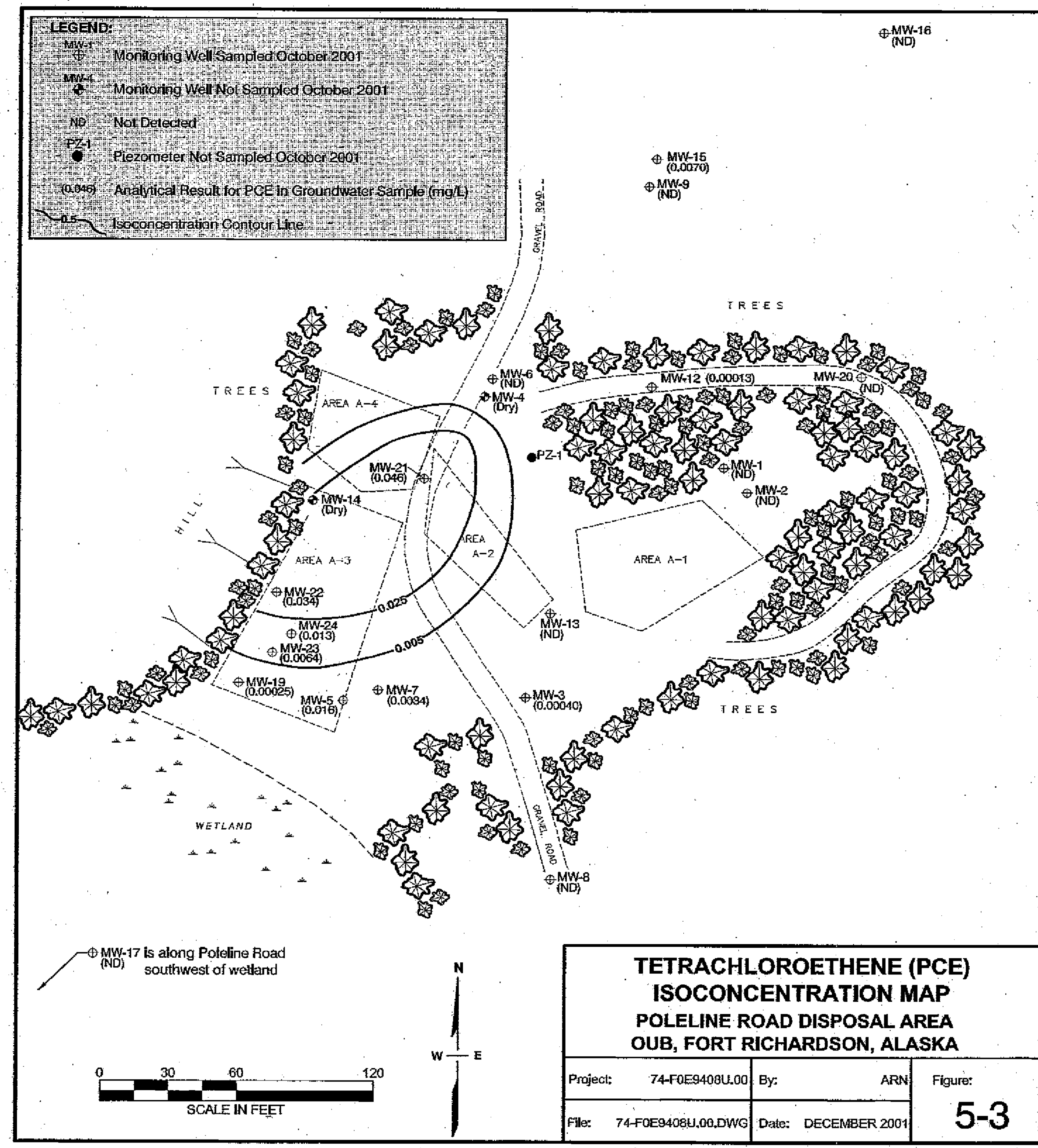
Dwg: PATH5-1.AI	By: AR	Figure:
Project: 74-F0E9408U	Date: DECEMBER 2001	5-1



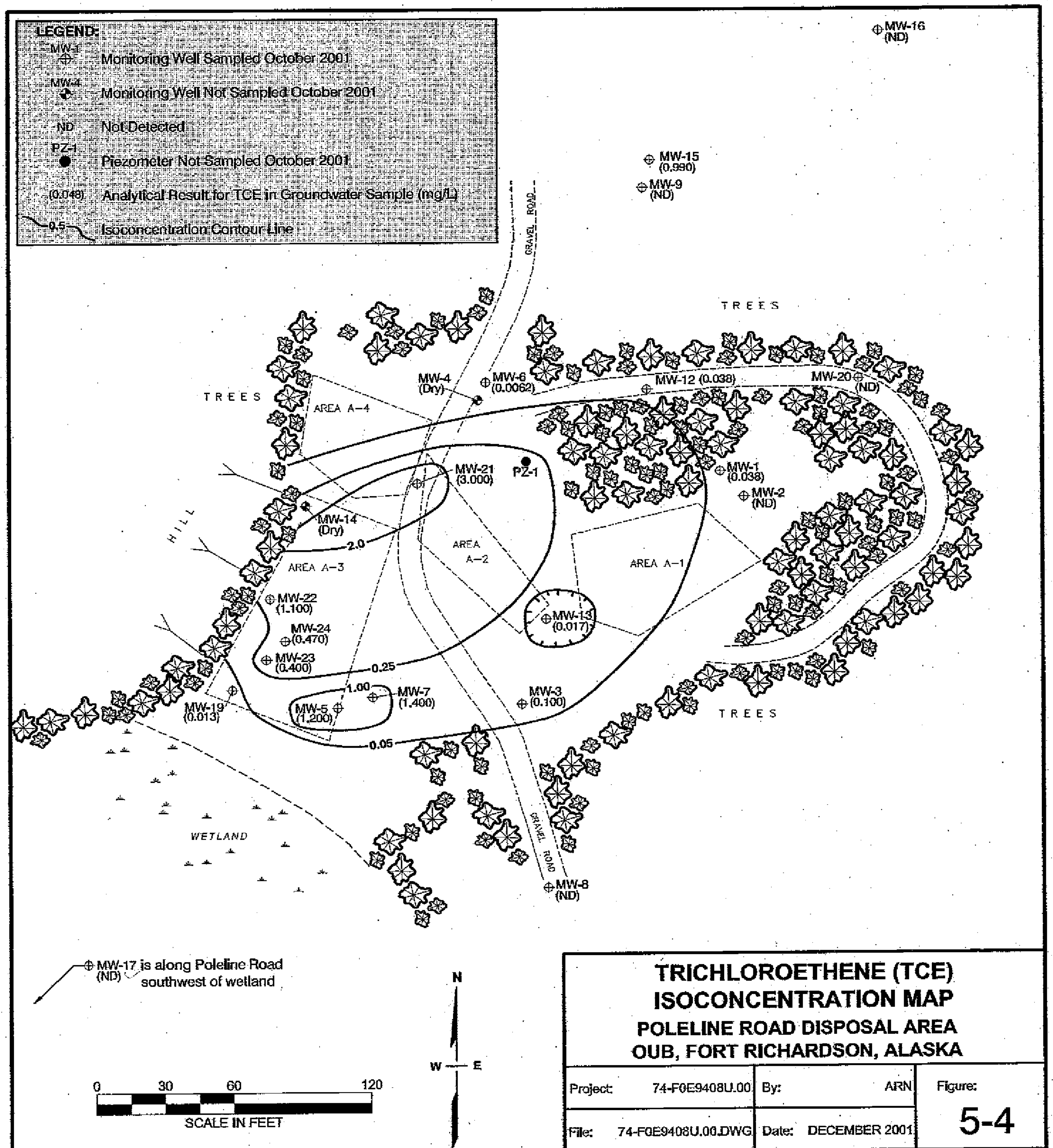
1,1,2,2-TETRACHLOROETHANE ISOCONCENTRATION MAP

POLELINE ROAD DISPOSAL AREA
OUB, FORT RICHARDSON, ALASKA

Project: 74-F0E9408U.00	By: ARN	Figure:
File: 74-F0E9408U.00.DWG	Date: DECEMBER 2001	5-2



TETRACHLOROETHENE (PCE) ISOCONCENTRATION MAP POLELINE ROAD DISPOSAL AREA OUB, FORT RICHARDSON, ALASKA		
Project: 74-F0E9408U.00	By: ARN	Figure:
File: 74-F0E9408U.00.DWG	Date: DECEMBER 2001	5-3


LEGEND:
MW-1 Monitoring Well Sampled October 2001
MW-4 Monitoring Well Not Sampled October 2001
ND Not Detected
PZ-1 Piezometer Not Sampled October 2001
(0.048) Analytical Result for TCE in Groundwater Sample (mg/L)
0.5 Isoconcentration Contour Line
MW-16 (ND)
MW-15 (0.990)
MW-9 (ND)
GRAVEL ROAD
TREES
MW-4 (Dry)
MW-6 (0.0062)
MW-12 (0.038)
MW-20 (ND)
AREA A-4
MW-21 (3.000)
PZ-1
MW-1 (0.038)
MW-2 (ND)
HILL
MW-14 (Dry)
2.0
AREA A-2
AREA A-1
AREA A-3
MW-13 (0.017)
MW-22 (1.100)
MW-24 (0.470)
MW-23 (0.400)
0.25
1.00
MW-7 (1.400)
MW-3 (0.100)
MW-19 (0.013)
MW-5 (1.200)
0.05
WETLAND
MW-8 (ND)
MW-17 is along Poleline Road (ND) southwest of wetland
N
W E
0 30 60 120
SCALE IN FEET
TRICHLOROETHENE (TCE) ISOCONCENTRATION MAP
POLELINE ROAD DISPOSAL AREA
OUB, FORT RICHARDSON, ALASKA
Project: 74-F0E9408U.00
By: ARN
Figure: 5-4
File: 74-F0E9408U.00.DWG
Date: DECEMBER 2001

6.1 CONCLUSIONS

Nine rounds of groundwater data have been collected from October 1995 through October 2001. During this time, several remedial activities occurred at the site that may have impacted the concentration of contaminants in the groundwater (see Section 3.6). In groundwater collected from several wells, the concentrations of primary VOCs (1,1,2,2-tetrachloroethane, TCE, and PCE) were reduced as a result of the SPH tests in 1997 and 1999. Because of the slow groundwater flow at the site, it may take from several months to several years for the concentration of contaminants in groundwater to be impacted at wells away from the test area. Four rounds of groundwater samples have been collected since the SPH system was shut off.

6.2 RECOMMENDATIONS

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

- Long-term groundwater monitoring should be reduced to annual sampling. This recommendation is based on the insignificant changes in contamination concentration observed at the site.
- The number of monitoring wells to be included for annual long-term monitoring should be reduced from 20 wells to 6 monitoring wells. These include MW2, MW12, and MW15 in the shallow aquifer; and MW1, MW6 and MW9 from the deep aquifer. These well are located down-gradient of the source area, and could be used to monitor migration.
- Wells should sampled for PCE, 1,1,2,2 tetrachloroethane, and daughter compounds.
- A five-year review of the long-term monitoring process to assess whether groundwater contamination levels are decreasing, or migrating towards the Eagle River.

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