

WASHINGTON STATE DEPARTMENT OF ECOLOGY
ENVIRONMENTAL INVESTIGATIONS AND LABORATORY SERVICES

December 11, 1989

TO: Sherman Spencer
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SUBJECT: Review of Burlington Northern Rail Yard Site Characterization.

SUMMARY

Previous studies of ground water and soil contamination at the Burlington Northern Railyard located in Othello Washington, were evaluated to determine if further characterization of the site is needed. Two aquifers exist beneath the site. These are separated by a continuous silty clay layer. The ground water monitoring well network is inadequate to define the extent of contamination in either aquifer. Of seven wells installed in the upper aquifer, one is screened correctly; this well is located upgradient of potential contaminant sources. Only one monitoring well is completed in the lower aquifer; it has never been sampled and is also located upgradient of the site. Surficial soil contamination has been adequately defined. Deep soil sample analytical results suggest vertical migration of contaminants to a depth of at least sixty feet.

INTRODUCTION

Objectives

The Toxics Investigations/Ground Water Monitoring Section (TI/GWM) of the Department of Ecology was requested by the Eastern Regional Office to evaluate characterization of contamination at the Burlington Northern (B/N) Railyard site prior to signing a Consent Decree for cleanup. The specific objectives were:

- o To determine if the ground water monitoring network adequately defines the extent of contamination;
- o To determine if surface water, ground water, and soil contamination is adequately described;
- o To determine if additional sampling by Ecology is needed to define the extent of contamination.

Site Description

The Burlington Northern Railyard site consists of 13 acres located in Othello, Washington. The former railyard was built in 1908 and operated as a refueling facility until 1982. Bunker and diesel fuels were stored on-site. Paint wastes, solvents and degreasers were used on-site until 1956 when maintenance services were discontinued. Waste fluids generated at the railyard were discharged on property currently owned by the Chicago-Milwaukee Railroad (Norton, in progress). Possible sources of contamination are shown in Figure 1 and include a fuel storage area, a fueling area, an engine maintenance area, an oil/water separator, the turntable, and a depot. All structures have been removed from the site.

Previous Work

Previous investigations were initiated by Burlington Northern and conducted by Remediation Technologies Incorporated (ReTech). Results are presented in three reports: Phase I (ReTech, 1987), Phase II (ReTech, 1988), and a Status Report (ReTech, 1989). Since 1986, remedial activities at the site have included the following: removal of an above ground diesel tank; excavation of a buried oil/water separator; installation of a gravel collection trench, ground water migration barrier wall, and two sumps around the contaminated area to facilitate soil washing; and installation of nine ground water monitoring wells. Fifty-four test pits were dug on-site to allow mapping of a subsurface silty clay layer. Surface water, ground water, and soil samples have been collected and analyzed for polynuclear aromatic hydrocarbons (PNA), volatile organic compounds (VOC), oil and grease (OG), polychlorinated biphenyls (PCB), and priority pollutant metals. Pilot studies were conducted at B/N to determine the best method of soil treatment.

GEOLOGY AND HYDROGEOLOGY

Regional

The Burlington Northern Railyard is located in a broad basin between the Saddle Mountains and Frenchman Hills anticlines. The basin is composed of a thick sequence of basalts from the Columbia River Group. The basalts are overlain by interbedded lacustrine clay, silt and sand and eolian deposits of the Ringold formation. In the basin surrounding Othello, the Ringold formation is up to 600 feet thick (Grolier et al., 1971). Glaciofluvial gravel, sand, silt and clay overlie Ringold sediments and are less than 20 feet thick near Othello. The Ringold and glaciofluvial sediments comprise an upper unconfined aquifer. Regional ground water flow in the unconfined aquifer is southwest (Tanaka et al., 1974). Drinking water is obtained from the underlying basalts.

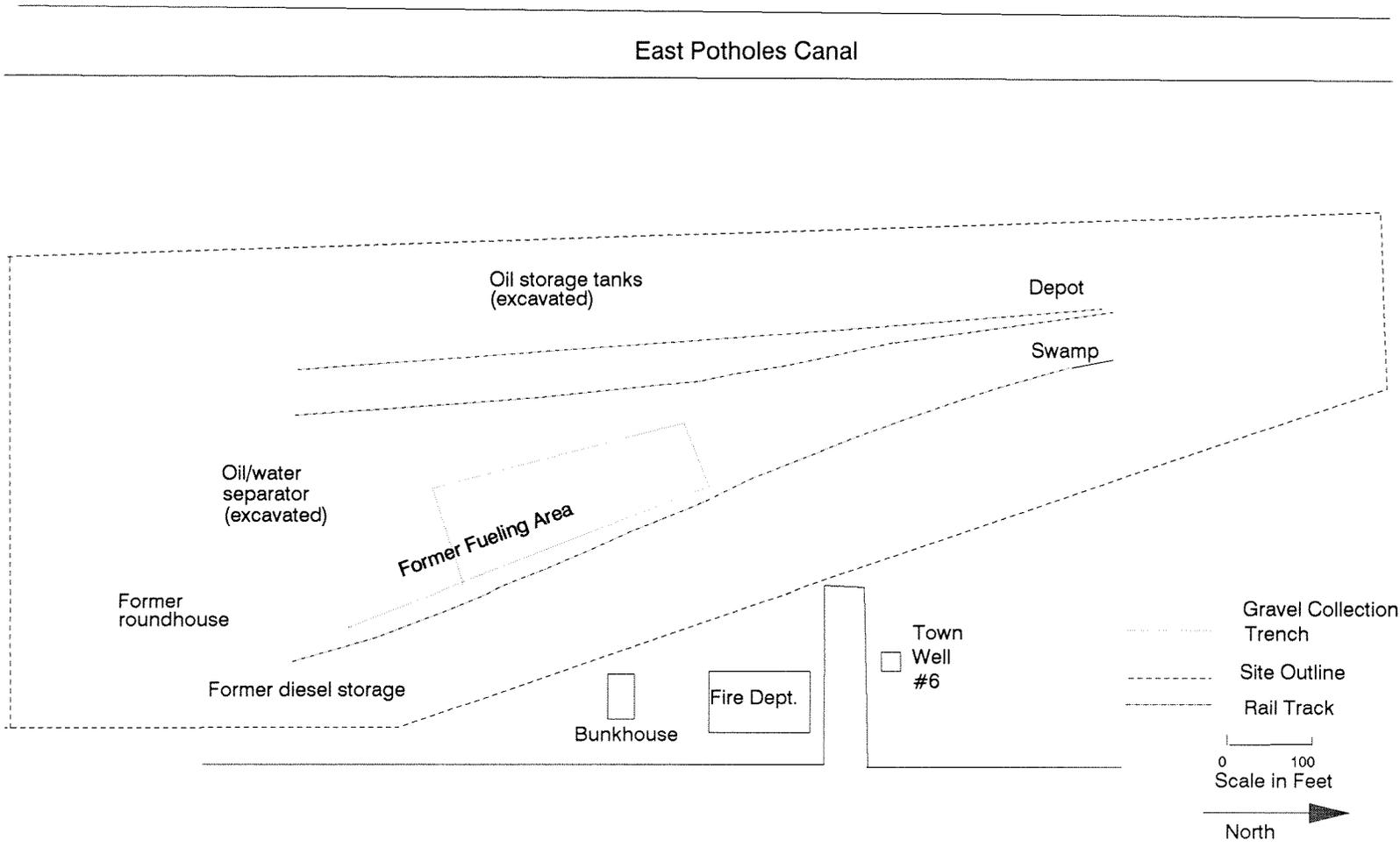


Figure 1: Site Map Burlington Northern Railyard, Othello, Washington

Local

Monitoring well logs, test pit logs, and soil boring logs from the B/N site show the geology consists of fill and glaciofluvial gravel 4 to 10 feet thick, 20 to 25 feet of Ringold varved lacustrine silty clay, underlain by Middle Ringold interbedded clay, silt and sand. A driller's log for Othello City Well Number 6, located approximately 400 feet east of the site, shows basalt at a depth of 214 feet from the surface. The ground water system is composed of two aquifers separated by the silty clay. The upper aquifer consists of gravel and may be saturated only during seasonal irrigation. The lower aquifer consists of sand, silt, and clay. The ground water flow pattern in the upper aquifer cannot be defined using the existing monitoring network. Ground water flow in the lower aquifer has not been defined. The upper and lower aquifers are separated by a continuous silty clay layer of lower permeability. This silty clay unit may be saturated all year. The permeability of the silty clay unit as determined in the laboratory using a constant head permeability test, ranged from 2.1×10^{-6} cm/sec to 3.9×10^{-7} cm/sec. No in situ aquifer tests to determine hydraulic conductivity have been conducted at the site.

METHODS

An independent analysis of existing site data was conducted. Hydro-geologic cross-sections were prepared from eight monitoring well and six piezometer logs. Lithology, well construction information, and water table elevations were plotted on the cross-sections. Figure 2 shows three cross-section lines corresponding to cross-sections in Figures 3, 4, and 5. The vertical axis is greatly exaggerated to show detail. Properly constructed monitoring wells and piezometers were used to construct a potentiometric surface map for the upper aquifer (see Figure 6). Surficial soil sample analyses data collected from nine test pits and field observation data from fifty-four test pits were used to determine the areal extent of contamination. Figure 7 shows the locations of test pits where contamination was detected. Soil boring logs and split-spoon sample analyses data were plotted on cross-sections to define the vertical extent of contamination. Cross-section lines are shown in Figure 8; cross-sections are shown in Figures 9 and 10.

RESULTS

Ground Water Monitoring Network

The ground water monitoring network was found to be inadequate for characterization of contamination in the upper and lower aquifers. Table 1 lists problems associated with each monitoring well and piezometer located on-site.

Table 1. Monitoring Well and Piezometer Analysis

Well Name	Location Up/Down Gradient	Screen Placement*	Acceptable Uses	Remarks
<u>Monitoring Wells</u>				
0-86-1	Up	Lower	Water level Background samples	This is the only well completed in the lower aquifer. There is no record of sample collection.
0-86-2	Up	G/C	None	Screen and filter pack do not intersect the water table. Water level and contaminant data characterize the silty clay.
0-86-3	Down	G/C	None	Screen and filter pack intersect the water table by a margin of only 0.5 feet. Vertical gradients between the gravel and clay could bias water level and contaminant data.
0-86-4	This well was destroyed.			
0-87-5	Down	Clay	None	Screen does not intersect the water table. Filter pack intersects the water table by a 0.25 foot margin. Could not observe floating product in this well.
0-87-6	Up	Clay	None	Screen does not intersect the water table. Filter pack intersects the water table by a 0.5 foot margin. Could not observe floating product in this well.
0-87-7	Up	Upper	Water level	Screen does not intersect the water table. Filter pack intersects the water table by two feet. Samples would not represent the water column; could not detect floating product.

Table 1. (continued)

Well Name	Location		Acceptable Uses	Remarks
	Up/Down Gradient	Screen Placement*		
<u>Monitoring Wells</u>				
O-87-8	Up	G/C	None	Screen and filter pack do not intersect the water table. Water level and contaminant data could be biased by vertical gradients between the gravel and clay.
O-87-9	Up	Upper	Water level Background Samples	This well is properly constructed and completed.
<u>Piezometers:</u>				
OP-87-1	Down	Upper	Water level	Screen intersects the water table by a 0.5 foot margin. Marginal for detecting product.
OP-87-2	Down	G/C	None	Available water level data indicates this well sometimes dry.
OP-87-3	Down	Clay	None	Available water level data indicate that this well is sometimes dry.
OP-87-4	Down	Upper	None	Water table is below the screen.
OP-87-5	Down	Upper	Water level	Screen is marginal for measuring water levels. Could not be used to detect floating product.
OP-87-6	Down	Clay	None	This well is dry.
* Clay : Silty clay unit G/C : Upper aquifer and silty clay unit				

Using water level data obtained from O-87-7, O-87-9, OP-87-1, and OP-87-5, in February 1988, the horizontal ground water flow direction was west southwest (Figure 6) and the horizontal gradient was 0.003 in the upper

East Potholes Canal

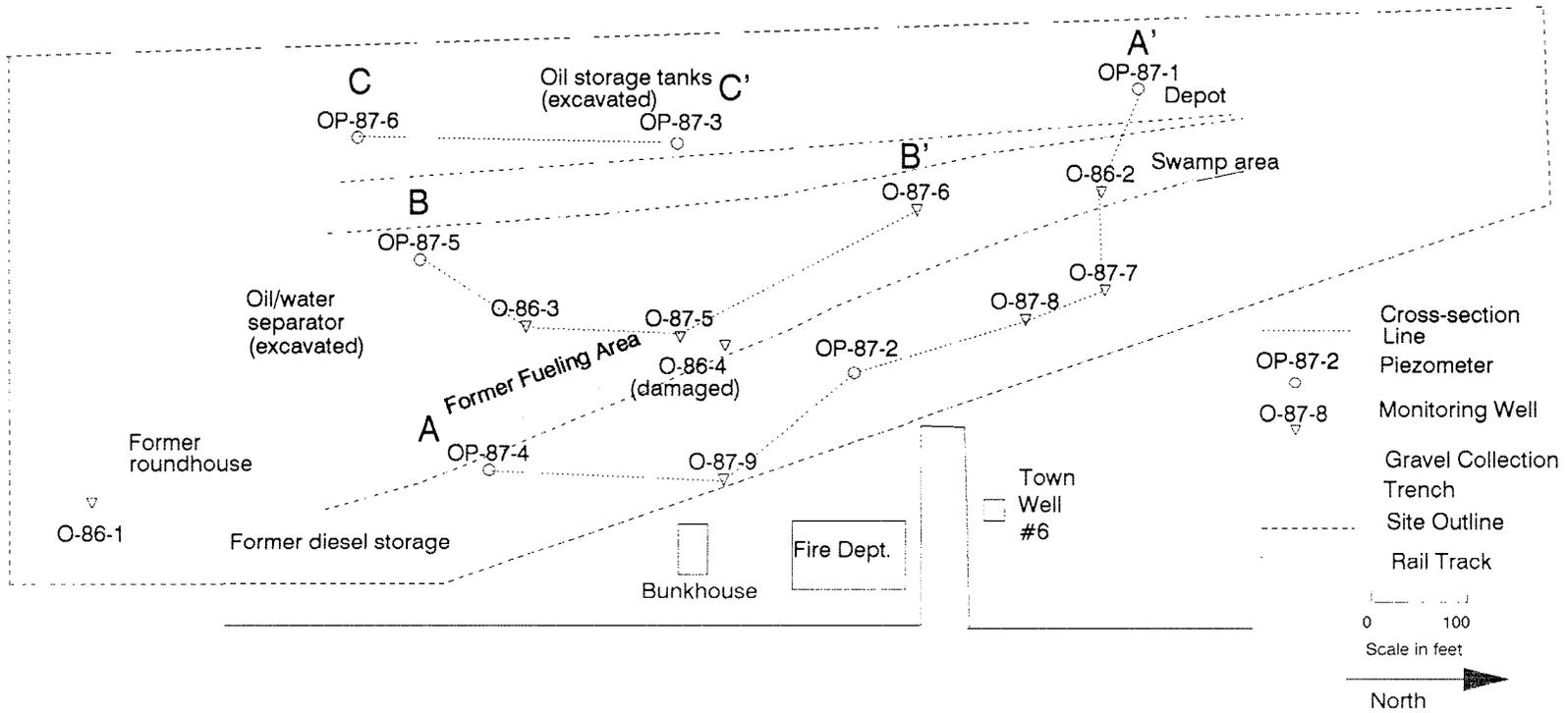


Figure 2: Burlington Northern Railyard Monitoring Well Cross-section Lines

Elevation Above MSL (feet)

1050
1045
1040
1035
1030

A
OP-87-4

O-87-9

OP-87-2

O-87-8

O-87-7

O-87-2

A'
OP-87-1

1033.79

1035.61

1035.71

1036.34

1036.50

1035.76

1035.62

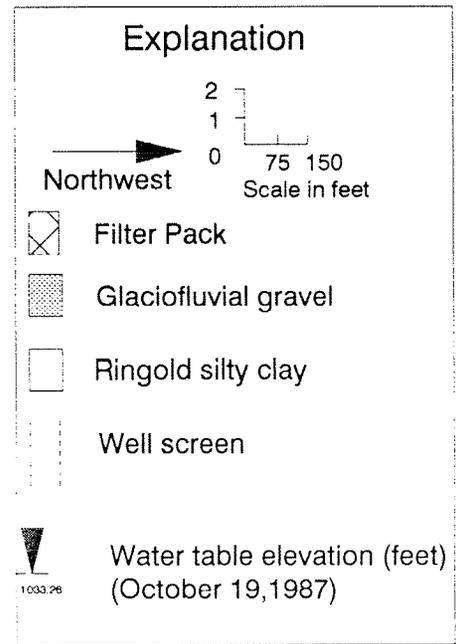


Figure 3: Cross Section A-A'

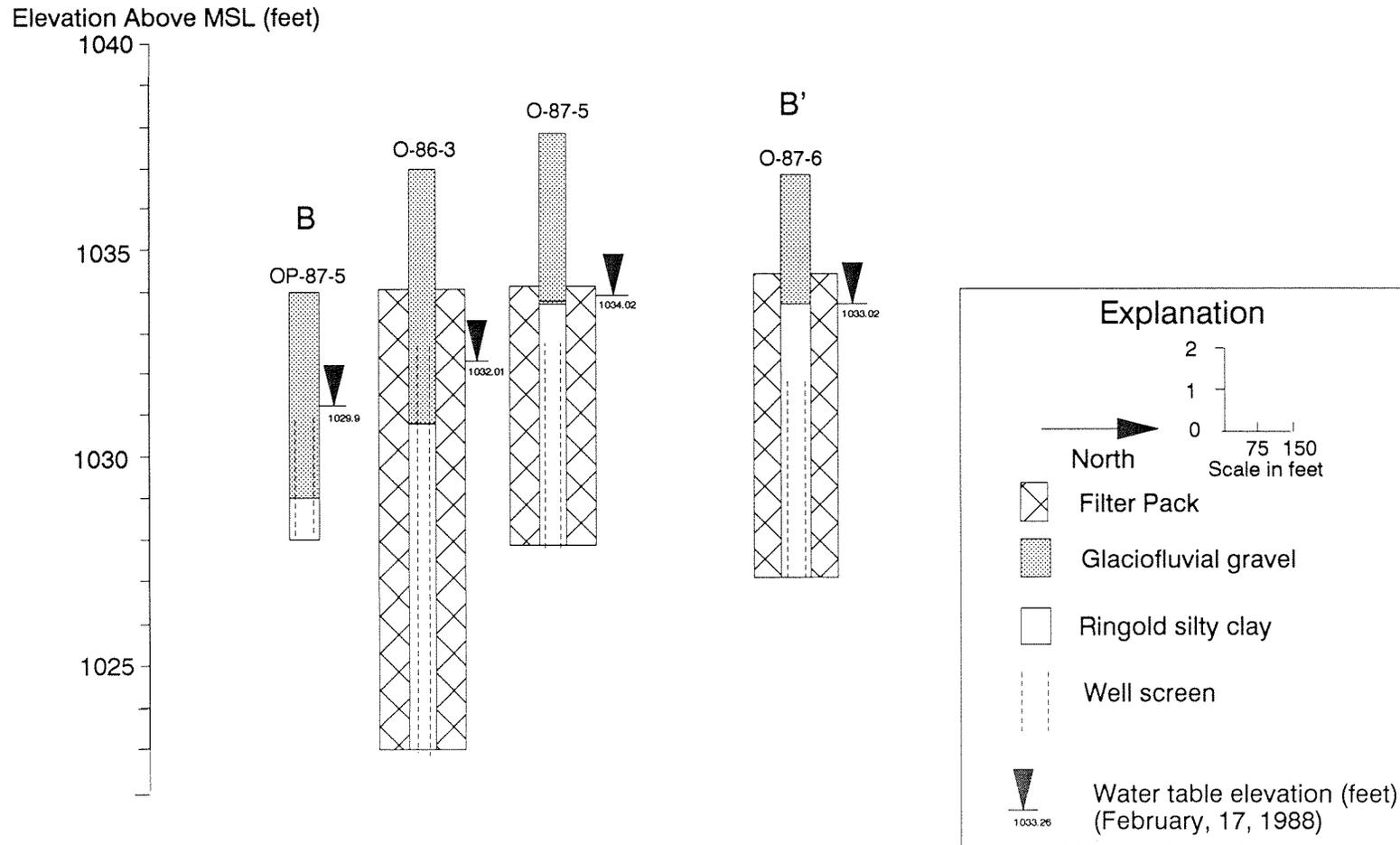


Figure 4: Cross Section B-B'

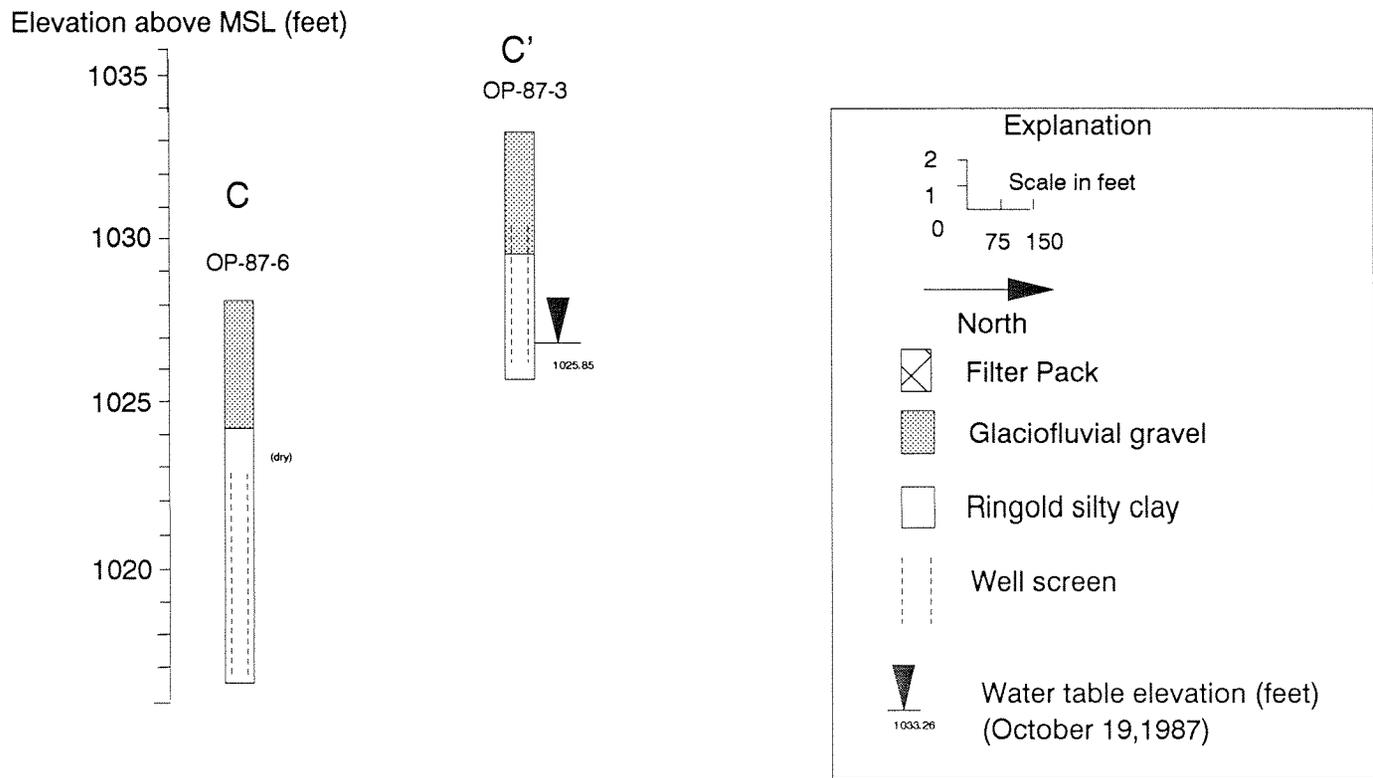


Figure 5: Cross Section C-C'

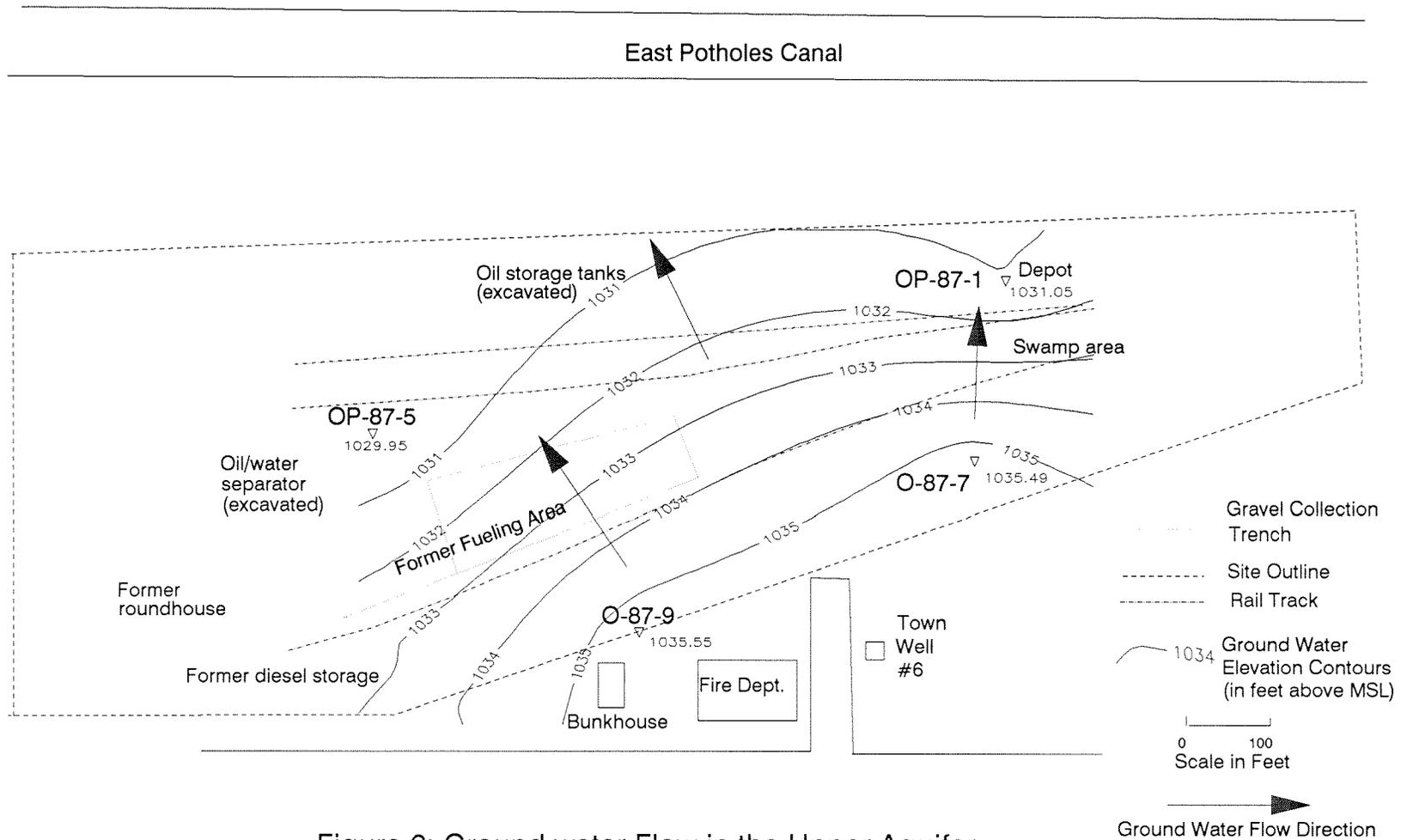


Figure 6: Ground water Flow in the Upper Aquifer Using Suitably Screened Monitoring Wells and Piezometers

aquifer. The ground water flow pattern presented here is based on only four data points and may vary significantly from true flow patterns. Ground water samples were collected and analyzed for volatile organic compounds, polynuclear aromatic hydrocarbons, oil and grease, polychlorinated biphenyls, pesticides, and priority pollutant metals (total). Low concentrations of volatile and semi-volatile organic compounds, oil and grease, and metals were detected. Sample analytical results (ReTech, 1987,1988) are presented in Appendix A. No conclusions about the adequacy of the data can be made until the monitoring network is upgraded.

Test Pit Data

Sixty-three test pits were dug in the upper glaciofluvial gravel/fill unit. Field observations by ReTech during two separate trenching operations documented hydrocarbon product, sheen, or odor in twelve test pits: TP-3, TP-4, TP-5, TP-7, TP-19, TP-22, TP-23, TP-30, TP-41, TP-46, TP-49, TP-50 and TP-52. Locations of these test pits are shown in Figure 7. Soil samples collected by ReTech in nine of the test pits from the surface, in the gravel, and at the gravel/clay interface, were analyzed for PNA, VOA, and OG, PCB, and priority pollutant metals. High concentrations of volatile and semi-volatile organic compounds, and oil and grease were detected in the former fueling area. Free hydrocarbon product was observed in the northern portion of the site, near the former diesel storage area, the excavated oil water separator, former oil storage tanks, and the former depot. Sample analytical results and field documentation are presented in Appendix B (ReTech, 1987).

Soil Borings

Five soil borings were drilled using air rotary. Borings were used to determine if soil contamination exists in the Ringold sand below the twenty-foot thick lacustrine Ringold silty clay. Boring depths ranged from 54 to 65 feet. Drilling logs of the borings and Monitoring Well O-86-1 were used to construct cross sections. Split spoon samples collected at lithologic boundaries were analyzed for PNA, VOC, OG, and priority pollutant metals. Locations of the soil borings are shown in Figure 8 along with cross-section lines. Cross-sections are shown in Figures 9 and 10. Where sample analyses data exceeded detection limits for contaminants, a symbol representing the contaminant was placed. Only boring B-1 showed no detectable contamination. Samples collected from the sandy Ringold showed low concentrations of volatile and semi-volatile organic compounds, and oil and grease to a depth of 60 feet below the confining silty clay layer. Sample analytical results are shown in Appendix C (ReTech, 1987).

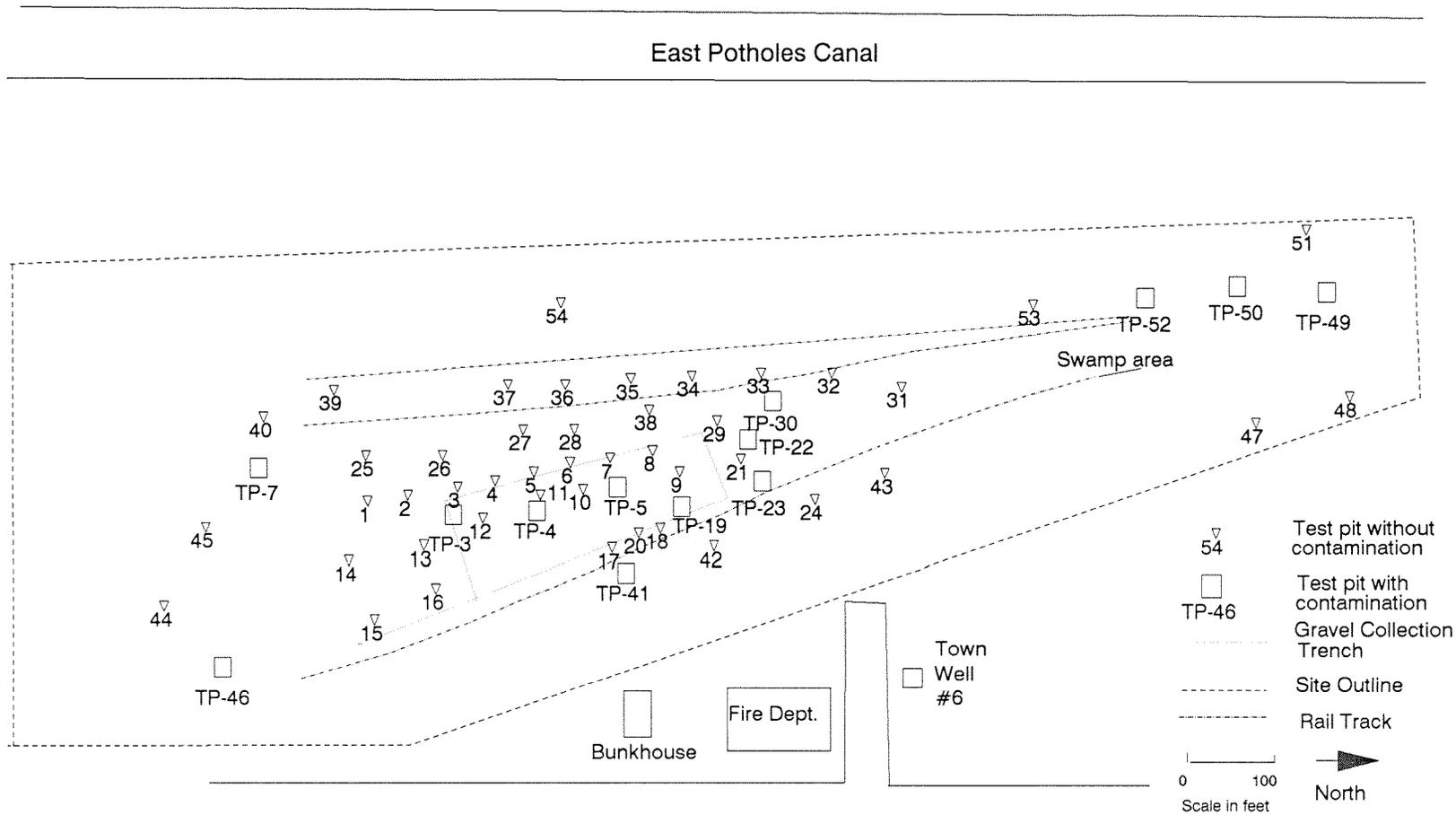


Figure 7: Test Plts Showing Analytical Contamination
or, Free Hydrocarbon Product

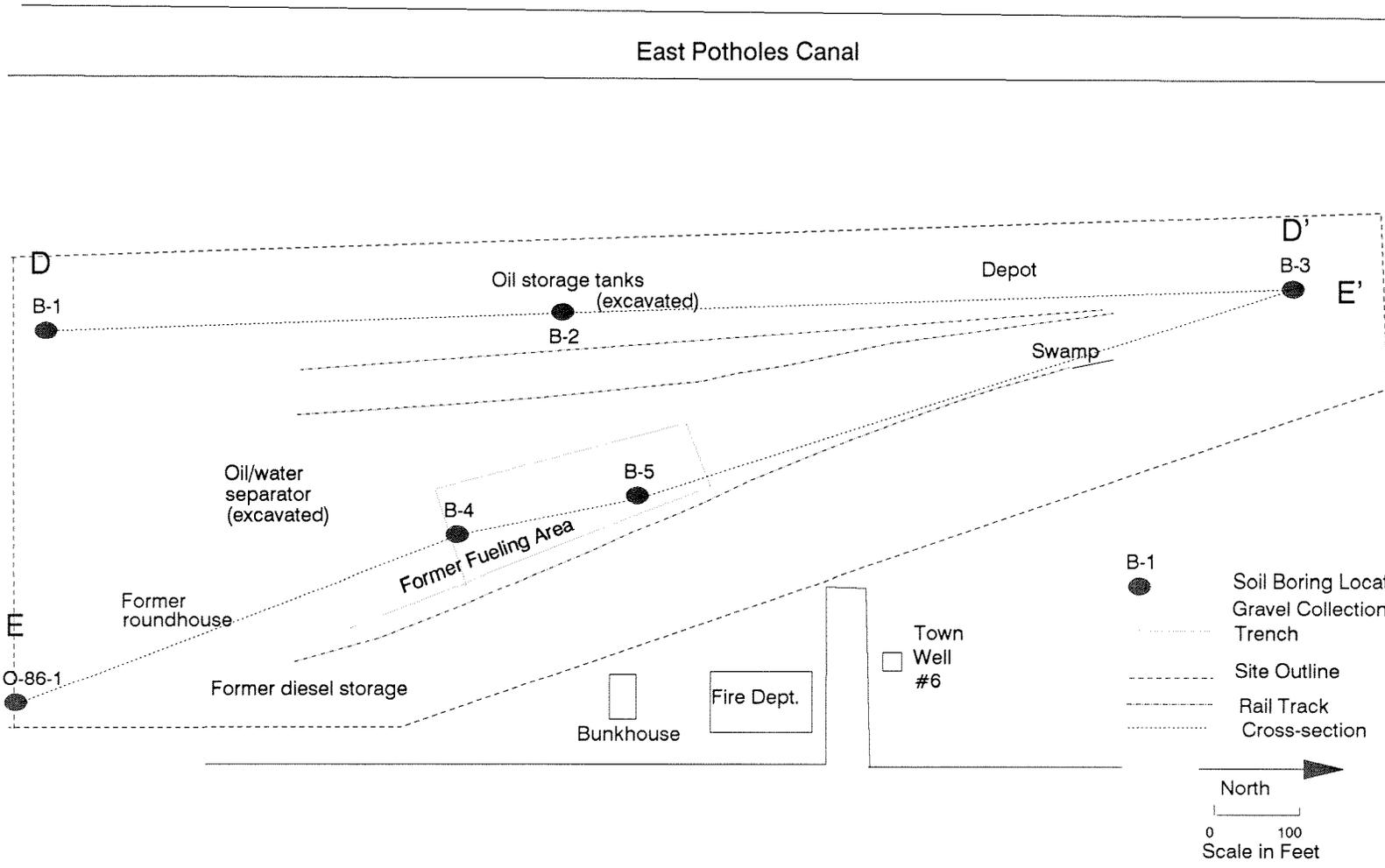


Figure 8: Soil Boring Cross Section Lines

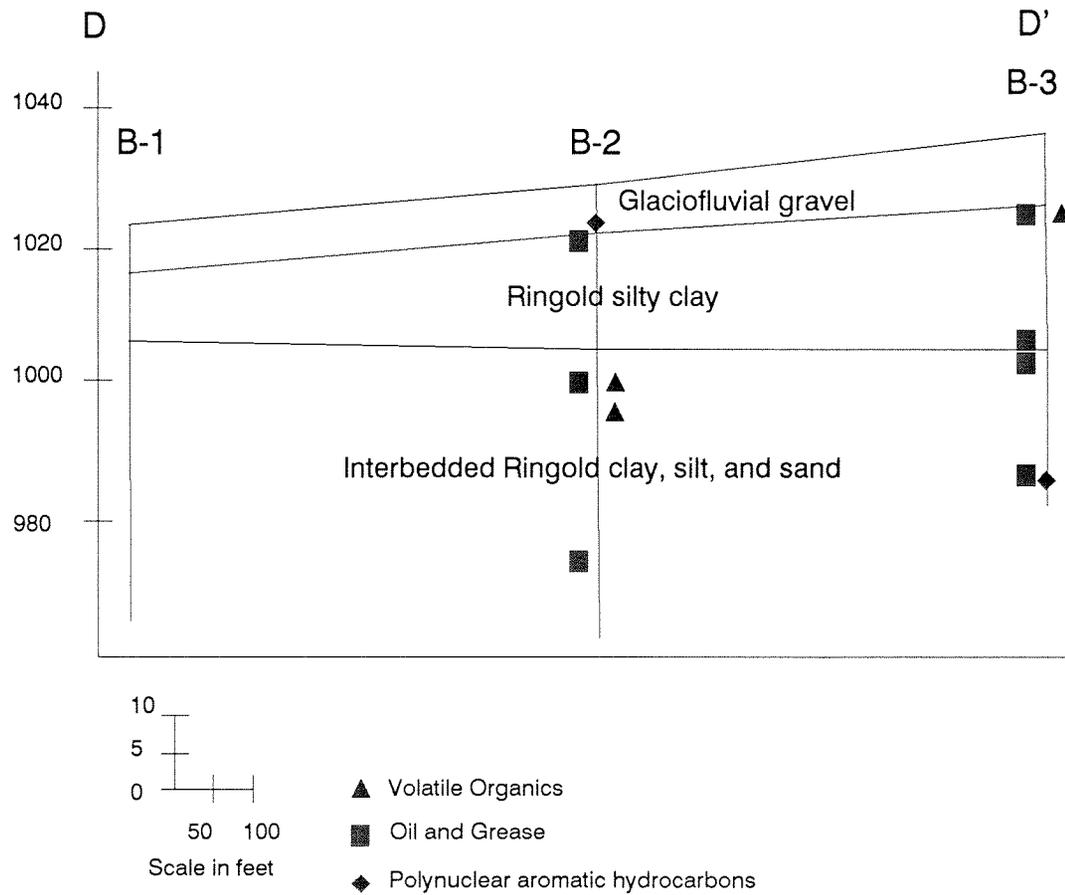


Figure 9: Cross Section of Soil Borings B-1, B-2, B-3

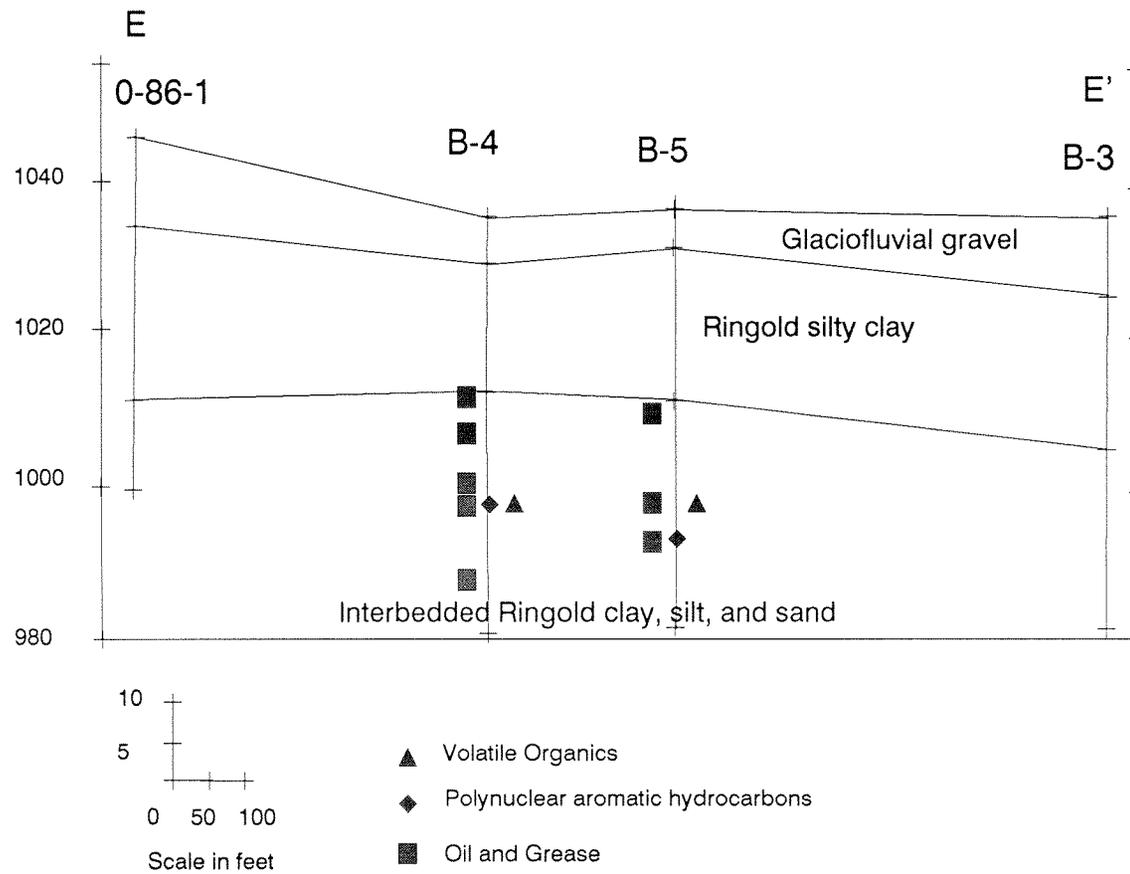


Figure 10: Cross Section of Soil Borings B-4, B-5, B-6, and Monitoring Well O-86-1

CONCLUSIONS

1. The monitoring well network is inadequate to characterize contamination in the upper aquifer. Monitoring wells O-86-1, O-86-2, O-87-6, O-87-7, O-87-8, and O-87-9 are located upgradient of potential contaminant sources. All of the monitoring wells with the exception of O-86-1 and O-87-9 were screened improperly.
2. Monitoring wells O-87-7 and O-87-9, and piezometers OP-87-1 and OP-87-5 can be used to measure water table elevations.
3. Test pits dug in the upper gravel layer show contamination to be greatest in the area near the fueling area. Free hydrocarbon product was observed in the northern portion of the site as well.
4. Contamination in the lower sandy confined aquifer has not been characterized. Only monitoring well O-86-1 penetrates the silty clay layer; no samples have been collected from this well.
5. No nested monitoring wells or piezometers exist to determine vertical gradients between the upper and lower aquifers.
6. Soil samples collected from borings which penetrate the silty clay show contamination in soils at depths of up to sixty feet. This may indicate that contaminants are moving vertically.

RECOMMENDATIONS

1. Additional monitoring wells must be installed to better characterize ground water contamination in the upper aquifer. These wells should be located downgradient of the following:

Contamination in the northern portion of the site
where free hydrocarbon was observed in test pits;
Diesel fueling area;
Diesel storage area;
Oil storage area;
Oil/water separator;
Roundhouse area;
Depot; and
Pilot study area.

Air photos or site plans should be used to better define possible contaminant sources for placement of monitoring wells. These wells should be screened in the upper aquifer. The screen should intersect the water table and allow for detection of possible floating product.

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2. Monitoring wells should be installed in the lower aquifer to define the ground water flow pattern, rate of ground water movement and to determine if it is contaminated. These wells should be placed adjacent to wells completed in the upper aquifer to define vertical gradients. Wells should be drilled and installed so water from the upper aquifer does not contaminate the lower aquifer. A double casing is recommended.
3. Undisturbed Shelby tube samples should be obtained from the silty clay unit. These samples should be tested for saturated hydraulic conductivity, moisture content, degree of saturation, and field capacity in the unsaturated zone below the silty clay.
4. Leakage across the silty clay layer should be estimated.
5. Comprehensive monitoring of the site should include monthly water level measurements and periodic sampling for constituents of concern.
6. After installation and sampling of additional monitoring wells has been completed, the network should be reevaluated to determine if further investigation is needed.

LC:sk

cc: Bill Yake

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Appendix A

TABLE 4-10

GROUNDWATER/SURFACE WATER DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
POLYNUCLEAR AROMATIC HYDROCARBONS
Concentrations in part per billion

Compound	Detection Limits (ug/l)	Detection				CANAL UP	CANAL DOWN	LAB BLANK
		0-86-2	0-86-2d	0-86-3	0-86-4			
Acenaphthene	1	U	U	5	(200	U	U	U
Acenaphthylene	1	U	U	U	(200	U	U	U
Anthracene	1	U	U	U	(200	U	U	U
Benzo(a)Anthracene	1	U	U	U	(200	U	U	U
Benzo(b)Fluoranthene	1	U	U	U	(200	U	U	U
Benzo(k)Fluoranthene	1	U	U	U	(200	U	U	U
Benzo(g,h,i)Perylene	1	U	U	U	(200	U	U	U
Benzo(a)Pyrene	1	U	U	U	(200	U	U	U
Chrysene	1	U	U	U	(200	U	U	U
Dibenz(a,h)Anthracene	1	U	U	U	(200	U	U	U
Fluoranthene	1	U	U	U	330	U	U	U
Fluorene	1	U	U	5	1100	U	U	U
Indeno(1,2,3-cd)Pyrene	1	U	U	U	(200	U	U	U
2-Methylnaphthalene	1	U	U	15	3000	U	U	U
Naphthalene	1	U	U	U	(200	U	U	U
Phenanthrene	1	U	U	5	1400	U	U	U
Pentachlorophenol	1	U	U	U	(10	U	U	U
Bis(2-ethylhexyl)phthalate	1	6	U	12	(200	U	U	U
Di-n-octyl pthalate	1	U	U	3	(200	U	U	U
Pyrene	1	U	U	U	(200	U	U	U

TABLE 4-11

GROUNDWATER/SURFACE WATER DATA - OTHELLO, WA.
ANALYTICAL RESULTS
VOLATILE ORGANICS
Concentrations in part per billion

Compound	Detection Limit (ug/kg)									
		0-86-2	0-86-2d	0-86-3	0-86-4	CANAL-UP	CANAL-DN	FIELD BL	LAB BL1	LAB BL2
ACETONE	1	9300	19,000	6600	(50	U	U	U	U	U
ACROLEIN	5	U	(2500	U	(250	U	U	U	U	U
ACRYLONITRILE	5	U	(2500	U	(250	U	U	U	U	U
BENZENE	1	U	(500	U	(50	U	U	U	U	U
BROMODICHLOROMETHANE	1	U	(500	U	(50	U	U	U	U	U
BROMOFORM	1	U	(500	U	(50	U	U	U	U	U
BROMOMETHANE	1	U	(500	U	(50	U	U	U	U	U
2-BUTANONE	1	U	(500	U	(50	U	U	U	U	U
CARBON DISULFIDE	1	U	(500	U	(50	U	U	U	U	U
CARBON TETRACHLORIDE	1	U	(500	U	(50	U	U	U	U	U
CHLOROBENZENE	1	U	(500	U	(50	U	U	U	U	U
CHLOROETHANE	1	U	(500	U	(50	U	U	U	U	U
2-CHLOROETHYL VINYLETHER	1	U	(500	U	(50	U	U	U	U	U
CHLOROFORM	1	8	(500	U	(50	U	U	U	U	U
CHLOROMETHANE	1	U	(500	U	(50	U	U	U	U	U
CHLORODIBROMOMETHANE	1	U	(500	U	(50	U	U	U	U	U
1,1,-DICHLOROETHANE	1	U	(500	U	(50	U	U	U	U	U
1,2-DICHLOROETHANE	1	U	(500	U	(50	U	U	U	U	U
1,1,-DICHLOROETHYLENE	1	U	(500	U	(50	U	U	U	U	U
TRANS-1,2-DICHLOROETHYL	1	U	(500	U	(50	U	U	U	U	U
1,2-DICHLOROPROPANE	1	U	(500	U	(50	U	U	U	U	U
CIS-1,3-DICHLOROPROPENE	1	U	(500	U	(50	U	U	U	U	U
TRANS-1,3-DICHLOROPROPE	1	U	(500	U	(50	U	U	U	U	U
ETHYLBENZENE	1	U	(500	U	(50	U	U	U	U	U
2-HEXANONE	1	U	(500	U	(50	U	U	U	U	U
METHYLENE CHLORIDE	1	70,000	160,000	99,000	700	26	17	22	U	U
4-METHYL-2-PENTANONE	1	U	(500	U	(50	U	U	U	U	U
STYRENE	1	U	(500	U	(50	U	U	U	U	U
TETRACHLOROETHENE	1	U	(500	U	(50	U	U	U	U	U
1,1,2,2-TETRACHLOROETHA	1	U	(500	U	(50	U	U	U	U	U
TOLUENE	1	trace	(500	U	(50	U	U	U	U	U
1,1,1-TRICHLOROETHANE	1	U	(500	U	(50	U	U	U	U	U
1,1,2-TRICHLOROETHANE	1	U	(500	U	(50	U	U	U	U	U
TRICHLOROETHYLENE	1	U	(500	U	(50	U	U	U	U	U
VINYL ACETATE	1	U	(500	U	(50	U	U	U	U	U
VINYL CHLORIDE	1	U	(500	U	(50	U	U	U	U	U
O-XYLENE	1	U	(500	U	(50	U	U	U	U	U

U - Undetected

TABLE 4-12

GROUNDWATER/SURFACE WATER DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
OIL AND GREASE
Part per million

Sample Location	Result (mg/kg)
0-86-2	0.5
0-86-2d	0.2
0-86-3	29
0-86-4	2000
CANAL-UP	0.5
CANAL-DN	1.3

TABLE 4-14

GROUNDWATER/SURFACE WATER DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
TOTAL SUSPENDED SOLIDS
Part per million

Sample Location	Result (mg/kg)
0-86-2	88
0-86-2d	290
0-86-3	350
0-86-4	320
CANAL-UP	15
CANAL-DN	14

TABLE 4-13

GROUNDWATER/SURFACE WATER DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
METALS
Part per billion

METAL	Detection Limit (ug/kg)	Sample Location						
		0-86-2	0-86-2d	0-86-3	0-86-4	CANAL UP	CANAL DOWN	LAB BLANK
Antimony	5	U	U	U	U	U	8	U
Arsenic	5	U	U	15	30	U	U	U
Beryllium	1	U	U	1	U	U	U	U
Cadmium	1	U	U	U	U	U	U	U
Chromium	1	8	9	98	37	2	1	U
Copper	10	5	5	110	28	4	3	4
Lead	10	U	U	68	17	120	U	U
Mercury	1	U	U	U	U	U	U	U
Nickel	1	10	13	180	280	3	2	4
Selenium	5	U	U	U	U	U	U	U
Silver	1	U	U	U	U	U	U	U
Thallium	20	U	U	U	U	U	U	U
Zinc	1	1600	1500	440	110	120	220	3

Appendix B

TABLE 4-1

TEST PIT DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
POLYNUCLEAR AROMATIC HYDROCARBONS
DETECTION LIMITS : 130 (ug/kg)

Concentrations in part per billion

Compound	Sample Location (1)											
	TP-1B	82-B	TP-3B	TP-4B	TP-5B	86-B	TP-7B	TP-8B	TP-9B	TP-10B	TP-11B	812-B
Acenaphthene	1	2581	U	U	U	13 J	23 J	U	U	U	U	2 J
Acenaphthylene	1	U	10 J	U	U	32 J	13 J	54 J	U	U	127 J	11 J
Anthracene	1	420	40 J	250 J	80 J	100 J	U	177 J	U	U	569	U
Benzo(a)Anthracene	1	13 J	150 J	70 J	70 J	260 J	33 J	94 J	U	U	414	101 J
Benzo(b)Fluoranthene	1	U	130 J	60 J	280 J	250 J	26 J	271 J	U	U	657	178 J
Benzo(k)Fluoranthene	1	532	U	30 J	U	250 J	31 J	U	U	U	600	235 J
Benzo(g,h,i)Perylene	1	164 J	U	U	U	U	20 J	177 J	U	U	816	U
Benzo(a)Pyrene	1	483	U	210 J	U	500	6 J	314 J	U	U	309 J	61 J
Chrysene	1	270 J	U	150 J	260 J	570	14 J	158 J	U	U	443	134 J
Dibenz(a,h)Anthracene	1	U	U	U	U	U	3 J	U	U	U	248 J	U
Fluoranthene	1	236 J	100 J	100 J	3900	700	54 J	177 J	U	U	809	208 J
Fluorene	1	99 J	U	U	U	U	11 J	20 J	U	U	U	9 J
Indeno(1,2,3-cd)Pyrene	1	110 J	U	U	U	20 J	1 J	166 J	U	U	620	U
2-Methylnaphthalene	1	462 J	30 J	80 J	167 J	53 J	48 J	188 J	U	U	385	20 J
Naphthalene	1	285 J	22 J	U	57 J	20 J	41 J	92 J	U	U	433	31 J
Phenanthrene	1	743	50 J	80 J	160 J	130 J	76 J	237 J	U	U	1037	106 J
Pyrene	1	4418	170 J	140 J	430	2000	141 J	162 J	U	U	592	246 J
Compound	TP-1A	82-A	TP-3A	TP-4A	TP-5A	86-A	TP-7A	TP-8A	TP-9A	TP-10A	TP-11A	812-A
Acenaphthene	U (1)	1	2075	710	5717	1	1043	636	3 J	1	23 J	1
Acenaphthylene	U	1	471	U	915	1	484	199 J	16 JK	1	14 J	1
Anthracene	U	1	5470	460	1670	1	2375	163 J	U	1	U	1
Benzo(a)Anthracene	45 (J)	1	664	U	177 J	1	178 J	13 J	U	1	U	1
Benzo(b)Fluoranthene	75 J	1	U	U	7 J	1	84 J	115 J	5 J	1	3	1
Benzo(k)Fluoranthene	63 J	1	564	U	7 J	1	214 J	83 J	7 J	1	U	1
Benzo(g,h,i)Perylene	U	1	665	U	U	1	1018	75 J	U	1	U	1
Benzo(a)Pyrene	41 J	1	298 J	U	48 J	1	145 J	140 J	35 J	1	U	1
Chrysene	35 J	1	1154	U	233 J	1	287 J	20 J	U	1	U	1
Dibenz(a,h)Anthracene	U	1	463	U	U	1	687	265 J	U	1	U	1
Fluoranthene	U	1	1094	110 J	666	1	281 J	31 J	2 J	1	U	1
Fluorene	U	1	3176	1200	9606	1	2274	3165	18 J	1	11 J	1
Indeno(1,2,3-cd)Pyrene	U	1	457	U	U	1	722	43 J	U	1	U	1
2-Methylnaphthalene	U	1	8101	7400	20,306	1	9826	3317	60 J	1	37 J	1
Naphthalene	U	1	4550	1500	339	1	1687	712	20 J	1	12 J	1
Phenanthrene	U	1	8739	2500	17,662	1	3952	1348	50 J	1	20 J	1
Pyrene	U	1	2096	180 J	872	1	326 J	36 J	27 J	1	1 J	1
Compound	TP-1B	82-B	TP-3B	TP-4B	TP-5B	86-B	TP-7B	TP-8B	TP-9B	TP-10B	TP-11B	812-B
Acenaphthene	1	1	1441	160 J	1609	1	600	U	U	1	41 J	1
Acenaphthylene	1	1	225 J	U	267 J	1	270 J	U	U	1	8 J	1
Anthracene	1	1	280 J	730	710	1	600	U	U	1	210 J	1
Benzo(a)Anthracene	1	1	449	55 J	100 J	1	U	U	U	1	U	1
Benzo(b)Fluoranthene	1	1	135 J	U	7 J	1	U	U	U	1	15 J	1
Benzo(k)Fluoranthene	1	1	114 J	U	7 J	1	U	U	U	1	14 J	1
Benzo(g,h,i)Perylene	1	1	287 J	U	U	1	U	U	U	1	U	1
Benzo(a)Pyrene	1	1	254 J	U	U	1	U	U	U	1	3 J	1
Chrysene	1	1	609	50 J	98 J	1	U	U	U	1	U	1
Dibenz(a,h)Anthracene	1	1	94 J	U	U	1	U	U	U	1	U	1
Fluoranthene	1	1	2011	60 J	277 J	1	100 J	U	U	1	21 J	1
Fluorene	1	1	1383	477	3742	1	760	U	34 J	1	86 J	1
Indeno(1,2,3-cd)Pyrene	1	1	140 J	U	U	1	U	U	U	1	U	1
2-Methylnaphthalene	1	1	2782	900	8458	1	9100	U	U	1	U	1
Naphthalene	1	1	1621	U	441	1	1100	U	U	1	U	1
Phenanthrene	1	1	610	933	6934	1	1530	U	U	1	194 J	1
Pyrene	1	1	140 J	50 J	419	1	150 J	U	U	1	18 J	1

1 - S:Surface grab sample
A:Gravel unit, 0-6 ft.
B:Clay unit, 6-10 ft.
‡:Composite surface sample

* - Background sample

: - No sample collected

U - Undetected

J - Indicates an estimated value when the substance is detected but is below the specified limits, or when it is a tentatively identified compound

TABLE 4-2

TEST PIT DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
VOLATILE ORGANICS
Concentrations in part per billion

Compound	Detection Limits (ug/kg)	TP-3B TP-4B TP-5B TP-7B TP-8B TP-9B TP-11B						
		TP-3B	TP-4B	TP-5B	TP-7B	TP-8B	TP-9B	TP-11B
ACETONE	10	340 B	331 B	373 B	226 B	66.0 B	125.0 B	57.5 B
BENZENE	5	<27	<18	U	<19	U	U	U
BROMODICHLOROMETHANE	5	7.4 J	<18	5 J	<19	0.9 J	1.8 J	U
BROMOFORM	5	<27	<18	0.2 J	<19	U	U	U
BROMOMETHANE	10	<53	<36	U	<37	U	U	U
2-BUTANONE	10	31 B	27 B	8 J	44 B	14.5 B	17.1 B	21.3 B
CARBON DISULFIDE	5	<27	<18	U	<19	U	U	U
CARBON TETRACHLORIDE	5	<27	<18	U	<19	U	U	U
CHLOROBENZENE	5	<27	<18	U	<19	U	U	U
CHLOROETHANE	10	<53	<36	U	<37	U	U	U
2-CHLOROETHYLVINYLETHER	10	<53	<36	U	<37	U	U	U
CHLOROFORM	5	<27	<18	2 J	2 J	U	U	U
CHLOROMETHANE	5	<53	<36	U	<37	U	U	U
DIBROMOCHLOROMETHANE	5	<27	<18	0.6 J	<19	0.1 J	0.2 J	U
1,1,-DICHLOROETHANE	5	<27	<18	U	<19	U	U	U
1,2-DICHLOROETHANE	5	<27	<18	U	<19	U	U	U
1,1,-DICHLOROETHENE	5	<27	<18	U	<19	U	U	U
TRANS-1,2-DICHLOROETHENE	5	<27	<18	U	<19	U	U	U
1,2-DICHLOROPROPANE	5	<27	<18	U	<19	U	U	U
CIS-1,3-DICHLOROPROPENE	5	<27	<18	U	<19	U	0.35 J	U
TRANS-1,3-DICHLOROPROPENE	5	<27	<18	U	<19	U	U	U
ETHYLBENZENE	5	93	4 J	116	200	0.1 J	0.4 J	0.7 J
2-HEXANONE	10	<53	<36	U	<37	U	U	0.3 J
METHYLENE CHLORIDE	5	<27 B	<18 B	19 B	93 B	22.9 B	40.0 B	23.2 B
4-METHYL-2-PENTANONE	10	<53	<36	U	<37	U	U	U
STYRENE	5	<27	<18	U	<19	U	U	U
TETRACHLOROETHENE	5	9 J	<18	4 J	<19	U	0.1 J	U
1,1,2,2-TETRACHLOROETHANE	5	<27	<18	U	<19	U	U	U
TOLUENE	5	<27	<18	U	<19	U	9.9	U
1,1,1-TRICHLOROETHANE	5	<27	<18	0.5 J	<19	U	U	U
1,1,2-TRICHLOROETHANE	5	<27	<18	1.3 J	<19	0.1 J	0.3 J	U
TRICHLOROETHENE	5	<27	<18	U	<19	U	U	U
VINYL ACETATE	10	<53	<36	U	<37	U	U	U
VINYL CHLORIDE	10	<53	<36	U	<37	U	U	U
TOTAL XYLENES	5	<27	<18	191	<19	U	U	U

U - Undetected

B - Compound found in blank as well as sample

J - Indicates an estimated value when the substance is detected but is below the specified limits, or is a tentatively identified compound

* - Background sample

TABLE 4-2a

TEST PIT DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
VOLATILE ORGANICS
Concentrations in part per billion

Compound	Detection Limits (ug/kg)	#										
		#2-S	TP-3S	TP-4S	TP-5S	#6-S	TP-7S	TP-8S	TP-9S	TP-10S	TP-11S	#12-S
ACETONE	10	79.3	845	154 B	336.8 B	126 B	(17	240 B	781.1 B	1300 B	213	132.9 B
BENZENE	5	U	95	8	8	U	(17	(5	U	U	U	U
BROMODICHLOROMETHANE	5	7.8	33	17.0	17.0	17	11 J	22	11.2	28	14.9 J	3.4
BROMOFORM	5	U	1 J	U	0.5 J	0.3 J	(17	1 J	0.9 J	1.4 J	0.3 J	0.1 J
BROMOMETHANE	10	U	(25	U	U	U	(34	(10	U	U	U	U
2-BUTANONE	10	16.8	73	U	20.1	U	(34	45 B	12.1 B	61 B	U	U
CARBON DISULFIDE	5	U	(12	U	U	U	(17	(5	U	U	U	U
CARBON TETRACHLORIDE	5	U	(12	U	3.9 J	U	(17	(5	U	U	U	U
CHLOROBENZENE	5	U	(12	U	U	U	(17	(5	U	U	U	U
CHLOROETHANE	10	U	(25	U	U	U	(34	(10	U	U	U	U
2-CHLOROETHYL VINYLETHER	10	U	(25	U	0.1 J	U	(34	(10	U	U	U	U
CHLOROFORM	5	3.2 J	14.7	5.4	7.2	8	5 J	6	4.7 J	3.8 J	7	U
CHLOROMETHANE	5	U	(25	U	U	U	(34	(10	U	U	U	U
DIBROMOCHLOROMETHANE	5	0.6 J	3 J	1.8 J	2.2 J	1.6 J	2 J	3 J	1.8 J	3 J	1.3 J	0.5 J
1,1,-DICHLOROETHANE	5	0.4 J	2.5 J	1.5 J	U	1.6 J	(17	3 J	2.3 J	1.3 J	2 J	U
1,2-DICHLOROETHANE	5	U	(12	U	2.4 J	U	(17	(5	U	4.1 J	U	U
1,1,-DICHLOROETHENE	5	U	(12	U	U	U	(17	(5	U	U	U	U
TRANS-1,2-DICHLOROETHENE	5	U	(12	0.5 J	1.0 J	U	(17	(5	U	0.8 J	0.5 J	U
1,2-DICHLOROPROPANE	5	U	(12	U	U	U	(17	(5	U	U	U	U
CIS-1,3-DICHLOROPROPENE	5	U	(12	U	0.2 J	U	(17	2 J	U	U	U	U
TRANS-1,3-DICHLOROPROPENE	5	U	3 J	U	U	U	(17	(5	1.5 J	U	U	U
ETHYLBENZENE	5	1.7	12.5	5.6	6.6	5	15	18	14.0	134	13	U
2-HEXANONE	10	U	(25	U	U	U	(34	(10	U	U	U	U
ETHYLENE CHLORIDE	5	9.5	(12	U	36.1 B	27 B	(17	24 B	18.0 B	38.0 B	32	23.4 B
2-METHYL-2-PENTANONE	10	U	(25	U	1.1 J	U	(34	(10	U	U	U	2.8 J
TYRENE	5	U	(12	U	U	U	(17	(5	U	U	U	U
TETRACHLOROETHENE	5	4.9	21	14.6	15.7	13	7 J	20	11.8	20	12	3.2 J
1,1,2,2-TETRACHLOROETHANE	5	U	(12	U	U	U	(17	(5	U	U	U	U
STOLUENE	5	6.6	50	34.6	33.8	48	19	46	26.0	49	32	14.4
1,1,1-TRICHLOROETHANE	5	0.2 J	(12	3 J	2.2 J	1.2 J	(17	3 J	1.8 J	U	1.3 J	1.2 J
1,1,2-TRICHLOROETHANE	5	0.8 J	(12	U	3.6 J	2.7 J	3 J	5 J	4.0 J	5	1.9 J	0.5 J
TRICHLOROETHENE	5	U	(12	11	U	U	(17	(5	U	9	U	U
ETHYL ACETATE	10	U	(25	U	U	U	(34	(10	U	U	U	U
ETHYL CHLORIDE	10	U	(25	U	U	U	(34	(10	U	U	U	U
MIXED XYLENES	5	1.0	5.5 J	9.0	14.6	3	(17	(5	33.6	42	U	0.5 J

- Undetected
- Compound found in blank as well as sample
- Indicates an estimated value when the substance is detected but is below the specified limits, or is a tentatively identified compound
- Background sample

TABLE 4-2b

TEST PIT DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
VOLATILE ORGANICS
Concentrations in part per billion

Compound	Detection Limits (ug/kg)								
		TP-1A	TP-3A	TP-4A	TP-5A	TP-7A	TP-8A	TP-9A	TP-11A
ACETONE	10	77 B	290		(30 B	37 J, B	(30	159.7 B	10 B
BENZENE	5	U	(24	(19	(15	(20	(15	U	U
BROMODICHLOROMETHANE	5	2.5 J	(24	12 J	5 J	5 J	(15	U	U
BROMOFORM	5	U	(24	(19	(15	(20	(15	U	U
BROMOMETHANE	10	U	(48	(37	(30	(40	(30	U	U
2-BUTANONE	10	16 B	26 B	(37	(30 B	(40 B	(30	15.3 B	(10 B
CARBON DISULFIDE	5	U	(24	(19	(15	(20	(15	U	U
CARBON TETRACHLORIDE	5	U	(24	(19	(15	(20	(15	U	U
CHLOROBENZENE	5	U	(24	(19	(15	(20	(15	U	U
CHLOROETHANE	10	U	(48	(37	(30	(40	(30	U	U
2-CHLOROETHYL VINYLETHER	10	U	(24	(37	(30	(40	(30	U	U
CHLOROFORM	5	U	(24	5 J	4 J	(20	(15	U	U
CHLOROMETHANE	5	U	(48	(37	(30	(40	(30	U	U
DIBROMOCHLOROMETHANE	5	0.4 J	10 J	(19	0.6 J	0.8 J	(15	U	U
1,1,-DICHLOROETHANE	5	U	(24	(19	(15	(20	(15	U	U
1,2-DICHLOROETHANE	5	U	(24	(19	(15	(20	(15	U	U
1,1,-DICHLOROETHENE	5	U	(24	(19	(15	(20	(15	U	U
TRANS-1,2-DICHLOROETHENE	5	U	(24	(19	(15	(20	(15	U	U
1,2-DICHLOROPROPANE	5	U	(24	(19	(15	(20	(15	U	U
CIS-1,3-DICHLOROPROPENE	5	U	(24	(19	(15	(20	(30	U	U
TRANS-1,3-DICHLOROPROPENE	5	U	(24	(19	(15	(20	(15	U	U
ETHYLBENZENE	5	0.4 J	(24	(19	152	146	3 J	0.1 J	U
2-HEXANONE	10	U	(48	(37	(30	(40	(30	U	U
METHYLENE CHLORIDE	5	6 B	(24 B	(19	(15 B	(20 B	3 J, B	17.9 B	(5 B
4-METHYL-2-PENTANONE	10	U	(48	(37	(30	(40	(30	U	U
STYRENE	5	U	(24	(19	(15	(20	(15	U	U
TETRACHLOROETHENE	5	0.7 J	9 J	(19	(15	(20	4 J	U	U
1,1,2,2-TETRACHLOROETHANE	5	U	(24	(19	(15	(20	(15	U	U
TOLUENE	5	U	22	(19	(15	(20	(15	U	U
1,1,1-TRICHLOROETHANE	5	U	(24	(19	(15	(20	(15	U	U
1,1,2-TRICHLOROETHANE	5	U	(24	3 J	(15	2 J	(15	U	U
TRICHLOROETHENE	5	U	(24	(19	(15	(20	(15	U	U
VINYL ACETATE	10	U	(48	(37	(30	(40	(30	U	U
VINYL CHLORIDE	10	U	(48	(37	(30	(40	(30	U	U
TOTAL XYLENES	5	U	(24	(19	(15	(20	13 J	U	U

U - Undetected

B - Compound found in blank as well as sample

J - Indicates an estimated value when the substance is detected but is below the specified limits, or is a tentatively identified compound

* - Background sample

TABLE 4-2c

TEST PIT DATA - OTHELLO, WA.

ANALYTICAL SUMMARY

VOLATILE ORGANICS

Concentrations in part per billion

Compound	Detection Limits (ug/kg)							
		TP-3B	TP-4B	TP-5B	TP-7B	TP-8B	TP-9B	TP-11B
ACETONE	10	340 B	331 B	373 B	226 B	66.0 B	125.0 B	57.5 B
BENZENE	5	(27	(18	U	(19	U	U	U
BROMODICHLOROMETHANE	5	7.4 J	(18	5 J	(19	0.9 J	1.8 J	U
BROMOFORM	5	(27	(18	0.2 J	(19	U	U	U
BROMOMETHANE	10	(53	(36	U	(37	U	U	U
2-BUTANONE	10	31 B	27 B	8 J	44 B	14.5 B	17.1 B	21.3 B
CARBON DISULFIDE	5	(27	(18	U	(19	U	U	U
CARBON TETRACHLORIDE	5	(27	(18	U	(19	U	U	U
CHLOROBENZENE	5	(27	(18	U	(19	U	U	U
CHLOROETHANE	10	(53	(36	U	(37	U	U	U
2-CHLOROETHYL VINYLETHER	10	(53	(36	U	(37	U	U	U
CHLOROFORM	5	(27	(18	2 J	2 J	U	U	U
CHLOROMETHANE	5	(53	(36	U	(37	U	U	U
DIBROMOCHLOROMETHANE	5	(27	(18	0.6 J	(19	0.1 J	0.2 J	U
1,1,-DICHLOROETHANE	5	(27	(18	U	(19	U	U	U
1,2-DICHLOROETHANE	5	(27	(18	U	(19	U	U	U
1,1,-DICHLOROETHENE	5	(27	(18	U	(19	U	U	U
TRANS-1,2-DICHLOROETHENE	5	(27	(18	U	(19	U	U	U
1,2-DICHLOROPROPANE	5	(27	(18	U	(19	U	U	U
CIS-1,3-DICHLOROPROPENE	5	(27	(18	U	(19	U	0.35 J	U
TRANS-1,3-DICHLOROPROPENE	5	(27	(18	U	(19	U	U	U
ETHYLBENZENE	5	93	4 J	116	200	0.1 J	0.4 J	0.7 J
2-HEXANONE	10	(53	(36	U	(37	U	U	0.3 J
METHYLENE CHLORIDE	5	(27 B	(18 B	19 B	93 B	22.9 B	40.0 B	23.2 B
4-METHYL-2-PENTANONE	10	(53	(36	U	(37	U	U	U
STYRENE	5	(27	(18	U	(19	U	U	U
TETRACHLOROETHENE	5	9 J	(18	4 J	(19	U	0.1 J	U
1,1,2,2-TETRACHLOROETHANE	5	(27	(18	U	(19	U	U	U
TOLUENE	5	(27	(18	U	(19	U	9.9	U
1,1,1-TRICHLOROETHANE	5	(27	(18	0.5 J	(19	U	U	U
1,1,2-TRICHLOROETHANE	5	(27	(18	1.3 J	(19	0.1 J	0.3 J	U
TRICHLOROETHENE	5	(27	(18	U	(19	U	U	U
VINYL ACETATE	10	(53	(36	U	(37	U	U	U
VINYL CHLORIDE	10	(53	(36	U	(37	U	U	U
TOTAL XYLENES	5	(27	(18	191	(19	U	U	U

U - Undetected

B - Compound found in blank as well as sample

J - Indicates an estimated value when the substance is detected but is below the specified limits, or is a tentatively identified compound

+ - Background sample

TABLE 4-3

TEST PIT DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
OIL AND GREASE
part per million

Sample # (1)	Result (mg/kg)
TP-1A	U (2)
#2-S	2,600
TP-3S	5,900
TP-3A	16,900
TP-3B	11,500
TP-4S	3,200
TP-4A	9,500
TP-4B	8,500
TP-5S	5,400
TP-5A	19,700
TP-5B	1,900
#6-S	10,500
#6-SD	10,100
TP-7S	18,000
TP-7A	8,800
TP-7B	1,500
TP-8S	1,400
TP-8A	1,700
TP-8B	110
TP-9S	140
TP-9A	40
TP-9B	10
TP-10S #	20
TP-11S	1,300
TP-11A	U
TP-11B	160
#12-S	260

S: SURFACE GRAB SAMPLE
A: GRAVEL UNIT, 0-6 FT
B: CLAY UNIT, 6-10 FT
#: SURFACE COMPOSITE SAMPLE

J: UNDETECTED

#: BACKGROUND SAMPLE

TABLE 4-4

SURFACE SAMPLE DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
PCB
Concentrations in part per billion

Location (1)	Detection limits in parentheses below compounds in units of (ug/kg)						
	Aroclor 1016 (80)	Aroclor 1221 (80)	Aroclor 1232 (80)	Aroclor 1242 (80)	Aroclor 1248 (80)	Aroclor 1254 (160)	Aroclor 1260 (160)
TP-3S	U (2)	U	U	U	U	U	U
TP-4S	U	U	U	U	U	U	U
TP-5S	U	U	U	U	U	U	U
#6-S	U	U	U	U	U	U	U
TP-7S	U	U	U	U	U	U	1250
TP-8S	U	U	U	U	U	U	U
TP-9S	U	U	U	U	U	U	U
TP-10S (3)	U	U	U	U	U	U	U
TP-11A	U	U	U	U	U	U	U

(1) S - surface grab sample
A - silty gravel unit, 0-6 feet
- surface composite sample

(2) Analyzed for but undetected

(3) Background

TABLE 4-5

TEST PIT AND SURFACE SAMPLE DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
METALS

Concentrations in part per million

Location (1)	Detection limits in parentheses below elements (mg/kg)						
	Barium (0.5)	Cadmium (0.5)	Chromium (0.5)	Copper (0.3)	Lead (2.0)	Mercury (0.05)	Vanadium (0.2)
TP-1A	74	ND (2)	9.1	7.1	12	0.11	130
#2-S	106	3.7	20	166	190	0.07	36
TP-3S	94	1.2	17	69	110	ND	51
TP-3A	95	0.5	7.3	13	18	ND	110
TP-3B	150	ND	17	6.5	13	ND	32
TP-4S	553	3.2	32	100	1360	ND	45
TP-4A	94	ND	5.3	16	12	ND	93
TP-4B	120	ND	27	14	17	ND	49
TP-5S	250	1.5	14	130	280	ND	45
TP-5A	59	0.7	7.3	6.8	12	ND	100
TP-5B	71	ND	16	9.2	12	ND	43
#6-S	210	1.7	12	150	200	ND	41
TP-7S	46	0.5	8.8	10	15	ND	160
TP-7A	212	4.0	20	337	1300	ND	81
TP-7B	121	0.5	25	16	18	ND	75
TP-8S	170	2.0	24	180	374	ND	69
TP-8A	97	ND	15	10	13	ND	55
TP-8B	118	0.5	22	13	14	ND	46
TP-9S	127	0.7	8.8	19	26	ND	84
TP-9A	120	0.7	5.7	8.0	10	ND	80
TP-9B	111	ND	19	9.4	14	ND	49
TP-10S (3)	120	0.6	7.6	10	27	ND	50
TP-11S	172	2.1	34	194	306	0.15	40
TP-11A	87	ND	5.4	6.2	9	ND	32
TP-11B	91	0.4	16	20	15	ND	42
#12-S	124	ND	8.1	21	34	ND	49

- (1) S - surface grab sample
A - silty gravel unit, 0-6 feet
B - varved clay unit, 6+ feet
- surface composite sample

(2) Not detected

(3) Background

OTHELLO

HOT, CLEAR, NO WIND

20 JULY MONDAY

Bryan Stone - Karl Reichert

We arrived at site at 11:30.

South sump has been vandalized.

The top protective cover has been crushed in.

We are going to map clay layers & to install 3rd sump if time permits.

The main St and mainline track is starting point. We measured South along mainline every 50' and marked track. at 1200 we measured east and will set up a 2-d grid of test pit locations.

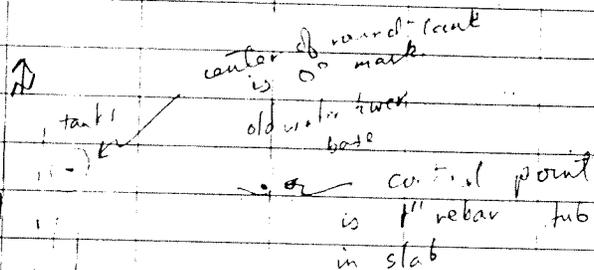
We had Larry Hollenback fill 3 55 gal 66's w/ gravel from the piles and shipped it out on Silver Eagle freight lines to Kart.

Larry began digging in vicinity of swamp to create irrigation reservoir. We will set a 5' dia 6' long sump w/ gravel

LEITZ SOKKISHA C3E auto level
D 10346

STATION	BS	FS	STADIA	ELEV
0-86-2	2.605 2.70		-	1037.86
PIN	2.310 3.38	3.220 3.32	-	1037.25 1037.24
0-86-2		1.38 <small>read lower x.1.1</small> 2.755	-	1037.87
control point elevation = 1037.25' ◀				
Larry H	12 - 5 pm			5 hr
Bryan Karl	7a - 6p			11 hr
Sargent Pump has a 6' length of 5' dia galv. sump for ~ 48' per ft they will perforate lower half and deliver to site tomorrow.				
Larry M. Cortis of CWC concrete came by to see gravel needs. They have 3/4" washed in othello and we need ~ 80 cy. will deliver tomorrow.				

Other: Tues 21 H.T. clear,
 Set up survey equip over
 control point and will turn x,
 shot elev. and stadia on all
 pit locations.



CONTROL POINT COORDINATES

S 1050'; E 154.6' OF MAIN ST. #
 Gary H. brought pump out
 that is making 75 gpm. (Sgal/4sec)
 We pumped trench open also
 Pumped trench for 1 hour and
 it drew down ~ 1 foot! (~ 4500 gal)

TEST PITS FROM CONTROL
 INSTRUMENT HI = 4.9'

1037.25'
 1042.15'

PIT #	SR	STADIA	READING	ELEV	TIP
1	267°	13.20 10.53	337.0 12.21'	1029.94	600
2	268°	12.71 9.93	278.0 11.32'	1030.83	700
3	270°	13.67 11.54	213.0 12.60'	1029.55	170
4	272.5°	12.64 10.99	165.0 11.81'	1030.34	460
5	277.5	12.62 11.49	113.0 12.05'	1030.10	205
6	291.0°	12.89 12.21	68.0 12.55'	1029.60	470
7	335.5	11.74 11.41	33.0 11.57'	1030.58	890
8	46.5°	12.53 11.97	56.0 12.25'	1029.90	380
9	85.5	11.02 10.27	73.0 10.64'	1031.51	136
10	255.0	13.36 11.0	57.0 12.79'	1029.08	380
11	255.5	11.93 10.83	105.0 11.38'	1030.77	257
12	255.0	12.38	11.42'		116
H2O AT BOTTOM		10.47 191.0		1030.73	22

PIT #	SR°	STADIA	READING	ELEV	TIP
13	250.5°	11.53 8.74 ³⁷⁶	10.13	1032.02	
14	254.0°	11.78 8.02 ³⁷⁶	9.89	1032.26	10
15	240.0°	10.93 7.08 ³⁸⁵	9.00	1033.15	199
16	239.5°	9.42 6.50 ³⁹²	7.95	1034.20	40
17	190.5°	2.51 8.40 ¹¹¹	8.95	1033.20	6 10 bat
18	153.0°	10.80 7.85 ⁹⁵	10.32	1031.83	sheen oily
19	117°	10.06 8.76 ¹³⁰	9.33	1032.75	sheen
20	169.5°	9.67 8.74 ⁹³	9.21	1032.94	
21	86°	11.33 2.80 ¹⁵³	10.56	1031.59	
22	82°	12.37 10.20 ¹¹⁷	11.28	1030.87	sheen
23	96°	11.13 8.85 ²²⁸	9.95	1032.20	Soil stinger sheen, oil
24	102.0°	10.27 7.75 ¹⁵²	9.00	1033.15	clean

stopped at 5:15 pm 1/2 hrs

22 July wed 1037.25, HI = 4.81: 1042.06'

PIT #	SR°	STADIA	READING	ELEV	TIP
25	278.5°	15.18 11.80 ^{338.0}	13.49	1028.57	56
26	281.0°	14.38 12.02 ²³⁶	13.19	1028.87	207
27	302.0°	14.03 12.59 ¹⁴⁴	13.31	1028.75	210
28	321.5°	13.93 12.96 ⁹⁷	13.45	1028.61	300
29	59.0°	12.15 10.67 ¹⁴⁸	11.41	1030.65	250 15
30	69.0°	12.60 9.93 ²⁶⁷	11.26	1030.80	85 oil
31	73.0°	13.19 9.27 ³⁹²	11.22	1030.84	
32	63.0°	14.16 10.99 ³¹⁷	12.57	1029.49	
33	52.0°	13.80 11.46 ²³⁴	12.63	1029.43	
34	34.0°	14.81 13.06 ¹⁹⁵	13.93	1028.13	40
35	6.0°	15.15 13.68 ¹⁴⁷	14.41	1027.65	
36	335°	15.58 13.98 ¹⁶⁰	14.79	1027.27	
37	316.5°	16.02 14.97 ¹⁰⁵	15.00	1027.06	

PT #	S-R	STADIA	READING	ELEV	TIP
38	20	13.21	12.68		150
		12.16		1029.38	
39	291.5°	18.75	16.80		10 bat
		14.75		1025.26	
40	283.5°	18.60	16.74		10 bat
		13.84		1025.32	
41	169.0°	8.79 ₁₄₄	8.07		10 bat
		7.35		1033.99	oil
42	133.0°	9.26	8.46		constant bench; layer with 4-5'
		7.67			
43	92.0°	11.75 ₂₄₀	9.98		
		8.26		1032.08	
0-86-1	From wheel at bunkhouse chimney		H1=2.49	1046.91	
				1049.40	
44	291	18.20	17.48		
		16.75		1031.92	
45	291	19.10	17.73		
		16.37		1031.67	
46	343	15.66	14.90		oder in clay.
		14.18			
0-86-2	STA 1	BS	FS	1037.86	
	444'S	OF MAIN ST ON RAIL			
STA 2	218°	2.67			
300' mark on rail	= CONTROL N		4.31	1036.22	▲
North control at 300' Rail mark E.					
w/	0° line	mainline rail		1040.85'▲	H1=4.63

PT #	S-R	STADIA	READING	ELEV	TIP
47	64.0	9.59	8.86		water 9.2'
		8.16		1031.90	above clay
48	265°	3.84			
		1.96			backfilled due to excessive cavity and flowing water
49	341.0	14.10	13.15		diesel oder in clay; black areas in blue clay
	Flay 2.5 from bottom	12.21		? 1030.20	
50	310.0	12.25	11.71		diesel in clay
		11.17		1029.14	
51	313.0°	18.21	17.15	1040.72	Fill for depot
	NEW HI 4.50	16.04	TOP OF GRAVEL		park lot
52	234.5°	11.65	11.15		strong diesel odor in clay
	Trace of water	10.76			
53				8.70' BS	
	water		515'S on main line	12' E DIRT ROAD	main control point
54	352	20.57			NEW HI 4.91
	DR	9.02	19.23		Central
Larry H.					
		M	Tu	We	Σ
		5	9	10	24
	level	2	9	9	20
	pump		2hr		2

Appendix C

TABLE 4-6

SOIL BORING DATA - OTHELLO, WA.

ANALYTICAL SUMMARY

POLYNUCLEAR AROMATIC HYDROCARBONS

DETECTION LIMITS : 330 ug/kg

Concentrations in part per billion

Compound	B-2				B-3				B-4				B-5			
	7'	28'	32'	55'	11'	31'	34'	49'	24	29'	36	38'	49'	27'	39'	45'
Acenaphthene	U	U	U	U	U	U	U	2100	U	U	U	1720	U	U	U	U
Acenaphthylene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Anthracene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo(a)Anthracene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo(b)Fluoranthene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo(k)Fluoranthene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo(g,h,i)Perylene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo(a)Pyrene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chrysene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Dibenz(a,h)Anthracene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Fluoranthene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Fluorene	208 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Ideno(1,2,3-cd)Pyrene	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Methylnaphthalene	958	U	U	U	U	U	U	U	U	U	U	U	U	U	U	76.5 J
Naphthalene	40 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Phenanthrene	394	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Pyrene	U	U	U	U	U	U	U	2400	U	U	U	3339	U	U	U	U

U - Undetected

J - Indicates an estimated value when the substance is detected but is below the specified limits, or when it is a tentatively identified compound

SOIL BORING DATA - OTHELLO, WA.
ANALYTICAL SUMMARY
VOLATILE ORGANICS
in part per billion

Compound	Detection Limits (ug/kg)	Boring Number and Depth															
		7'	B-2			B-3				B-4			B-5				
		28'	32'	55'	11'	31'	34'	49'	24'	29'	36'	38'	49'	27'	39'	45'	
ACETONE	10	91, B	27	740	260, B	500	180, B	50, B	98, B	5, B	26, B	150, B	100, B	35, B	10, B	32, B	74, B
BENZENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
BROMODICHLOROMETHANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
BROMOFORM	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
BROMOMETHANE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-BUTANONE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CARBON DISULFIDE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CARBON TETRACHLORIDE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CHLOROBENZENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CHLOROETHANE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-CHLOROETHYL VINYLETHER	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CHLOROFORM	5	U	U	U	U	22	U	U	U	U	U	U	U	U	U	U	U
CHLOROMETHANE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
DIBROMOCHLOROMETHANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,-DICHLOROETHANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-DICHLOROETHANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,-DICHLOROETHENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
TRANS-1,2-DICHLOROETHENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-DICHLOROPROPANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CIS-1,3-DICHLOROPROPENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
TRANS-1,3-DICHLOROPROPENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ETHYLBENZENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-HEXANONE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
METHYLENE CHLORIDE	5	720, B	860	100	1840, B	5800	3800, B	1100, B	853, B	190, B	178, B	330, B	2200, B	839, B	37, B	4, J, B	10, B
4-METHYL-2-PENTANONE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
STYRENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
TETRACHLOROETHENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2,2-TETRACHLOROETHANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
TOLUENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,1-TRICHLOROETHANE	5	U	U	U	U	U	U	U	U	U	U	U	2 J	U	2 J	U	U
1,1,2-TRICHLOROETHANE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
TRICHLOROETHENE	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
VINYL ACETATE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
VINYL CHLORIDE	10	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
TOTAL XYLENES	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

U - Undetected

B - Compound found in blank as well as sample

J - Indicates an estimated value when the substance is detected but is below the specified limits, or is a tentatively identified compound.

TABLE 4-8

SOIL BORING DATA - OTHELLO, WA.
ANALYTICAL RESULTS
OIL AND GREASE
part per million

Boring # and Depth	Result (mg/kg)
B-2	
7'	510
28'	940
32'	390
55'	43
B-3	
11'	1300
31'	750
34'	3900
49'	40
B-4	
24'	5200
29'	40
36'	280
38'	200
49'	70
B-5	
27'	150
39'	90
45'	60

TABLE 4-9

SOIL BORING DATA, OTHELLO, WA.
ANALYTICAL SUMMARY
METALS
part per million

Boring # and Depth	Metals, (mg/kg) dry weight						
	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Vanadium
B-2							
7'	184	2.16	62	49	32	0.015	93
28'	77	2.22	27	49	10	0.004	78
32'	289	0.76	25	15.8	9	0.004	59
55'	59	0.90	20	9.2	6	0.004	45
B-3							
11'	208	2.08	64	44.2	23	0.004	87
31'	159	1.58	39	28.8	21	0.011	72
34'	14	1.39	32	24.6	14	0.004	63
49'	105	0.89	11	8.0	2	0.004	38
B-4							
24'	1803	1.92	29	42.8	45	0.025	63
29'	133	1.48	12	16	23	0.009	35
36'	222	2.16	37	30.8	18	0.041	89
38'	40	2.56	19	21.7	7	0.015	47
49'	33	0.85	23	6.5	5	0.014	47
B-5							
27'	39	1.00	11	7.2	140	0.014	42
39'	250	4.46	18	13.8	8	0.012	37
45'	54	0.50	20	7.7	4	0.005	100