REMEDIAL SERVICES

USPCI
A Subsidiary of
Union Pacific Corporation

Hydrocarbon Investigation and Remedial Design Union Pacific Railroad Yard Oakland, California

June 5, 1991

HYDROCARBON INVESTIGATION AND REMEDIAL DESIGN AT UNION PACIFIC RAILROAD'S OAKLAND, CALIFORNIA TOFC YARD

June 5, 1991

Prepared For
Union Pacific Railroad
By
USPCI
Job Number 96199

EXECUTIVE SUMMARY

Union Pacific Railroad's Oakland TOFC (Trailer On Freight Car) Railyard is an active railyard with refueling capabilities located adjacent to the Oakland Estuary. During February, 1991 two incidents were recorded in which diesel oil reached the estuary via storm sewers presumably originating from the refueling area within the railyard. USPCI initiated an investigation of the site designed to recover information necessary to design a remedial system optimally suited for this site.

During the coarse of the investigation it was determined that;

- Groundwater at the site is shallow (2 - 6 feet below ground surface) with a shallow gradient which slopes toward the estuary. During the past few years of drought, groundwater levels may have been lower (6 - 9 feet below ground surface).

- The hydrocarbon contaminate is diesel fuel.

- Hydrocarbon (diesel) contaminated soil is limited to the area of the fueling rack and fuel storage tanks.

- Floating free product on groundwater is limited to the immediate area of the fueling rack.

- The concentration of dissolved hydrocarbon in groundwater is low. TPH values range from non-detect to 3.2 ppm. Low levels of BTXE have been detected below USEPA maximum contaminate levels for drinking water.

- The downgradient limit of the dissolved hydrocarbon plume has been delineated with monitoring wells. The projected 1 ppm TPH boundary is presently 600 hundred feet upgradient of the estuary.

- An active groundwater depression trench, located near the fuel storage tanks, which was installed in the past to prevent groundwater from coming in contact with rail switches has served to recover an indeterminate amount of free diesel product from the groundwater. The active trench will not prevent downgradient migration of dissolved hydrocarbon contaminates in the groundwater.

Based on the above summarized findings USPCI recommends the following remedial action and additional investigation:

- Initiate a program to begin recovery of hydrocarbon contaminated groundwater at the site. The remediation program should be designed to recover free product from the heart of the plume, and prevent further downgradient migration of free and dissolved product toward the Oakland Estuary. The proposed remediation program would initially consist of three recovery wells equipped with total fluids pumps. Groundwater should be discharged to a surface oil/water separator.

- Install two additional monitoring wells to delineate the northern (upgradient) and western limits of the free and dissolved product plumes. And install one additional monitoring well to be used for observation during pumping tests and recovery efforts.

- Conduct hydrologic tests to evaluate aquifer characteristics which may impact the long tern design and operation of a hydrocarbon recovery system.

- Sample select monitoring wells for salinity to assist in determining appropriate cleanup levels for groundwater at the site.

- Prepare an operations and maintenance manual for the groundwater remediation system. Prepare a report summarizing results from the installation of the three additional monitor wells, hydrologic tests, and additional groundwater sampling.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Where are B1 to B9?

LIST OF APPENDICES

1.0 INTRODUCTION

This report, prepared by USPCI, was completed at the request of Union Pacific Railroad, (UPRR) on their Oakland, California TOFC (Trailer On Freight Car) Yard. The activities described in this report were completed in accordance with the workplan submitted to UPRR by USPCI on March 2, 1990. The workplan was designed to evaluate the extent and distribution of petroleum hydrocarbon contamination, while providing an assessment of the shallow aquifer characteristics. The investigation concentrated on the locomotive fueling facility located in the northern portion of the site. The collection and analysis of this data is required for the optimal design of a remedial action plan.

The Oakland TOFC Yard is located at 1717 Middle Harbor Road in Oakland California. UPRR operations at this facility consist of loading and unloading over-the-road trailers on flatcars (TOFC) for rail transport. The facility also includes a small re-fueling rack for diesel locomotives. The site is bounded on the south and west by the Oakland Estuary and on the north by the Navy Supply Center (see Figure 1).

The hydrocarbon investigation involved the completion of 17 soil borings, eight of which were completed as shallow monitoring wells. The subsurface investigation was concentrated in the area of the re-fueling racks located adjacent to the Navy Supply Center (See Figure 2). Through the collection and analysis of soil and water samples from the soil borings and monitoring wells, free phase and dissolved hydrocarbon plumes were identified and partially delineated beneath the site.

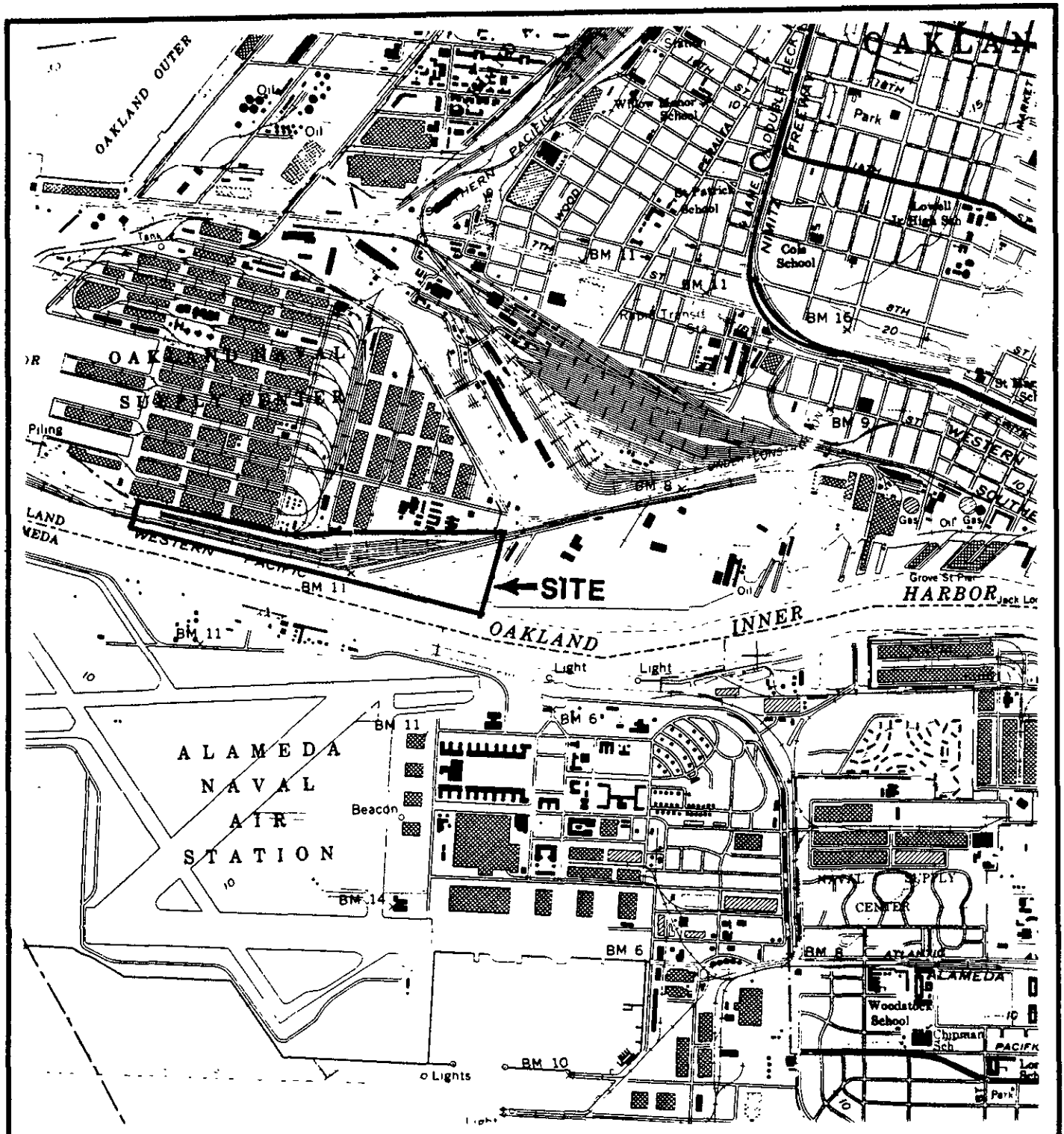

FIGURE 1

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OAKLAND WEST, CA

USGS 7 1/2 MINUTE QUAD
1959 PHOTOREVISED 1980

SCALE: 1"=24000' | APPROVED/DATE

2.0 SITE HISTORY

This investigation was requested after two incidents on February 4 and February 7, 1991 at the Oakland Yard. Both incidents were observed by the U. S. Coast Guard as releases of diesel/oil to the Oakland Estuary. The original incident may have been the result of overland flow from the railyard to the estuary. The second incident was caused by storm sewer clean-out operations.

The UPRR took immediate actions to contain and cleanup the releases as well as to prevent additional releases to the Oakland Estuary. Initial observations at the railyard revealed diesel product in two catch basins feeding a storm sewer that empties into the estuary at the point of release. This source along with possible overland flow from the drip pans (spill containment devices in the refueling area) during a storm event of the previous week, appeared to have caused the original release.

The storm sewers were cleaned out and the sewer that was the source of the release was plugged with concrete at the two catch basins and at its out-fall to the estuary. The upstream end of this sewer ends in the refueling area, beneath the refueling rack. The sewer was observed to have holes and perforations allowing the possible influx of diesel from beneath the refueling area. The sewer abandonment completed by UPRR should prevent any future repeat of the diesel release.

3.0 SITE INVESTIGATION

Since the suspected source of the diesel fuel release to the estuary is the locomotive refueling facility, USPCI recommended the following tasks be completed in the area of the refueling facility to define the nature and extent of soil and groundwater contamination. Results of the investigation would be used in the design and implementation of a remedial action plan.

- o Drilling of 17 soil borings to delineate the extent of hydrocarbon contamination in subsurface soils. This included the screening of soils encountered for organic vapors with an organic vapor monitor (OVM).

- o Installation of 8 groundwater monitoring wells in selected borings to define the groundwater environment and evaluate the extent of free and dissolved product contamination.

- o Collection of soil and groundwater samples from all borings and wells as appropriate. Analysis of all samples by a certified laboratory for Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Xylene, and Ethyl-benzene (BTXE) employing EPA methods 8015 and 8020.

- o Review, interpretation and presentation of data collected in an interim report (presented here).

Field activities completed as part of this investigation were conducted between April 4 and April 8, 1991. Details of the methods used during drilling, installation of monitor wells, and collection of soil and groundwater samples are reviewed in Appendix A. Boring logs and well completion forms are included in Appendix B. Copies of original laboratory reports are included in Appendix C.

4.0 SITE GEOLOGY

The stratigraphy underlying the site consists of surficial fill of variable thickness and composition, overlying a sequence of naturally deposited bay sediments. The fill material generally consists of either asphalt with a sandy sub-grade base (1 to 3.5 ft thick), or railroad ballast with a clastic sub-grade base (2.5 to 4.5 ft thick). In some instances an additional fill layer can be distinguished between the surficial fill layer and the natural sediments. This unit is distinguished by the presence of brick fragments as in boring B-4.

The natural bay sediments underlying the fill appear to be laterally continuous and fairly homogeneous. Layers of different lithology were distinguished on the basis of silt content and degree of sorting (see cross sections Figures 3A, 3B). Lithologies range from silty sand of variable grain size to fairly clean sand of a uniform grain size. The sand units extend from the fill contact, usually 4 to 5 feet BGS, to a depth of 12 feet to greater than 15 feet. The sands represent the uppermost unit of the natural bay sediments, and are completely saturated with groundwater.

A basal silty/clayey unit was encountered beneath the sand in two of the monitoring well borings (OMW-2, and OMW-3). Because of the fine grained nature of this basal unit, it may act to retard vertical migration of groundwater in the vicinity of the railyard.

5.0 SITE HYDROLOGY

Groundwater was typically encountered during drilling at depths ranging from 3 to 7 feet below the ground surface (BGS). Groundwater generally appears to be unconfined, with little difference between the depths at which water was first encountered during drilling and the subsequent static water level recorded in the monitoring well. Groundwater was observed near or below the contact between the poorly sorted sandy bay material and the fill or asphalt sub-grade.

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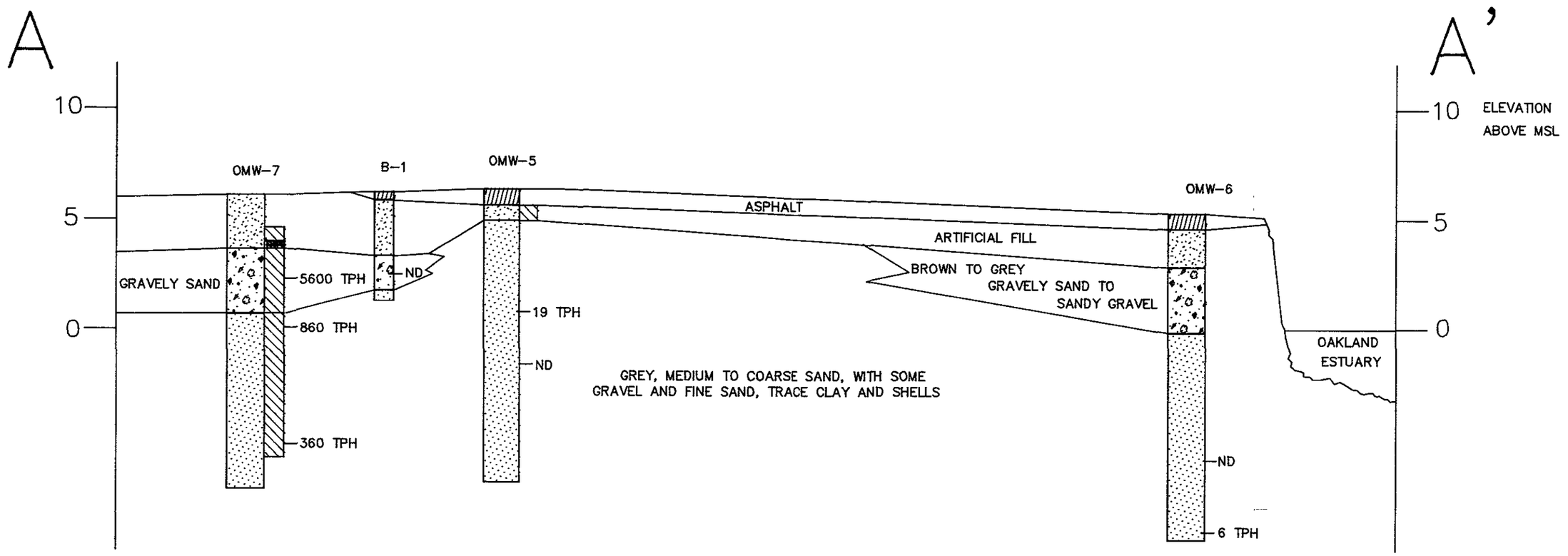

FIGURE 3A
GEOLOGIC CROSS SECTION A-A'

UPRR
OAKLAND TOFC YARD

DIESEL ODOR
FREE PRODUCT

VERTICAL SCALE 1" = 5'
HORIZONTAL SCALE 1" = 100'
TPH IN PPM

DWG NO:	SIGNED	DATE
96199-04		

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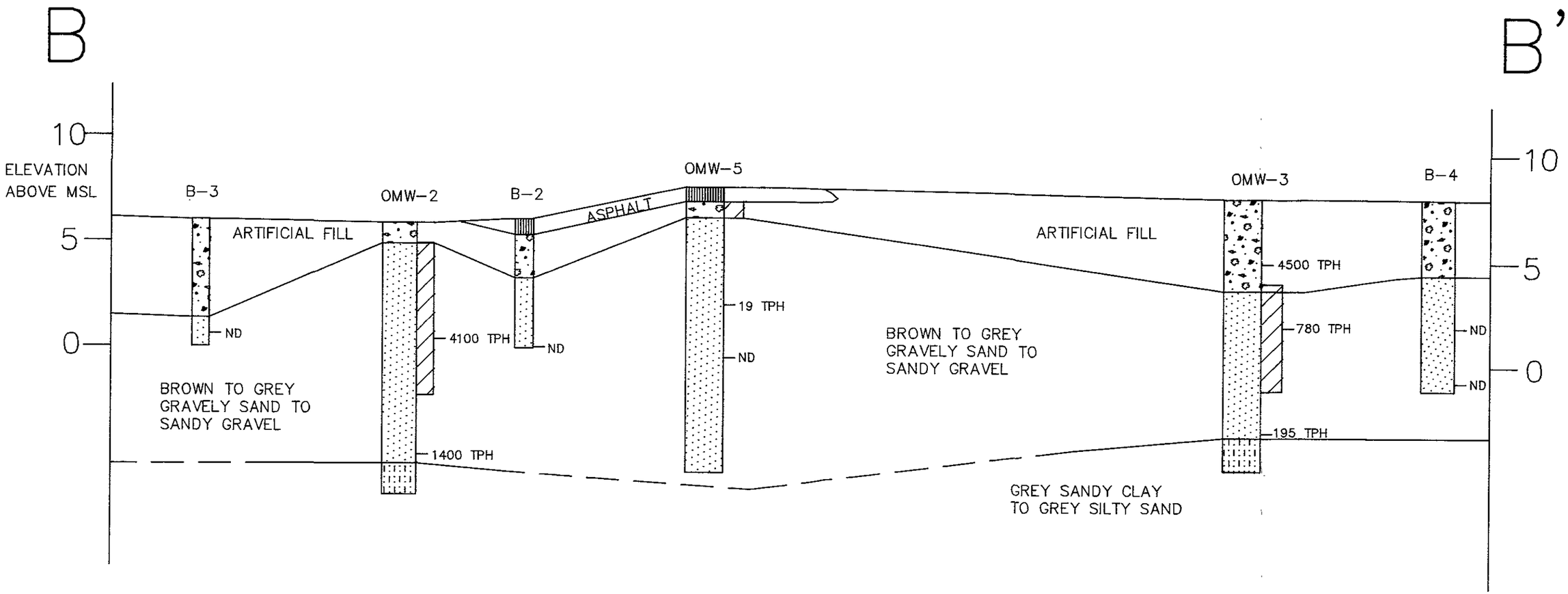

FIGURE 3B
GEOLOGIC CROSS SECTION B-B'

UPRR
OAKLAND TOFC YARD

DIESEL ODOR
FREE PRODUCT

VERTICAL SCALE 1" = 5'
HORIZONTAL SCALE 1" = 100'
TPH IN PPM

DWG NO:	SIGNED	DATE
96199-05		

Figure 3A

Figure 3B

Depth to groundwater as measured in the monitoring wells is summarized in Table 1. The local groundwater gradient dips gently to the south towards the Oakland Estuary. A groundwater potentiometric surface map based on water levels recorded on April 9, 1991 is presented in Figure 2.

The UPRR Oakland Railyard is immediately adjacent to the Oakland Estuary, which is located in the northern portion of the San Francisco Bay. The close proximity of the Estuary to the site suggests a direct hydrologic connection may exist between the Estuary and groundwater beneath the site. Tidal influences from the Estuary may influence water levels in monitor wells at the railyard and impact future remediation efforts. Previous studies in the San Francisco Bay Area, however, suggests that tidal influences are generally minimal and are only detectable in monitor wells in very close proximity to the bay (less than 100 to 200 feet). The actual degree of influence is dependent on individual site characteristics. The magnitude of the tidal influence on groundwater at the Oakland TOFC Yard should be investigated to determine its impact on groundwater remediation.

6.0 HYDROCARBON CONTAMINATION

6.1 Soil Results

Soil samples were collected and analyzed from each soil boring and monitoring well installed on site. These samples were analyzed for TPH and BTXE using EPA methods 8015 and 8020. Analyses were completed by Superior Analytical Laboratories of Martinez, California. Laboratory results for soils are summarized in Table 2. Copies of original laboratory reports are included in Appendix C.

Total hydrocarbon concentrations in the soil ranged from a high of 13,000 ppm TPH (B-8) in the vicinity of the re-fueling facility, to non-detect (method detection limit of 0.05 ppm) for soil samples from outlying areas of the site. Low levels of BTXE contamination in soils were also detected in soil samples which had corresponding elevated TPH concentrations. Total

TABLE 1

WELL GAUGING DATA
UNION PACIFIC RAILYARD
OAKLAND, CALIFORNIA
APRIL, 1991

WELL NO.	DATE	WELL HEAD ELEVATION	DEPTH TO PRODUCT	DEPTH TO WATER	WATER LEVEL ELEVATION	PRODUCT THICKNESS	CORRECTED GROUND WATER SURFACE *
OMW-1	4/9/91	8.79		5.54	3.25		3.25
OMW-2	4/9/91	5.88		2.10	3.78		3.78
OMW-3	4/9/91	7.16		3.93	3.23		3.23
OMW-4	4/9/91	7.41	3.79	6.23	1.18	2.44	3.23
OMW-5	4/9/91	7.62		4.64	2.98		2.98
OMW-6	4/9/91	5.78		7.60	-1.82		-1.82
OMW-7	4/9/91	7.03	3.26	7.48	-0.45	4.22	3.09
OMW-8	4/9/91	7.52		4.25	3.27		3.27

* CORRECTED GROUNDWATER SURFACE ASSUMES DENSITY OF 0.84 g/cm3

TABLE 2

ANALYTICAL RESULTS OF SOIL SAMPLES
FROM SOIL BORINGS AT OAKLAND TOFC YARD
April 4-8, 1991 (Collection Date)

BORING #	MATRIX DEPTH	TPH	B	T	X	E
OMW-1	SOIL 5.5'	ND	NA	NA	NA	NA
	SOIL 7'	ND	NA	NA	NA	NA
	SOIL 11'	ND	NA	NA	NA	NA
OMW-2	SOIL 5.5'	4100	.008	.026	.048	.310
	SOIL 11'	1400	NA	NA	NA	NA
OMW-3	SOIL 3'	4500	NA	NA	NA	NA
	SOIL 6'	780	NA	NA	NA	NA
	SOIL 11'	195	NA	NA	NA	NA
OMW-4	SOIL 3'	9600	ND	.310	.860	5.300
	SOIL 6'	ND	NA	NA	NA	NA
	SOIL 11'	ND	NA	NA	NA	NA
OMW-5	SOIL 5.5'	19	NA	NA	NA	NA
	SOIL 8'	ND	NA	NA	NA	NA
OMW-6	SOIL 11'	ND	.0033	.005	ND	ND
	SOIL 14.5'	6+	NA	NA	NA	NA
OMW-7	SOIL 3.5'	5600	.086	.150	.290	1.400
	SOIL 6'	860	.025	.019	.025	.075
	SOIL 11'	360	NA	NA	NA	NA
OMW-8	SOIL 5.5'	ND	ND	.004	.004	.011
	SOIL 11'	ND	NA	NA	NA	NA

Detection Limits TPH (EPA Method 8015) 0.05 mg/l
BTXE (EPA Method 8020) 0.0003 mg/l

ND = Below the Limit of Detection
NA = Not Analized

TABLE 2 (CONTINUED)
ANALYTICAL RESULTS OF SOIL SAMPLES
FROM SOIL BORINGS AT OAKLAND TOFC YARD
April 4-8, 1991 (Collection Date)

BORING #	MATRIX DEPTH	TPH	B	T	X	E
B-1	SOIL 3.5'	ND	NA	NA	NA	NA
B-2	SOIL 6'	ND	NA	NA	NA	NA
B-3	SOIL 5.5'	ND	NA	NA	NA	NA
B-4	SOIL 6'	ND	NA	NA	NA	NA
	SOIL 9'	ND	NA	NA	NA	NA
B-5	SOIL 4.5'	ND	NA	NA	NA	NA
B-6	SOIL 3.5'	ND	NA	NA	NA	NA
B-7	SOIL 3.5'	8,900	0.095	.390	.530	2.700
B-8	SOIL 4'	13,000	.280	.720	1.400	6.200
B-9	SOIL 5'	ND	NA	NA	NA	NA
Detection Limits		TPH (EPA Method 8015) 0.05 mg/l BTXE (EPA Method 8020) 0.0003 mg/l				

ND = Below the Limit of Detection
NA = Not Analized

BTXE contamination ranged from a high of 8.6 ppm (B-8) to non-detect (method detection limit of 0.0003 ppm) in the majority of samples. The hydrocarbon contamination of soil is concentrated in the immediate vicinity of the re-fueling rack and fuel storage tanks located to the west of the racks (OMW-7, 4, 3, 2 and B-7, 8).

Evidence from field observation and laboratory analysis suggests the dominate hydrocarbon contaminate is diesel fuel. The refueling rack and associated storage tanks are considered the most likely source of the contamination. Contamination of soil extends the entire length of the fueling rack and fuel storage tanks, and to the south of the rack approximately 200 feet (OMW-2, 3, 7). Hydrocarbon impacted soils also underlie the active rails in the vicinity of the fueling facility.

The lithologic units affected by the contamination along the northern edge of the fueling rack area include artificial fill and the natural bay sediments down to a depth of approximately 4.5 feet (OMW-4). This depth roughly corresponds to the depth of groundwater in this area. The natural groundwater gradient to the south has probably served to inhibit northward migration of hydrocarbon. An additional up-gradient well located on adjacent Naval Supply Center property is required to confirm this assumption.

South of the fueling rack, soils contamination has extend to lower lithologies. As seen in soil samples from OMW-2, a TPH concentration of 1,400 ppm was measured in fine to coarse sand at a depth of 11 feet below the ground surface (9 feet below present day water level). The contamination of soil below the present groundwater surface is problematic and may be the result of two different factors.

- o During the previous few years, severe drought conditions existed in the San Francisco Bay area and the groundwater surface beneath the railyard may have been lower. Product may have migrated downward into lower sediments during this period of time.

- o Depression of the groundwater surface as the result of a significant hydrocarbon release, could also result in contamination of normally groundwater saturated sediments.

6.2 Groundwater Results

Groundwater samples were collected and analyzed for TPH and BTXE from the eight wells located on site. The analyses were completed by Superior Analytical Laboratories of Martinez, California, using EPA method 8015 and 8020. Sampling procedures are presented in detail in the field methods section located in Appendix A. Results of groundwater analysis are presented in Table 3, copies of original laboratory reports are included in Appendix C.

Free diesel product was detected on top of groundwater in two monitor wells completed at the site (OMW-4, 2.44 feet and OMW-7, 4.22 feet, Table 1). Both wells are located immediately adjacent to the fueling rack. None of the other monitoring wells contained detectable free product. Figure 4 is a map showing the distribution of free product in the fueling area.

Sufficient data exists to define the extent of free product on top of groundwater to the south (downgradient) and east of the fueling area. Additional information is required to further define the free product plume to the north (upgradient) and to the west of the fueling area. USPCI recommends that three additional monitor wells be completed at the locations shown on Figure 5.

Laboratory results indicate low levels of dissolved contaminates in groundwater from monitoring wells that did not contain free product. The maximum TPH concentration detected in groundwater was 3.2 ppm (OMW-2, method detection limit of 0.05 ppm). Dissolved BTEX contamination was also low, indicative of diesel fuel contamination. Maximum total BTEX was

TABLE 3

ANALYTICAL RESULTS OF WATER SAMPLES
FROM MONITORING WELLS AT OAKLAND TOFC YARD
April 8, 1991 (Collection Date)

WELL #	SAMPLE	TPH	B	T	X	E
		mg/l	----------	----mg/l--	----------	
OMW-1	WATER	0.06	ND	ND	ND	ND
OMW-2	WATER	3.2	ND	ND	.0012	.0067
OMW-3	WATER	1.4	.0004	.0005	.0056	.026
OMW-4	WATER	FREE PRODUCT		WELL NOT SAMPLED		
OMW-5	WATER	ND	ND	ND	ND	ND
OMW-6	WATER	0.08	ND	.0004	ND	.0005
OMW-7	WATER	FREE PRODUCT		WELL NOT SAMPLED		
OMW-8	WATER	0.05	ND	ND	ND	ND

Detection Limits: TPH (EPA Method 8015) 0.05 mg/l
BTXE (EPA Method 8020) .0003 mg/l

0.041 ppm (OMW-3, method detection limit of 0.0003 ppm). Benzene was detected below drinking water standards (0.001 ppm) in only one groundwater sample (OMW-3, 0.0004 ppm).

The distribution of dissolved groundwater contamination is shown in Figure 4. The downgradient extent of groundwater contamination is well defined. Using an action level of 1.0 ppm, the dissolved hydrocarbon plume is confined to the area immediately surrounding the fueling area. In particular the southern (downgradient) and eastern edge of the plume appears to be well defined. Installation of two additional monitor wells discussed previously are recommended to define the northern (upgradient) and western limits of the dissolved hydrocarbon plume.

Measurements of conductivity taken during groundwater sampling indicate potentially brackish water quality. In all but one monitoring well, measured conductivities exceeded the limit of the conductivity meter (1,999 umho/cm). Groundwater salinity will have an impact on defining site remediation goals. Additional groundwater analysis for salinity (Total Dissolved Solids, cations, anions, etc) is warranted.

6.3 Operating Groundwater Recovery System

An operating groundwater recovery system (french drain) exists just west of the fueling facility. The system is designed to depress the groundwater surface and prevent water damage to rail switches and has been in operation for several years. The design and operational characteristics of the recovery system are poorly documented. The trench is approximately 60 feet long with a perforated drainage pipe at approximately 1.5 feet below ground surface.

The recovery system was not designed to recover free product, but does discharge to an oil/water separator. The amount of oil which may have been recovered to date by the system is not known. Because of the shallow nature of the french drain, the system will only recover groundwater (and associated free product) at times when the watertable is unusually high.

7.0 CONCLUSIONS

Data collected and analyzed to date has provided the following insights into site hydrogeology and subsurface hydrocarbon contamination.

- o The hydrocarbon contaminant in groundwater and soil is primarily diesel fuel.
- o The source of hydrocarbon product is probably the re-fueling facility.
- o Groundwater is encountered at an elevation of 0 to 4 feet above mean sea level. The groundwater gradient slopes southward toward the Oakland Estuary.
- o Free hydrocarbon product on groundwater is limited to the area immediately surrounding the train re-fueling rack.
- o Dissolved hydrocarbon contamination in groundwater is low and is limited to the vicinity of the re-fueling rack and the area immediately downgradient.
- o The downgradient boundary of the dissolved contaminate plume (1ppm TPH) is adequately defined and is approximately 600 feet north of the Oakland Estuary
- o The release of diesel fuel to the Oakland Estuary appears to have resulted from a leaking storm sewer extending beneath the fueling facility. The release of diesel fuel to the Oakland Estuary was <u>not</u> the result of product migration through subsurface soils to the bay.

8.0 RECOMMENDATIONS

The following activities should be conducted to further define the extent of groundwater contamination and initiate groundwater remediation at the site.

- Complete the final design, permitting, and installation of three recovery wells to depress the groundwater surface and recover free product. The wells should be installed near the center of the free product plume, equipped with total fluids airlift pumps, and discharge to an on-site oil water separator.

- Install two additional monitoring wells to define the northern (upgradient) and western extent of the free product and dissolved contaminate plumes and install one close in (downgradient) observation well to be used in future hydrologic tests and system operations.

- Sample and analyze water from select monitoring wells to determine groundwater salinity and evaluate appropriate cleanup levels for dissolved hydrocarbons in groundwater.

- Complete hydrologic tests to determine aquifer characteristics which will impact the operation and modification of the recovery system.

- Evaluate the influence of tidal fluctuations in the Oakland Estuary on groundwater levels in monitoring wells and proposed remediation activities at the railyard.

The implementation of a groundwater remediation system to recover free product and the collection of additional data should be initiated concurrently. Modification to the recovery system should be made as additional data is provided from the ongoing investigation.

9.0 REMEDIAL ACTION PLAN

A remedial action plan is recommended to begin the recovery of free product and impacted groundwater concurrently with the continuation of investigative and evaluation efforts. The recovery system should focus on the heart of the plume area to maximize free product recovery and prevent the migration of free and dissolved product toward the Oakland Estuary. Contemporaneous with installation of the system, additional monitoring wells are recommended to further delineate the western and northern (upgradient) limits of the free and dissolved product plumes. Hydrologic pumping tests should be performed to evaluate aquifer characteristics which impact the long term operation and performance of the recovery system. Additional sampling of monitor wells for groundwater salinity is necessary to determine appropriate cleanup goals for groundwater at the railyard.

The impact of the initial recovery system on the groundwater environment should be evaluated to assure capture and remediation of the entire free and dissolved hydrocarbon plume. It may be necessary after further delineation of the plume area and additional site investigation to modify the recovery system (additional wells, french drains, etc.) to maximize performance.

9.1 Alternative Analysis

Two remedial alternatives to initiate free product recovery at the site were evaluated. Remedial Option 1 consists of three recovery wells located within the refueling area in the heart of the free product plume. Remedial Option 2 consists of a french drain recovery system located on the south side of the fueling area, just downgradient of the heart of the free product plume. Because an oil/water separator exists adjacent to the fueling area, both systems employed total fluids pumps to recover free product and groundwater. The recovered fluids will be discharged to the existing water treatment system consisting of surge tank, oil/water separator, oil storage tank, and discharge piping. It is assumed that the modifications to the existing discharge permit issued by the East Bay Municipal Utility District will be obtained. The advantage and disadvantages of each system are considered in the following discussion.

Remedial Option One

Three Well Recovery System

Spacing between wells: 100 ft.

Depth of wells: 15 ft.

Advantages:

- o Easy and quick to install. Can be installed in the heart of the plume to maximize initial free product recovery.
- o Can be installed with minimum disturbance to ongoing railyard activities.
- o Construction does not result in substantial volume of hydrocarbon contaminated soil requiring off-site disposal or treatment.
- o System can be expanded or modified in the future to enhance performance and accelerate groundwater remediation.

Disadvantages:

- o Because of multiple pumps, the system is operationally more complex than comparable french drain system, resulting in potentially higher operations and maintenance costs.
- o Well spacing must be carefully evaluated to assure free and dissolved product does not migrate downgradient past the recovery system. Rapid installation requires the use of assumed hydraulic conductivities and other aquifer characteristics in design of the recovery system.

Remedial Option Two

French Drain Recovery System

Design criteria: 400 ft. long

Depth: 10 ft.

Advantages:

- o Single pump operation results in potentially reduced operational and maintenance costs.
- o Continuous nature of trench results in positive barrier to free and dissolved product migration. May result in more rapid remediation of contaminated groundwater.

Disadvantages:

- o Can not be installed in the heart of the free product plume without substantial disruption to ongoing railyard operations.
- o Results in substantial volume of hydrocarbon contaminated soil requiring off-site treatment or disposal.
- o Not as flexible as recovery well approach to remediation. Expansion and modification of system more difficult.

The immediate goal of this segment of the remedial action plan is to initiate free product recovery in the heart of the free product plume. The installation of a recovery well system is recommended instead of a french drain because it will accomplish this goal in a timely fashion, while minimizing the impact on railyard operations. The flexibility of a recovery well system also allows modification to the system (additional recovery wells, changes in well spacing, etc.) in the future as data is collected to enhance product and groundwater control.

9.2 System Design

Three recovery wells are proposed for installation at the locations shown on Figure 5. The wells will be approximately 100 feet apart and located within the fueling area in the heart of the free product plume. Each well will be constructed from 6 inch PVC casing to a depth of approximately 15 feet, 10 feet below the present groundwater surface. Factory slotted well screen (0.010 inch slot) will be installed in each well from total depth to approximately 3 feet below ground surface. A washed silica sand pack will be placed between the screen and the borehole annulus. The sand pack will extend to above the top of the screened casing. A 6 inch bentonite pellet seal will be placed above the sand pack and the well completed to the surface with a cement-bentonite slurry. The wells will be completed at the surface with a traffic rated grade level well cover

Each well will be equipped with an air displacement total fluids, pump. Well head controllers will be located within the grade level well cover at the top of each well. Groundwater from each well will be discharged to an on-site oil/water separator located adjacent to the fueling area (Figure 5). The entire system will be pneumatically operated and intrinsically explosion proof. Air for the pumps will be supplied by the existing air system at the railyard.

Water and oil produced by the system will be pumped to a surge tank at the existing railyard water treatment system. Major system components include an auto skimmer and oil/water separator. Recovered product will be stored in an oil storage tank for recycling. Water will be discharged to the East Bay Municipal Utility District sanitary sewer system under a modification of permit # 233-90851. In the event a modification of permit #233-90851 can not be obtained, other options such as an NPDES permit will be pursued. All other applicable permits will be obtained as necessary.

9.3 Continuing Investigation

Supplemental investigation efforts include the installation of additional monitoring wells as shown on Figure 5. These wells, combined with existing monitoring wells, should complete the delineation of the phase separated and dissolved product plumes. The wells will allow an assessment of the effect the recovery system has on the aquifer. Additional recovery wells will be recommended as required. Water quality and use information will be gathered to support evaluation of appropriate clean up targets.

APPENDIX A

FIELD METHODS

FIELD METHODS

Drilling and Soil Sampling

All borings were advanced under the technical supervision of a USPCI geologist or hydrogeologist. The on-site geologist was present at all times during drilling to: 1) technically supervise the drilling subcontractor; 2) maintain a continuous log of materials penetrated by the borehole; 3) obtain and document soil samples; 4) test soil samples, drill cuttings, and atmospheric conditions with an organic vapor analyzer (OVA); and 5) oversee implementation of USPCI's Health and Safety Plan.

Soil borings were completed using a truck-mounted drilling rig equipped with 8-inch and 10-inch diameter hollow-stem augers. This drilling method was performed without the introduction of drilling fluids and allowed for the collection of relatively undisturbed soil samples through the hollow stem of the auger.

During drilling, soil samples were obtained using a split spoon sampler lowered through the hollow stem of the auger and advanced along with the auger to the desired depth. This method allowed for monitoring of soils penetrated during drilling. After retrieving the sampler, soils were screened in the field for organic vapor emissions using an Organic Vapor Analyzer (OVA). The OVA was also used to monitor organic vapor emissions from drill cuttings during drilling. Organic vapor measurements were recorded on the boring logs.

Soil samples collected for possible chemical analysis were placed in 8-ounce glass sample jars. The sample jars were equipped with teflon lined lids and were supplied by the analytical laboratory. Labels were attached to each sample and will include the following information: 1) boring number; 2) sample number; 3) date and time; 4) collectors name; 5) owner; and 6) location. Appropriately sealed and labeled samples were stored in ice chests cooled with dry or blue ice. Chain of custody records were maintained during the sampling

program and transmitted to the laboratory with the samples. Samples were delivered to the laboratory by direct delivery or overnight courier, whichever is most convenient.

Prior to initiating each boring, the downhole equipment, including auger sections and sampling equipment, was thoroughly steam cleaned. The core barrel sampling equipment was either steam cleaned or carefully washed in a dilute trisodium phosphate (TSP) solution and rinsed in de-ionized water before retrieving each sample.

Monitoring Well Installation and Sampling

Eight of the soil borings were completed as groundwater monitoring wells. The monitoring well locations are displayed on Figure 2.

The monitoring wells were completed to a depth of 13 to 15 feet. Wells were installed through the hollow stem of the auger. All wells were constructed from threaded, 2-inch schedule 40 PVC casing. Factory slotted 0.010 inch well screen was installed from a depth of approximately 3 feet below ground surface to total depth. The upper 3 feet of the monitoring well was completed with blank casing.

The annular space between the well screen and borehole was filled with pre-washed silica sand to a position approximately one foot above the top of the well screen to form a filter pack. A bentonite seal was then placed above the filter pack. The remainder of the borehole was then back-filled to the ground surface with a cement-bentonite slurry. A locking cap and protective cover was installed over the well head and finished slightly above grade to limit ponding of water around the well head.

The wells were developed using the surge and bail technique. Measurements of the Ph and conductivity of the produced water was taken at regular intervals during development, and development proceeded until these parameters stabilize and produced water is relatively free of sediment.

Groundwater Sampling

During sampling of monitor wells for water quality, extreme care was taken to prevent cross contamination between wells or introduction of surface contamination into the well environment. All sampling equipment was decontaminated before use on each well, or should be disposable equipment certified as clean by the supplier.

Prior to sampling the monitoring wells, 3 to 5 well casing volumes of water were purged from each well. This helped assure that the water sample is representative of groundwater in the formation and not stagnant water which has been in contact with the well casing for several months. Wells were bailed using disposable polyethylene bailers. Clean nylon line (not previously used) was employed to lower the bailer down the well. The individual purging the well wore new latex gloves and clean Tyvex coveralls when purging the well. Care was taken to avoid agitating water in the well or allowing the bailer to contact contaminated materials at the surface (asphalt pavement, surface soil etc).

While purging the well, Ph and conductivity readings were taken at least every third bailer full of fluid removed using a calibrated meter. Calibration of Ph and Conductivity meters were undertaken daily prior to sampling. Samples for laboratory analysis were collected within 2 hours of purging the well.

As with purging, a clean pair of disposable latex gloves was worn during the groundwater sampling events. The bailer was attached to clean nylon cord and lowered slowly into the well to acquire the groundwater sample. Agitation of groundwater in the well was avoided. The bailer was retrieved the contents emptied into appropriate sample containers while minimizing agitation of the sample and contact between the sample and the atmosphere. The sample container was sealed immediately and labeled with all pertinent information prior to placement in an ice chest cooled with blue ice. Chain of custody records were completed and accompanied samples to the laboratory.

APPENDIX B

SOIL BORING LOGS
MONITOR WELL COMPLETION FORMS

U.S
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CONTROL INC.
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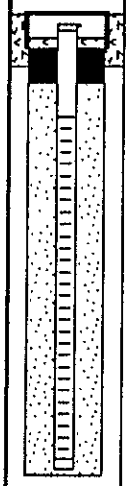
LOG

BORING NO. OMW-1

WELL NO. OMW-1

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:8.79 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 5.0 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE		ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT		AF			
		0.7 TO 4.5 ASPHALT SUB-GRADE FILL, DAMP, SLIGHT ODOR. RED CHERT GRAVEL AT 3.5'		AF	2.5	OMW1-2	TPH=ND
	5	4.5 to 13.5 GREY, MEDIUM TO COARSE SAND, WITH SOME GRAVEL AND FINE SAND, WET, NO ODOR. TRACE CLAY AND SHELLS			1.5	OMW1-5.5	TPH=ND
					0	OMW1-7	TPH=ND
	10			SW			
					0	OMW1-11	
	15	BORING COMPLETED ON APRIL 4, 1991					
		**********					
		MONITOR WELL STATISTICS					
		**********					
	20	TOC EL: 8.79 MSL FT GS EL: 9.01 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 2.0 TO 13.5 FT 2.5 SACKS 8X12					
	25	BENTONITE SEAL: 2.0 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT					
	30						
	35						
	40						

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POLLUTION
CONTROL INC.
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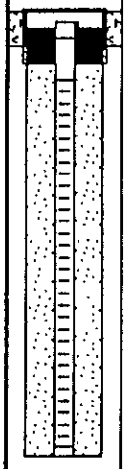
LOG

BORING NO. OMW-2
WELL NO. OMW-2

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:5.88 MSL	TD: 13.0 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 3.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 1.0 RR BALLAST, GREY SANDY PEA GRAVEL, NO STAINING	AF			
	5	1.0 TO 11.5 GREY, FINE TO COARSE SAND AND GRAVEL, VERY MOIST, STRONG ODOR (2') TRACE SHELLS. AT 8' AS ABOVE, WET, SLIGHT ODOR, SHEEN.	SP	18	OMW2-5.5	4,100 TPH
	10			7.0	OMW2-11	1,400 TPH
	15	11.5 TO 13 FINE SANDY CLAY AND SILT, DARK GREY, TRACE SHELLS, BAY MUD, SLIGHT H2S ODOR.	ML			
	20	BORING COMPLETED ON APRIL 4, 1991 ********** MONITOR WELL STATISTICS ********** TOC EL: 5.88 MSL FT GS EL: 6.10 MSL FT BLANK CASING: .3 TO 2.0 FT SCREEN CASING: 2.0 TO 12.0 FT BOTTOM CAP: 12.0 TO 12.3 FT SAND PACK: 2.0 TO 12.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 1.5 TO 0.5 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 0.5 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	25					
	30					
	35					
	40					

U.S
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CONTROL INC.
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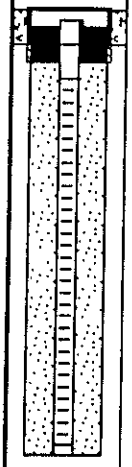
LOG

BORING NO. OMW-3
WELL NO. OMW-3

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/5/91	DATE COMP: 4/5/91	SURF. EL:7.16 MSL	TD: 13.0 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 4.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 4.5 RR BALLAST, GREY TO BROWN SANDY GRAVEL, STAINED, DRY, BECOMES ODIFEROUS AT 4', WET WITH STRONG ODOR AT 4.5'.	AF	61	OMW3-3.0	4,500 TPH
	5	4.5 TO 11.5 GREY, FINE TO MEDIUM SAND WITH MINOR GRAVEL AND COARSE SAND. SLIGHT ODOR, SATURATED. AT 9' AS ABOVE, WET, VERY SLIGHT ODOR.	SW	55	OMW3-6	780 TPH
	10	11.5 TO 13 FINE GRAINED SILTY SAND, GREY, BAY MUD.	SM	86	OMW2-11	195 TPH
	15	BORING COMPLETED ON APRIL 5, 1991				
	20	********** MONITOR WELL STATISTICS ********** TOC EL: 7.16 MSL FT GS EL: 7.36 MSL FT BLANK CASING: .3 TO 2.0 FT SCREEN CASING: 2.0 TO 12.0 FT BOTTOM CAP: 12.0 TO 12.3 FT SAND PACK: 2.0 TO 12.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 1.5 TO 0.5 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 0.5 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	25					
	30					
	35					
	40					

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CONTROL INC.
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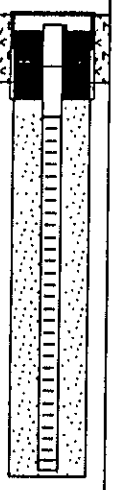
LOG

BORING NO. OMW-4
WELL NO. OMW-4

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/8/91	DATE COMP: 4/8/91	SURF. EL:7.41 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 4.5 FT.



DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
0	0.0 to 0.7 ASPHALT	AF			
	ASPHALT SUB-GRADE, GREY TO BROWN SANDY GRAVEL, MOIST, ODOR.	AF	7	OMW4-3.0	9,600 TPH
5	AT 1.5' BECOMES GREENISH-GREY, WITH STRONG ODOR.		4	OMW4-6	TPH=ND
	4.0 TO 13.0 GREY, FINE TO MEDIUM SAND WITH MINOR GRAVEL AND COARSE SAND. SLIGHT ODOR, SATURATED, TRACE SHELLS.	SW			
10	AT 11' AS ABOVE, WET, VERY SLIGHT ODOR.		1	OMW4-11	TPH=ND
15	BORING COMPLETED ON APRIL 8, 1991				
20	********** MONITOR WELL STATISTICS ********** TOC EL: 7.41 MSL FT GS EL: 7.57 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 2.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.0 TO 0.5 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 0.5 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
25					
30					
35					
40					

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CONTROL INC.
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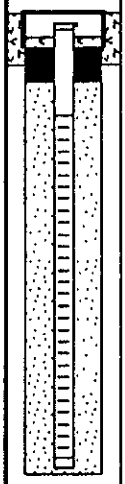
LOG

BORING NO. OMW-5
WELL NO. OMW-5

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:7.62 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 7.0 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT	AF AF			
		0.7 TO 1.5 ASPHALT SUB-GRADE FILL, DAMP, SLIGHT ODOR. GREY SANDY GRAVEL.				
	5	1.5 to 13.0 GREY, MEDIUM TO COARSE SAND, WITH SOME GRAVEL AND FINE SAND, WET AT 7'. TRACE CLAY AND SHELLS, NO ODOR.		0	OMW5-5.5	19 TPH
		SAND BECOMES FINER, NO ODOR.	SW	0	OMW5-8	TPH=ND
	10					
	15	BORING COMPLETED ON APRIL 4, 1991				
		********** MONITOR WELL STATISTICS **********				
	20	TOC EL: 7.62 MSL FT GS EL: 7.87 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 2.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.0 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	25					
	30					
	35					
	40					

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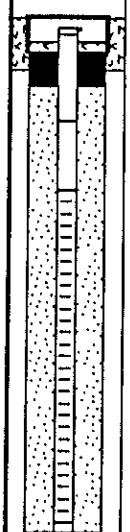
LOG

BORING NO. OMW-6

WELL NO. OMW-6

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:5.78 MSL	TD: 15.0 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 7.0 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT	AF			
			AF			
		0.7 TO 1.5 ASPHALT SUB-GRADE FILL, DAMP, SLIGHT ODOR. BROWN COARSE SANDY GRAVEL, TRACE FINES, NO ODOR, DAMP.	GM	0 0		
	5	2.5 to 5.5 BROWN TO GREY GRAVELY SAND TO SANDY GRAVEL. WOOD DEBRIS AT 3', DAMP, NO ODOR.		0		
		5.5 TO 15 GREY TO DARK GREY SILTY FINE GRAINED SAND, MINOR COARSE TO MEDIUM GRAINED SAND, WET, TRACE SHELLS, WOOD DEBRIS, NO ODOR. BAY MUD.		0		
	10		SW	0	OMW6-11	TPH=ND
	15			0	OMW6-145	6 TPH
	20	BORING COMPLETED ON APRIL 4, 1991				
	25	********** MONITOR WELL STATISTICS ********** TOC EL: 5.78 MSL FT GS EL: 5.88 MSL FT BLANK CASING: .3 TO 4.5 FT SCREEN CASING: 4.5 TO 14.5 FT BOTTOM CAP: 14.5 TO 14.8 FT SAND PACK: 3.5 TO 15.0 FT 2.5 SACKS 8X12 BENTONITE SEAL: 3.5 TO 2.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 2.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	30					
	35					
	40					

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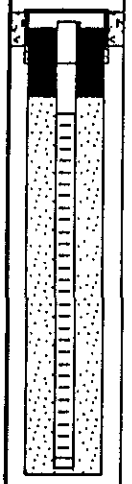
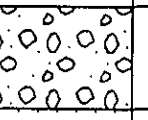
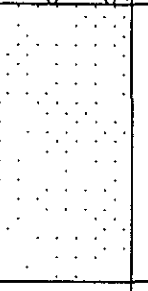
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-7
WELL NO. OMW-7

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:7.03 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 4.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE		ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 2.5 RR BALLAST, GREY LIMESTONE GRAVEL, NO STAINING		AF			
	5	2.5 TO 5.5 GREY TO DARK GREENISH GREY, FINE TO COARSE SAND VERY MOIST, STRONG DIESEL ODOR STARTING AT 3', FREE PRODUCT AT 4.5'TO 5'.		GM	28	OMW7-3.5	5,600 TPH
		5.5 TO 13.5 FINE TO MEDIUM SAND, GREY, MINOR COARSE SAND, TRACE GRAVEL AND SHELLS, DIESEL ODOR STRONG AT 6', BECOMES SLIGHT AT 12', SATURATED.		SW	67	OMW7-6	860 TPH
	10				8.0	OMW2-11	360 TPH
	15	BORING COMPLETED ON APRIL 4, 1991					
		********** MONITOR WELL STATISTICS **********					
	20	TOC EL: 7.03 MSL FT GS EL: 7.20 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 3.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.5 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT					
	25						
	30						
	35						
	40						

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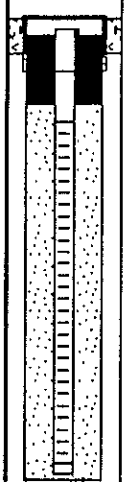
LOG

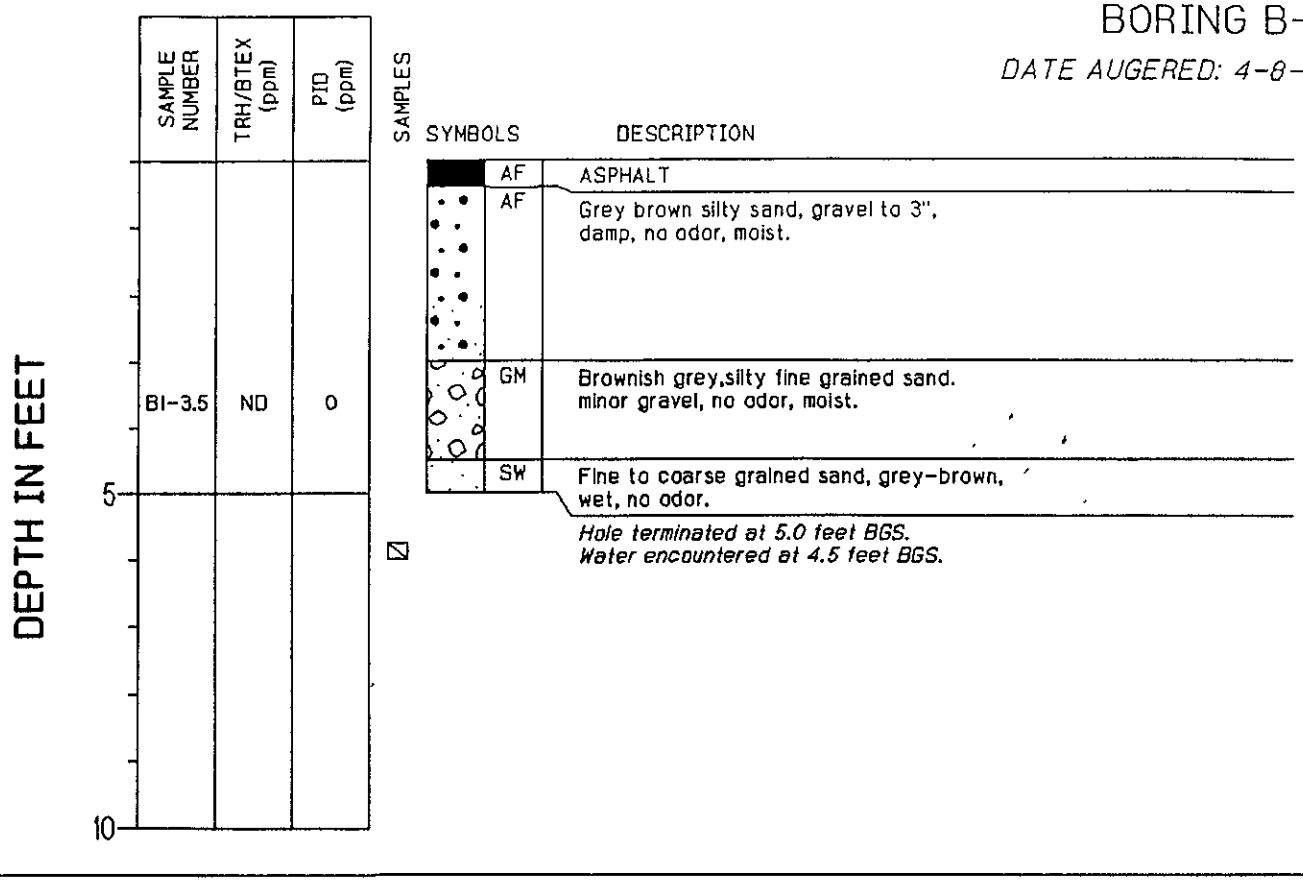
BORING NO. OMW-8
WELL NO. OMW-8

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:7.52 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 5.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 1.5 RR BALLAST, GREY LIMESTONE GRAVEL, NO STAINING	AF GM			
	5	1.5 TO 3.0 BROWN SILTY SAND, SOME GRAVEL, TRACE CLAY. MOIST, STRONG DIESEL ODOR STARTING AT 2.5'. BECOMES STAINED DARKER GREY ALSO AT 2.5'. 3.0 TO 13.5 FINE TO MEDIUM SAND, GREY, MINOR COARSE SAND, TRACE GRAVEL AND SHELLS, DIESEL ODOR MODERATE AT 3.5', BECOMES FAINT AT 10', SATURATED.	SW		OMW8-5.5	TPH=ND
	10				OMW8-11	TPH=ND
	15	BORING COMPLETED ON APRIL 4, 1991 ********** MONITOR WELL STATISTICS ********** TOC EL: 7.52 MSL FT GS EL: 7.69 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 3.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.5 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	20					
	25					
	30					
	35					
	40					

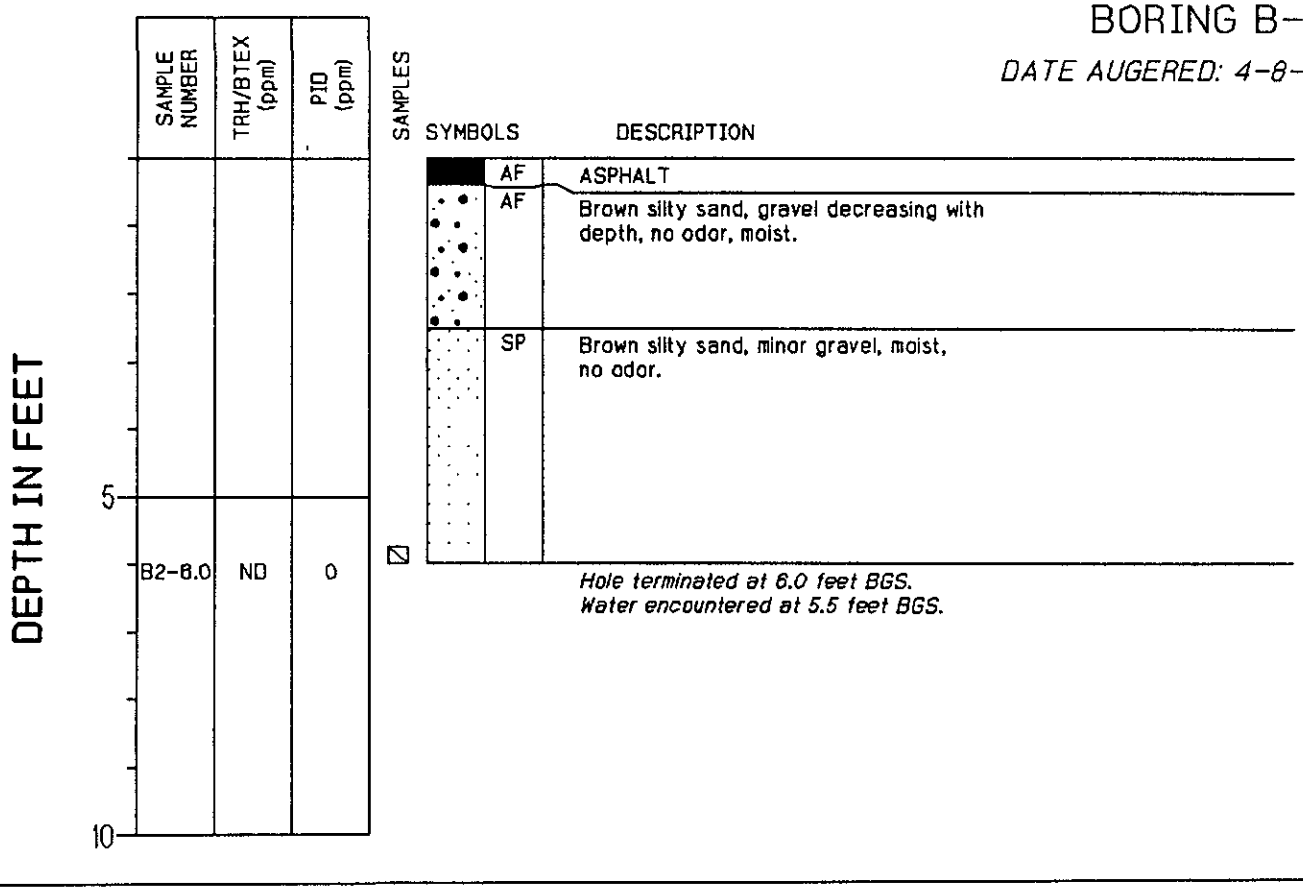
BORING B-1

DATE AUGERED: 4-8-91



BORING B-2

DATE AUGERED: 4-8-91



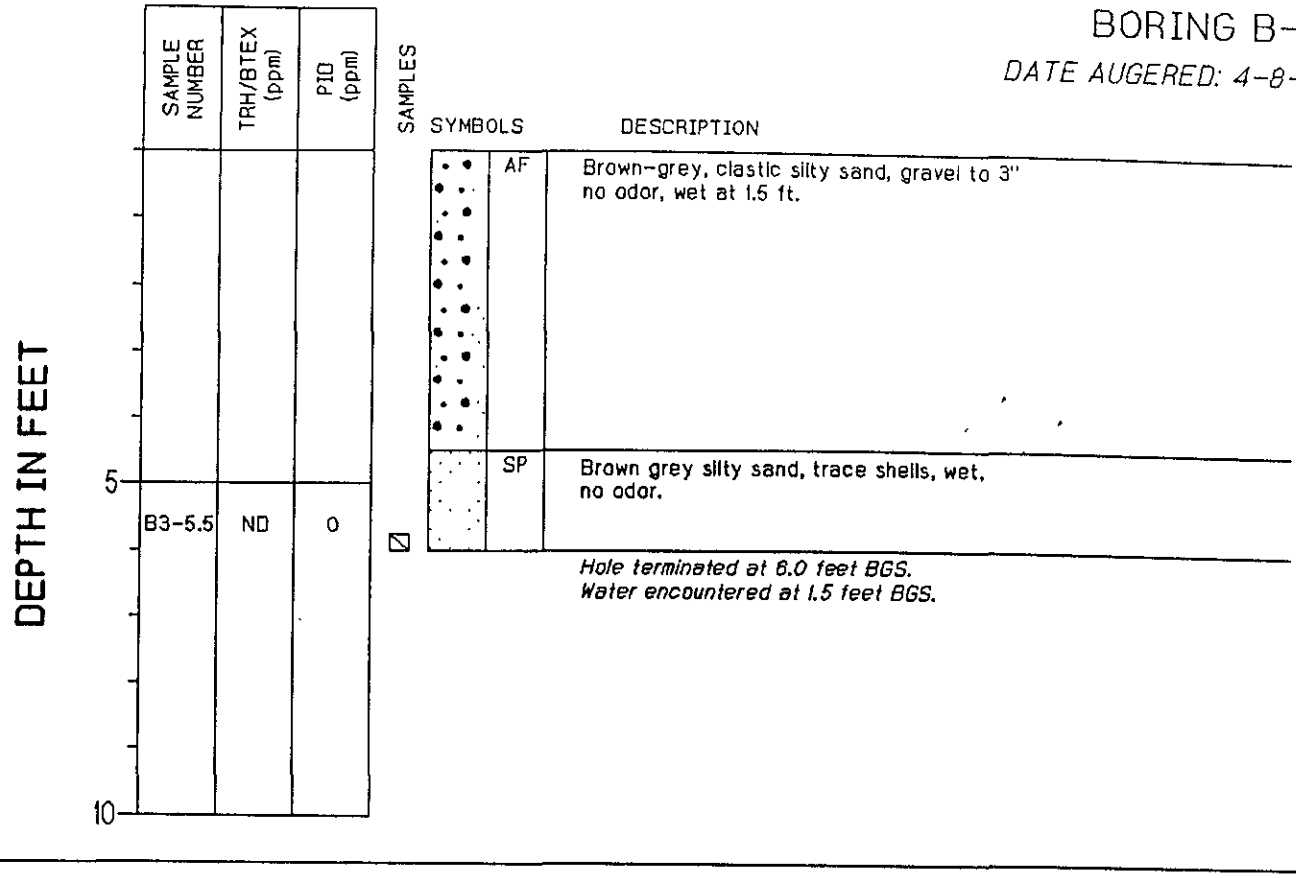
USPCI
REMEDIAL SERVICES
A Subsidiary of Union Pacific Corporation

LOG OF HOLES B-1 AND B-2
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

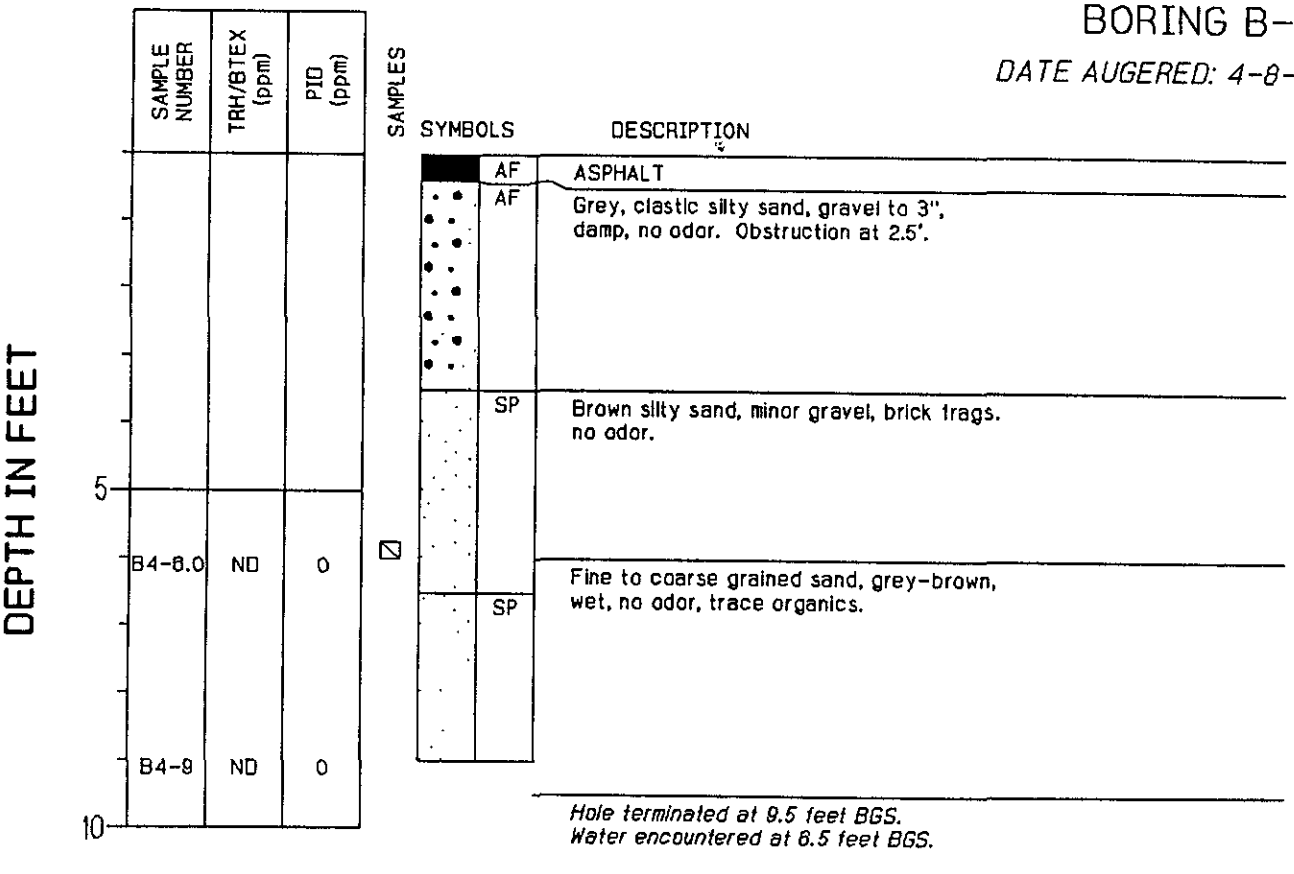
BORING B-3

DATE AUGERED: 4-8-91



BORING B-4

DATE AUGERED: 4-8-91



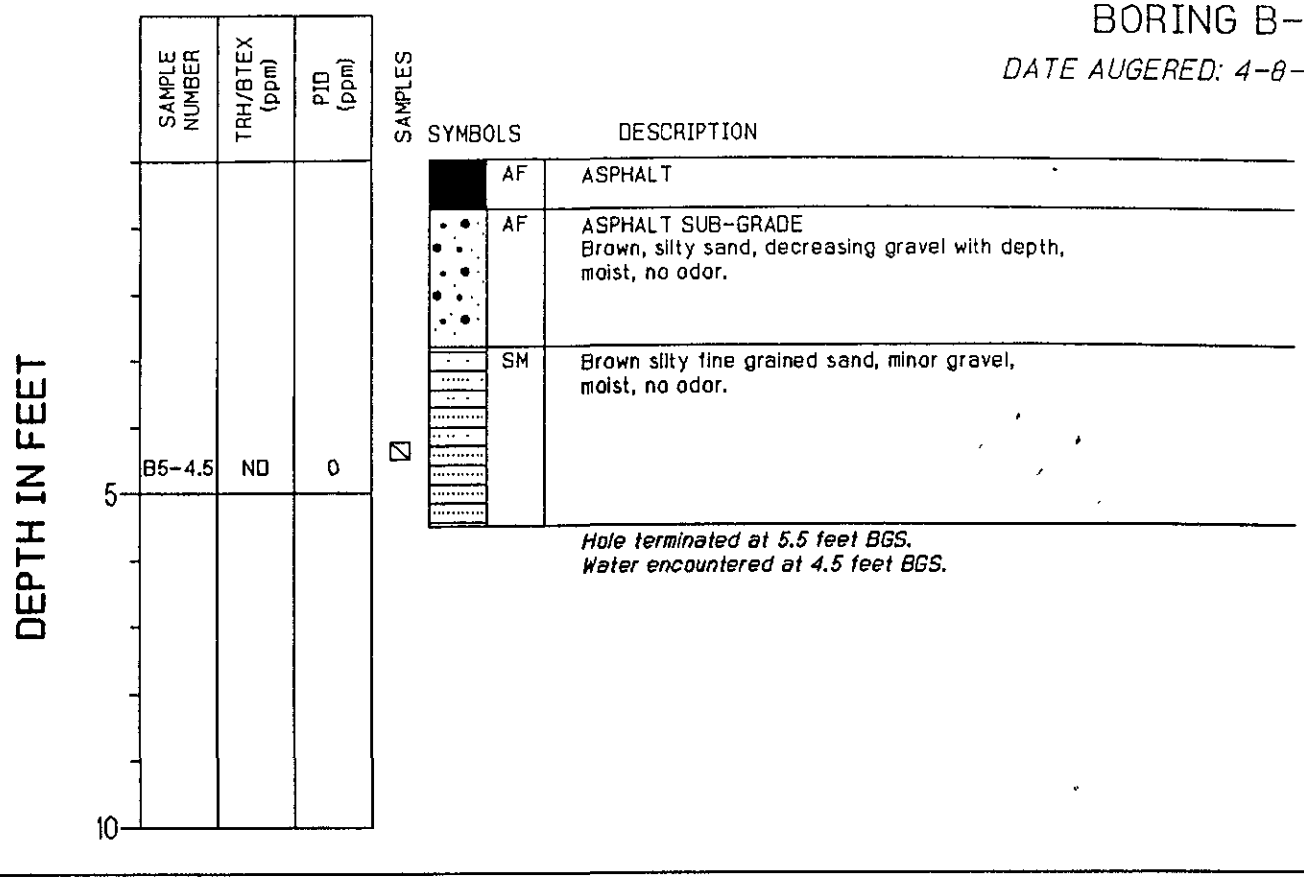
USPCI
REMEDIAL SERVICES
A Subsidiary of Union
Pacific Corporation

LOG OF HOLES B-3 AND B-4
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT
REPORT

BORING B-5

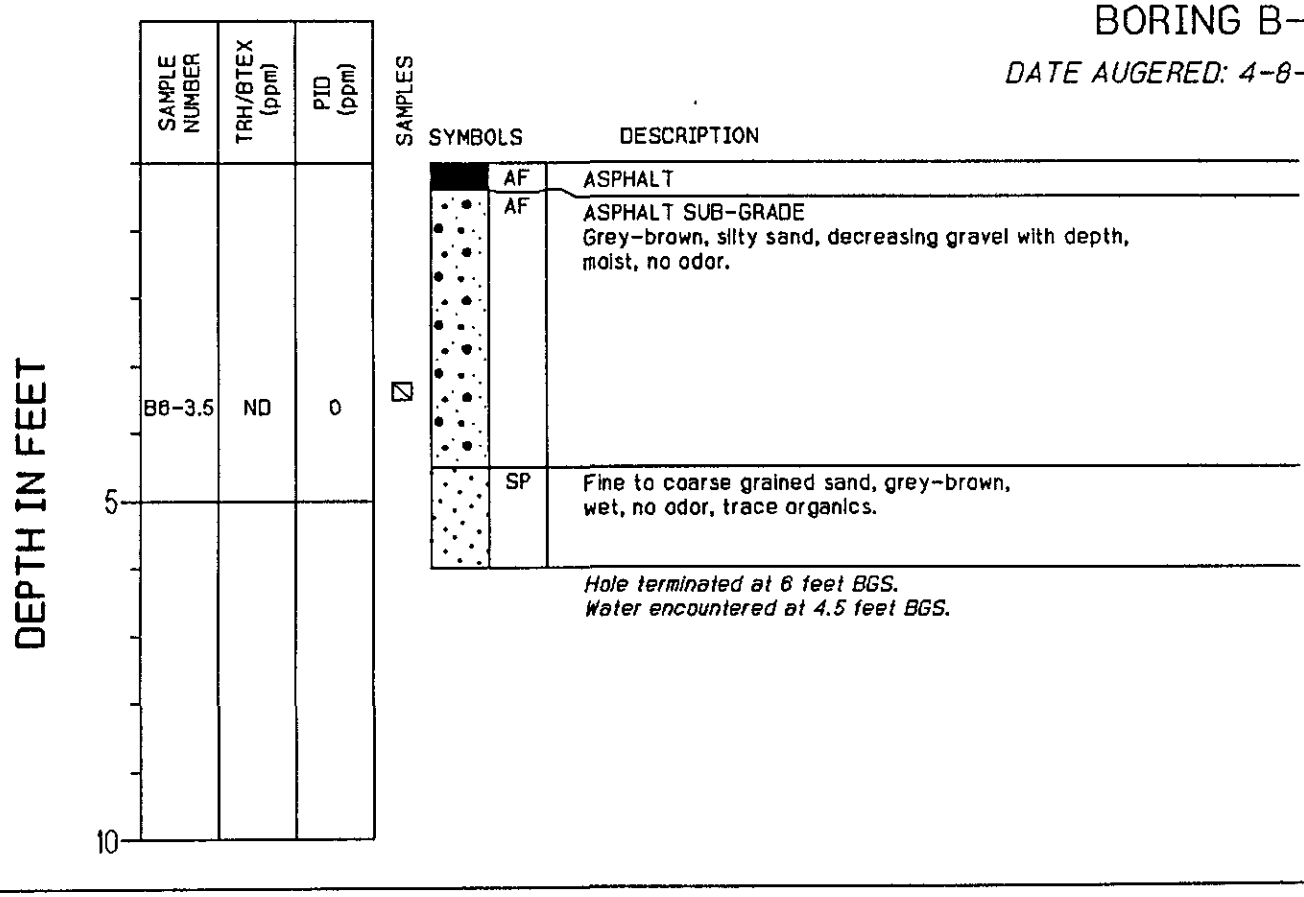
DATE AUGERED: 4-8-91



Hole terminated at 5.5 feet BGS.
Water encountered at 4.5 feet BGS.

BORING B-6

DATE AUGERED: 4-8-91



Hole terminated at 6 feet BGS.
Water encountered at 4.5 feet BGS.

USPCI
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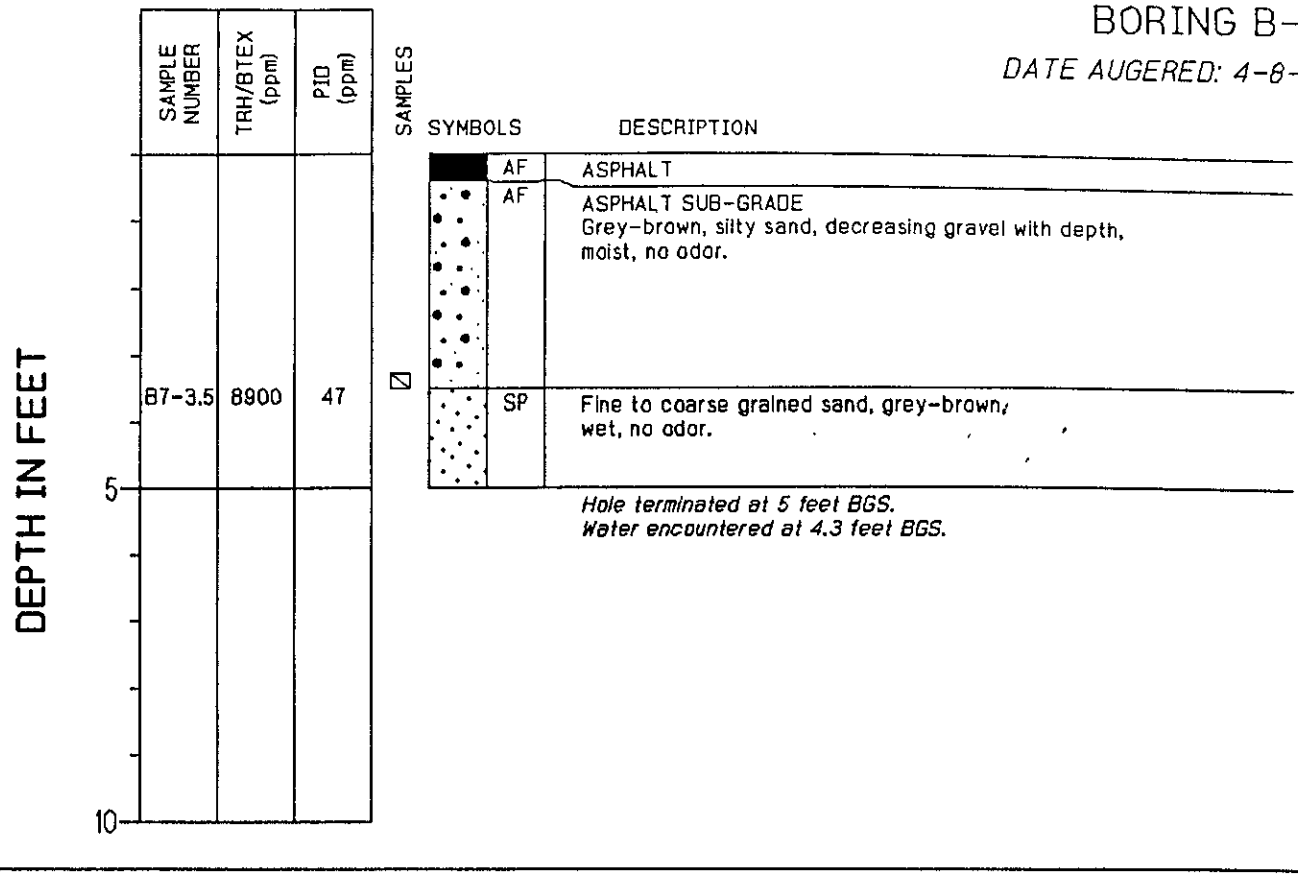
LOG OF HOLES B-5 AND OAK-B6
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

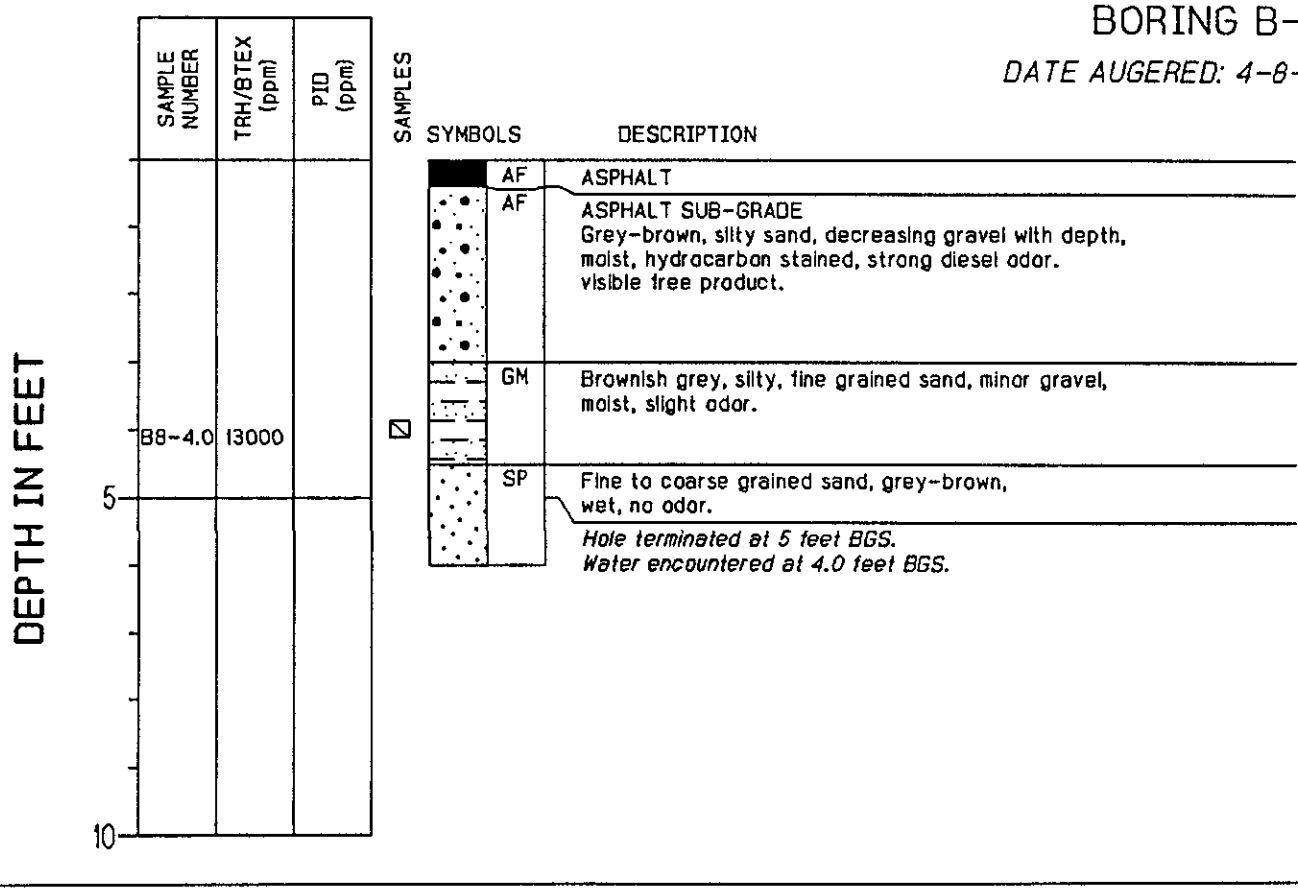
BORING B-7

DATE AUGERED: 4-8-91



BORING B-8

DATE AUGERED: 4-8-91



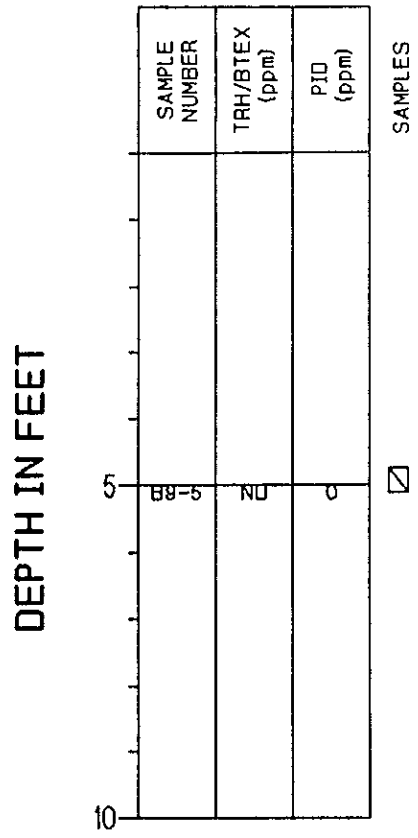
USPCI
REMEDIAL SERVICES
A Subsidiary of Union Pacific Corporation

LOG OF HOLES B-7 AND OAK-B8
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

BORING B-9

DATE AUGERED: 4-8-91



SAMPLES

SYMBOLS		DESCRIPTION
	AF	ASPHALT
	AF	ASPHALT SUB-GRADE Brown, silty sand, decreasing gravel with depth, moist, no odor.
	SM	Brown silty fine grained sand, minor gravel, moist, no odor.
	SP	Fine to coarse grained sand, grey-brown, wet, no odor.

Hole terminated at 6 feet BGS.
Water encountered at 5.5 feet BGS.

USPCI
REMEDIAL SERVICES
A Subsidiary of Union Pacific Corporation

LOG OF HOLE B-9
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

APPENDIX C

LABORATORY REPORTS
CHAIN OF CUSTODY DOCUMENTATION

APPENDIX D

FIGURES 2, 4, AND 5

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82866
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/12/91
DATE REPORTED: 04/19/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/L) Diesel Range
1	omw-6	0.08

mg/L - parts per million (ppm)

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Gasoline = NA
RPD Diesel = 10
MS/MSD Average Recovery = 107%: Duplicate RPD = 12

Richard Srna, Ph.D.

Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82866
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/12/91
DATE REPORTED: 04/19/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

#	Sample Identification	Concentration(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
1	omw-6	ND<0.3	0.4	ND<0.3	0.5

ug/L - parts per billion (ppb)

Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery =89 %: Duplicate RPD = <8

Richard Srna, Ph.D.
Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82823
CLIENT: USPCI
CLIENT JOB NO.: 96199
DATE RECEIVED: 04/08/91
DATE REPORTED: 04/17/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/Kg) Diesel Range
1	OMW-1,1A,5.5'	ND<10
2	OMW-1,2A,7'	ND<10
3	OMW-1,3A,11'	ND<10
4	OMW-2,1A,5.5'	4100
5	OMW-2,2A,11'	1400
6	OMW-3,1A,3'	4500
7	OMW-3,2A,6'	780
8	OMW-4,1A,3'	9600
9	OMW-4,2A,6'	ND<10
10	OMW-5,1A,5.5'	19
11	OMW-5,2A,8'	ND<10
12	OMW-6,1A,11'	ND<10
13	OMW-6,2A,14.5'	6*
14	OMW-7,1A,3.5'	5600
15	OMW-7,2A,6'	860
16	B-1,1A,3.5'	ND<10
17	B-2,1A,6'	ND<10
18	B-3,1A,5.5'	ND<10
19	B-4,1A,6'	ND<10
20	B-4,2A,9'	ND<10
21	B-5,1A,4.5'	ND<10
22	B-6,1A,3.5'	ND<10
23	B-7,1A,3.5'	8900
24	B-8,1A,4'	13000
25	B-9,1A,5'	ND<10
26	OMW-3,3A,11'	195
27	OMW-4,3A,11'	ND<10
28	OMW-8,1A,5.5'	ND<10
39	OMW-7,3A,11'	360
40	OMW-8,2A,11'	ND<10

Method Detection Limit for Gasoline and Diesel in Soil: 10 mg/Kg
QAQC Summary:
Daily Standard run at 200mg/L: RPD Gasoline = 18
RPD Diesel = 1
MS/MSD Average Recovery = 114%: Duplicate RPD = 5
* not typical diesel pattern present.

Richard Srna, Ph.D.
Laboratory Manager

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SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82823
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/08/91
DATE REPORTED: 04/17/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/L) Diesel Range
30	OMW-1,2A	0.06*
32	OMW-2,2A	3.2
34	OMW-3,2A	1.4
36	OMW-5,2A	ND<0.05
37	OMW-8,2A	0.05*

mg/L - parts per million (ppm)
not Typical diesel pattern present.

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Diesel = 10
MS/MSD Average Recovery = 111%: Duplicate RPD = 3

Richard Srna, Ph.D.

Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82823
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/08/91
DATE REPORTED: 04/17/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg)(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
4	OMW-2,1A,5.5'	8	26	48	310
8	OMW-4,1A,3'	ND<150	310	860	5300
12	OMW-6,1A,11'	3.3	5	ND<3	ND<3
14	OMW-7,1A,3.5'	86	150	290	1400
15	OMW-7,2A,6'	25	19	25	75
23	B-7,1A,3.5'	95	390	530	2700
24	B-8,1A,4'	280	720	1400	6200
28	OMW-8,1A,5.5'	ND<3	4	4	11
29	OMW-1,1AB *	ND<0.3	ND<0.3	ND<0.3	ND<0.3
31	OMW-2,1AB *	ND<0.3	ND<0.3	1.2	6.7
33	OMW-3,1AB *	0.4	0.5	5.6	26
35	OMW-5,1AB *	ND<0.3	ND<0.3	ND<0.3	ND<0.3
38	OMW-8,1AB *	ND<0.3	ND<0.3	ND<0.3	ND<0.3

* ug/L - parts per billion (ppb)

ug/kg - parts per billion (ppb)

Method Detection Limit in Soil: 3 ug/Kg
Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery = 91%: Duplicate RPD = <2

Richard Srna, Ph.D.

Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

U.S. POLLUTION CONTROL, INC.

5665 Flatiron Parkway
Boulder, Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO.: 96199

PROJECT NAME: UPRR - Oakland TOFC Yard

SAMPLERS: (Signature)

STAT. NO	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	TPH (8015 Mod)	BTEX (8020)	REMARKS
OMW-1	4/4/91	0945			OMW-1, 1A, 5.5'	1	X		
OMW-1	4/4/91	0955			OMW-1, 2A, 7'	1	X		
OMW-1	4/4/91	1000			OMW-1, 3A, 11'	1	X		
OMW-2	4/5/91	0800			OMW-2, 1A, 5.5'	1	X	X	
OMW-2	4/5/91	0810			OMW-2, 2A, 11'	1	X		
OMW-3	4/5/91	1010			OMW-3, 1A, 3'	1	X		Note: OMW-3, 3A, 11' on next COC
OMW-3	4/5/91	1020			OMW-3, 2A, 6'	1	X		
OMW-4	4/3/91	0830			OMW-4, 1A, 3'	1	X	X	Note: OMW-4, 3A, 11' on next COC
OMW-4	4/8/91	0840			OMW-4, 2A, 6'	1	X		
OMW-5	4/4/91	1645			OMW-5, 1A, 5.5	1	X		
OMW-5	4/4/91	1700			OMW-5, 2A, 8'	1	X		
OMW-6	4/5/91	1330			OMW-6, 1A, 11'	1	X	X	
OMW-6	4/5/91	1350			OMW-6, 2A, 14.5'	1	X		
OMW-7	4/4/91	1208			OMW-7, 1A, 3.5'	1	X	X	
OMW-7	4/4/91	1215			OMW-7, 2A, 6	1	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	4/8/91				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution: Original Accompanies Shipment, First Copy to Coordinator Field Files, Second Copy to Representative of Inspected Facility

Split Samples: _____

U.S. POLLUTION CONTROL, INC.

5665 Flatiron Parkway
Boulder Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
96199	Oakland TOFC

SAMPLERS: (Signature)

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH (8015)	BTEX (8020)	REMARKS
B-1	4/8/91	0920			B-1, 1A, 3.5'	1	X		
B-2		1020			B-2, 1A, 6'		X		
B-3		1115			B-3, 1A, 5.5'		X		
B-4		1145			B-4, 1A, 6'		X		
B-4		1200			B-4, 2A, 9'		X		
B-5		1300			B-5, 1A, 4.5		X		
B-6		1320			B-6, 1A, 3.5		X		
B-7		1400			B-7, 1A, 3.5		X	X	
B-8		1420			B-8, 1A, 4'		X	X	
B-9	4/8/91	1500			B-9, 1A, 5'		X		
OMW-3	4/5/91	1030			OMW-3, 3A, 11'	1	X		
OMW-4	4/8/91	0850			OMW-4, 3A, 11'	1	X		
OMW-8	4/4/91	1480			OMW-8, 1A, 5.5'	1	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	4/8/91				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution Original Accompanies Shipment First Copy to Coordinator Field Files Second Copy to Representative of Inspected Facility

Split Samples.
☐ Accepted ☐ Declined
Signature

U.S. POLLUTION CONTROL, INC.

5665 Flatiron Parkway
Boulder, Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
96199	Oakland TOFC Yard

SAMPLERS: *(Signature)* K Rosa

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH (8015)	BTEX (8020)	REMARKS
OMW-1	4/7/91	1850			OMW-1, 1AB	2		X	
OMW-1		1855			OMW-1, 2A	1	X		
OMW-2		1930			OMW-2, 1AB	2		X	
OMW-2		1935			OMW-2, 2A	1	X		
OMW-3		1830			OMW-3, 1AB	2		X	
OMW-3		1835			OMW-3, 2A	1	X		
OMW-5		1800			OMW-5, 1AB	2		X	
OMW-5	4/7/91	1805			OMW-5, 2A	1	X		

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
K Rosa	4/8/91				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	

Split Samples: ☐ Accepted ☐ Declined _____ Signature

Distribution: Original Accompanies Shipment, First Copy to Coordinator Field Files, Second Copy to Representative of Inspected Facility

U.S. POLLUTION CONTROL, INC.

5685 Flatiron Parkway
Boulder Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
96199	Oakland TOFC Yard

SAMPLERS: (Signature) K Ross

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH (8015)	BTEX (8020)	REMARKS
OMW-6	4/9/91	1405			OMW-6, 1A,B (H_2O)	2		X	
OMW-6	4/9/91	1400			OMW-6, 2A (H_2O)	1	X		
OMW-8	4/7/91	1910			OMW-8, 1A,B (H_2O)	2		X	Note: Delivered 4/8/91
OMW-8	4/7/91	1915			OMW-8, 2A (H_2O)	1	X		" "
OMW-7	4/4/91	1230			OMW-7, 3A, 11' (Soil)	1	X		" "
OMW-8	4/4/91	1410			OMW-8, 2A, 11' (Soil)	1	X		" "
									For Questions Call Ken Ross (303) 938 5562

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
K Ross	4/12/91 1430				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution Original Accompanies Shipment First Copy to Coordinator Field Files: Second Copy to Representative of Inspected Facility

Split Samples: ☐ Accepted ☐ Declined Signature

USPCI
A Subsidiary of
Union Pacific Corporation

Remedial Services

June 10, 1991

Ray Balcon
California Regional Water Quality Control Board
San Francisco Bay Region
1111 Jackson St., Room 6040
Oakland, CA 94607

Dear Mr. Balcon:

At the request of Union Pacific Railroad (UPRR) USPCI is forwarding to you a draft copy of the Hydrocarbon Investigation Report and Remedial Action Plan for UPRR's Oakland, California TOFC Railyard. We are sending you the draft report, because we intend to begin installation of three recovery wells on Thursday June 13, 1991 and wish to provide you an opportunity to review and comment on our proposed plan. The final report will be forwarded to you within a few days, pending signature by our California Registered Civil Engineer (presently out of the office).

Should you have any questions concerning our investigation or the proposed remediation plan, please feel free to call me at (303) 938-5566.

Sincerely,

Ted Petranoff
Project Geologist
Groundwater Remediation

Attachments

cc: Jim Moran, USPCI
Steve Brinkman, USPCI
Harry Patterson, UPRR

5665 Flatiron Parkway • Boulder, Colorado 80301 • 303/938-5500 • Fax 303/938-5520

HYDROCARBON INVESTIGATION AND REMEDIAL DESIGN AT UNION PACIFIC RAILROAD'S OAKLAND, CALIFORNIA TOFC YARD

June 5, 1991

DRAFT

Prepared For
Union Pacific Railroad
By
USPCI
Job Number 96199

EXECUTIVE SUMMARY

Union Pacific Railroad's Oakland TOFC (Trailer On Freight Car) Railyard is an active railyard with refueling capabilities located adjacent to the Oakland Estuary. During February, 1991 two incidents were recorded in which diesel oil reached the estuary via storm sewers presumably originating from the refueling area within the railyard. USPCI initiated an investigation of the site designed to recover information necessary to design a remedial system optimally suited for this site.

During the coarse of the investigation it was determined that;

- Groundwater at the site is shallow (2 - 6 feet below ground surface) with a shallow gradient which slopes toward the estuary. During the past few years of drought, groundwater levels may have been lower (6 - 9 feet below ground surface).

- The hydrocarbon contaminate is diesel fuel.

- Hydrocarbon (diesel) contaminated soil is limited to the area of the fueling rack and fuel storage tanks.

- Floating free product on groundwater is limited to the immediate area of the fueling rack.

- The concentration of dissolved hydrocarbon in groundwater is low. TPH values range from non-detect to 3.2 ppm. Low levels of BTXE have been detected below USEPA maximum contaminate levels for drinking water.

- The downgradient limit of the dissolved hydrocarbon plume has been delineated with monitoring wells. The projected 1 ppm TPH boundary is presently 600 hundred feet upgradient of the estuary.

- An active groundwater depression trench, located near the fuel storage tanks, which was installed in the past to prevent groundwater from coming in contact with rail switches has served to recover an indeterminate amount of free diesel product from the groundwater. The active trench will not prevent downgradient migration of dissolved hydrocarbon contaminates in the groundwater.

Based on the above summarized findings USPCI recommends the following remedial action and additional investigation:

- Initiate a program to begin recovery of hydrocarbon contaminated groundwater at the site. The remediation program should be designed to recover free product from the heart of the plume, and prevent further downgradient migration of free and dissolved product toward the Oakland Estuary. The proposed remediation program would initially consist of three recovery wells equipped with total fluids pumps. Groundwater should be discharged to a surface oil/water separator.

- Install two additional monitoring wells to delineate the northern (upgradient) and western limits of the free and dissolved product plumes. And install one additional monitoring well to be used for observation during pumping tests and recovery efforts.

- Conduct hydrologic tests to evaluate aquifer characteristics which may impact the long tern design and operation of a hydrocarbon recovery system.

- Sample select monitoring wells for salinity to assist in determining appropriate cleanup levels for groundwater at the site.

- Prepare an operations and maintenance manual for the groundwater remediation system. Prepare a report summarizing results from the installation of the three additional monitor wells, hydrologic tests, and additional groundwater sampling.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

DRAFT

1.0 INTRODUCTION

This report, prepared by USPCI, was completed at the request of Union Pacific Railroad, (UPRR) on their Oakland, California TOFC (Trailer On Freight Car) Yard. The activities described in this report were completed in accordance with the workplan submitted to UPRR by USPCI on March 2, 1990. The workplan was designed to evaluate the extent and distribution of petroleum hydrocarbon contamination, while providing an assessment of the shallow aquifer characteristics. The investigation concentrated on the locomotive fueling facility located in the northern portion of the site. The collection and analysis of this data is required for the optimal design of a remedial action plan.

The Oakland TOFC Yard is located at 1717 Middle Harbor Road in Oakland California. UPRR operations at this facility consist of loading and unloading over-the-road trailers on flatcars (TOFC) for rail transport. The facility also includes a small re-fueling rack for diesel locomotives. The site is bounded on the south and west by the Oakland Estuary and on the north by the Navy Supply Center (see Figure 1).

The hydrocarbon investigation involved the completion of 17 soil borings, eight of which were completed as shallow monitoring wells. The subsurface investigation was concentrated in the area of the re-fueling racks located adjacent to the Navy Supply Center (See Figure 2). Through the collection and analysis of soil and water samples from the soil borings and monitoring wells, free phase and dissolved hydrocarbon plumes were identified and partially delineated beneath the site.

DRAFT

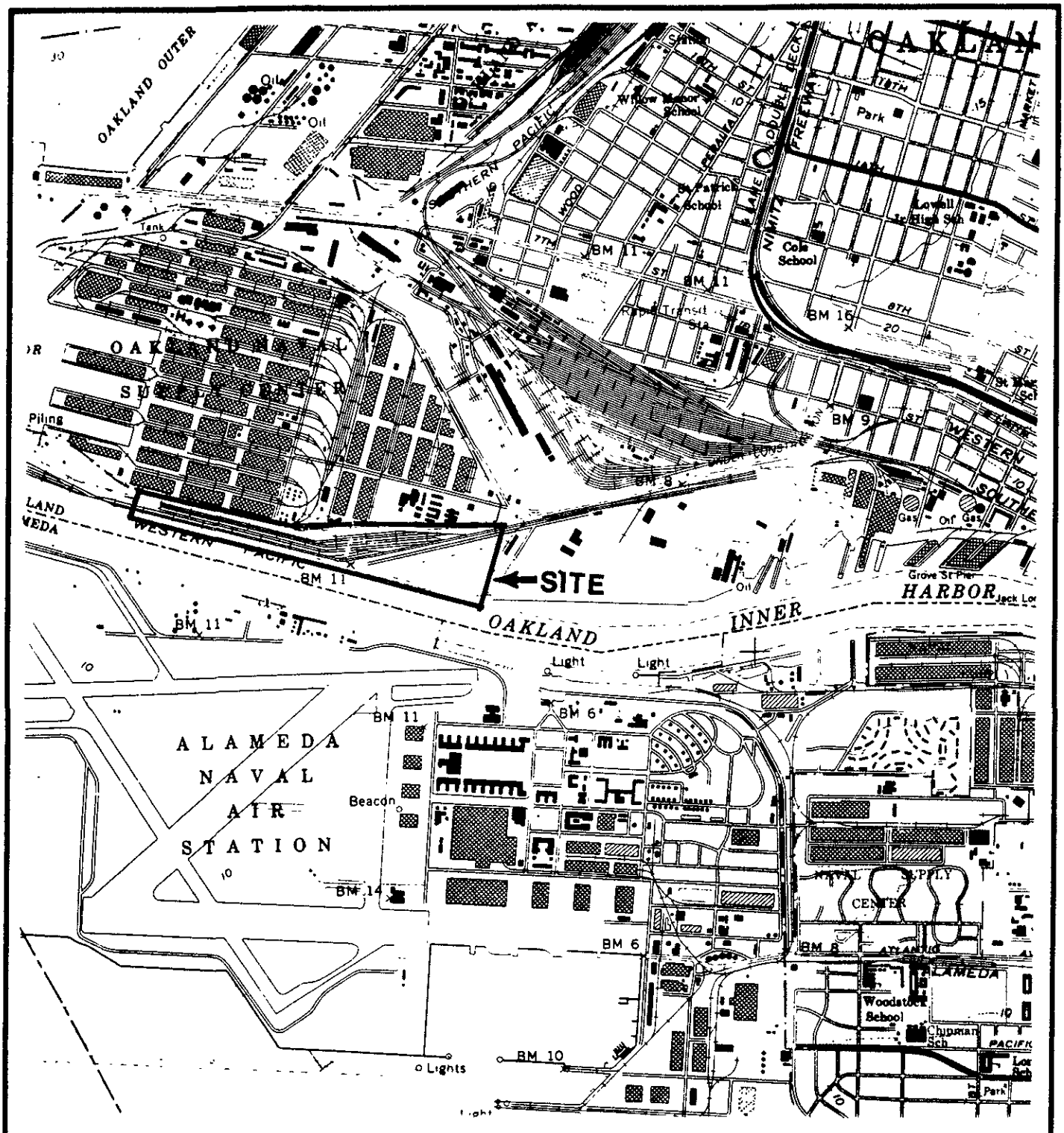

FIGURE 1

USPCI
A Subsidiary of Union Pacific Corporation

OAKLAND WEST, CA

USGS 7 1/2 MINUTE QUAD
1959 PHOTOREVISED 1980

SCALE: 1"=24000' | APPROVED/DATE

2.0 SITE HISTORY

This investigation was requested after two incidents on February 4 and February 7, 1991 at the Oakland Yard. Both incidents were observed by the U. S. Coast Guard as releases of diesel/oil to the Oakland Estuary. The original incident may have been the result of overland flow from the railyard to the estuary. The second incident was caused by storm sewer clean-out operations.

The UPRR took immediate actions to contain and cleanup the releases as well as to prevent additional releases to the Oakland Estuary. Initial observations at the railyard revealed diesel product in two catch basins feeding a storm sewer that empties into the estuary at the point of release. This source along with possible overland flow from the drip pans (spill containment devices in the refueling area) during a storm event of the previous week, appeared to have caused the original release.

The storm sewers were cleaned out and the sewer that was the source of the release was plugged with concrete at the two catch basins and at its out-fall to the estuary. The upstream end of this sewer ends in the refueling area, beneath the refueling rack. The sewer was observed to have holes and perforations allowing the possible influx of diesel from beneath the refueling area. The sewer abandonment completed by UPRR should prevent any future repeat of the diesel release.

3.0 SITE INVESTIGATION

Since the suspected source of the diesel fuel release to the estuary is the locomotive refueling facility, USPCI recommended the following tasks be completed in the area of the re-fueling facility to define the nature and extent of soil and groundwater contamination. Results of the investigation would be used in the design and implementation of a remedial action plan.

- Drilling of 17 soil borings to delineate the extent of hydrocarbon contamination in subsurface soils. This included the screening of soils encountered for organic vapors with an organic vapor monitor (OVM).

- Installation of 8 groundwater monitoring wells in selected borings to define the groundwater environment and evaluate the extent of free and dissolved product contamination.

- Collection of soil and groundwater samples from all borings and wells as appropriate. Analysis of all samples by a certified laboratory for Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Xylene, and Ethyl-benzene (BTXE) employing EPA methods 8015 and 8020.

- Review, interpretation and presentation of data collected in an interim report (presented here).

Field activities completed as part of this investigation were conducted between April 4 and April 8, 1991. Details of the methods used during drilling, installation of monitor wells, and collection of soil and groundwater samples are reviewed in Appendix A. Boring logs and well completion forms are included in Appendix B. Copies of original laboratory reports are included in Appendix C.

4.0 SITE GEOLOGY

The stratigraphy underlying the site consists of surficial fill of variable thickness and composition, overlying a sequence of naturally deposited bay sediments. The fill material generally consists of either asphalt with a sandy sub-grade base (1 to 3.5 ft thick), or railroad ballast with a clastic sub-grade base (2.5 to 4.5 ft thick). In some instances an additional fill layer can be distinguished between the surficial fill layer and the natural sediments. This unit is distinguished by the presence of brick fragments as in boring B-4.

The natural bay sediments underlying the fill appear to be laterally continuous and fairly homogeneous. Layers of different lithology were distinguished on the basis of silt content and degree of sorting (see cross sections Figures 3A, 3B). Lithologies range from silty sand of variable grain size to fairly clean sand of a uniform grain size. The sand units extend from the fill contact, usually 4 to 5 feet BGS, to a depth of 12 feet to greater than 15 feet. The sands represent the uppermost unit of the natural bay sediments, and are completely saturated with groundwater.

A basal silty/clayey unit was encountered beneath the sand in two of the monitoring well borings (OMW-2, and OMW-3). Because of the fine grained nature of this basal unit, it may act to retard vertical migration of groundwater in the vicinity of the railyard.

5.0 SITE HYDROLOGY

Groundwater was typically encountered during drilling at depths ranging from 3 to 7 feet below the ground surface (BGS). Groundwater generally appears to be unconfined, with little difference between the depths at which water was first encountered during drilling and the subsequent static water level recorded in the monitoring well. Groundwater was observed near or below the contact between the poorly sorted sandy bay material and the fill or asphalt sub-grade.

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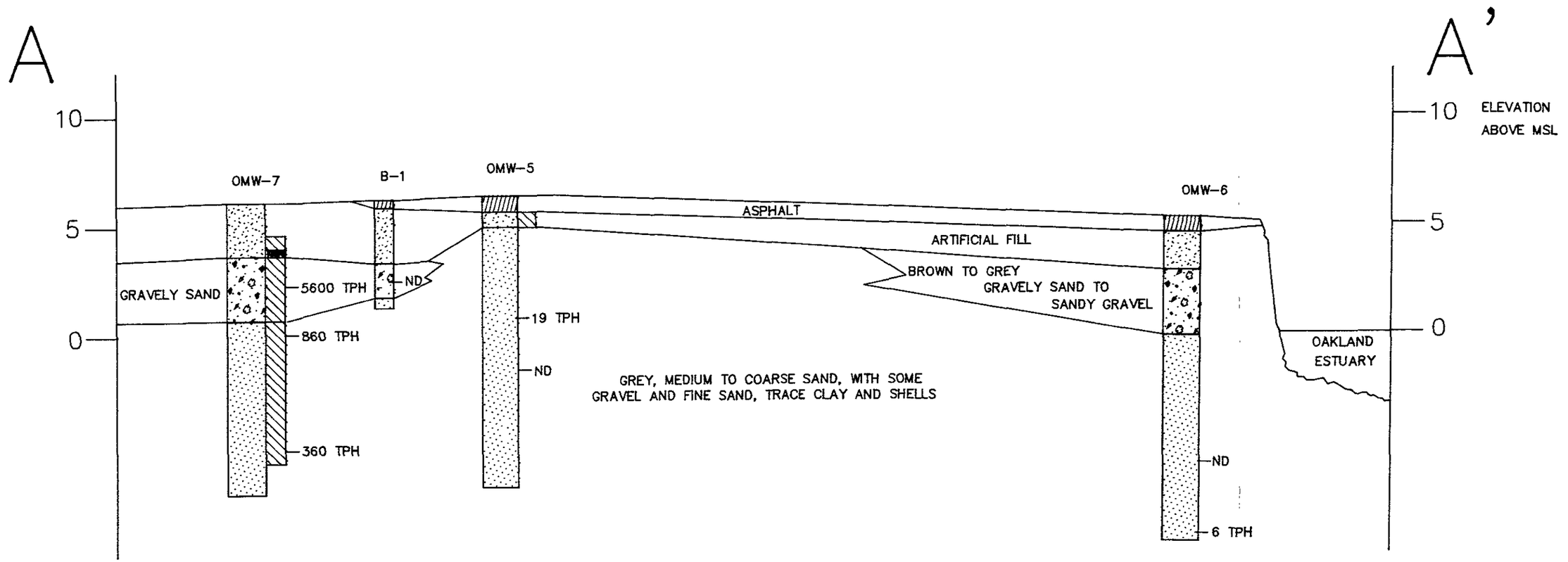

FIGURE 3A
GEOLOGIC CROSS SECTION A-A'

UPRR
OAKLAND TOFC YARD

DIESEL ODOR
FREE PRODUCT

VERTICAL SCALE 1" = 5'
HORIZONTAL SCALE 1" = 100'
TPH IN PPM

DWG NO:	SIGNED	DATE
96199-04		

USPCI
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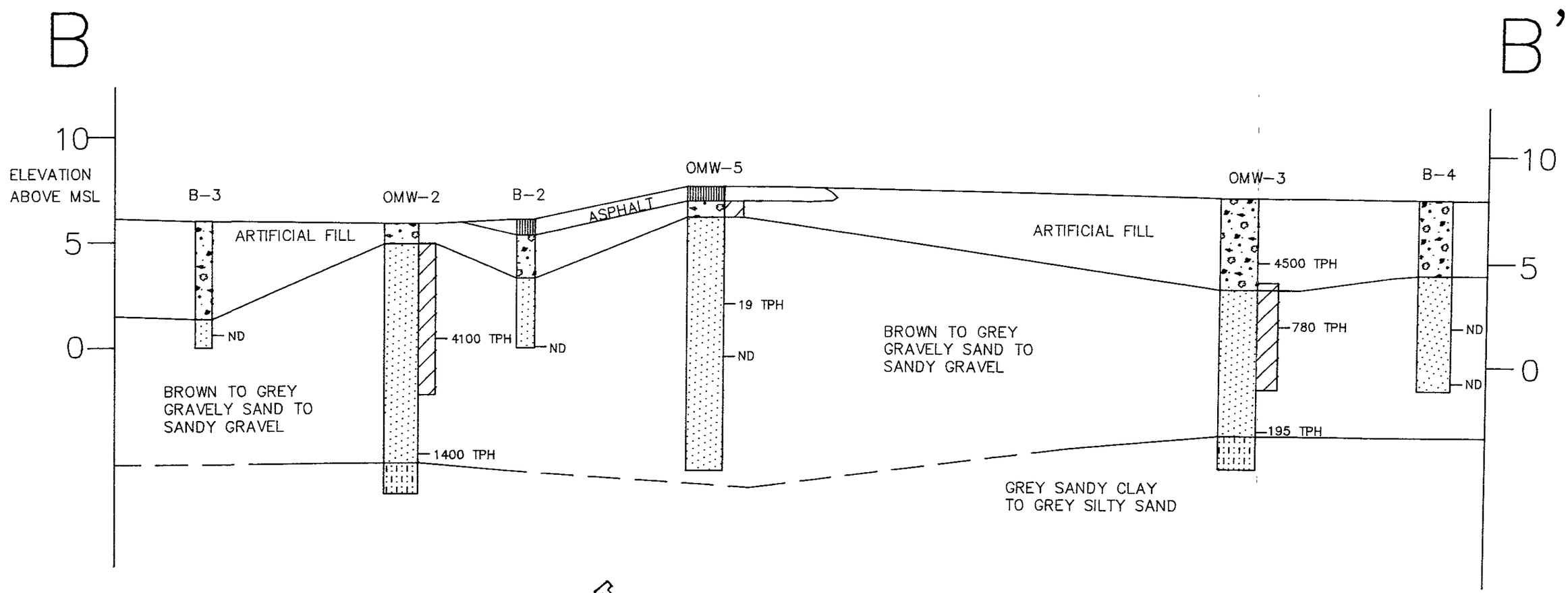

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FIGURE 3B
GEOLOGIC CROSS SECTION B-B'

UPRR
OAKLAND TOFC YARD

DIESEL ODOR
FREE PRODUCT

VERTICAL SCALE 1" = 5'
HORIZONTAL SCALE 1" = 100'
TPH IN PPM

DWG NO:	SIGNED	DATE
96199-05		

Depth to groundwater as measured in the monitoring wells is summarized in Table 1. The local groundwater gradient dips gently to the south towards the Oakland Estuary. A groundwater potentiometric surface map based on water levels recorded on April 9, 1991 is presented in Figure 2.

The UPRR Oakland Railyard is immediately adjacent to the Oakland Estuary, which is located in the northern portion of the San Francisco Bay. The close proximity of the Estuary to the site suggests a direct hydrologic connection may exist between the Estuary and groundwater beneath the site. Tidal influences from the Estuary may influence water levels in monitor wells at the railyard and impact future remediation efforts. Previous studies in the San Francisco Bay Area, however, suggests that tidal influences are generally minimal and are only detectable in monitor wells in very close proximity to the bay (less than 100 to 200 feet). The actual degree of influence is dependent on individual site characteristics. The magnitude of the tidal influence on groundwater at the Oakland TOFC Yard should be investigated to determine its impact on groundwater remediation.

6.0 HYDROCARBON CONTAMINATION

6.1 Soil Results

Soil samples were collected and analyzed from each soil boring and monitoring well installed on site. These samples were analyzed for TPH and BTXE using EPA methods 8015 and 8020. Analyses were completed by Superior Analytical Laboratories of Martinez, California. Laboratory results for soils are summarized in Table 2. Copies of original laboratory reports are included in Appendix C.

Total hydrocarbon concentrations in the soil ranged from a high of 13,000 ppm TPH (B-8) in the vicinity of the re-fueling facility, to non-detect (method detection limit of 0.05 ppm) for soil samples from outlying areas of the site. Low levels of BTXE contamination in soils were also detected in soil samples which had corresponding elevated TPH concentrations. Total

TABLE 1

WELL GAUGING DATA
UNION PACIFIC RAILYARD
OAKLAND, CALIFORNIA
APRIL, 1991

WELL NO.	DATE	WELL HEAD ELEVATION	DEPTH TO PRODUCT	DEPTH TO WATER	WATER LEVEL ELEVATION	PRODUCT THICKNESS	CORRECTED GROUND WATER SURFACE *
OMW-1	4/9/91	8.79		5.54	3.25		3.25
OMW-2	4/9/91	5.88		2.10	3.78		3.78
OMW-3	4/9/91	7.16		3.93	3.23		3.23
OMW-4	4/9/91	7.41	3.79	6.23	1.18	2.44	3.23
OMW-5	4/9/91	7.62		4.64	2.98		2.98
OMW-6	4/9/91	5.78		7.60	-1.82		-1.82
OMW-7	4/9/91	7.03	3.26	7.48	-0.45	4.22	3.09
OMW-8	4/9/91	7.52		4.25	3.27		3.27

* CORRECTED GROUNDWATER SURFACE ASSUMES DENSITY OF 0.84 g/cm3

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TABLE 2

ANALYTICAL RESULTS OF SOIL SAMPLES FROM SOIL BORINGS AT OAKLAND TOFC YARD

April 4-8, 1991 (Collection Date)

BORING #	MATRIX DEPTH	TPH	B	T	X	E
OMW-1	SOIL 5.5'	ND	NA	NA	NA	NA
	SOIL 7'	ND	NA	NA	NA	NA
	SOIL 11'	ND	NA	NA	NA	NA
OMW-2	SOIL 5.5'	4100	.008	.026	.048	.310
	SOIL 11'	1400	NA	NA	NA	NA
OMW-3	SOIL 3'	4500	NA	NA	NA	NA
	SOIL 6'	780	NA	NA	NA	NA
	SOIL 11'	195	NA	NA	NA	NA
OMW-4	SOIL 3'	9600	ND	.310	.860	5.300
	SOIL 6'	ND	NA	NA	NA	NA
	SOIL 11'	ND	NA	NA	NA	NA
OMW-5	SOIL 5.5'	19	NA	NA	NA	NA
	SOIL 8'	ND	NA	NA	NA	NA
OMW-6	SOIL 11'	ND	.0033	.005	ND	ND
	SOIL 14.5'	6+	NA	NA	NA	NA
OMW-7	SOIL 3.5'	5600	.086	.150	.290	1.400
	SOIL 6'	860	.025	.019	.025	.075
	SOIL 11'	360	NA	NA	NA	NA
OMW-8	SOIL 5.5'	ND	ND	.004	.004	.011
	SOIL 11'	ND	NA	NA	NA	NA

Detection Limits TPH (EPA Method 8015) 0.05 mg/l
BTXE (EPA Method 8020) 0.0003 mg/l

ND = Below the Limit of Detection
NA = Not Analized

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TABLE 2 (CONTINUED)
ANALYTICAL RESULTS OF SOIL SAMPLES
FROM SOIL BORINGS AT OAKLAND TOFC YARD
April 4–8, 1991 (Collection Date)

BORING #	MATRIX DEPTH	TPH	B	T	X	E
B–1	SOIL 3.5'	ND	NA	NA	NA	NA
B–2	SOIL 6'	ND	NA	NA	NA	NA
B–3	SOIL 5.5'	ND	NA	NA	NA	NA
B–4	SOIL 6'	ND	NA	NA	NA	NA
	SOIL 9'	ND	NA	NA	NA	NA
B–5	SOIL 4.5'	ND	NA	NA	NA	NA
B–6	SOIL 3.5'	ND	NA	NA	NA	NA
B–7	SOIL 3.5'	8,900	0.095	.390	.530	2.700
B–8	SOIL 4'	13,000	.280	.720	1.400	6.200
B–9	SOIL 5'	ND	NA	NA	NA	NA

Detection Limits: TPH (EPA Method 8015) 0.05 mg/l
BTXE (EPA Method 8020) 0.0003 mg/l

ND = Below the Limit of Detection
NA = Not Analized

BTXE contamination ranged from a high of 8.6 ppm (B-8) to non-detect (method detection limit of 0.0003 ppm) in the majority of samples. The hydrocarbon contamination of soil is concentrated in the immediate vicinity of the re-fueling rack and fuel storage tanks located to the west of the racks (OMW-7, 4, 3, 2 and B-7, 8).

Evidence from field observation and laboratory analysis suggests the dominate hydrocarbon contaminate is diesel fuel. The refueling rack and associated storage tanks are considered the most likely source of the contamination. Contamination of soil extends the entire length of the fueling rack and fuel storage tanks, and to the south of the rack approximately 200 feet (OMW-2, 3, 7). Hydrocarbon impacted soils also underlie the active rails in the vicinity of the fueling facility.

The lithologic units affected by the contamination along the northern edge of the fueling rack area include artificial fill and the natural bay sediments down to a depth of approximately 4.5 feet (OMW-4). This depth roughly corresponds to the depth of groundwater in this area. The natural groundwater gradient to the south has probably served to inhibit northward migration of hydrocarbon. An additional up-gradient well located on adjacent Naval Supply Center property is required to confirm this assumption.

South of the fueling rack, soils contamination has extend to lower lithologies. As seen in soil samples from OMW-2, a TPH concentration of 1,400 ppm was measured in fine to coarse sand at a depth of 11 feet below the ground surface (9 feet below present day water level). The contamination of soil below the present groundwater surface is problematic and may be the result of two different factors.

- o During the previous few years, severe drought conditions existed in the San Francisco Bay area and the groundwater surface beneath the railyard may have been lower. Product may have migrated downward into lower sediments during this period of time.

- o Depression of the groundwater surface as the result of a significant hydrocarbon release, could also result in contamination of normally groundwater saturated sediments.

6.2 Groundwater Results

Groundwater samples were collected and analyzed for TPH and BTXE from the eight wells located on site. The analyses were completed by Superior Analytical Laboratories of Martinez, California, using EPA method 8015 and 8020. Sampling procedures are presented in detail in the field methods section located in Appendix A. Results of groundwater analysis are presented in Table 3, copies of original laboratory reports are included in Appendix C.

Free diesel product was detected on top of groundwater in two monitor wells completed at the site (OMW-4, 2.44 feet and OMW-7, 4.22 feet, Table 1). Both wells are located immediately adjacent to the fueling rack. None of the other monitoring wells contained detectable free product. Figure 4 is a map showing the distribution of free product in the fueling area.

Sufficient data exists to define the extent of free product on top of groundwater to the south (downgradient) and east of the fueling area. Additional information is required to further define the free product plume to the north (upgradient) and to the west of the fueling area. USPCI recommends that three additional monitor wells be completed at the locations shown on Figure 5.

Laboratory results indicate low levels of dissolved contaminates in groundwater from monitoring wells that did not contain free product. The maximum TPH concentration detected in groundwater was 3.2 ppm (OMW-2, method detection limit of 0.05 ppm). Dissolved BTEX contamination was also low, indicative of diesel fuel contamination. Maximum total BTEX was

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TABLE 3

ANALYTICAL RESULTS OF WATER SAMPLES FROM MONITORING WELLS AT OAKLAND TOFC YARD

April 8, 1991 (Collection Date)

WELL #	SAMPLE	TPH	B	T	X	E
		mg/l	----------	----mg/l--	----------	
OMW-1	WATER	0.06	ND	ND	ND	ND
OMW-2	WATER	3.2	ND	ND	.0012	.0067
OMW-3	WATER	1.4	.0004	.0005	.0056	.026
OMW-4	WATER	FREE PRODUCT		WELL NOT SAMPLED		
OMW-5	WATER	ND	ND	ND	ND	ND
OMW-6	WATER	0.08	ND	.0004	ND	.0005
OMW-7	WATER	FREE PRODUCT		WELL NOT SAMPLED		
OMW-8	WATER	0.05	ND	ND	ND	ND

Detection Limits

TPH (EPA Method 8015) 0.05 mg/l
BTXE (EPA Method 8020) .0003 mg/l

0.041 ppm (OMW-3, method detection limit of 0.0003 ppm). Benzene was detected below drinking water standards (0.001 ppm) in only one groundwater sample (OMW-3, 0.0004 ppm).

The distribution of dissolved groundwater contamination is shown in Figure 4. The downgradient extent of groundwater contamination is well defined. Using an action level of 1.0 ppm, the dissolved hydrocarbon plume is confined to the area immediately surrounding the fueling area. In particular the southern (downgradient) and eastern edge of the plume appears to be well defined. Installation of two additional monitor wells discussed previously are recommended to define the northern (upgradient) and western limits of the dissolved hydrocarbon plume.

Measurements of conductivity taken during groundwater sampling indicate potentially brackish water quality. In all but one monitoring well, measured conductivities exceeded the limit of the conductivity meter (1,999 umho/cm). Groundwater salinity will have an impact on defining site remediation goals. Additional groundwater analysis for salinity (Total Dissolved Solids, cations, anions, etc) is warranted.

6.3 Operating Groundwater Recovery System

An operating groundwater recovery system (french drain) exists just west of the fueling facility. The system is designed to depress the groundwater surface and prevent water damage to rail switches and has been in operation for several years. The design and operational characteristics of the recovery system are poorly documented. The trench is approximately 60 feet long with a perforated drainage pipe at approximately 1.5 feet below ground surface.

The recovery system was not designed to recover free product, but does discharge to an oil/water separator. The amount of oil which may have been recovered to date by the system is not known. Because of the shallow nature of the french drain, the system will only recover groundwater (and associated free product) at times when the watertable is unusually high.

7.0 CONCLUSIONS

Data collected and analyzed to date has provided the following insights into site hydrogeology and subsurface hydrocarbon contamination.

- The hydrocarbon contaminant in groundwater and soil is primarily diesel fuel.
- The source of hydrocarbon product is probably the re-fueling facility.
- Groundwater is encountered at an elevation of 0 to 4 feet above mean sea level. The groundwater gradient slopes southward toward the Oakland Estuary.
- Free hydrocarbon product on groundwater is limited to the area immediately surrounding the train re-fueling rack.
- Dissolved hydrocarbon contamination in groundwater is low and is limited to the vicinity of the re-fueling rack and the area immediately downgradient.
- The downgradient boundary of the dissolved contaminate plume (1ppm TPH) is adequately defined and is approximately 600 feet north of the Oakland Estuary
- The release of diesel fuel to the Oakland Estuary appears to have resulted from a leaking storm sewer extending beneath the fueling facility. The release of diesel fuel to the Oakland Estuary was <u>not</u> the result of product migration through subsurface soils to the bay.

8.0 RECOMMENDATIONS

The following activities should be conducted to further define the extent of groundwater contamination and initiate groundwater remediation at the site.

- Complete the final design, permitting, and installation of three recovery wells to depress the groundwater surface and recover free product. The wells should be installed near the center of the free product plume, equipped with total fluids airlift pumps, and discharge to an on-site oil water separator.

- Install two additional monitoring wells to define the northern (upgradient) and western extent of the free product and dissolved contaminate plumes and install one close in (downgradient) observation well to be used in future hydrologic tests and system operations.

- Sample and analyze water from select monitoring wells to determine groundwater salinity and evaluate appropriate cleanup levels for dissolved hydrocarbons in groundwater.

- Complete hydrologic tests to determine aquifer characteristics which will impact the operation and modification of the recovery system.

- Evaluate the influence of tidal fluctuations in the Oakland Estuary on groundwater levels in monitoring wells and proposed remediation activities at the railyard.

The implementation of a groundwater remediation system to recover free product and the collection of additional data should be initiated concurrently. Modification to the recovery system should be made as additional data is provided from the ongoing investigation.

9.0 REMEDIAL ACTION PLAN DRAFT

A remedial action plan is recommended to begin the recovery of free product and impacted groundwater concurrently with the continuation of investigative and evaluation efforts. The recovery system should focus on the heart of the plume area to maximize free product recovery and prevent the migration of free and dissolved product toward the Oakland Estuary. Contemporaneous with installation of the system, additional monitoring wells are recommended to further delineate the western and northern (upgradient) limits of the free and dissolved product plumes. Hydrologic pumping tests should be performed to evaluate aquifer characteristics which impact the long term operation and performance of the recovery system. Additional sampling of monitor wells for groundwater salinity is necessary to determine appropriate cleanup goals for groundwater at the railyard.

The impact of the initial recovery system on the groundwater environment should be evaluated to assure capture and remediation of the entire free and dissolved hydrocarbon plume. It may be necessary after further delineation of the plume area and additional site investigation to modify the recovery system (additional wells, french drains, etc.) to maximize performance.

9.1 Alternative Analysis

Two remedial alternatives to initiate free product recovery at the site were evaluated. Remedial Option 1 consists of three recovery wells located within the refueling area in the heart of the free product plume. Remedial Option 2 consists of a french drain recovery system located on the south side of the fueling area, just downgradient of the heart of the free product plume. Because an oil/water separator exists adjacent to the fueling area, both systems employed total fluids pumps to recover free product and groundwater. The recovered fluids will be discharged to the existing water treatment system consisting of surge tank, oil/water separator, oil storage tank, and discharge piping. It is assumed that the modifications to the existing discharge permit issued by the East Bay Municipal Utility District will be obtained. The advantage and disadvantages of each system are considered in the following discussion.

Remedial Option One
Three Well Recovery System
Spacing between wells: 100 ft.
Depth of wells: 15 ft.

Advantages:

- o Easy and quick to install. Can be installed in the heart of the plume to maximize initial free product recovery.
- o Can be installed with minimum disturbance to ongoing railyard activities.
- o Construction does not result in substantial volume of hydrocarbon contaminated soil requiring off-site disposal or treatment.
- o System can be expanded or modified in the future to enhance performance and accelerate groundwater remediation.

Disadvantages:

- o Because of multiple pumps, the system is operationally more complex than comparable french drain system, resulting in potentially higher operations and maintenance costs.
- o Well spacing must be carefully evaluated to assure free and dissolved product does not migrate downgradient past the recovery system. Rapid installation requires the use of assumed hydraulic conductivities and other aquifer characteristics in design of the recovery system.

Remedial Option Two

French Drain Recovery System

Design criteria: 400 ft. long

Depth: 10 ft.

Advantages:

- o Single pump operation results in potentially reduced operational and maintenance costs.
- o Continuous nature of trench results in positive barrier to free and dissolved product migration. May result in more rapid remediation of contaminated groundwater.

Disadvantages:

- o Can not be installed in the heart of the free product plume without substantial disruption to ongoing railyard operations.
- o Results in substantial volume of hydrocarbon contaminated soil requiring off-site treatment or disposal.
- o Not as flexible as recovery well approach to remediation. Expansion and modification of system more difficult.

The immediate goal of this segment of the remedial action plan is to initiate free product recovery in the heart of the free product plume. The installation of a recovery well system is recommended instead of a french drain because it will accomplish this goal in a timely fashion, while minimizing the impact on railyard operations. The flexibility of a recovery well system also allows modification to the system (additional recovery wells, changes in well spacing, etc.) in the future as data is collected to enhance product and groundwater control.

9.2 System Design

Three recovery wells are proposed for installation at the locations shown on Figure 5. The wells will be approximately 100 feet apart and located within the fueling area in the heart of the free product plume. Each well will be constructed from 6 inch PVC casing to a depth of approximately 15 feet, 10 feet below the present groundwater surface. Factory slotted well screen (0.010 inch slot) will be installed in each well from total depth to approximately 3 feet below ground surface. A washed silica sand pack will be placed between the screen and the borehole annulus. The sand pack will extend to above the top of the screened casing. A 6 inch bentonite pellet seal will be placed above the sand pack and the well completed to the surface with a cement-bentonite slurry. The wells will be completed at the surface with a traffic rated grade level well cover

Each well will be equipped with an air displacement total fluids, pump. Well head controllers will be located within the grade level well cover at the top of each well. Groundwater from each well will be discharged to an on-site oil/water separator located adjacent to the fueling area (Figure 5). The entire system will be pneumatically operated and intrinsically explosion proof. Air for the pumps will be supplied by the existing air system at the railyard.

Water and oil produced by the system will be pumped to a surge tank at the existing railyard water treatment system. Major system components include an auto skimmer and oil/water separator. Recovered product will be stored in an oil storage tank for recycling. Water will be discharged to the East Bay Municipal Utility District sanitary sewer system under a modification of permit # 233-90851. In the event a modification of permit #233-90851 can not be obtained, other options such as an NPDES permit will be pursued. All other applicable permits will be obtained as necessary.

9.3 Continuing Investigation

Supplemental investigation efforts include the installation of additional monitoring wells as shown on Figure 5. These wells, combined with existing monitoring wells, should complete the delineation of the phase separated and dissolved product plumes. The wells will allow an assessment of the effect the recovery system has on the aquifer. Additional recovery wells will be recommended as required. Water quality and use information will be gathered to support evaluation of appropriate clean up targets.

APPENDIX A

FIELD METHODS

FIELD METHODS

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Drilling and Soil Sampling

All borings were advanced under the technical supervision of a USPCI geologist or hydrogeologist. The on-site geologist was present at all times during drilling to: 1) technically supervise the drilling subcontractor; 2) maintain a continuous log of materials penetrated by the borehole; 3) obtain and document soil samples; 4) test soil samples, drill cuttings, and atmospheric conditions with an organic vapor analyzer (OVA); and 5) oversee implementation of USPCI's Health and Safety Plan.

Soil borings were completed using a truck-mounted drilling rig equipped with 8-inch and 10-inch diameter hollow-stem augers. This drilling method was performed without the introduction of drilling fluids and allowed for the collection of relatively undisturbed soil samples through the hollow stem of the auger.

During drilling, soil samples were obtained using a split spoon sampler lowered through the hollow stem of the auger and advanced along with the auger to the desired depth. This method allowed for monitoring of soils penetrated during drilling. After retrieving the sampler, soils were screened in the field for organic vapor emissions using an Organic Vapor Analyzer (OVA). The OVA was also used to monitor organic vapor emissions from drill cuttings during drilling. Organic vapor measurements were recorded on the boring logs.

Soil samples collected for possible chemical analysis were placed in 8-ounce glass sample jars. The sample jars were equipped with teflon lined lids and were supplied by the analytical laboratory. Labels were attached to each sample and will include the following information: 1) boring number; 2) sample number; 3) date and time; 4) collectors name; 5) owner; and 6) location. Appropriately sealed and labeled samples were stored in ice chests cooled with dry or blue ice. Chain of custody records were maintained during the sampling

program and transmitted to the laboratory with the samples. Samples were delivered to the laboratory by direct delivery or overnight courier, whichever is most convenient.

Prior to initiating each boring, the downhole equipment, including auger sections and sampling equipment, was thoroughly steam cleaned. The core barrel sampling equipment was either steam cleaned or carefully washed in a dilute trisodium phosphate (TSP) solution and rinsed in de-ionized water before retrieving each sample.

Monitoring Well Installation and Sampling

Eight of the soil borings were completed as groundwater monitoring wells. The monitoring well locations are displayed on Figure 2.

The monitoring wells were completed to a depth of 13 to 15 feet. Wells were installed through the hollow stem of the auger. All wells were constructed from threaded, 2-inch schedule 40 PVC casing. Factory slotted 0.010 inch well screen was installed from a depth of approximately 3 feet below ground surface to total depth. The upper 3 feet of the monitoring well was completed with blank casing.

The annular space between the well screen and borehole was filled with pre-washed silica sand to a position approximately one foot above the top of the well screen to form a filter pack. A bentonite seal was then placed above the filter pack. The remainder of the borehole was then back-filled to the ground surface with a cement-bentonite slurry. A locking cap and protective cover was installed over the well head and finished slightly above grade to limit ponding of water around the well head.

The wells were developed using the surge and bail technique. Measurements of the Ph and conductivity of the produced water was taken at regular intervals during development, and development proceeded until these parameters stabilize and produced water is relatively free of sediment.

Groundwater Sampling

During sampling of monitor wells for water quality, extreme care was taken to prevent cross contamination between wells or introduction of surface contamination into the well environment. All sampling equipment was decontaminated before use on each well, or should be disposable equipment certified as clean by the supplier.

Prior to sampling the monitoring wells, 3 to 5 well casing volumes of water were purged from each well. This helped assure that the water sample is representative of groundwater in the formation and not stagnant water which has been in contact with the well casing for several months. Wells were bailed using disposable polyethylene bailers. Clean nylon line (not previously used) was employed to lower the bailer down the well. The individual purging the well wore new latex gloves and clean Tyvex coveralls when purging the well. Care was taken to avoid agitating water in the well or allowing the bailer to contact contaminated materials at the surface (asphalt pavement, surface soil etc).

While purging the well, Ph and conductivity readings were taken at least every third bailer full of fluid removed using a calibrated meter. Calibration of Ph and Conductivity meters were undertaken daily prior to sampling. Samples for laboratory analysis were collected within 2 hours of purging the well.

As with purging, a clean pair of disposable latex gloves was worn during the groundwater sampling events. The bailer was attached to clean nylon cord and lowered slowly into the well to acquire the groundwater sample. Agitation of groundwater in the well was avoided. The bailer was retrieved the contents emptied into appropriate sample containers while minimizing agitation of the sample and contact between the sample and the atmosphere. The sample container was sealed immediately and labeled with all pertinent information prior to placement in an ice chest cooled with blue ice. Chain of custody records were completed and accompanied samples to the laboratory.

APPENDIX B

SOIL BORING LOGS
MONITOR WELL COMPLETION FORMS

U.S
POLLUTION
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-1

WELL NO. OMW-1

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:8.79 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 5.0 FT.

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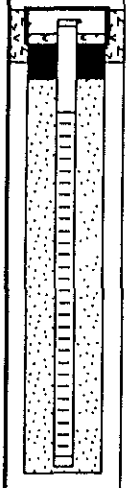
WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE		ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT		AF			
		0.7 TO 4.5 ASPHALT SUB-GRADE FILL, DAMP, SLIGHT ODOR. RED CHERT GRAVEL AT 3.5'		AF	2.5	OMW1-2	TPH=ND
	5	4.5 to 13.5 GREY, MEDIUM TO COARSE SAND, WITH SOME GRAVEL AND FINE SAND, WET, NO ODOR. TRACE CLAY AND SHELLS			1.5	OMW1-5.5	TPH=ND
					0	OMW1-7	TPH=ND
	10			SW			
					0	OMW1-11	
	15	BORING COMPLETED ON APRIL 4, 1991					
		********** MONITOR WELL STATISTICS **********					
	20	TOC EL: 8.79 MSL FT GS EL: 9.01 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 2.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.0 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT					
	25						
	30						
	35						
	40						

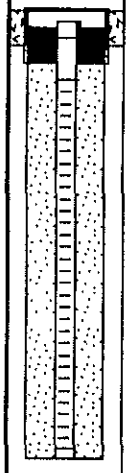
U.S
POLLUTION
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-2

WELL NO. OMW-2

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:5.88 MSL	TD: 13.0 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 3.5 FT.

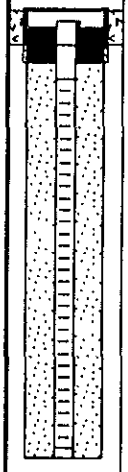
WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 1.0 RR BALLAST, GREY SANDY PEA GRAVEL, NO STAINING	AF			
	5	1.0 TO 11.5 GREY, FINE TO COARSE SAND AND GRAVEL, VERY MOIST, STRONG ODOR (2) TRACE SHELLS. AT 8' AS ABOVE, WET, SLIGHT ODOR, SHEEN.	SP	18	OMW2-5.5	4,100 TPH
	10			7.0	OMW2-11	1,400 TPH
	15	11.5 TO 13 FINE SANDY CLAY AND SILT, DARK GREY, TRACE SHELLS, BAY MUD, SLIGHT H2S ODOR.	ML			
	20	BORING COMPLETED ON APRIL 4, 1991 ********** MONITOR WELL STATISTICS ********** TOC EL: 5.88 MSL FT GS EL: 6.10 MSL FT BLANK CASING: .3 TO 2.0 FT SCREEN CASING: 2.0 TO 12.0 FT BOTTOM CAP: 12.0 TO 12.3 FT SAND PACK: 2.0 TO 12.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 1.5 TO 0.5 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 0.5 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	25					
	30					
	35					
	40					

U.S
POLLUTION
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-3
WELL NO. OMW-3

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/5/91	DATE COMP: 4/5/91	SURF. EL:7.16 MSL	TD: 13.0 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 4.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE		ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 4.5 RR BALLAST, GREY TO BROWN SANDY GRAVEL, STAINED, DRY, BECOMES ODIFEROUS AT 4'. WET WITH STRONG ODOR AT 4.5'.		AF	61	OMW3-3.0	4,500 TPH
	5	4.5 TO 11.5 GREY, FINE TO MEDIUM SAND WITH MINOR GRAVEL AND COARSE SAND. SLIGHT ODOR, SATURATED.		SW	55	OMW3-6	780 TPH
	10	AT 9' AS ABOVE, WET, VERY SLIGHT ODOR.			86	OMW2-11	195 TPH
		11.5 TO 13 FINE GRAINED SILTY SAND, GREY, BAY MUD.		SM			
	15	BORING COMPLETED ON APRIL 5, 1991					
		********** MONITOR WELL STATISTICS **********					
	20	TOC EL: 7.16 MSL FT GS EL: 7.36 MSL FT BLANK CASING: .3 TO 2.0 FT SCREEN CASING: 2.0 TO 12.0 FT BOTTOM CAP: 12.0 TO 12.3 FT SAND PACK: 2.0 TO 12.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 1.5 TO 0.5 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 0.5 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT					
	25						
	30						
	35						
	40						

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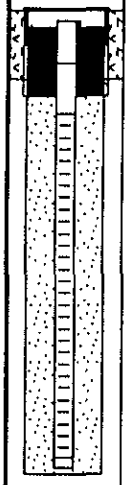
POLLUTION
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-4
WELL NO. OMW-4

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/8/91	DATE COMP: 4/8/91	SURF. EL:7.41 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 4.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT	AF			
		ASPHALT SUB-GRADE, GREY TO BROWN SANDY GRAVEL, MOIST, ODOR.	AF	7	OMW4-3.0	9,600 TPH
	5	AT 1.5' BECOMES GREENISH-GREY, WITH STRONG ODOR.		4	OMW4-6	TPH=ND
		4.0 TO 13.0 GREY, FINE TO MEDIUM SAND WITH MINOR GRAVEL AND COARSE SAND. SLIGHT ODOR, SATURATED, TRACE SHELLS.	SW			
	10	AT 11' AS ABOVE, WET, VERY SLIGHT ODOR.		1	OMW4-11	TPH=ND
	15	BORING COMPLETED ON APRIL 8, 1991				
	20	********** MONITOR WELL STATISTICS ********** TOC EL: 7.41 MSL FT GS EL: 7.57 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 2.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.0 TO 0.5 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 0.5 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	25					
	30					
	35					
	40					

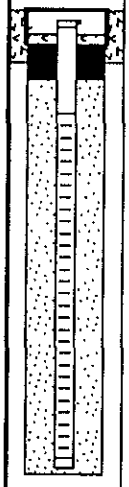
U.S
POLLUTION
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-5

WELL NO. OMW-5

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:7.62 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 7.0 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE		ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT		AF AF			
		0.7 TO 1.5 ASPHALT SUB-GRADE FILL, DAMP, SLIGHT ODOR. GREY SANDY GRAVEL.					
	5	1.5 to 13.0 GREY, MEDIUM TO COARSE SAND, WITH SOME GRAVEL AND FINE SAND, WET AT 7'. TRACE CLAY AND SHELLS, NO ODOR.			0	OMW5-5.5	19 TPH
		SAND BECOMES FINER, NO ODOR.		SW	0	OMW5-8	TPH=ND
	10						
	15	BORING COMPLETED ON APRIL 4, 1991					
		********** MONITOR WELL STATISTICS **********					
	20	TOC EL: 7.62 MSL FT GS EL: 7.87 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 2.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.0 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT					
	25						
	30						
	35						
	40						

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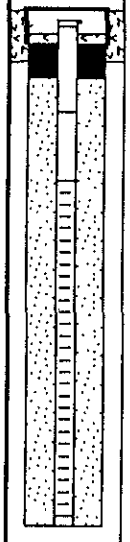
POLLUTION
CONTROL INC.
Remedial Services

LOG

BORING NO. OMW-6
WELL NO. OMW-6

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:5.78 MSL	TD: 15.0 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 7.0 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 0.7 ASPHALT	AF			
			AF			
		0.7 TO 1.5 ASPHALT SUB-GRADE FILL, DAMP, SLIGHT ODOR. BROWN COARSE SANDY GRAVEL, TRACE FINES, NO ODOR, DAMP.		0		
	5		GM	0		
		2.5 to 5.5 BROWN TO GREY GRAVELY SAND TO SANDY GRAVEL. WOOD DEBRIS AT 3', DAMP, NO ODOR.		0		
		5.5 TO 15 GREY TO DARK GREY SILTY FINE GRAINED SAND, MINOR COARSE TO MEDIUM GRAINED SAND, WET, TRACE SHELLS, WOOD DEBRIS, NO ODOR. BAY MUD.		0		
	10		SW	0	OMW6-11	TPH=ND
	15			0	OMW6-145	6 TPH
	20					
	25					
	30					
	35					
	40					

BORING COMPLETED ON APRIL 4, 1991

****
MONITOR WELL STATISTICS
****

TOC EL: 5.78 MSL FT
GS EL: 5.88 MSL FT
BLANK CASING: .3 TO 4.5 FT
SCREEN CASING: 4.5 TO 14.5 FT
BOTTOM CAP: 14.5 TO 14.8 FT
SAND PACK: 3.5 TO 15.0 FT
2.5 SACKS 8X12
BENTONITE SEAL: 3.5 TO 2.0 FT
0.5 BUCK 3/8"
CONCRETE SEAL: 0.0 TO 2.0 FT
1.0 SACKS CMIX
FLUSH MOUNT: 0 TO 1.2 FT

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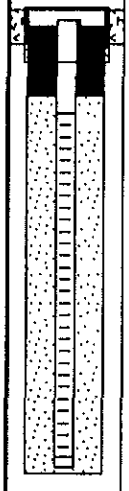
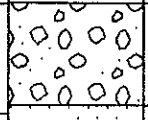
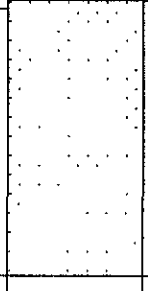
LOG

BORING NO. OMW-7

WELL NO. OMW-7

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:7.03 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 4.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE		ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 2.5 RR BALLAST, GREY LIMESTONE GRAVEL, NO STAINING		AF			
	5	2.5 TO 5.5 GREY TO DARK GREENISH GREY, FINE TO COARSE SAND VERY MOIST, STRONG DIESEL ODOR STARTING AT 3', FREE PRODUCT AT 4.5'TO 5'.		GM	28	OMW7-3.5	5,600 TPH
		5.5 TO 13.5 FINE TO MEDIUM SAND, GREY, MINOR COARSE SAND, TRACE GRAVEL AND SHELLS, DIESEL ODOR STRONG AT 6', BECOMES SLIGHT AT 12', SATURATED.		SW	67	OMW7-6	860 TPH
	10				8.0	OMW2-11	360 TPH
	15	BORING COMPLETED ON APRIL 4, 1991					
		********** MONITOR WELL STATISTICS **********					
	20	TOC EL: 7.03 MSL FT GS EL: 7.20 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 3.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.5 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT					
	25						
	30						
	35						
	40						

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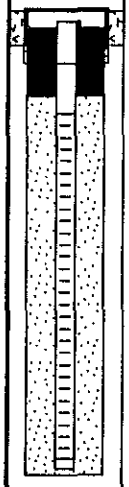
POLLUTION
CONTROL INC.
Remedial Services

LOG

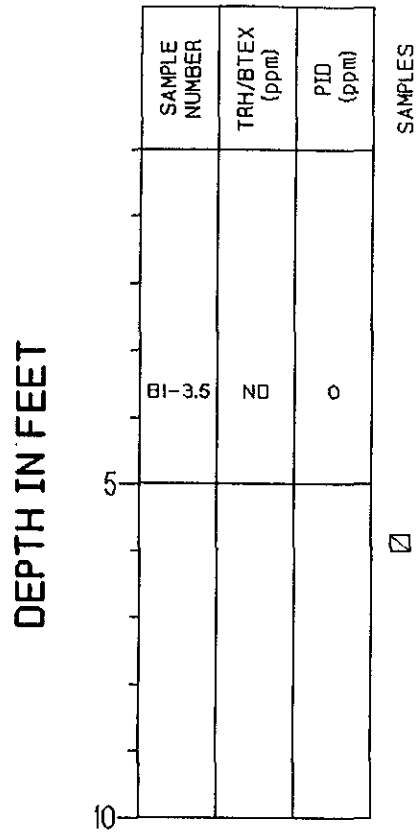
BORING NO. OMW-8
WELL NO. OMW-8

CLIENT: UP RAILROAD			JOB NUMBER: 96199
PROJECT: OAKLAND, UPRR YARD		LOCATION: OAKLAND, CALIFORNIA	
DRILLED BY: PC EXPLORATION	DRILLER: BRAD		METHOD: 4-1/4" HSA
DATE START: 4/4/91	DATE COMP: 4/4/91	SURF. EL:7.52 MSL	TD: 13.5 BGS
LOGGED BY: KV ROSE	APPROVED BY:		DEPTH TO WATER: 5.5 FT.

WELL COMP	DPT	DESCRIPTION	GRAPHIC LOG USCS CODE	ODOR	SAMPLE NUMBER	SAMPLE ANAL
	0	0.0 to 1.5 RR BALLAST, GREY LIMESTONE GRAVEL, NO STAINING	AF			
			GM			
	5	1.5 TO 3.0 BROWN SILTY SAND, SOME GRAVEL, TRACE CLAY. MOIST, STRONG DIESEL ODOR STARTING AT 2.5'. BECOMES STAINED DARKER GREY ALSO AT 2.5'.			OMW8-5.5	TPH=ND
		3.0 TO 13.5 FINE TO MEDIUM SAND, GREY, MINOR COARSE SAND, TRACE GRAVEL AND SHELLS, DIESEL ODOR MODERATE AT 3.5', BECOMES FAINT AT 10', SATURATED.	SW			
	10				OMW8-11	TPH=ND
	15	BORING COMPLETED ON APRIL 4, 1991				
		********** MONITOR WELL STATISTICS **********				
	20	TOC EL: 7.52 MSL FT GS EL: 7.69 MSL FT BLANK CASING: .3 TO 3.0 FT SCREEN CASING: 3.0 TO 13.0 FT BOTTOM CAP: 13.0 TO 13.3 FT SAND PACK: 3.0 TO 13.5 FT 2.5 SACKS 8X12 BENTONITE SEAL: 2.5 TO 1.0 FT 0.5 BUCK 3/8" CONCRETE SEAL: 0.0 TO 1.0 FT 1.0 SACKS CMIX FLUSH MOUNT: 0 TO 1.2 FT				
	25					
	30					
	35					
	40					

BORING B-1

DATE AUGERED: 4-8-91

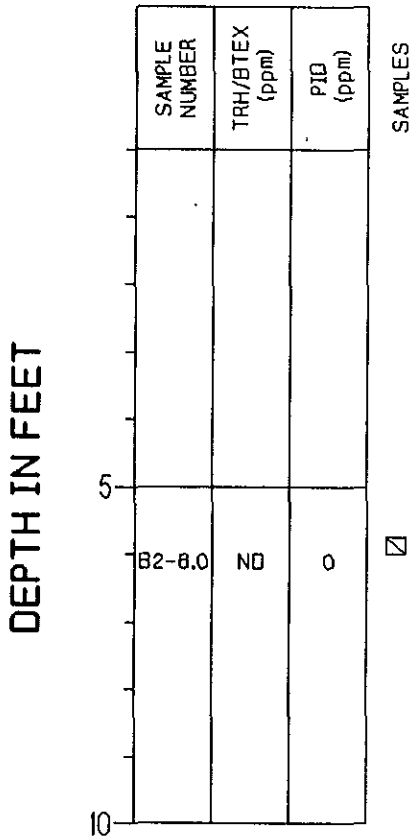


SYMBOLS		DESCRIPTION
	AF	ASPHALT
	AF	Grey brown silty sand, gravel to 3", damp, no odor, moist.
	GM	Brownish grey, silty fine grained sand. minor gravel, no odor, moist.
	SW	Fine to coarse grained sand, grey-brown, wet, no odor.

Hole terminated at 5.0 feet BGS.
Water encountered at 4.5 feet BGS.

BORING B-2

DATE AUGERED: 4-8-91



SYMBOLS		DESCRIPTION
	AF	ASPHALT
	AF	Brown silty sand, gravel decreasing with depth, no odor, moist.
	SP	Brown silty sand, minor gravel, moist, no odor.

Hole terminated at 6.0 feet BGS.
Water encountered at 5.5 feet BGS.

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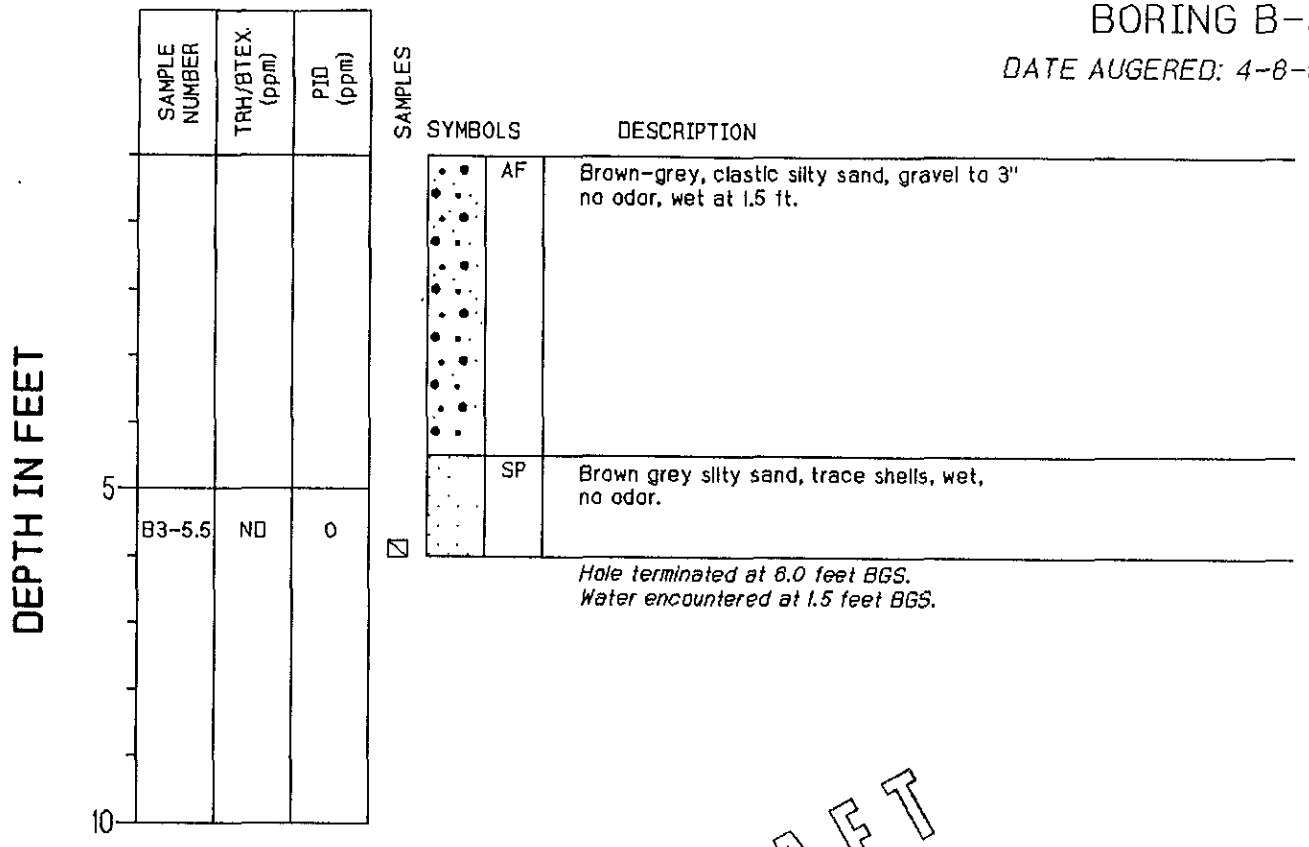
A Subsidiary of Union Pacific Corporation

LOG OF HOLES B-1 AND B-2
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

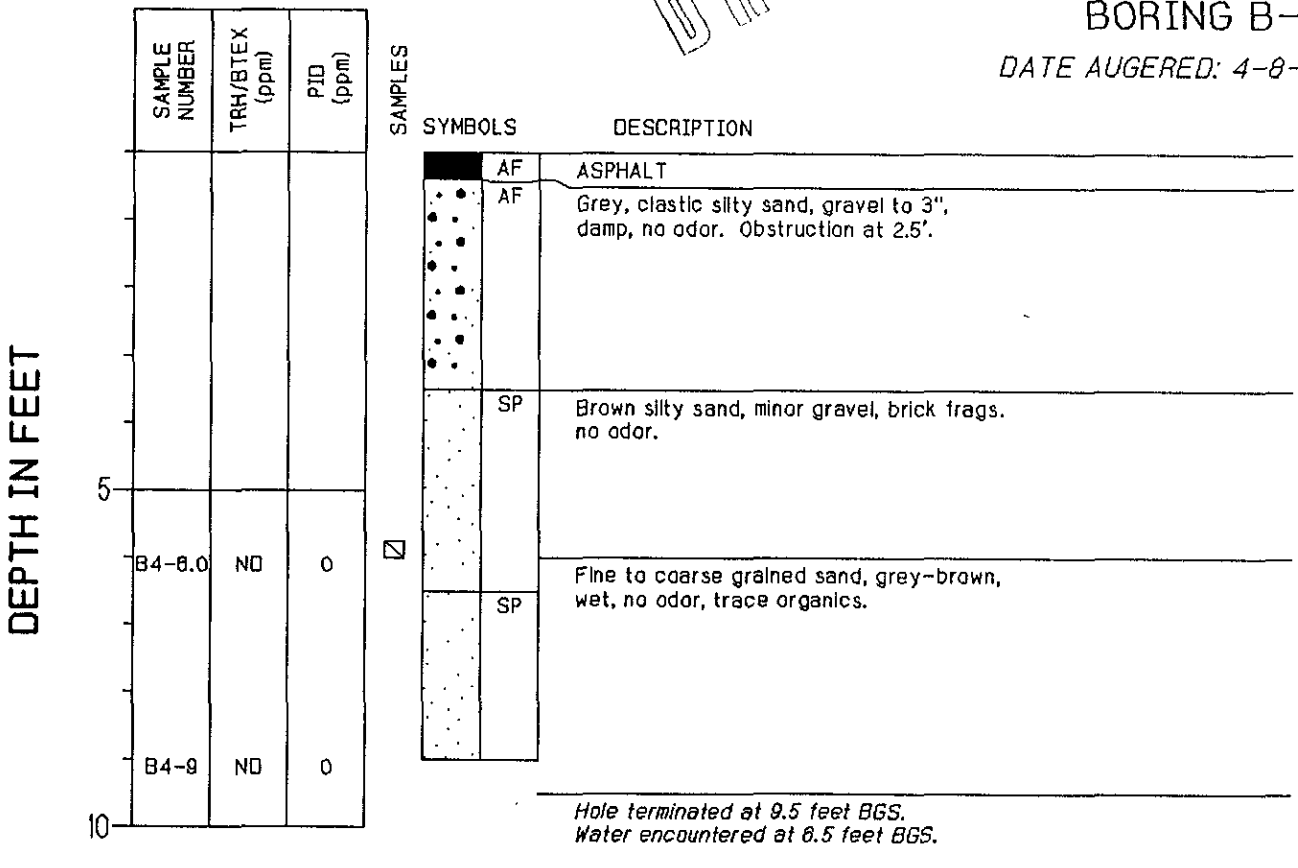
BORING B-3

DATE AUGERED: 4-8-91



BORING B-4

DATE AUGERED: 4-8-91



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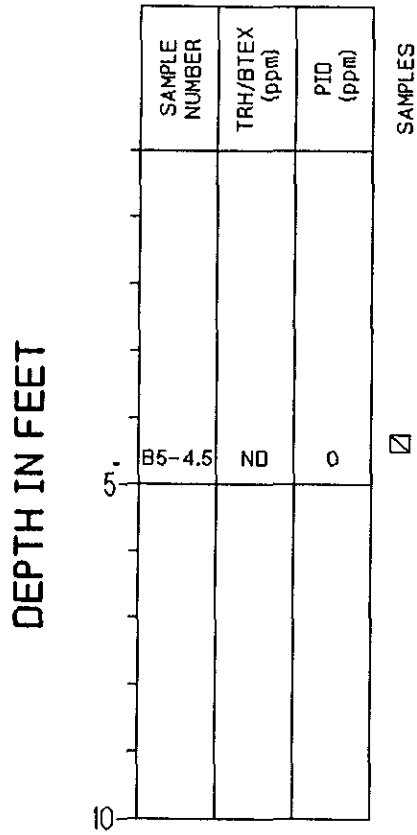
LOG OF HOLES B-3 AND B-4
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

BORING B-5

DATE AUGERED: 4-8-91



SAMPLES

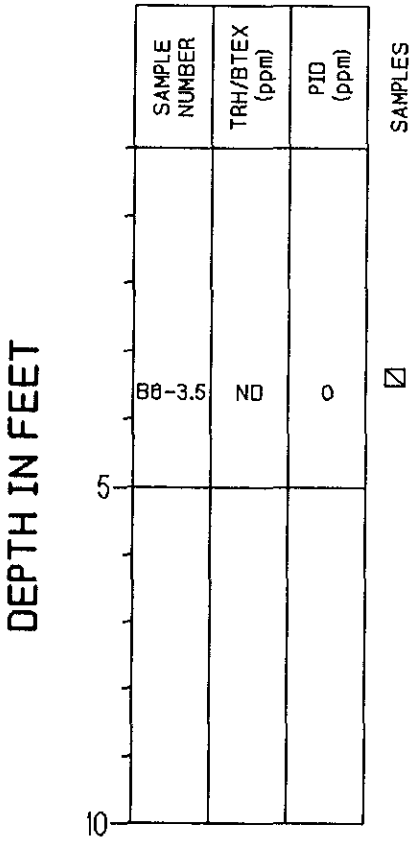
SYMBOLS		DESCRIPTION
	AF	ASPHALT
	AF	ASPHALT SUB-GRADE Brown, silty sand, decreasing gravel with depth, moist, no odor.
	SM	Brown silty fine grained sand, minor gravel, moist, no odor.

Hole terminated at 5.5 feet BGS.
Water encountered at 4.5 feet BGS.

DRAFT

BORING B-6

DATE AUGERED: 4-8-91



SAMPLES

SYMBOLS		DESCRIPTION
	AF	ASPHALT
	AF	ASPHALT SUB-GRADE Grey-brown, silty sand, decreasing gravel with depth, moist, no odor.
	SP	Fine to coarse grained sand, grey-brown, wet, no odor, trace organics.

Hole terminated at 6 feet BGS.
Water encountered at 4.5 feet BGS.

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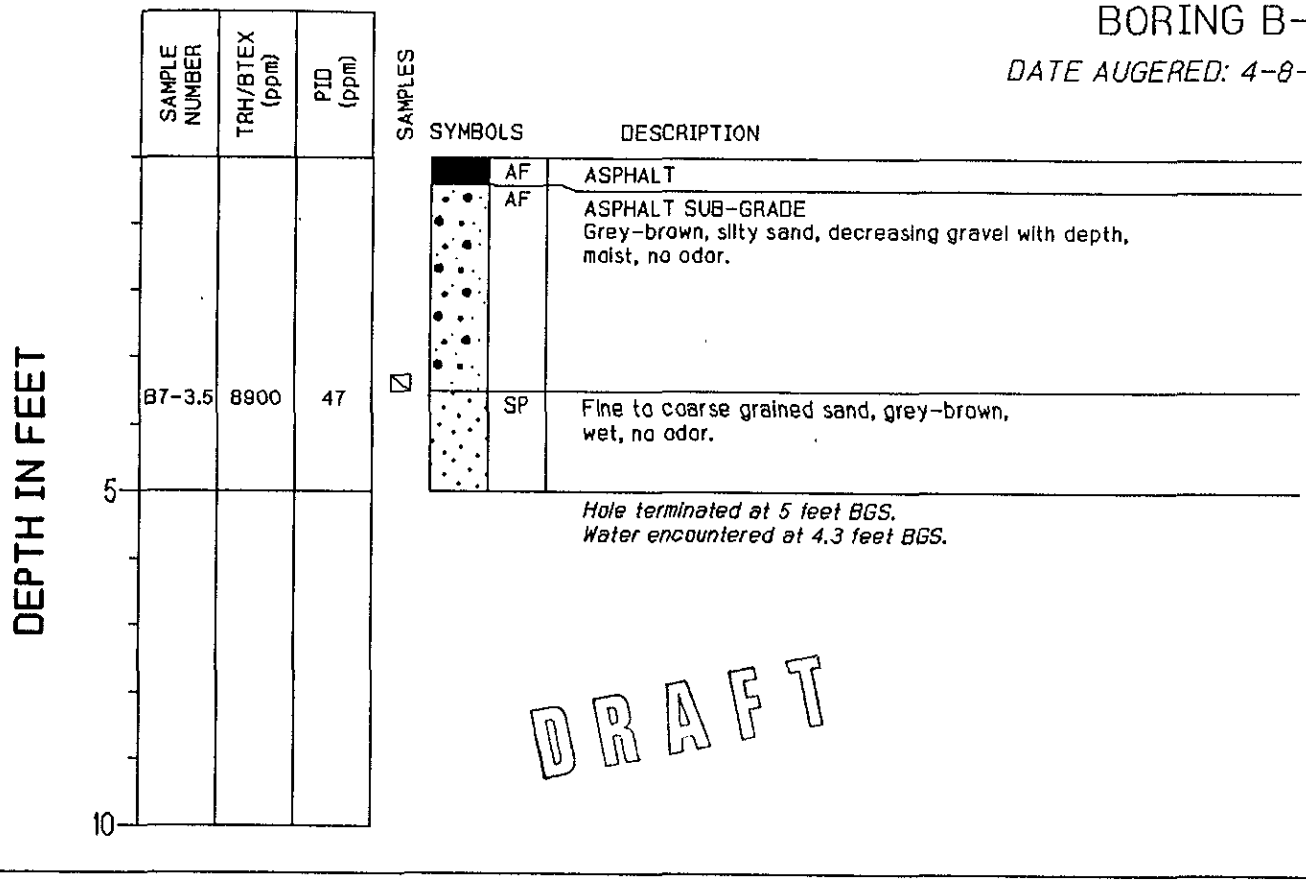
LOG OF HOLES B-5 AND OAK-B6
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

BORING B-7

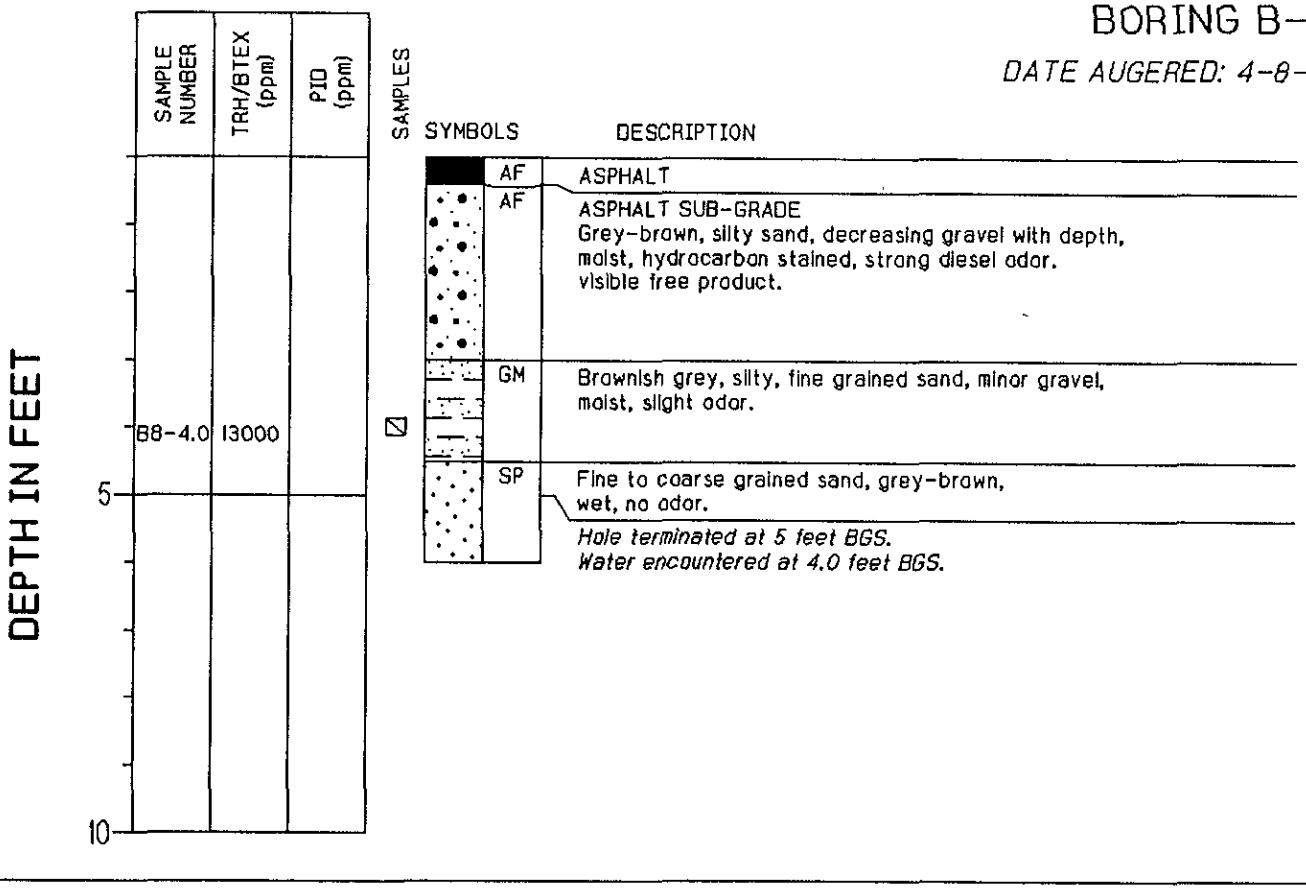
DATE AUGERED: 4-8-91



DRAFT

BORING B-8

DATE AUGERED: 4-8-91



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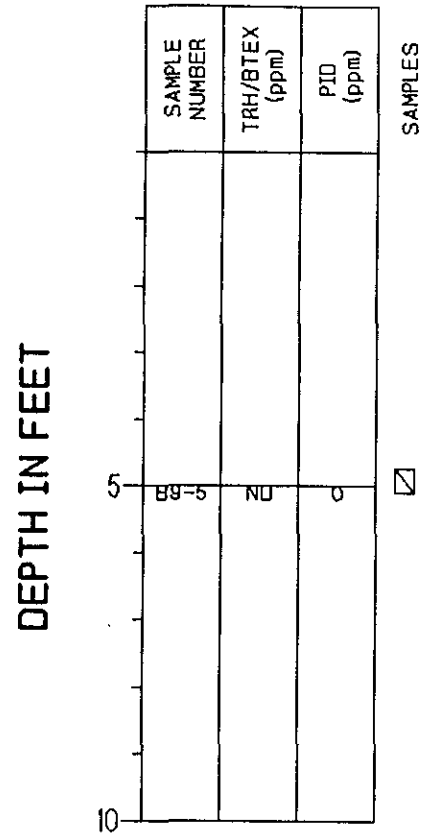
A Subsidiary of Union Pacific Corporation

LOG OF HOLES B-7 AND OAK-B8
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

BORING B-9

DATE AUGERED: 4-8-91



SYMBOLS		DESCRIPTION
	AF	ASPHALT
	AF	ASPHALT SUB-GRADE Brown, silty sand, decreasing gravel with depth, moist, no odor.
	SM	Brown silty fine grained sand, minor gravel, moist, no odor.
	SP	Fine to coarse grained sand, grey-brown, wet, no odor.

Hole terminated at 6 feet BGS.
Water encountered at 5.5 feet BGS.

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LOG OF HOLE B-9
Oakland TOFC
OAKLAND, CALIFORNIA

TEST PIT REPORT

APPENDIX C

LABORATORY REPORTS
CHAIN OF CUSTODY DOCUMENTATION

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82866
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/12/91
DATE REPORTED: 04/19/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/L) Diesel Range
1	omw-6	0.08

mg/L - parts per million (ppm)

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Gasoline = NA
RPD Diesel = 10
MS/MSD Average Recovery = 107%: Duplicate RPD = 12

Richard Srna, Ph.D.
Laboratory Manager

^Z

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 82866
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/12/91
DATE REPORTED: 04/19/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
1	omw-6	ND<0.3	0.4	ND<0.3	0.5

ug/L - parts per billion (ppb)

Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery =89 %: Duplicate RPD = <8

Richard Srna, Ph.D.
Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82823 DATE RECEIVED: 04/08/91
CLIENT: USPCI DATE REPORTED: 04/17/91
CLIENT JOB NO.: 96199

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/Kg) Diesel Range
1	OMW-1,1A,5.5'	ND<10
2	OMW-1,2A,7'	ND<10
3	OMW-1,3A,11'	ND<10
4	OMW-2,1A,5.5'	4100
5	OMW-2,2A,11'	1400
6	OMW-3,1A,3'	4500
7	OMW-3,2A,6'	780
8	OMW-4,1A,3'	9600
9	OMW-4,2A,6'	ND<10
10	OMW-5,1A,5.5'	19
11	OMW-5,2A,8'	ND<10
12	OMW-6,1A,11'	ND<10
13	OMW-6,2A,14.5'	6*
14	OMW-7,1A,3.5'	5600
15	OMW-7,2A,6'	860
16	B-1,1A,3.5'	ND<10
17	B-2,1A,6'	ND<10
18	B-3,1A,5.5'	ND<10
19	B-4,1A,6'	ND<10
20	B-4,2A,9'	ND<10
21	B-5,1A,4.5'	ND<10
22	B-6,1A,3.5'	ND<10
23	B-7,1A,3.5'	8900
24	B-8,1A,4'	13000
25	B-9,1A,5'	ND<10
26	OMW-3,3A,11'	195
27	OMW-4,3A,11'	ND<10
28	OMW-8,1A,5.5'	ND<10
39	OMW-7,3A,11'	360
40	OMW-8,2A,11'	ND<10

Method Detection Limit for Gasoline and Diesel in Soil: 10 mg/Kg
QAQC Summary:
Daily Standard run at 200mg/L: RPD Gasoline = 18
RPD Diesel = 1
MS/MSD Average Recovery = 114%: Duplicate RPD = 5
* not typical diesel pattern present.

Richard Srna, Ph.D.
Laboratory Manager

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SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 82823
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/08/91
DATE REPORTED: 04/17/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/L) Diesel Range
30	OMW-1,2A	0.06*
32	OMW-2,2A	3.2
34	OMW-3,2A	1.4
36	OMW-5,2A	ND<0.05
37	OMW-8,2A	0.05*

mg/L - parts per million (ppm)
not Typical diesel pattern present.

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Diesel = 10
MS/MSD Average Recovery = 111%: Duplicate RPD = 3

Richard Srna, Ph.D.

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OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82823
CLIENT: USPCI
CLIENT JOB NO.: 96199

DATE RECEIVED: 04/08/91
DATE REPORTED: 04/17/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg)(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
4	OMW-2,1A,5.5'	8	26	48	310
8	OMW-4,1A,3'	ND<150	310	860	5300
12	OMW-6,1A,11'	3.3	5	ND<3	ND<3
14	OMW-7,1A,3.5'	86	150	290	1400
15	OMW-7,2A,6'	25	19	25	75
23	B-7,1A,3.5'	95	390	530	2700
24	B-8,1A,4'	280	720	1400	6200
28	OMW-8,1A,5.5'	ND<3	4	4	11
29	OMW-1,1AB *	ND<0.3	ND<0.3	ND<0.3	ND<0.3
31	OMW-2,1AB *	ND<0.3	ND<0.3	1.2	6.7
33	OMW-3,1AB *	0.4	0.5	5.6	26
35	OMW-5,1AB *	ND<0.3	ND<0.3	ND<0.3	ND<0.3
38	OMW-8,1AB *	ND<0.3	ND<0.3	ND<0.3	ND<0.3

* ug/L - parts per billion (ppb)

ug/kg - parts per billion (ppb)

Method Detection Limit in Soil: 3 ug/Kg
Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery = 91%: Duplicate RPD = <2

Richard Srna, Ph.D.

Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

U.S. POLLUTION CONTROL, INC.

5665 Flatiron Parkway
Boulder Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO. 96199

PROJECT NAME: UPRR - Oakland TOFC Yard

SAMPLERS: (Signature)

STAT. NO	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH (8015 mod)	BTEX (8020)					REMARKS
OMW-1	4/4/91	0945			OMW-1, 1A, 5.5'	1	X						
OMW-1	4/4/91	0955			OMW-1, 2A, 7'	1	X						
OMW-1	4/4/91	1000			OMW-1, 3A, 11'	1	X						
OMW-2	4/5/91	0800			OMW-2, 1A, 5.5'	1	X	X					
OMW-2	4/5/91	0810			OMW-2, 2A, 11'	1	X						
OMW-3	4/5/91	1010			OMW-3, 1A, 3'	1	X						Note: OMW-3, 3A, 11' on next COC
OMW-3	4/5/91	1020			OMW-3, 2A, 6'	1	X						
OMW-4	4/8/91	0830			OMW-4, 1A, 3'	1	X	X					Note: OMW-4, 3A, 11' on next COC
OMW-4	4/8/91	0840			OMW-4, 2A, 6'	1	X						
OMW-5	4/4/91	1645			OMW-5, 1A, 5.5	1	X						
OMW-5	4/4/91	1700			OMW-5, 2A, 8'	1	X						
OMW-6	4/5/91	1330			OMW-6, 1A, 11'	1	X	X					
OMW-6	4/5/91	1350			OMW-6, 2A, 14.5'	1	X						
OMW-7	4/4/91	1208			OMW-7, 1A, 3.5	1	X	X					
OMW-7	4/4/91	1215			OMW-7, 2A, 6	1	X	X					

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	4/8/91				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution Original Accompanies Shipment First Copy to Coordinator Field Files, Second Copy to Representative of Inspected Facility

Split Samples.
☐ Accepted ☐ Declined
Signature

U.S. POLLUTION CONTROL, INC.

5665 Flatiron Parkway
Boulder Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
96199	Oakland TOFC

SAMPLERS: *(Signature)*

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH (8015)	BTEX (8020)	REMARKS
B-1	4/8/91	0930			B-1, 1A, 3.5'	1	X		
B-2		1030			B-2, 1A, 6'		X		
B-3		1115			B-3, 1A, 5.5'		X		
B-4		1145			B-4, 1A, 6'		X		
B-4		1200			B-4, 2A, 9'		X		
B-5		1300			B-5, 1A, 4.5		X		
B-6		1330			B-6, 1A, 3.5		X		
B-7		1400			B-7, 1A, 3.5		X	X	
B-8		1420			B-8, 1A, 4'		X	X	
B-9	4/8/91	1500			B-9, 1A, 5'		X		
OMW-3	4/5/91	1030			OMW-3, 3A, 11'	1	X		
OMW-4	4/8/91	0850			OMW-4, 3A, 11'	1	X		
OMW-8	4/4/91	1400			OMW-8, 1A, 5.5'	1	X	X	

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
	4/8/91				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	

Distribution: Original Accompanies Shipment. First Copy to Coordinator Field Files. Second Copy to Representative of Inspected Facility

Split Samples.
☐ Accepted ☐ Declined _____ Signature

U.S. POLLUTION CONTROL, INC.

5665 Flatiron Parkway
Boulder Colorado 80301
(303) 938-5500

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
96199	Oakland TOFC Yard

SAMPLERS: *(Signature)*

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH (8015)	BTEX (8020)	REMARKS
OMW-1	4/7/91	1850			OMW-1, 1AB	2		X	
OMW-1		1855			OMW-1, 2A	1	X		
OMW-2		1930			OMW-2, 1AB	2		X	
OMW-2		1935			OMW-2, 2A	1	X		
OMW-3		1830			OMW-3, 1AB	2		X	
OMW-3		1835			OMW-3, 2A	1	X		
OMW-5		1800			OMW-5, 1AB	2		X	
OMW-5	4/7/91	1805			OMW-5, 2A	1	X		

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
	4/8/91				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	

Distribution: Original Accompanies Shipment, First Copy to Coordinator Field Files, Second Copy to Representative of Inspected Facility

Split Samples: ☐ Accepted ☐ Declined _____ Signature

APPENDIX D

FIGURES 2, 4, AND 5