BP OIL

BP Oil Company
16400 Southcenter Parkway, Suite 301
Tukwila, Washington 98188
(206) 575-4077

February 22, 1993

Alameda County Health Care Services Agency
Attention Mr. Barney Chan
80 Swan Way, Suite 200
Oakland, CA 94621

California Regional Water Quality Control Board
San Francisco Bay Region
Attention Mr. Richard Hiett
2101 Webster Street, Suite 500
Oakland, CA 94612

RE: **BP Oil Site No. 11133**
2220 98th Avenue
Oakland, CA

Gentlemen:

Enclosed please find a report entitled Remedial Action Plan, prepared by Resna on behalf of BP Oil. If you have any comments, questions, or concerns, please advise as soon as possible. If we do not hear from you prior to March 26, 1993, or we will consider this plan approved.

You should note that we have installed product recovery canister in RW-1 on April 2, 1992. We have also bailed any product present in MW-1 when our consultant visited the site to drain the recovery canister, or to perform periodic groundwater monitoring. To date, we have recovered approximately 18 gallons of mixed product and groundwater. We will continue these efforts until the remediation system described in the enclosed Remedial Action PLan has been installed.

Sincerely,

Scott T. Hooton
Environmental Resources Management

attachment

RESNA
Working to Restore Nature

73 Digital Drive, Suite 108
Novato, California 94949-5704
Phone: (415) 382-7400
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REMEDIAL ACTION PLAN
for
BP Oil Facility No. 11133
2220 98th Avenue
Oakland, California

94603

Jan 1993

Report No. 32006-3

Report Prepared For

BP Oil Company
16400 Southcenter Parkway, Suite 301
Tukwila, Washington 98188

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January 20, 1993

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REMEDIAL ACTION PLAN
for
BP Oil Facility No. 11133
2220 98th Avenue
Oakland, California

1.0 INTRODUCTION

At the request of BP Oil Company (BP), RESNA Industries (RESNA) has prepared this Remedial Action Plan (RAP) for BP Oil Facility No. 11133 in Oakland, California. Previous environmental investigations have identified residual gasoline hydrocarbons in soil underlying the existing gasoline-storage tanks, free product on ground water onsite, and dissolved hydrocarbons in ground water onsite and offsite.

The purpose of this RAP is to summarize the results of environmental investigations performed to date, and to identify appropriate technologies that can be applied at this site to remediate the identified hydrocarbons.

2.0 BACKGROUND

The site is an operating BP Oil retail service station located on the southeast corner of the intersection of 98th Avenue and Bancroft Avenue and is shown on the Site Vicinity Map (Plate 1). We understand that BP acquired the service station from Mobil Oil Corporation (Mobil) in 1989. The adjacent properties are a mixture of residential and commercial developments. To the north of the site, across 98th Avenue, is a vacant lot which was

formerly occupied by a service station. Residential homes and an apartment building are southeast of the site. A school is southwest of the site. The site is at an elevation of approximately 40 feet above mean sea level. The locations of the existing underground storage tanks and monitoring wells installed during previous investigations are shown on Plate 2.

3.0 SCOPE OF PREVIOUS INVESTIGATIONS

In June 1987, Kaprealian Engineering, Inc. (Kaprealian) observed removal of three underground gasoline-storage tanks at the site and collected soil samples from the base of the tank cavity (Kaprealian, July 2, 1987). It is our understanding that new underground storage tanks were installed in the same tank pit at the site. Because residual hydrocarbons were detected in soil underlying the former tanks, in May 1988, Mobil retained a consultant to install three ground-water monitoring wells (MW-1, MW-2, and MW-3) at the site.

In January 1990, Alton Geoscience (Alton) of Concord, California, observed drilling of eight soil borings and construction of temporary wells (TW-1 through TW-8) in the borings (Alton Geoscience, August 27, 1990). The locations of these temporary wells are shown on Plate 2. Soil samples were not collected during this investigation. Wells MW-1 and TW-4 contained 0.2 foot of free product. In May and June 1990, Alton observed drilling of five additional soil borings and construction of four ground-water monitoring wells (AW-1 through AW-4) and one recovery well (RW-1). We understand Alton purged approximately 100 gallons of product/water from well RW-1 (Alton, August 27, 1990).

In February 1991, Alton observed drilling of two onsite soil borings (SBA-5 and SBA-6) and two offsite soil borings (SBA-7 and SBA-8). The borings were converted to ground-water monitoring wells (AW-5 through AW-8).

In April 1992, RESNA observed the drilling of three soil borings and construction of vapor-extraction wells VW-1 through VW-3. These wells were constructed to enable RESNA to perform a vapor-extraction test at the site.

In April 1992, RESNA installed a GRS passive floating product removal system in well RW-1. The system collects and contains floating product and is emptied by personnel of RESNA on a monthly basis.

Ground water has been monitored since installation of the wells. The last monitoring event was conducted by Alisto Engineering Group in October 1992 (Alisto, November 18, 1992).

4.0 SITE CONDITIONS

4.1 Regional Geology and Hydrogeology

The site is located along the eastern margin of San Francisco Bay within the East Bay Plain (Hickenbottom and Muir, 1988). The East Bay Plain lies within the Coast Range geomorphic province and is characterized by broad alluvial fans sloping westward into San Francisco Bay. The eastern side of the plain in the Oakland area is marked by the active Hayward Fault, which crops out along the base of the Diablo Range escarpment (Herd, 1978). Branches of the Hayward Fault are present approximately 1,600 to 2,700 feet east of the site (Radbruch, 1969; California Division of Mines and Geology, 1982). The local topography is characterized by a gentle southwestward slope in the immediate area of the site; however, a steep, eroded hilly area approximately 1,600 feet east of the site is associated with traces of the Hayward Fault.

The site is located in a 580-square-mile basin drained by the Guadalupe River and Alameda, Coyote, Redwood, and San Francisquito Creeks. The site is approximately 2 miles east of San Leandro Bay, which is a small portion of San Francisco Bay. The nearest streams to the site are Arroyo Viejo, approximately 1 mile north of the site, and San Leandro Creek, approximately 1-1/2 miles south of the site. Both creeks originate in the East Bay Hills, and drain directly into San Leandro Bay. Water enters these creeks by direct runoff from rural and urban areas, through numerous small tributaries, and through numerous storm sewer outlets originating in the urban areas. Water also enters the much larger San Leandro Creek from overflow from the East Bay Municipal Utility District's Lake Chabot reservoir located in the East Bay Hills north of Castro Valley.

Helley, et al. (1979) mapped the earth materials underlying the area as Holocene to Late Pleistocene alluvial deposits composed of unconsolidated to weakly consolidated, moderately to poorly sorted, irregularly interbedded to well-bedded sand, silt, clay, and minor gravel. Well log records kept by the County of Alameda Public Works Agency (CAPWA) indicate that the maximum thickness of these fluvial deposits is approximately 15 feet. Beneath the surficial fluvial deposits in the site area, older alluvium units are present.

Alameda County uses ground water as part of its domestic water supply. The remainder of the water supply is derived from surface reservoirs and from imported water that is transported from the Mokelumne Aqueduct, the State Water Project, and the Hetch Hetchy Aqueduct (Hickenbottom and Muir, 1988).

The area is located within the Oakland Upland and Alluvial Plain, a ground water subarea of the East Bay Plain. Ground water in the water-bearing units of the Oakland Upland and Alluvial Plain meets recommended primary and secondary standards for drinking water. The most productive water wells in the Oakland Upland and Alluvial Plain are those

completed within the older alluvium units. Lesser amounts of ground water occur in the younger alluvium, fluvial deposits, interfluvial basin deposits, and Bay Mud estaurine deposits. These deposits generally are relatively thin (less than 120 feet thick) and yield only small amounts of ground water to wells.

The surfical deposits are permeable but generally yield only small amounts of ground water to wells. Data from the CAPWA well logs indicate that the older alluvium is approximately 500 to 600 feet thick in the area.

The inferred direction of regional ground water flow in the vicinity of the site is to the southwest, based on regional and local topography and surface drainage patterns. The depth to the unconfined groundwater beneath the site has been measured to be approximately 13 to 27 feet below surface grade.

4.2 Site Geology

The site is underlain predominantly by silty clay and silty sand units overlying a silty clay unit. Cross sections A-A' and B-B' (Plate 3) shows our interpretation of the gelogy underlying the site.

4.3 Site Hydrogeology

Based on data from the initial investigations, Alton (August 21, 1991) concluded that two separate, shallow water-bearing zones underlie the site. Their conclusion was based on the relatively high water levels observed in wells MW-1 through MW-3 (approximately 16 feet below grade) compared to the lower levels observed in the other wells (approximately 26 feet below grade). However, our field observations indicate that wells MW-1 through MW-3

are completed to depths ranging from 28 feet (well MW-1) to 34 feet (well MW-2) below grade; this depth range is similar to that of the other wells. It is our opinion that the shallow ground water underlying the site to the depth explored occurs in one hydraulically connected water-table aquifer, and that the apparently anomalous water levels observed in wells MW-1 through MW-3 are the result of external circumstances unrelated to natural hydrogeologic conditions (e.g. leakage from a water line or sewer along Bancroft Avenue, or perching of ground water in the tank cavity).

Ground-water monitoring data collected in October 1992 indicates that the depths to ground water for wells MW-1 through MW-3 were 15.15, 15.08, and 21.83 feet below grade, respectively. The depths to ground water for the remainder of the wells ranged from 24.64 to 28.59 feet below grade.

4.4 Distribution of Residual Hydrocarbons in Soil

Soil samples collected after removal of the former tanks contained residual gasoline hydrocarbons (total petroleum hydrocarbons as gasoline [TPHg]) at concentrations ranging from 12 to 420 parts per million (ppm) (Alton, August 27, 1990).

Soil samples collected above 16 feet below grade from onsite and offsite borings (AW-1 through AW-4, RW-1, and SBA-5 through SBA-8) drilled in May 1990 and February 1991 did not contain detectable concentrations of gasoline. TPHg concentrations of 1.2 ppm, 1.0 ppm and 33 ppm were detected at 20 feet below grade in boring AW-1, 21 feet below grade in boring AW-4, and 25 feet below grade in boring RW-1, respectively. Detectable concentrations of benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) were detected in soil samples collected from boring AW-3, drilled northeast of the site in

Springfield Road. Analytical results were not available for borings MW-1 through MW-3. It is not known if soil samples were collected from these borings for chemical analysis.

Analyses of soil samples collected during installation of vapor extraction wells VW-1 through VW-3 in April 1992 detected a TPHg concentration of 320 ppm at a depth of 16.5 feet in boring B-11 (well VW-2); concentrations of TPHg were not detected in the other borings. Results of soil laboratory analyses are presented in Tables 1 and 2.

On the basis of the data collected to date, it appears residual hydrocarbons in soil are mainly present near the gasoline tank pit and within the capillary fringe extending southeast from the tank pit.

4.5 Distribution of Free Product and Dissolved Hydrocarbons

Floating gasoline product has been noted in temporary well TW-4, monitoring well MW-1 and recovery well RW-1 located approximately 45 feet southeast of the existing underground gasoline storage tanks. The estimated limits of floating product and residual hydrocarbons (TPHg) in capillary fringe soil are shown on Plate 4. The results of analyses of ground water samples collected from temporary wells are shown in Table 3.

Laboratory analyses of ground-water samples collected from the monitoring wells in July 1992 indicated concentrations of dissolved gasoline hydrocarbons (TPHg and benzene) ranged from below detection limits (wells MW-2, MW-3, AW-2, AW-6, AW-7, and AW-8) to 38,000 ppb (TPHg) and 16,000 ppb benzene (well AW-4). Dissolved hydrocarbons in ground water have been delineated to the west (well MW-2), southwest (well AW-2), south (wells MW-3 and AW-7), southeast (wells AW-8 and AW-6). Because dissolved gasoline hydrocarbon concentrations detected in well AW-3 (located approximately 175 feet northeast

of well AW-5, in Springfield Road) are higher than dissolved gasoline hydrocarbon concentrations in onsite well AW-5, we believe an offsite source is present. Cumulative results of ground-water analyses are shown in Table 4. The estimated limits of dissolved TPHg and benzene in ground water are shown on Plates 5 and 6.

5.0 FEASIBILITY TESTING

5.1 Vapor-Extraction Well Installation

On March 26, 1992, RESNA observed Kvilhaug Drilling Company of Concord, California, drill borings B-9 through B-11 and install vapor-extraction wells VW-1 through VW-3 in these borings (Plate 2). Field procedures for drilling, soil sampling and well construction are included in Appendix A. Soil samples were collected at 5-foot intervals for classification and chemical analysis. A TPHg concentration of 320 ppm was detected in a sample from boring B-11 (VW-2). Concentrations of TPHg were not detected in the other samples collected from these borings. Ground water was encountered at approximately 16 feet below grade in each boring. Copies of the laboratory report and Chain of Custody Records are included in Appendix B.

Each well was screened from approximately 9 and 16.5 feet below grade within primarily silt and sandy clay that comprise the vadose zone within this portion of the site. Logs of Borings are included in Appendix C.

5.2 Vapor-Extraction Test

RESNA performed a vapor-extraction test (VET) on April 8, 1992, using vapor-extraction wells VW-1 through VW-3. The VET was conducted to collect site-specific data and

evaluate the feasibility of vapor extraction as a remediation alternative for vadose soil and to select the most appropriate off-gas treatment alternative, if applicable. The VET equipment consisted of an internal combustion (I.C.) engine, instrumentation for measuring air flow rate, air velocity, air pressure/temperature, and volatile organic compound concentrations; and polyvinyl chloride piping and fittings for the wellhead connections.

The I.C. engine was initially operated for approximately 15 minutes on well VW-2 to collect an influent soil vapor sample. This procedure was then repeated on well VW-3. The I.C. engine was then operated for approximately 3.5 hours on vapor-extraction well VW-1 while the vacuum influence on wells VW-2, VW-3, MW-1, and MW-3 was observed. While well VW-1 was used as the extraction well, flow rates of approximately 22 and 87 cubic feet per minute (cfm) were achieved, and four influent and one effluent vapor samples were collected. The effluent vapor sample was collected to estimate the destruction efficiency of the I.C. engine. The VET monitoring data are recorded in Table 5.

RESNA initiated a Chain of Custody Record that accompanied the vapor samples to a State-certified laboratory. The vapor samples were analyzed at RESNA Environmental Laboratories in Rancho Cordova, California (Hazardous Waste Testing Laboratory Certificate No. E773), for benzene, toluene, ethylbenzene, and total xylene isomers using modified Environmental Protection Agency (EPA) Method 8020 and for TPHg using modified EPA Method 8015. The results of the laboratory analyses are recorded in Table 5. Copies of the Chain-of-Custody Records and laboratory reports are included in Appendix B.

During the VET, the highest observed vacuum was 1.0 inches of water from observation well VW-2 while extraction well VW-1 was undergoing an air flow rate of 87 cfm and a vacuum of 8 inches of water. Wells VW-1 and VW-2 are approximately 21 feet apart. Results of

laboratory analyses of vapor samples collected from wells VW-1, VW-2, and VW-3 indicated that influent TPHg concentrations ranged from 9.0 to 9,500 milligrams per cubic meter. The analytical results of the I.C. engine effluent vapor sample indicates that the I.C. engine has a destruction efficiency of approximately 95 percent.

We evaluated the approximate effective radius of influence at the site utilizing the vacuum and distance measurements obtained during the VET. The effective radius of influence is defined as the radial distance from a vapor-extraction well within which recorded vacuum levels indicate that subsurface air flow rates are sufficient for remediation. In general, minimum vacuum responses of 0.3 to 0.5 inches of water are necessary for effective remediation. Evaluation of the VET data yields the following conclusions:

- At extraction rates between 22 and 87 cfm, vacuum responses were not observed at distances of 35 to 46 feet from the extraction well.
- Vacuum response appears to drop significantly at a distance beyond 21 feet from the extraction well.
- One observation well (VW-2, located 21 feet from extraction well VW-1) exhibited vacuum responses; these responses existed for all flow rates achieved during the 3.5-hour test and ranged from 0.29 to 1.0 inch of water.
- The average vacuum responses in well VW-2 for the flow rates of 22 to 26 and 86 to 87 cfm were 0.44 and 0.93 inches of water, respectively.

RESNA estimates that a wellhead flow rate of 30 cfm and a vacuum of 11 inches of water will result in an effective radius of influence of approximately 20 feet for one vapor-extraction well as shown on Plate 7. This estimated radius of influence applies to the silty clay, silt, and sandy clay within which the vapor-extraction wells were installed. A review of site geology indicates that floating product and capillary fringe residual hydrocarbons exist within a silty sand to fine-grained sand that ranges in depth from approximately 15 to 19 feet below grade to 38 feet below grade. This zone was not subject to vapor-extraction pilot

testing; however, since the soil within this zone is more permeable than the upper zone that was subject to pilot testing, we estimate, based on our experience, that an extraction flow rate of 30 cfm will yield an effective radius of influence of 25 feet within this zone (Plate 7).

5.3 Ground-Water Pumping Test

On April 26, 1991, Alton performed a pumping test at the site to estimate aquifer parameters (Alton Geoscience, August 21, 1991). After approximately 9-1/2 hours of continual pumping (flow rate of 0.75 to 0.9 gallons per minute [gpm]), 12 feet of drawdown were recorded in pumping well RW-1 and 0.1 foot of drawdown was recorded in well AW-1. The value for transmissivity calculated by Alton was 0.1491 feet^2/minute, and the calculated value for storativity was 0.3493.

6.0 REMEDIAL ACTION PLAN

The objectives of the remediation program include removal of residual hydrocarbons from soil, removal of free liquid and dissolved hydrocarbons from ground water underlying the site and adjacent properties, and prevention of further migration of hydrocarbons. To accomplish these objectives, RESNA recommends a remediation system consisting of a vapor-extraction system, a ground-water recovery system, and aboveground equipment for treatment of extracted soil vapor and ground water.

6.1 Vapor-Extraction System

On the basis of the information accumulated during the VET and the soil characteristics at the site, RESNA recommends the installation of six vapor-extraction wells to remove residual hydrocarbons in soil near the tank pit and the capillary fringe of the water-bearing

zone and to remove floating gasoline from the ground-water surface. Approximately 180 cfm of vapor treatment capacity will be required for remediation of this zone. Because the soil stratigraphy beneath the site varies considerably, the wells will require specific screen zone assignments based upon geological conditions at each well site. [redacted] fringe of the deeper water was not subject to vapor-extraction pilot testing, these wells should be installed before designing and permitting the vapor extraction system. A VET may then be performed on these wells to obtain the information and data necessary to design and permit a vapor-treatment unit.

6.2 Ground-Water Recovery System

The vapor-extraction component of the remediation system will remove a significant portion of the free liquid and residual hydrocarbons and will also enhance volatilization of dissolved hydrocarbons from ground water. However, to provide hydraulic control and additional recovery of the dissolved hydrocarbon plume, RESNA recommends installation of a ground-water recovery system. We propose to initially utilize existing ground-water recovery well RW-1 for ground-water removal. After evaluating the capture zone and sustainable pumping rate for RW-1 over time, other wells may be necessary.

The ground-water treatment system will consist of a pneumatic pump to extract ground water at a flow rate of approximately 0.5 gpm. The pump will be set below the ground-water surface to avoid pumping free product into the ground-water treatment system. After filtration and pre-treatment of inorganic compounds (if required), the well flow will be routed to the primary treatment unit for the reduction of gasoline constituents. The design parameters used to evaluate the effectiveness and costs associated with viable groundwater treatment technologies were 1) a combined system extraction flow rate of 1.5 gpm and; 2) a start-up TPHg concentration of 75,000 ppb. The ground-water extraction flow rate was

based on three pumping wells and was selected from the pumping test, and the estimated start-up chemical concentrations were selected from the most recent ground-water monitoring data.

The viable technologies and costs evaluated for ground-water treatment were: 1) air-stripping, 2) liquid-phase activated carbon, 3) ultra-violet treatment, and 4) biological treatment. The results of our analysis indicate that the use of a two-stage aeration tank (commonly referred to as a low-profile air stripper) provides the most cost-effective treatment option. A proposed system process schematic diagram for the ground-water treatment system is shown on Plate 8.

7.0 PROJECT SCHEDULE

The project scope is divided into the following categories to be implemented in the order presented: (1) preliminary design, (2) air quality and sewer discharge permitting, (3) detailed engineering and construction design, (4) equipment procurement, (5) construction permits acquisition, (6) system installation and testing, and (7) on-going operation of the ground-water recovery and vapor-extraction treatment systems. Remediation effectiveness, including an estimate of cumulative product removed and ability of the system to hydraulically contain dissolved hydrocarbons, will be documented in a report approximately 90 days after system startup.

8.0 REFERENCES

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TABLE 1
RESULTS OF ANALYSES OF SOIL SAMPLES FROM TANK EXCAVATION
BP Oil Company Service Station No. 11133
2220 - 98th Avenue
Oakland, California

Sample Number	Sample Depth	TPHg	Benzene	Toluene	Total Xylenes
June 17, 1987					
A1	13.5	420	15	42	30
A2	13.5	16	2.3	2.2	0.95
B1	13.5	400	23	41	22
B2	14.0	150	4.6	11	12
C1	13.5	12	0.74	0.46	0.65

Results in parts per million (ppm)
< = less than detection limits
TPHg = Total petroleum hydrocarbons as gasoline

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TABLE 2
RESULTS OF ANALYSES OF SOIL SAMPLES FROM BORINGS
BP Oil Company Service Station No. 11133
2220 - 98th Avenue, Oakland, California
(page 1 of 2)

Boring Number	Sample Depth	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
June 1990						
AW-1	5.0	ND	ND	ND	ND	ND
AW-1	10.0	ND	0.011	ND	ND	ND
AW-1	15.0	ND	0.007	ND	ND	ND
AW-1	20.0	1.2	0.470	ND	ND	ND
AW-1	25.0	ND	0.013	ND	ND	ND
AW-1	30.0	ND	ND	ND	ND	ND
AW-2	21.0	ND	ND	ND	ND	ND
AW-2	26.0	ND	ND	ND	ND	ND
AW-3	21.0	ND	0.074	0.027	0.010	0.049
AW-3	26.0	ND	0.083	0.010	0.004	0.018
AW-4	11.0	ND	ND	ND	ND	ND
AW-4	16.0	ND	0.170	0.010	0.024	0.045
AW-4	21.0	1.0	0.150	0.013	0.040	0.090
RW-1	5.0	ND	ND	ND	ND	ND
RW-1	10.0	ND	0.006	ND	ND	ND
RW-1	15.0	ND	0.031	ND	ND	ND
RW-1	20.0	ND	0.230	0.088	0.010	0.040
RW-1	25.0	33.0	1.000	0.710	ND	2.300
April 1991						
SBA-5	10.5-11.0	<1	0.016	<0.003	<0.003	<0.003
(AW-5)	20.5-21.0	<1	0.020	<0.003	0.007	0.008
	25.5-26.0	<1	0.0077	<0.003	0.003	0.011
SBA-6	10.5-11.0	<1	0.091	0.022	0.008	0.040
(AW-6)	20.5-21.0	<1	<0.003	<0.003	<0.003	<0.003
	25.5-26.0	<1	0.005	0.010	<0.003	0.0066

Results in parts per million (ppm)
< = less than detection limits
TPHg = Total petroleum hydrocarbons as gasoline

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TABLE 2
RESULTS OF ANALYSES OF SOIL SAMPLES FROM BORINGS
BP Oil Company Service Station No. 11133
2220 - 98th Avenue, Oakland, California
(page 2 of 2)

Boring Number	Sample Depth	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
April 1991						
SBA-7	10.5-11.0	<1	<0.003	<0.003	<0.003	<0.003
(AW-7)	20.5-21.0	<1	<0.003	<0.003	<0.003	<0.003
	25.5-26.0	<1	<0.003	<0.003	<0.003	<0.003
SBA-8	10.5-11.0	<1	<0.003	<0.003	<0.003	<0.003
(AW-8)	20.5-21.0	<1	<0.003	<0.003	<0.003	<0.003
March 1992						
S-B9-16.0	9	<1	0.008	0.011	0.018	0.0064
S-B10-6.5	10	<1	<0.005	<0.005	<0.005	<0.005
S-B10-11.5	10	<1	<0.005	<0.005	<0.005	<0.005
S-B10-16.0	10	<1	<0.005	<0.005	<0.005	<0.005
S-B11-16.5	11	320	0.074	0.25	3.2	11

Results in parts per million (ppm)
< = less than detection limits
TPHg = Total petroleum hydrocarbons as gasoline

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TABLE 3
RESULTS OF ANALYSES FOR
GROUND WATER SAMPLES FROM TEMPORARY WELLS
BP Oil Company Station No. 11133
2220 - 98th Avenue
Oakland, California
(January 1990)

Well ID	TPH (ppm)	Benzene (ppb)	Toluene (ppb)	Ethyl-benzene (ppb)	Total Xylenes (ppb)
TW-1	77	6,600	5,500	2,900	1,500
TW-2	ND	1.4	1.4	0.6	5.0
TW-3	72	0.80	2.3	1.4	11
TW-4	FREE PRODUCT - N0 SAMPLE ANALYSIS				
TW-5	66	19,000	15,000	1,800	8,600
TW-6	170	32,000	41,000	4,500	24,000
TW-7	470	11,000	29,000	9,700	48,000
TW-8	720	4,200	38,000	12,000	71,000

ppm = parts per million
ppb = parts per billion

TABLE 4
SUMMARY OF RESULTS OF GROUND-WATER SAMPLING
BP Oil Company Station No. 11133
2220 - 98th Avenue
Oakland, California
(Page 1 of 2)

Well ID	Date of Sampling	Casing Elevation(a)	Depth to Water	Product Thickness	Ground-water Elevation(b)	THPg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
MW-1	04/05/91	34.46	-----	----	----	----	----	----	----	----
MW-1	04/01/92	34.46	11.25	0.01	23.22	FP	FP	FP	FP	FP
MW-1	07/06/92	34.46	13.61	0.02	20.87	FP	FP	FP	FP	FP
MW-2	04/05/91	35.50	18.62	0.00	18.88	<50	0.6	0.9	<0.3	<0.3
MW-2(c)	04/01/92	35.50	11.25	0.00	24.25	<50	<0.5	<0.5	<0.5	<0.5
MW-2	07/06/92	35.50	12.72	0.00	22.78	<50	<0.5	<0.5	<0.5	<0.5
MW-3	04/05/91	36.53	17.84	0.00	18.69	<50	<0.3	<0.3	<0.3	<0.3
MW-3(c)	04/01/92	36.53	15.64	0.00	20.89	<50	1.4	<0.5	<0.5	<0.5
MW-3	07/06/92	36.53	19.03	0.00	17.50	<50	<0.5	<0.5	<0.5	<0.5
AW-1	04/05/91	38.11	25.44	0.00	12.67	4100	1500	69	100	83
AW-1(c)	04/01/92	38.11	23.22	0.00	14.89	11000	1800	210	210	490
AW-1	07/06/92	38.11	24.89	0.00	13.22	6500	4000	40	290	530
AW-2	04/05/91	36.83	22.36	0.00	14.47	<50	<0.3	<0.3	<0.3	<0.3
AW-2(c)	04/01/92	36.83	20.81	0.00	16.02	130	25	2.3	0.7	2.1
AW-2	07/06/92	36.83	23.57	0.00	13.26	<50	<0.5	<0.5	<0.5	<0.5
AW-3	04/05/91	39.13	23.90	0.00	15.23	5200	980	450	95	310
AW-3	04/01/92	39.13	22.50	0.00	16.63	4700	890	47	43	110
AW-3	07/06/92	39.13	23.26	0.00	15.87	3900	3100	30	80	99
AW-4	04/05/91	39.08	25.12	0.00	13.96	110000	40000	13000	2000	5500
AW-4	04/01/92	39.08	23.56	0.00	15.52	230000	57000	31000	2900	7600
AW-4(d)	04/01/92	39.08	23.56	0.00	15.52	210000	55000	23000	2900	7000
AW-4	07/06/92	39.08	25.87	0.00	13.21	38000	16000	5400	2000	6100
AW-5	04/05/91	38.51	25.48	0.00	13.03	420	31	75	20	68
AW-5(c)	04/01/92	38.51	23.95	0.00	14.56	4000	270	63	190	290
AW-5	07/06/92	38.51	26.48	0.00	12.03	1400	160	<25	250	58
AW-6	04/05/91	37.08	22.48	0.00	14.60	1100	80	19	1.4	230
AW-6(c)	04/01/92	37.08	22.50	0.00	14.58	<50	<0.5	<0.5	<0.5	<0.5
AW-6	07/06/92	37.08	22.74	0.00	14.34	<50	<0.5	<0.5	<0.5	<0.5

See notes on page 2 of 2.

TABLE 4
SUMMARY OF RESULTS OF GROUND-WATER SAMPLING
BP Oil Company Station No. 11133
2220 - 98th Avenue
Oakland, California
(Page 2 of 2)

Well ID	Date of Sampling	Casing Elevation(a)	Depth to Water	Product Thickness	Ground-water Elevation(b)	THPg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
AW-7	04/05/91	37.60	23.38	0.00	14.22	<50	0.4	0.7	<0.3	<0.3
AW-7(c)	04/01/92	37.60	21.92	0.00	15.68	<50	<0.5	3.2	1.0	5.4
AW-7	07/06/92	37.60	24.50	0.00	13.10	<50	<0.5	<0.5	<0.5	<0.5
AW-8	04/05/91	40.86	26.68	0.00	14.18	80	1.9	2.2	0.5	1.3
AW-8	04/01/92	40.86	25.11	0.00	15.75	73	<0.5	0.7	<0.5	0.6
AW-8	07/06/92	40.86	26.43	0.00	14.43	<50	<0.5	<0.5	<0.5	<0.5
RW-1	04/05/91	37.73	----	0.00	----	----	----	----	----	----
RW-1	04/01/92	37.73	22.81	0.30	15.14	FP	FP	FP	FP	FP
RW-1	07/06/92	37.73	26.92	0.41	11.12	FP	FP	FP	FP	FP

ABBREVIATIONS:

FP = Not sampled due to the presence of free product
---- = Not analyzed/not available

NOTES:

< = Less than the dectection limits
Results in parts per billion (ppb)
(a) = Top of casing elevations were surveyed to the nearest 0.01 foot above Mean Sea Level
(b) = Ground-water elevations were adjusted assuming a specific gravity of 0.75 for the free product
(c) = Ground water was monitored on April 1, 1992 and sampled on April 2, 1992
(d) = Duplicate sample

TABLE 5
Vapor-Extraction Test Monitoring Data
BP Facility No. 11133, 2220 98th Avenue
Oakland, California
(April 8, 1992)

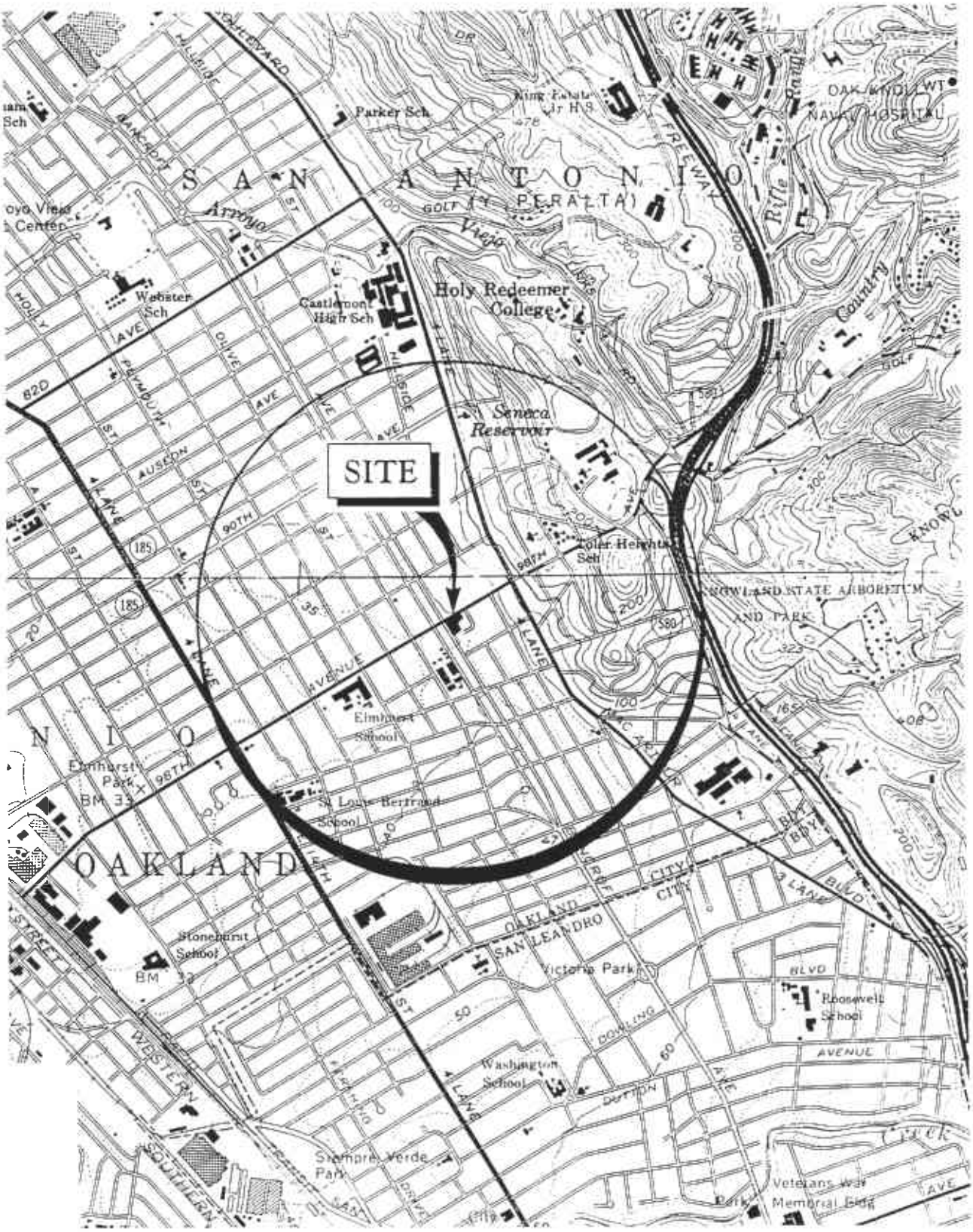
Air Stream Conditions						Vapor Sample Collection and Analysis					
Time	Vapor-Extraction Well	Air Velocity (fpm)	Air Flowrate (cfm)	Vacuum (in H2O)	OVA Conc. (ppm)	Vapor Sample No.	Benzene (mg/m^3)	Toluene (mg/m^3)	Ethyl-Benzene (mg/m^3)	Total Xylenes (mg/m^3)	TPHg (mg/m^3)
12:15	VW-2	1,900	70	>50	NR	A-0408-VW2-INF	250	5.5	20	49	9,500
13:10	VW-3	1,850	46	>50	NR	A-0408-VW3-INF	1.0	2.0	1.7	6.1	9.0

Air Stream Conditions for Vapor-Extraction Well VW-1						Observation Well Vacuum (in H_2O)				Vapor Sample Collection and Analysis (mg/m^3)					
Time	Air Velocity (fpm)	Air Flowrate (cfm)	OVA Conc. (ppm)	Vacuum (in H2O)	Temp. (F)	VW-2	VW-3	MW-1	MW-3	Vapor Sample No.	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	TPHg
13:45	1,200	26	NR	10	55	.54	0	0	0	NA	NA	NA	NA	NA	NA
14:15	1,100	24	148	10	55	.56	0	0	0	A-0408-VW1-INF1	120	8.3	24	21	5,100
14:45	1,000	22	NR	11	55	.36	0	0	0	NA	NA	NA	NA	NA	NA
15:15	1,000	22	NR	11	55	.29	0	0	0	A-0408-VW1-EFF	1.5	1.4	1.4	5.8	16
15:45	3,950	86	NR	8	55	.76	0	0	0	A-0408-VW1-INF2	0.7	0.6	1.1	3.0	15
16:15	4,000	87	157	8	55	1.0	0	0	0	NA	NA	NA	NA	NA	NA
16:45	4,000	87	NR	8	55	1.0	0	0	0	A-0408-VW1-INF3	240	12	9.5	13	6,900
17:15	4,000	87	145	8	55	0.8	0	0	0	A-0408-VW1-INF4	2.0	0.3	1.1	2.4	53
Distance from Vapor-Extraction Well VW-1 (feet):						21	35	46	46						

Notes:
fpm = feet per minute
cfm = cubic feet per minute
ppm = parts per million by volume
in H2O = inches of water column
> = greater than capacity of measuring device

NR = Not Recorded
NA = Not Analyzed
TPHg = Total Petroleum Hydrocarbons reported as gasoline
mg/m^3 = milligrams per cubic meter

Sample designation: A-0408-VW1-INF/EFF
A = Air sample
0408 = Sample Date
VW1 = extraction well no.
INF = influent air sample
EFF = effluent air sample



Source: USGS Topographic Map, 7 5 minute series, San Leandro, Calif and Oakland, Calif quadrangles

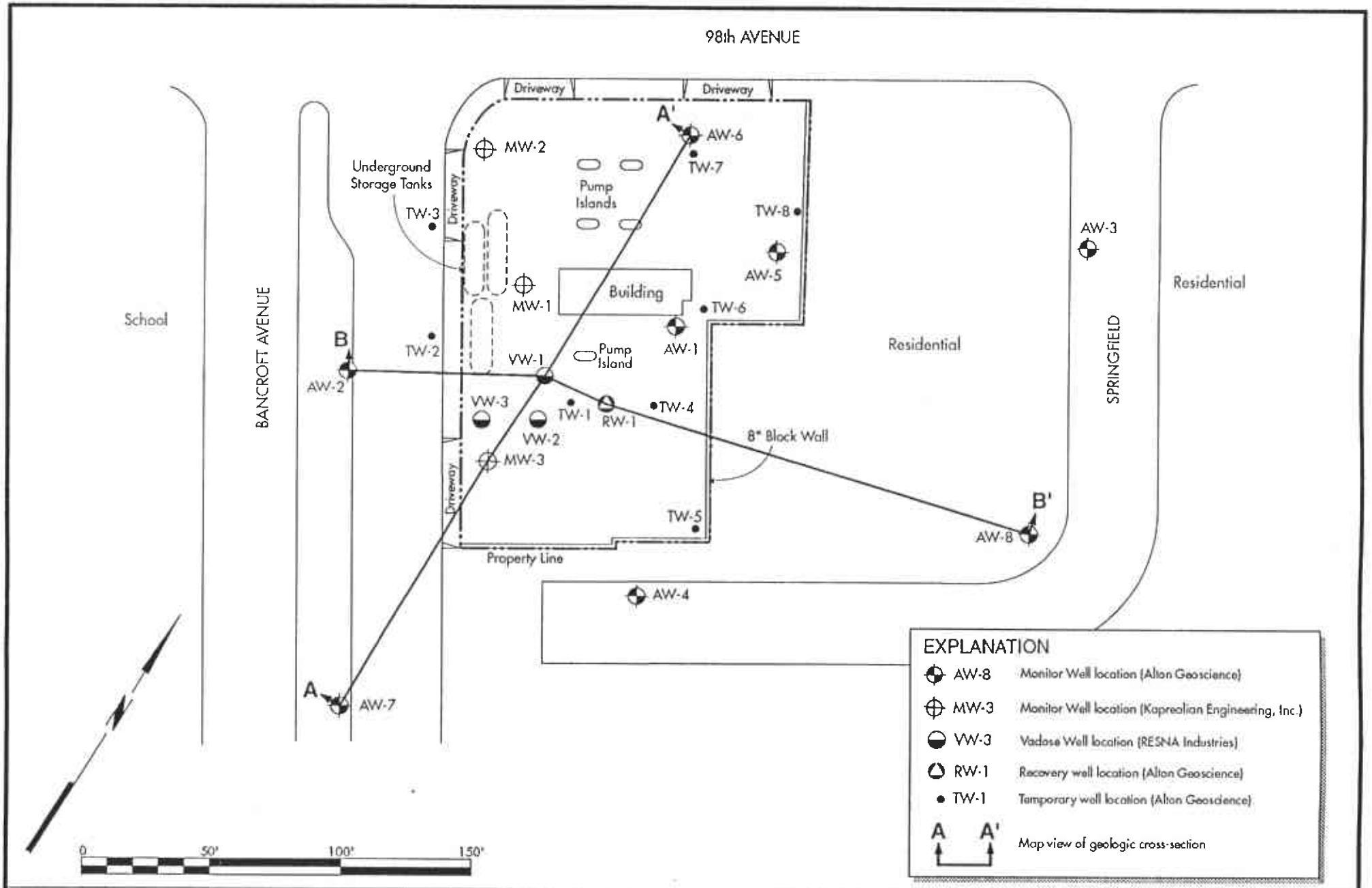
RESNA

PROJECT NO. 32006.03 | 12/92

SITE VICINITY MAP

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE 1



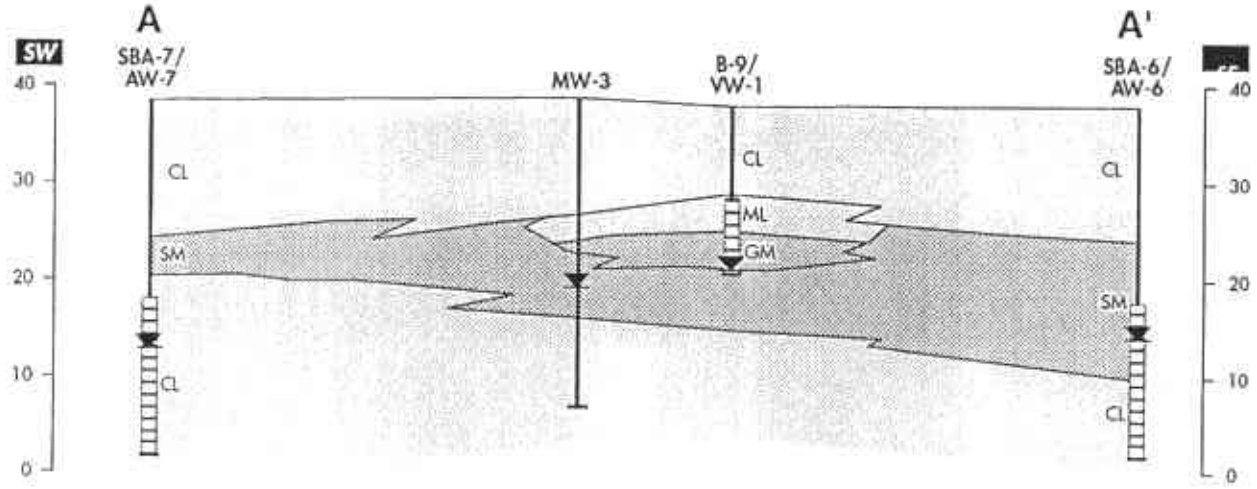
RESNA

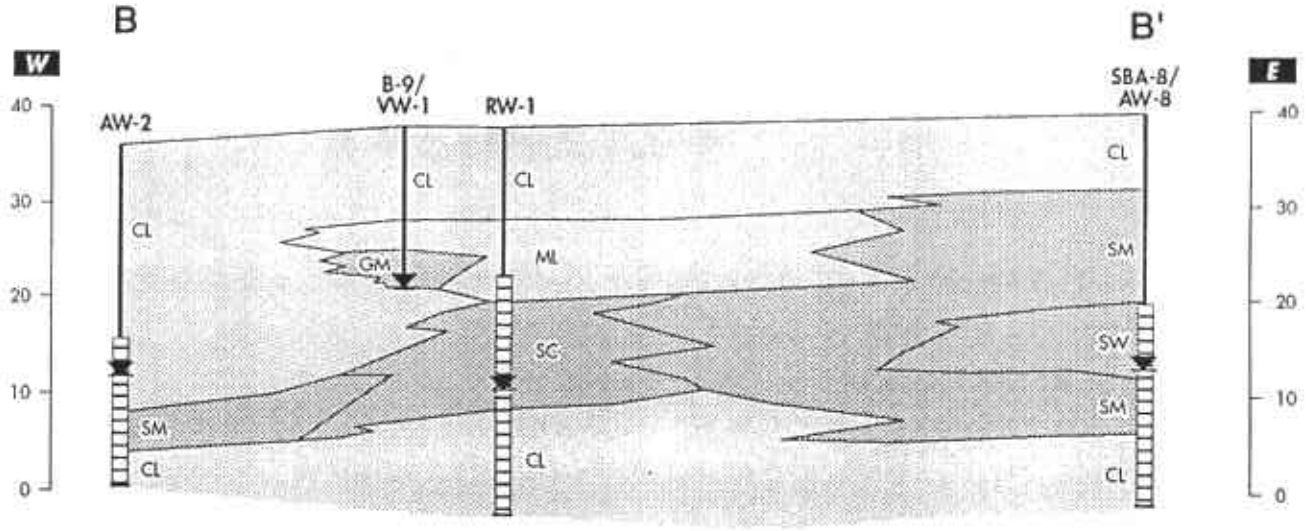
PROJECT NO. 32006.03 | 12/92

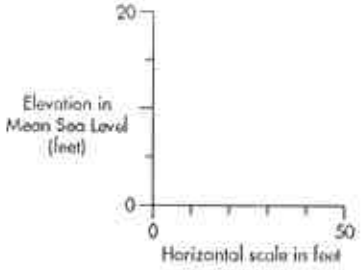
GENERALIZED SITE PLAN

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE
2







EXPLANATION

Silty CLAY (CL); SILT (ML)

Silty SAND (SM); SAND (SW); Clayey Sand/Sandy Clay (SC); Silty GRAVEL (GM)

SBA-7/ AM-7 — Boring/Monitor Well location (Alton Geoscience)

B-9/ VW-1 — Boring/Vadose Well location (RESNA Industries, Inc.)

MW-3 — Monitor Well location (Kaprealian Engineering, Inc.)

Boring

Screen interval

Static water level on July 6, 1992

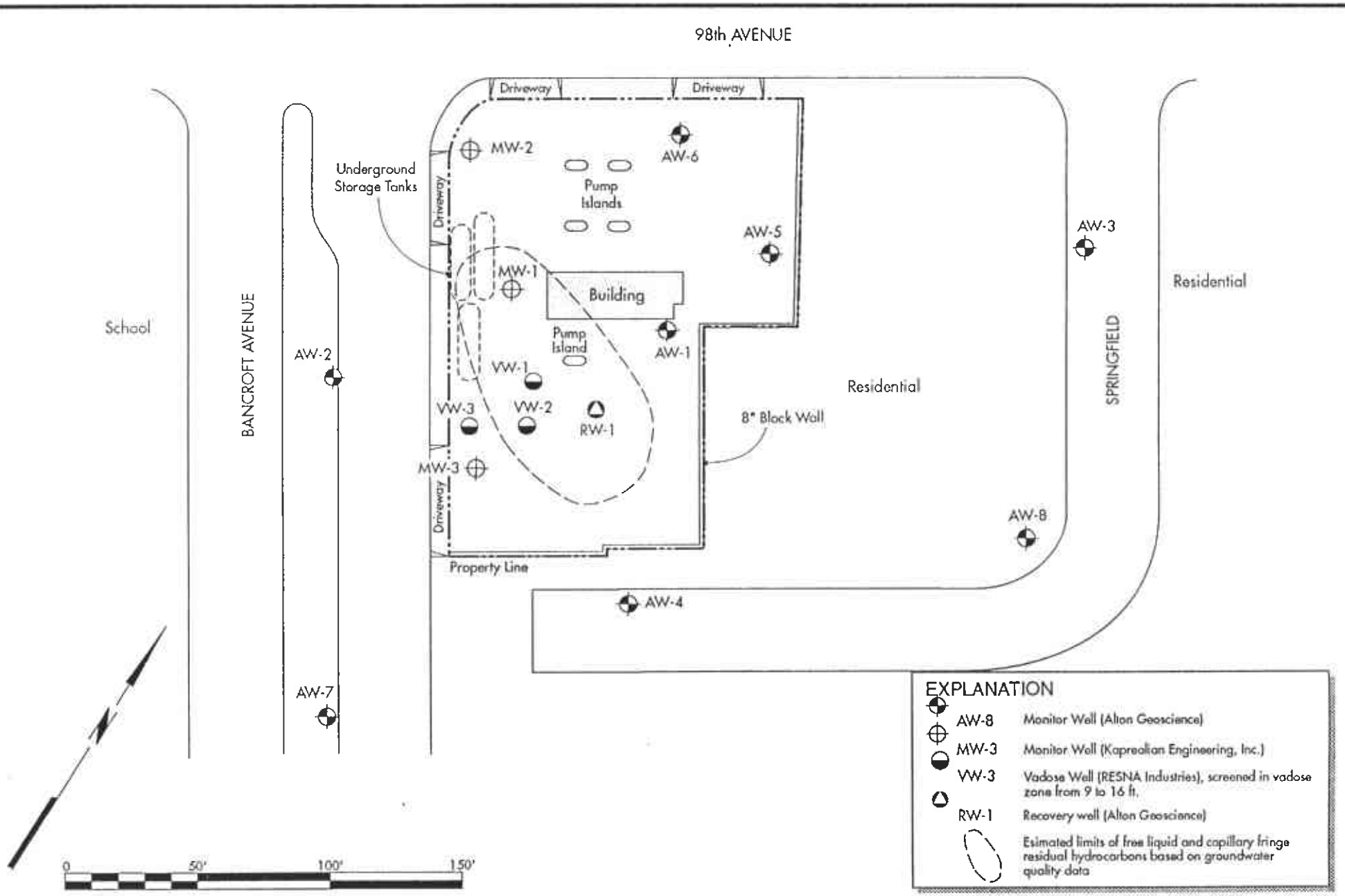
RESNA

PROJECT NO. 32006.03 | 12/92

CROSS-SECTIONS A-A' & B-B'

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE 3



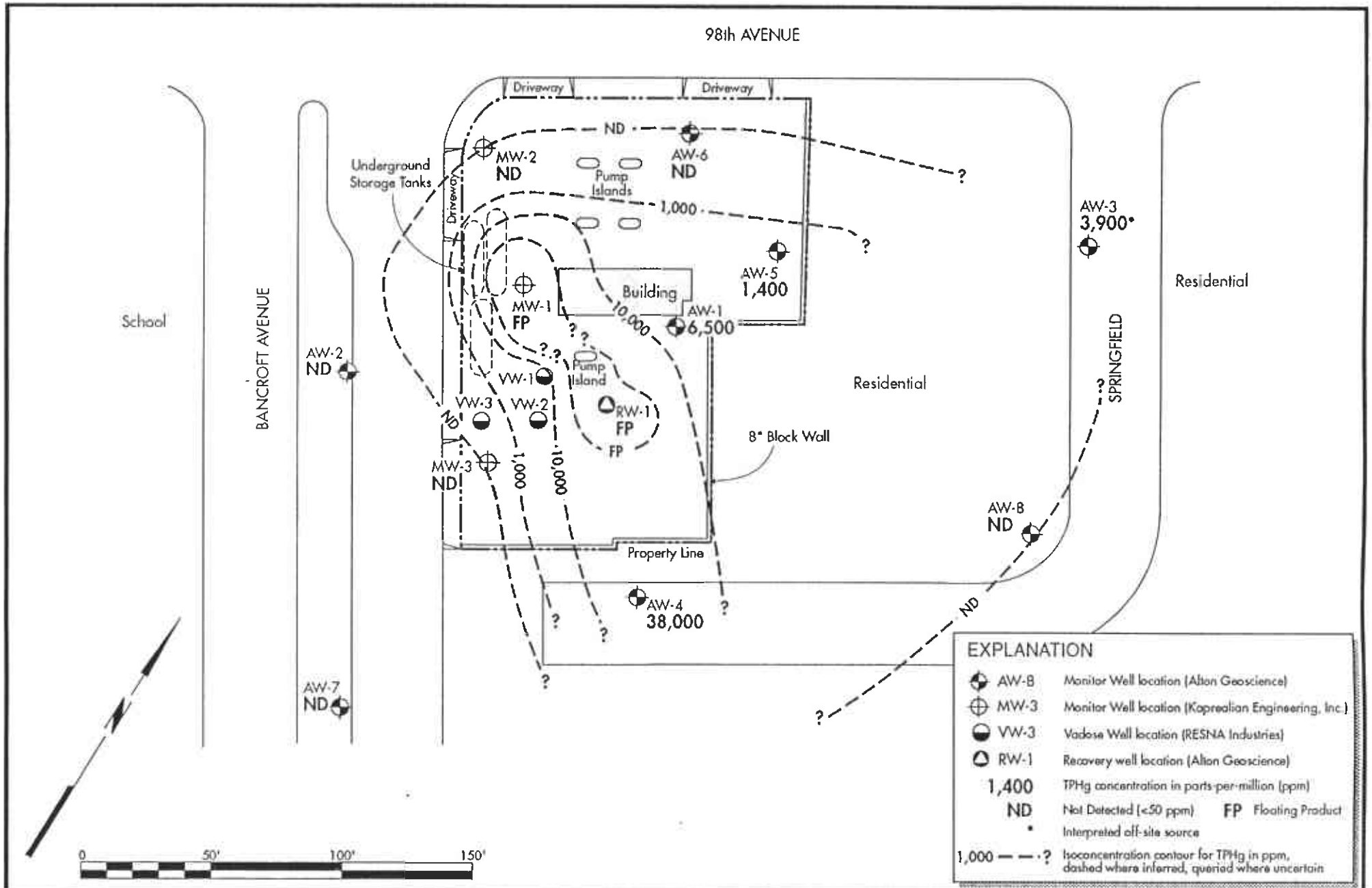
RESNA

PROJECT NO. 32006.03 | 12/92

ESTIMATED LIMITS OF FLOATING AND RESIDUAL HYDROCARBONS

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE
4



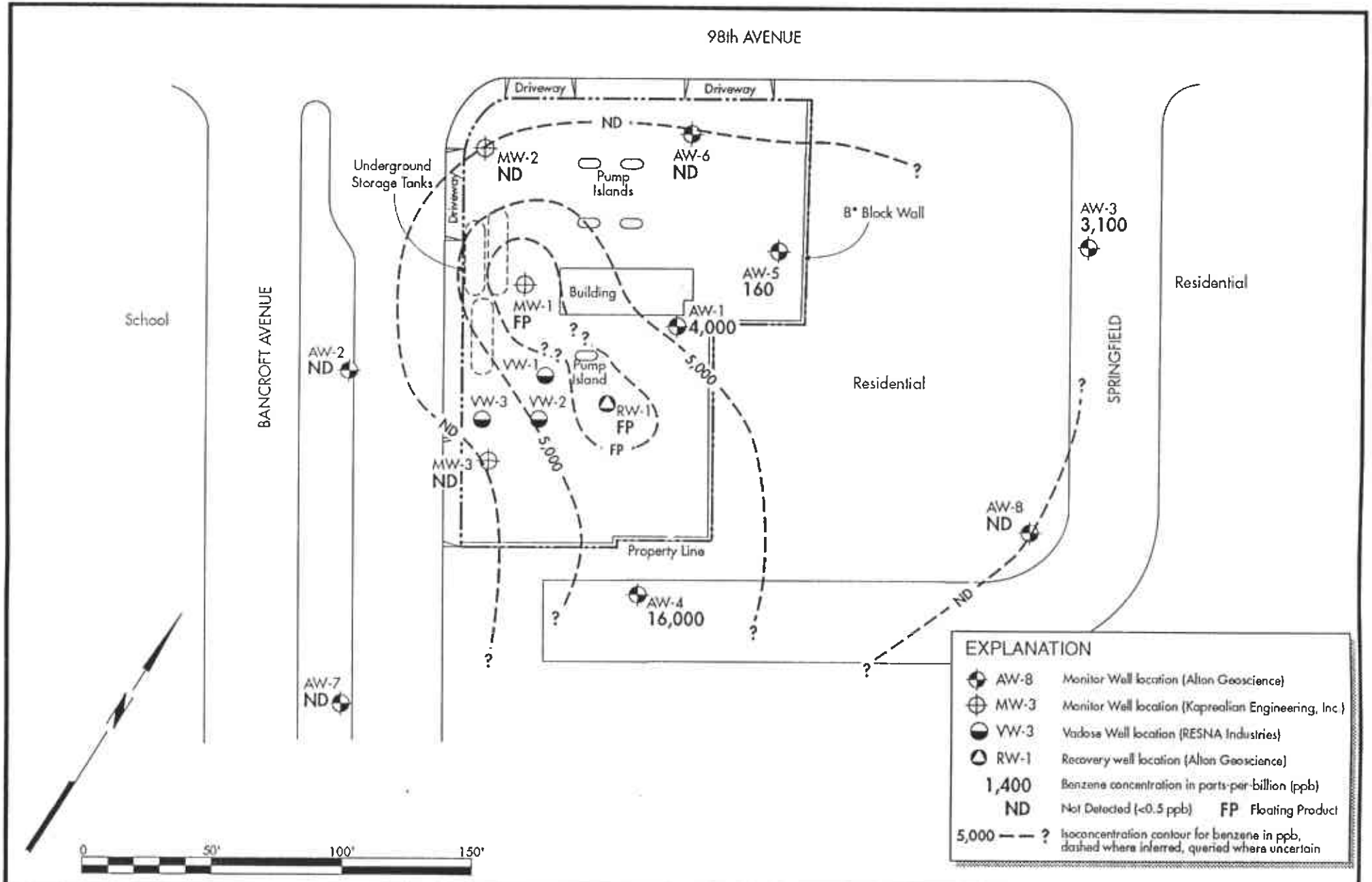
RESNA

PROJECT NO. 32006.03 | 12/92

TOTAL PETROLEUM HYDROCARBONS AS GASOLINE (TPHg) ISOCONCENTRATION MAP—July 6, 1992

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE
5



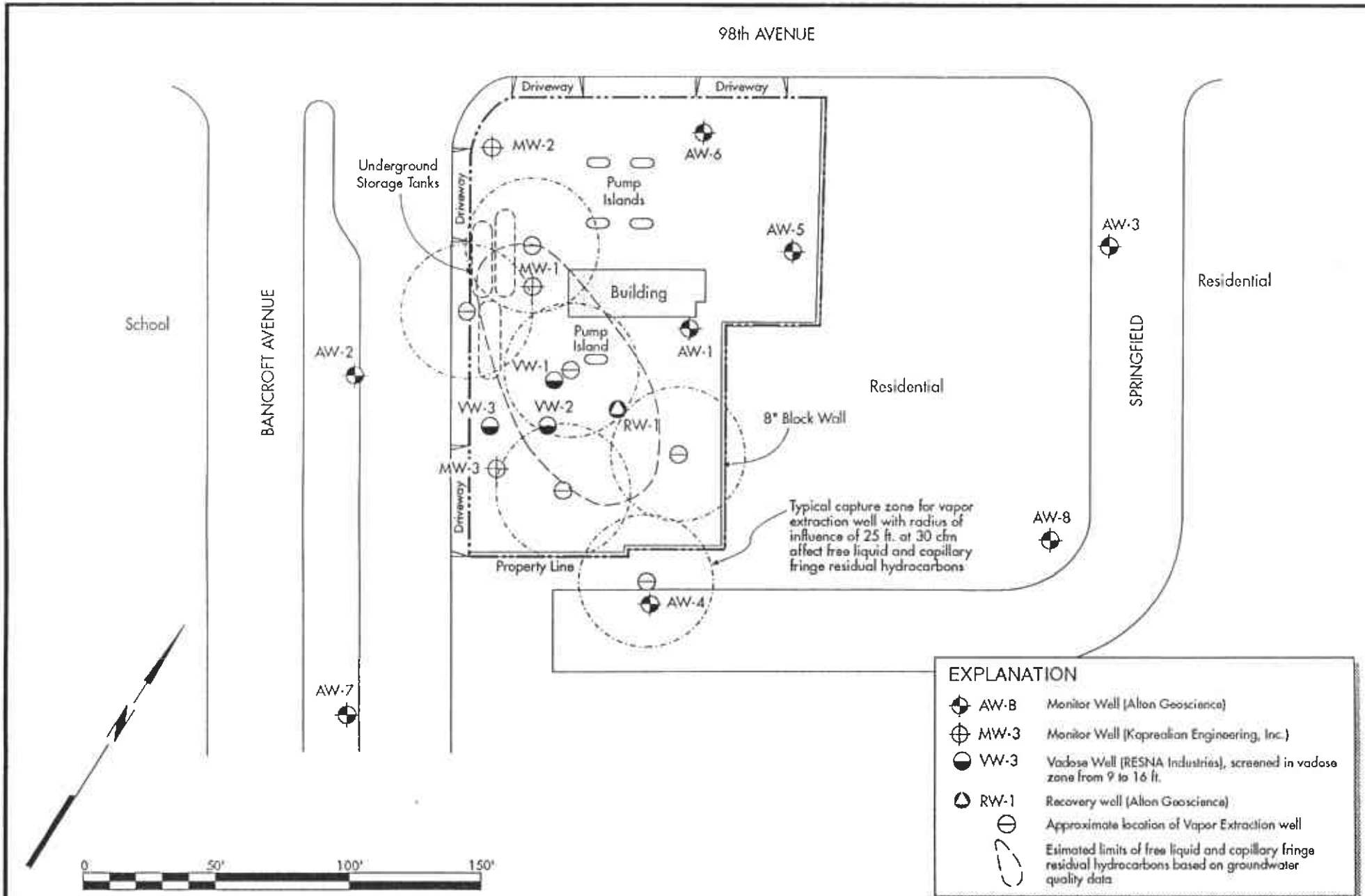
RESNA

PROJECT NO. 32006.03 | 12/92

BENZENE ISOCONCENTRATION MAP—July 6, 1992

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE
6



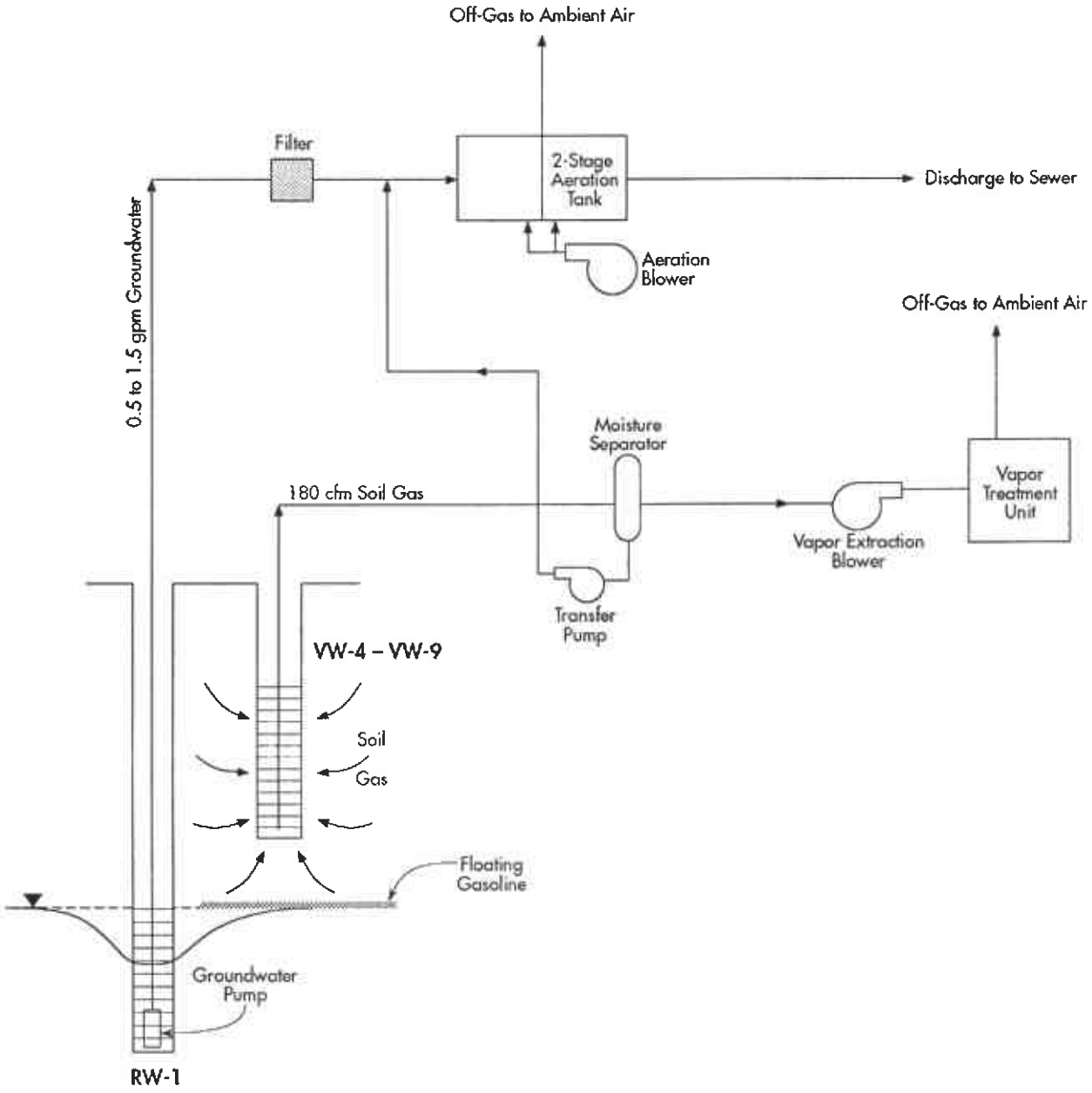
RESNA

PROJECT NO. 32006.03 | 12/92

VAPOR EXTRACTION CAPTURE ZONES

BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE
7



RESNA

PROJECT NO. 32006.03 | 12/92

REMEDIATION SYSTEM PROCESS DESIGN SCHEMATIC
BP Facility No. 11133
2220 98th Avenue
Oakland, California

PLATE 8

APPENDIX A

FIELD PROCEDURES

RESNA
Working To Restore Nature

Site Safety Plan

This plan describes the safety requirements for drilling, purging, and sampling ground-water monitoring wells. The site safety plan is applicable to personnel of RESNA Industries (RESNA) who perform work at the site. A copy of the site safety plan is available for reference by appropriate parties during the work. The onsite Staff Geologist or Technician of RESNA act as the Site Safety Officer.

Drilling and Soil Sampling

RESNA contacts Underground Service Alert to delineate public utility lines at the site before initiating drilling. Before drilling, the borehole locations are hand-augered 3 to 5 feet below grade. The soil borings are drilled using a truck-mounted rig using 8-, 10-, and 12-inch-diameter hollow-stem augers for soil borings and borings converted into two-inch monitoring wells. The drilling is performed under the guidance of a field geologist, and the earth materials are logged as drilled using the Unified Soil Classification System.

During drilling, soil samples are collected at 5-foot or other appropriate intervals using a California-modified, split-spoon sampler equipped with clean brass sleeves. Samples are taken by driving the sampler into the soil through the hollow center of the auger. The sampler is driven 18 inches with a standard 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler each successive 6-inch interval is counted and recorded on the field boring log to give an indication of soil consistency.

Soil samples are collected, identified, and evaluated for relative levels of hydrocarbons using a field photoionization detector. Field instruments such as the photoionization detector are useful for indicating relative levels of hydrocarbon vapors but do not detect the concentration of hydrocarbons present with the same precision as laboratory analyses. Any additional subjective evidence such as soil discoloration or obvious product order is noted.

Soil samples collected for laboratory analyses are accompanied by a Chain of Custody Record that is initiated by the geologist at the site and is completed as the samples are collected. Soil samples collected for possible chemical analyses are promptly sealed with aluminum foil, plastic caps, and tape. They are then labeled and placed in iced storage for transport to the analytical laboratory.

Well Construction

The wells are constructed using clean 2-, 4-, or 6-inch-inner-diameter, thread-jointed, Schedule 40 polyvinyl chloride (PVC) casing. No chemicals, glues, or solvents are used in construction of the wells. The screened portion of the monitoring wells consists of factory-perforated casing with slots and extends from the total depth of the boring to about 5 feet above the depth where water is first encountered. The screened portion of the vapor-extraction wells consists of a 10-foot section of factory-perforated casing with slots and extends from the approximately 1 foot above the depth where water was first encountered. Unperforated casing is set from the top of the screen to several inches below surface grade.

The annular space of each well is packed with sorted sand from the total depth of the boring to approximately 1 foot above the top of the screen. A plug of bentonite pellets (approximately 2 feet thick) was placed above the sand to prevent cement from entering the sand pack. This seal reduces the possibility that hydrocarbons migrating downward through the overlying sand will infiltrate the aquifer. The remaining annulus is backfilled to the ground surface with a mixture of water, cement, and bentonite. The construction details of the individual wells are shown on the Logs of Borings.

The wellheads are secured in cast-aluminum utility boxes with PVC aprons. The boxes have watertight seals and are set in concrete approximately flush with the surrounding ground surface to reduce surface-water infiltration. A special wrench is required to open the box. This design discourages vandalism and reduces the possibility of accidental disturbance to the well. Each wellhead is also fitted with a locking well cage to further protect against unauthorized disturbance of the well.

Well Development and Purging

RESNA waits a minimum of 24 hours after well installation before developing the ground-water monitoring wells to allow the grout to seal. Before developing the monitoring wells, a water sample is collected for subjective analysis from near the water surface in the well with a Teflon bailer cleaned with a laboratory-grade detergent and deionized water. The wells are developed by surge blocking the screened interval of the well and pumping until the discharge water is clear of silt and sand. Clay-size sediments derived from the screened portion of the formation cannot be entirely eliminated by well development.

After the wells stabilize for a minimum of 24 hours, the wells are purged of stagnant water and a sample is collected for laboratory analysis. The wells are purged of approximately 3 to 5 well volumes of water with a submersible pump, or until pH, conductivity, and temperature of the purged water have stabilized. Water purged from the wells is stored in labeled, 55-gallon, steel drums approved for this use by the Department of Transportation until suitable disposal options are selected based on laboratory analysis.

Subjective Ground-Water Observations

The depth to ground water in the monitoring wells is measured to the nearest 0.01-foot with an electronic water-level indicator. Samples of ground water are collected for subjective analysis from the air-fluid interface in each well by lowering approximately half the length of a clear Teflon bailer through the interface. The bailer is retrieved and the water sample examined for free product, sheen, or other subjective evidence of hydrocarbons.

Ground-Water Sampling

Ground-water samples are collected after water in each well recovered to near its original level. The ground-water samples are collected by lowering a clean Teflon bailer gently through the air-water interface to a depth approximately 3 feet below the ground-water surface. The bailer is retrieved and the samples are transferred slowly to laboratory-cleaned, 40-milliliter glass vials or other appropriate containers as required by the laboratory. The vials and bottles contain hydrochloric acid (or other appropriate preservative) and are filled so that no head space is left in the containers. The field technician initiates a Chain of Custody Record and it accompanies the samples to the analytical laboratory. A copy of that record is attached to this letter report.

APPENDIX B

CHAIN-OF-CUSTODY AND LABORATORY ANALYSES REPORTS

RESNA

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

PROJECT NO.	PROJECT NAME/SITE	P.O. #:
32006.01	BP 11133	

SAMPLERS: (SIGN) Peter Schurman (PRINT) PETER SCHURMAN

SAMPLE IDENTIFICATION	DATE	TIME	COMP	GRAB	PRES. USED	ICED	NO. CONTAINERS	SAMPLE TYPE	BTEX (602/8020)	TPHg (8015)	TPHd (8015)	TOG 418.1/5520	601/8010	624/8240	625/8270						REMARKS
A·0408-VW2 INF	8APR92	1215		✓			1	A	✓	✓											VAPOR SAMPLE
A·0408-VW3 INF	8APR92	1310		✓			1	A	✓	✓											72 hr holding
A·0408-VW1 INF 1	8APR92	1415		✓			1	A	✓	✓											time!
A·0408-VW1 INF 2	8APR92	1525		✓			1	A	✓	✓											
A·0408-VW1 INF 3	8APR92	1600		✓			1	A	✓	✓											
A·0408-VW1 INF 4	8APR92	1715		✓			1	A	✓	✓											
A·0408-VW1 EFF	8APR92	1530		✓			1	A	✓	✓											

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	LABORATORY:	PLEASE SEND RESULTS TO:
Peter Schurman	9APR92	0915		Applied Analytical R.C.	RESNA R.C.
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:		
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	REQUESTED TURNAROUND TIME: Normal	
RELINQUISHED BY:	DATE 4/9/92	TIME 09:15	RECEIVED BY LABORATORY: Dennis Santos	RECEIPT CONDITION: Good	PROJECT MANAGER: G. Gurss

Environmental Laboratories

RESNA
Working To Restore Nature

3164 Gold Camp Drive, Suite 200
Rancho Cordova, CA 95670
Phone: (916) 852-6699
Fax: (916) 852-6688

ANALYSIS REPORT

1020lab.frm

Attention:	Greg Gurss	Date Sampled:	4-08-92
	RESNA Industries	Date Received:	4-09-92
	3164 Gold Camp Drive, #200	BTEX Analyzed:	4-09-92
	Rancho Cordova, CA 95670	TPHg Analyzed:	4-09-92
Project:	32006.01	Matrix:	Air

	Benzene mg/m^3	Toluene mg/m^3	Ethyl-benzene mg/m^3	Total Xylenes mg/m^3	TPHg mg/m^3
Reporting Limit:	0.05	0.05	0.05	0.05	5.0
SAMPLE Laboratory Identification					
A-0408-VW2INF A3204003	250	5.5	20	49	9500
A-0408-VW3INF A3204004	1.0	2.0	1.7	6.1	9.0
A-0408-VW1INF1 A3204005	120	8.3	24	21	5100
A-0408-VW1INF2 A3204006	0.7	0.6	1.1	3.0	15

mg/m^3 = milligrams per cubic meter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.
NR = Analysis not requested.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by a modified TO-14/8020 and 602 methods which utilize a purge and trap,and a gas chromatograph (GC) equipped with a photoionization detector (PID).
TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by a modified EPA Method 8015 and TO-14, which utilize a Purge and Trap and a GC equipped with a FID.

Laboratory Representative

4-10-92
Date Reported

APPLIED ANALYTICAL LABORATORY IS CERTIFIED BY THE STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. E773)

Environmental Laboratories

RESNA
Working To Restore Nature

3164 Gold Camp Drive, Suite 200
Rancho Cordova, CA 95670
Phone: (916) 852-6699
Fax: (916) 852-6688

ANALYSIS REPORT

1020lab.frm

Attention:	Greg Gurss	Date Sampled:	4-08-92
	RESNA Industries	Date Received:	4-09-92
	3164 Gold Camp Drive, #200	BTEX Analyzed:	4-09-92
	Rancho Cordova, CA 95670	TPHg Analyzed:	4-09-92
Project:	32006.01	Matrix:	Air

	Benzene mg/m^3	Toluene mg/m^3	Ethyl-benzene mg/m^3	Total Xylenes mg/m^3	TPHg mg/m^3
Reporting Limit:	0.05	0.05	0.05	0.05	5.0
SAMPLE Laboratory Identification					
A-0408-VW1INF3 A3204007	240	12	9.5	13	6900
A-0408-VW1INF4 A3204008	2.0	0.3	1.1	2.4	53
A-0408-VW1EFF A3204009	1.5	1.4	1.4	5.8	16

mg/m^3 = milligrams per cubic meter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.
NR = Analysis not requested.

ANALYTICAL PROCEDURES

BTEX– Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by a modified TO-14/8020 and 602 methods which utilize a purge and trap,and a gas chromatograph (GC) equipped with a photoionization detector (PID).
TPHg–Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by a modified EPA Method 8015 and TO-14, which utilize a Purge and Trap and a GC equipped with a FID.

Laboratory Representative

4-10-92
Date Reported

APPLIED ANALYTICAL LABORATORY IS CERTIFIED BY THE STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. E773)

RESNA

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

094828

PROJECT NO.	PROJECT NAME/SITE
32006.01 SC 431.02	BP Oakland # 11133

SAMPLERS (SIGN) _____ (PRINT) Jcostin Power

SAMPLE IDENTIFICATION	DATE	TIME	COMP	GRAB	PRES. USED	ICED	NO. CONTAINERS	SAMPLE TYPE	BTEX (602/8020)	TPHg (8015)	TPHd (8015)	TOG 418.1/5520	601/8010	624/8240	625/8270							REMARKS
S-B9 16.0	3/26					4	1	S	X	X												
~~S-B9 DP~~																						
S-B10 6.5	3/26/92					4	1	S	X	X												
S-B10 11.5	3/26/92					4	1	S	X	X												
S-B10 16.0	3/26/92					4	1	S	X	X												
S-B11 16.5	3/26/92					4	1	S	X	X												

ANALYSIS REQUESTED

P.O. #:

Standard Turnaround

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Costin Power	3/27	11:00	X701
X701	3/27/92	1213	MBMENDOZA X748
MBMendoza X748	3-27-92	1436	
RELINQUISHED BY:	DATE	TIME	RECEIVED BY LABORATORY:
	3/27/92	14:36	Roberto Arcilla

LABORATORY: Applied Analytical Fremont

REQUESTED TURNAROUND TIME:

RECEIPT CONDITION:

PLEASE SEND RESULTS TO:
Keith Romstad
73 Digital Drive
Novato, CA
94949-5704
Fax (415) 382-7415

PROJECT MANAGER:

Environmental Laboratories

RESNA
Working to Restore Nature

42501 Albrae Street
Fremont, CA 94538
Phone: (510) 623-0775
(800) 247-5223
FAX: (510) 651-8754

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Keith Romstad	Date Sampled:	03-26-92
	RESNA	Date Received:	03-27-92
	73 Digital Dr.	BTEX Analyzed:	03-30-92
	Novato, CA 94949	TPHg Analyzed:	03-30-92
Project:	19519-L, Project #86-431.02	TPHd Analyzed:	NR
		Matrix:	Soil

	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPHg	TPHd
	ppm	ppm	ppm	ppm	ppm	ppm
Detection Limit:	0.005	0.005	0.005	0.005	1.0	10
SAMPLE Laboratory Identification						
S-B9-16.0 S1203749	0.008	0.011	0.018	0.064	ND	NR
S-B10-6.5 S1203750	ND	ND	ND	ND	ND	NR
S-B10-11.5 S1203751	ND	ND	ND	ND	ND	NR
S-B10-16.0 S1203752	ND	ND	ND	ND	ND	NR
S-B11-16.5 S1203753	0.074	0.25	3.2	11	320	NR

ppm = parts per million = mg/kg = milligrams per kilogram.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not requested.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020/602, which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID) and a flame-ionization detector (FID) in series.

TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by analysis using modified EPA Method 8015, which utilizes a GC equipped with an FID.

TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 for soils and EPA Method 3510 for water, followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Laboratory Representative

April 1, 1992
Date Reported

RESNA ENVIRONMENTAL LABORATORY IS CERTIFIED BY THE STATE OF CALIFORNIA DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. 1211)

RESNA

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

PROJECT NO.	PROJECT NAME/SITE
NOVATO 86-431.01	BP OAKLAND # 11133

SAMPLERS (SIGN) Mark Frye (PRINT) MARK FRYE

SAMPLE IDENTIFICATION	DATE	TIME	COMP	GRAB	PRES. USED	ICED	NO. CONTAINERS	SAMPLE TYPE	BTEX (602/8020)	TPHg (8015)	TPHd (8015)	TOG 418.1/5520	601/8010	624/8240	625/8270				REMARKS
SC-1	4-8-92	1000			—	X	1	S	X	X									LAB:
SC-2	↓	↓			↓	↓	↓	↓	↓	↓									PLEASE
SC-3	↓	↓			↓	↓	↓	↓	↓	↓									COMPOSITE
SC-4	↓	↓			↓	↓	↓	↓	↓	↓									ALL FOUR
																			SAMPLES INTO ONE
																			FOR A
																			SINGLE
																			ANALYSIS.

COMPOSITE

P.O. #:

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Mark Frye	4-8-92	1305	
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE 4/9/92	TIME 9:15	RECEIVED BY LABORATORY:

LABORATORY: APPLIED ANALYTICAL ~~FREMONT~~ SACRAMENTO

REQUESTED TURNAROUND TIME: NORMAL

RECEIPT CONDITION: good

PLEASE SEND RESULTS TO: JUSTIN POWERS RESNA NOVATO

PROJECT MANAGER: KEITH ROMSTADT

86-431 NOVATO CT 1/30 37006.1

Environmental Laboratories

RESNA
Working To Restore Nature

3164 Gold Camp Drive, Suite 200
Rancho Cordova, CA 95670
Phone: (916) 852-6699
Fax: (916) 852-6688

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Keith Romstad	Date Sampled:	04-08-92
	RESNA Industries	Date Received:	04-09-92
	3164 Gold Camp Drive	BTEX Analyzed:	04-13-92
	Rancho Cordova, CA 95670	TPHg Analyzed:	04-13-92
Project:	Novato 86-431.01	Matrix:	Soil

	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPHg
	ppm	ppm	ppm	ppm	ppm
Detection Limit:	0.005	0.005	0.005	0.005	1.0
SAMPLE Laboratory Identification					
SC-1234 S3204002	ND	ND	ND	ND	ND

ppm = parts per million = mg/L = milligram per liter
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

ANALYTICAL PROCEDURES

BTEX– Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020/602, which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID) and a flame-ionization detector (FID) in series.

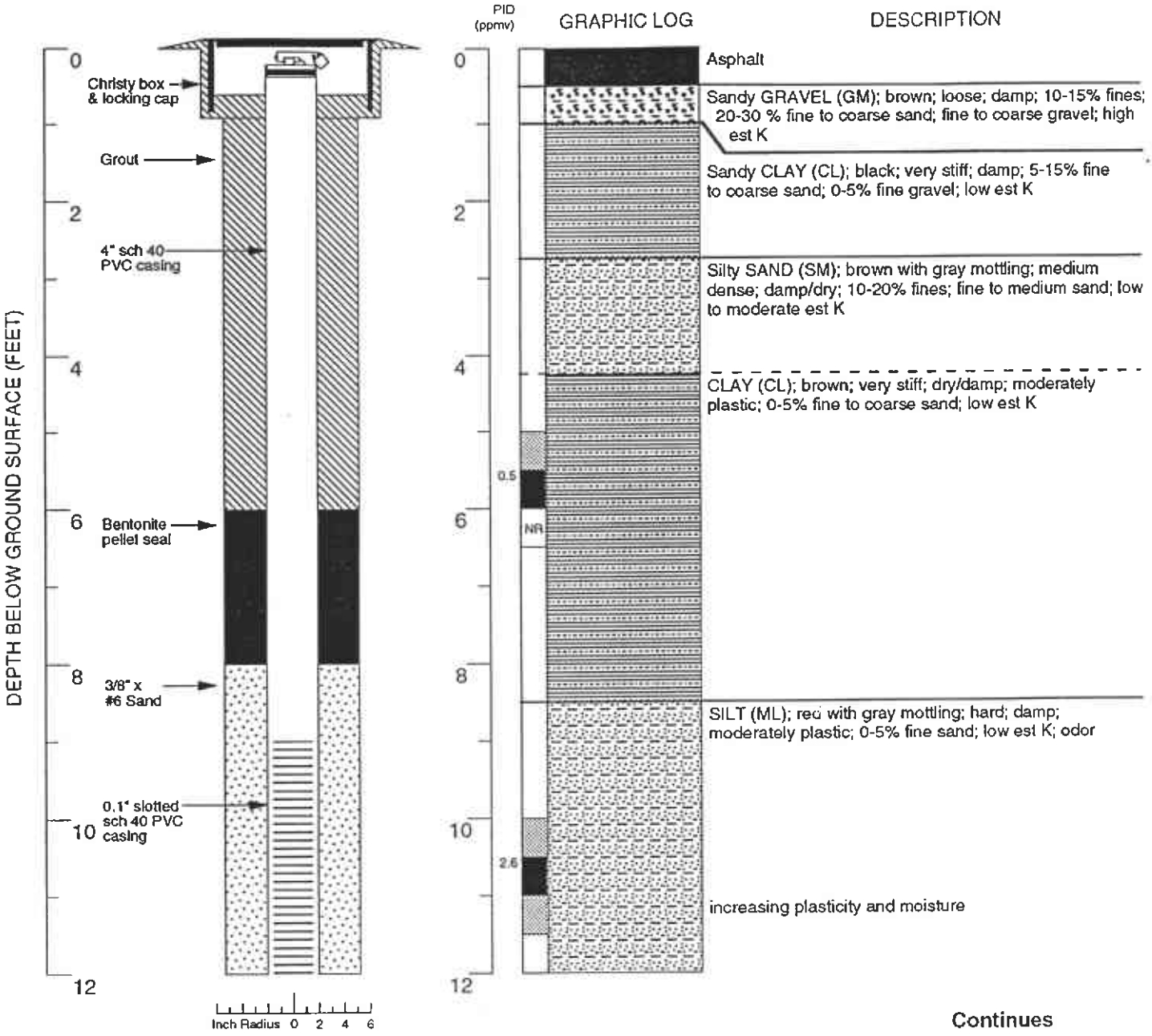
TPHg–Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by analysis using modified EPA Method 8015, which utilizes a GC equipped with an FID.

Laboratory Representative

04-15-92
Date Reported

APPENDIX C

LOGS OF BORINGS



Logged by:	Justin Power	Drilling Company:	Kvilhaug	Well Head Completion:	Christy box & locking cap
Project Mgr:	Keith Romstad	Drilling Method:	11" Hollow stem auger	Type of Sampler:	2.5" split barrel
Dates Drilled:	3/26/92	Driller:	Rod	TD (Total Depth):	16.6 ft.

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational

est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary

NR — No recovery

All symbols and definitions may not be applicable

Boring Log and Well Completion Details
VW-1 (Boring B-9)

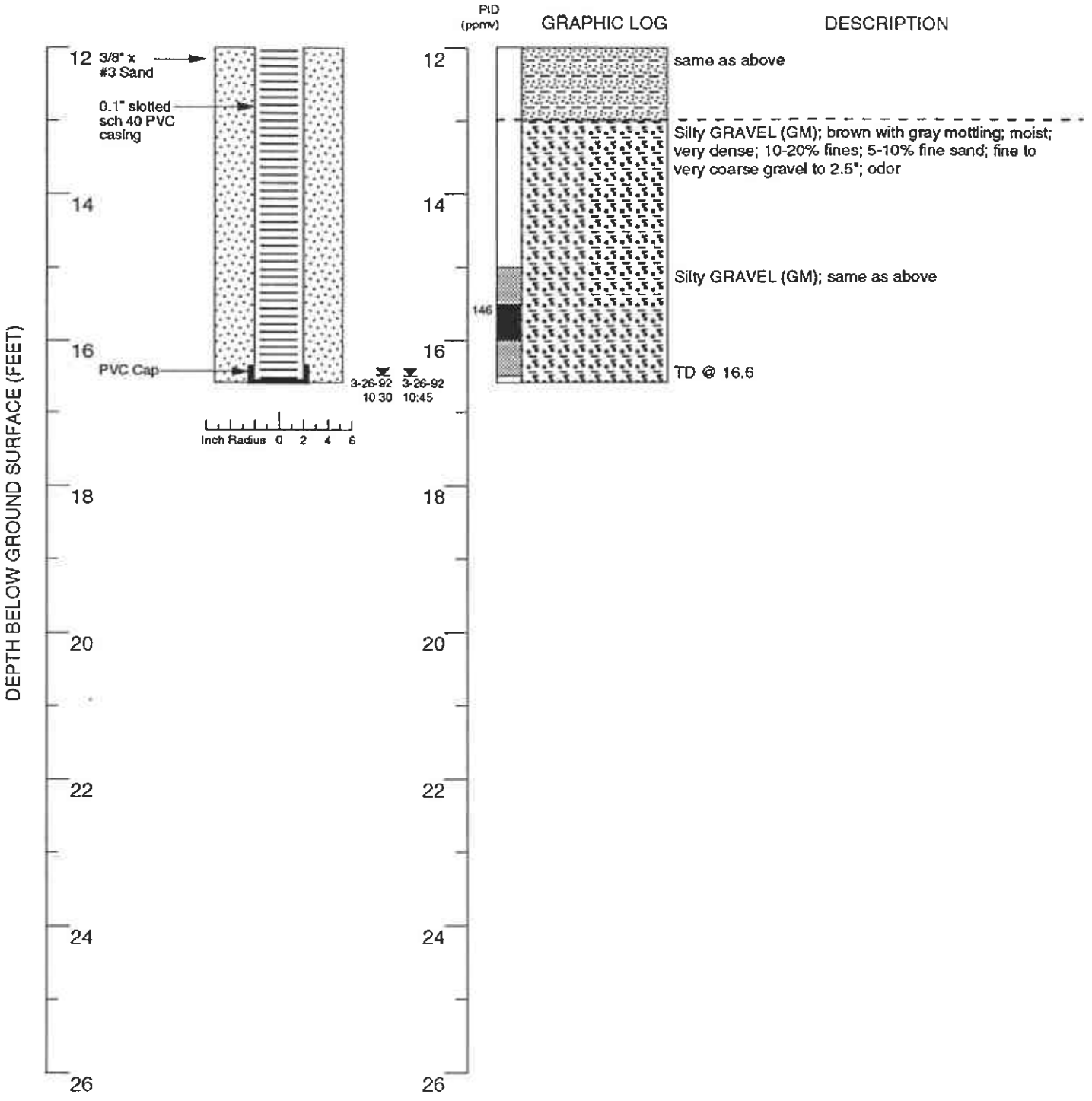
BP Service Station #11133
2220 98th Avenue
Oakland, California

VADOSE WELL

1

RESNA

32006.01



EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

All symbols and definitions may not be applicable

- Contacts: Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary
- NR — No recovery

Boring Log and Well Completion Details
VW-1 (Boring B-9)

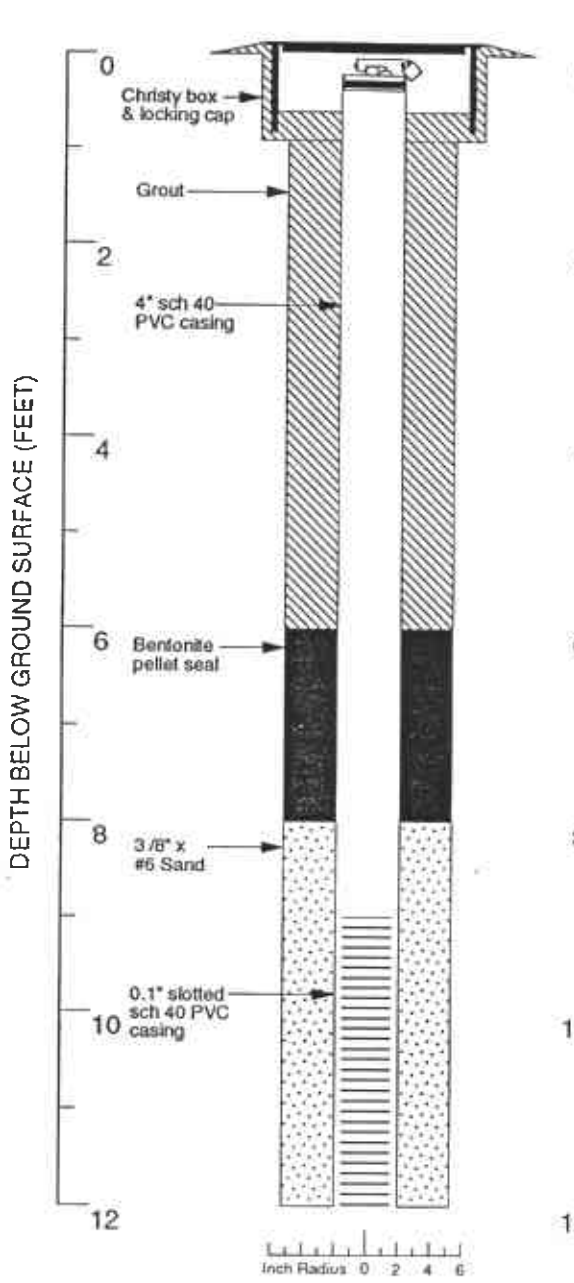
BP Service Station #11133
2220 98th Avenue
Oakland, California

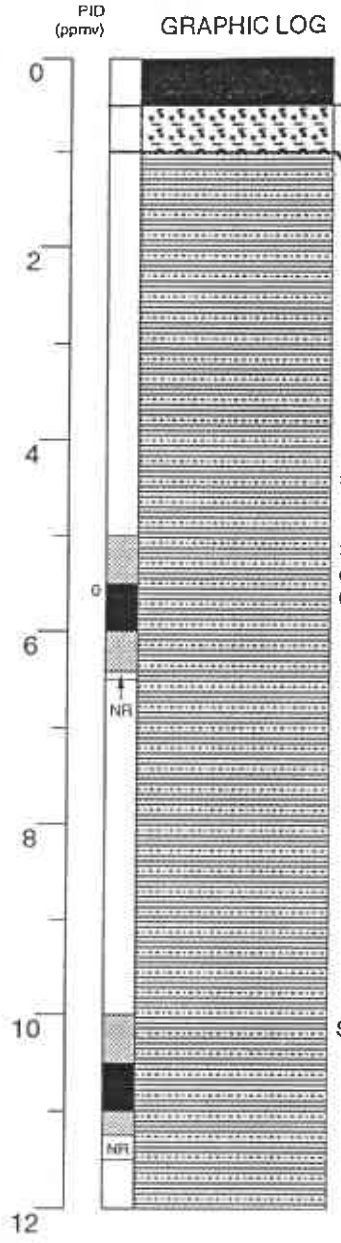
VADOSE WELL

1

RESNA

32006.01





DESCRIPTION

Asphalt

Sandy GRAVEL (GM); brown; medium dense; dry/damp; 5-15% fines; 25-30% fine to coarse sand; fine to coarse gravel; high est K

Sandy CLAY (CL); black; stiff; dry/damp; moderately plastic; 15-25% fine to coarse sand; 0-5% fine to coarse gravel; low est K

Same as above; brown (cuttings)

Same as above; brown with black mottling; medium stiff; very plastic (cuttings)

Sandy CLAY (CL); brown with black mottling; hard; dry/damp; slightly plastic; 5-15% fine to coarse sand; 0-5% fine to medium gravel; low est K

Same as above

Continues

Logged by:	Justin Power	Drilling Company:	Kvilhaug	Well Head Completion:	Christy box & locking cap
Project Mgr:	Keith Romstad	Drilling Method:	11" Hollow stem auger	Type of Sampler:	2.5" split barrel
Dates Drilled:	3/26/92	Driller:	Rod	TD (Total Depth):	16.5 ft.

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational

est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary

NR — No recovery

All symbols and definitions may not be applicable

Boring Log and Well Completion Details
VW-2 (Boring B-11)

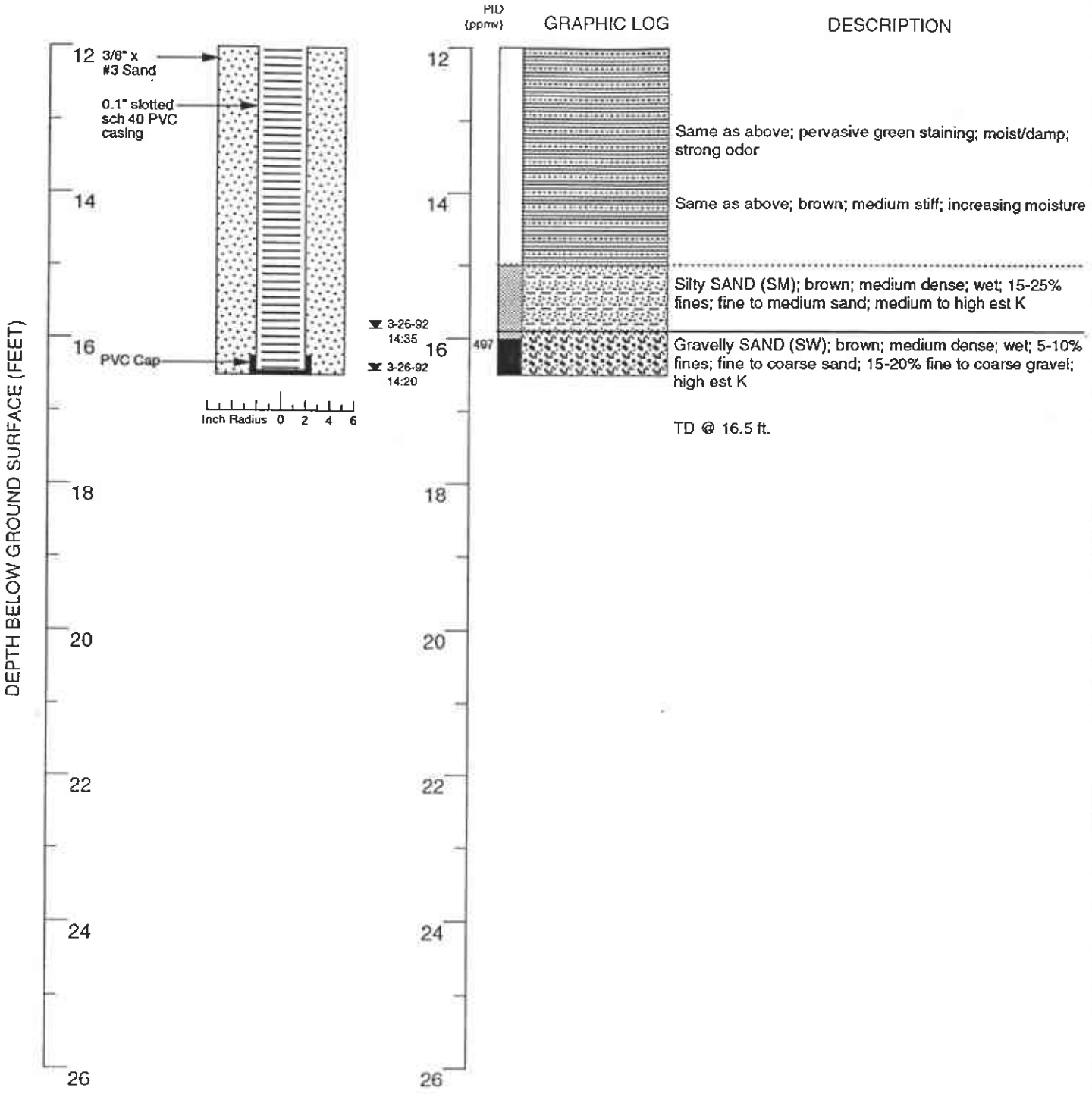
BP Service Station #11133
2220 98th Avenue
Oakland, California

VADOSE WELL

2

RESNA

32006.01



EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

All symbols and definitions may not be applicable

- Contacts: Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary
- NR — No recovery

Boring Log and Well Completion Details
VW-2 (Boring B-11)

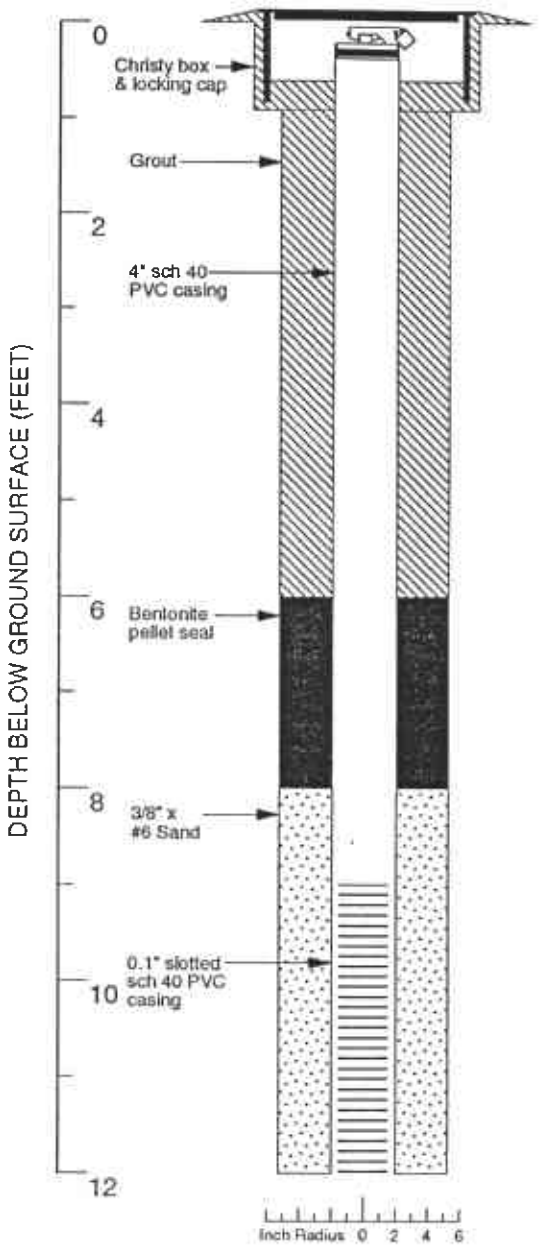
BP Service Station #11133
2220 98th Avenue
Oakland, California

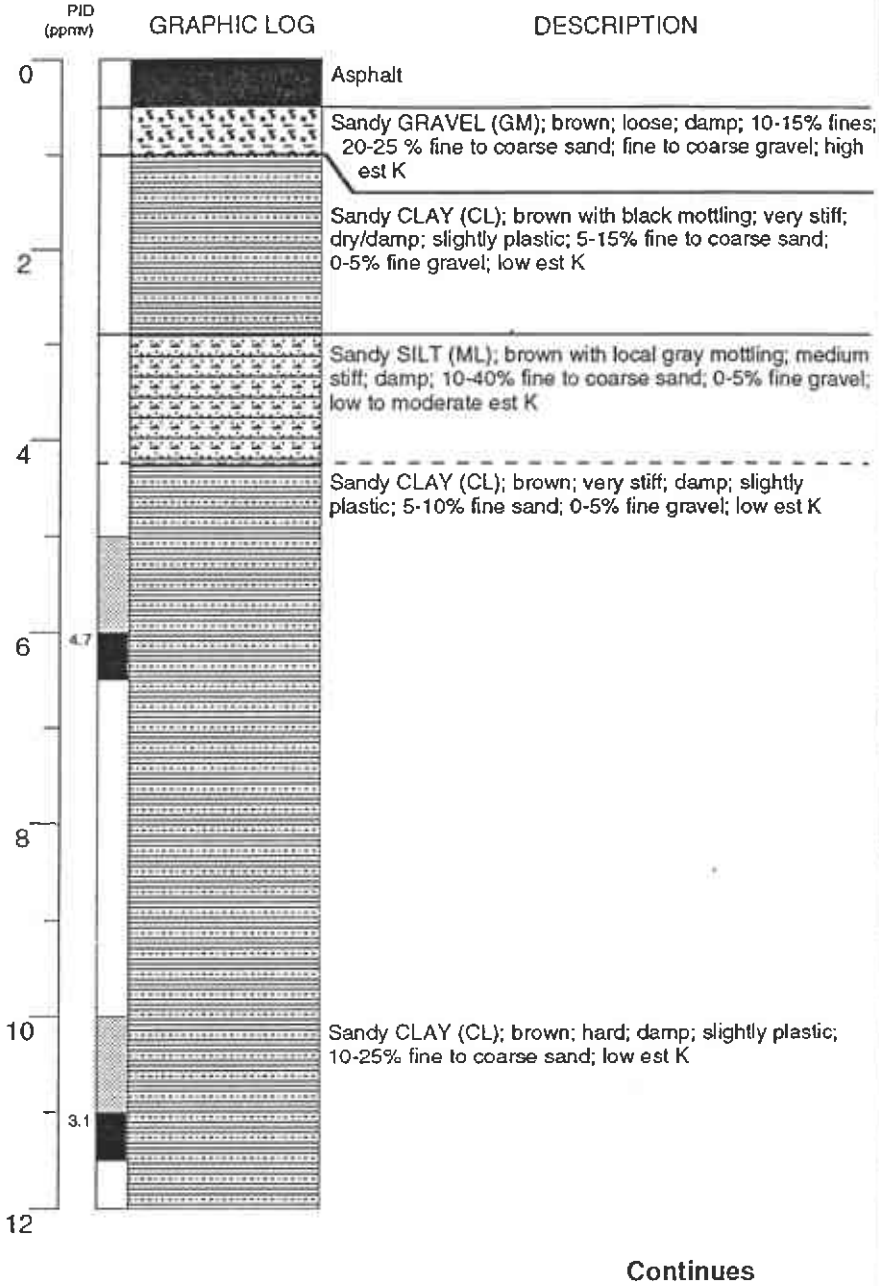
VADOSE WELL

2

RESNA

32006.01





Continues

Logged by:	Justin Power	Drilling Company:	Kvilhaug	Well Head Completion:	Christy box & locking cap
Project Mgr:	Keith Romstad	Drilling Method:	11" Hollow stem auger	Type of Sampler:	2.5" split barrel
Dates Drilled:	3/26/92	Driller:	Rod	TD (Total Depth):	16.5 ft.

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational

est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary

NR — No recovery

All symbols and definitions may not be applicable

Boring Log and Well Completion Details
VW-3 (Boring B-10)

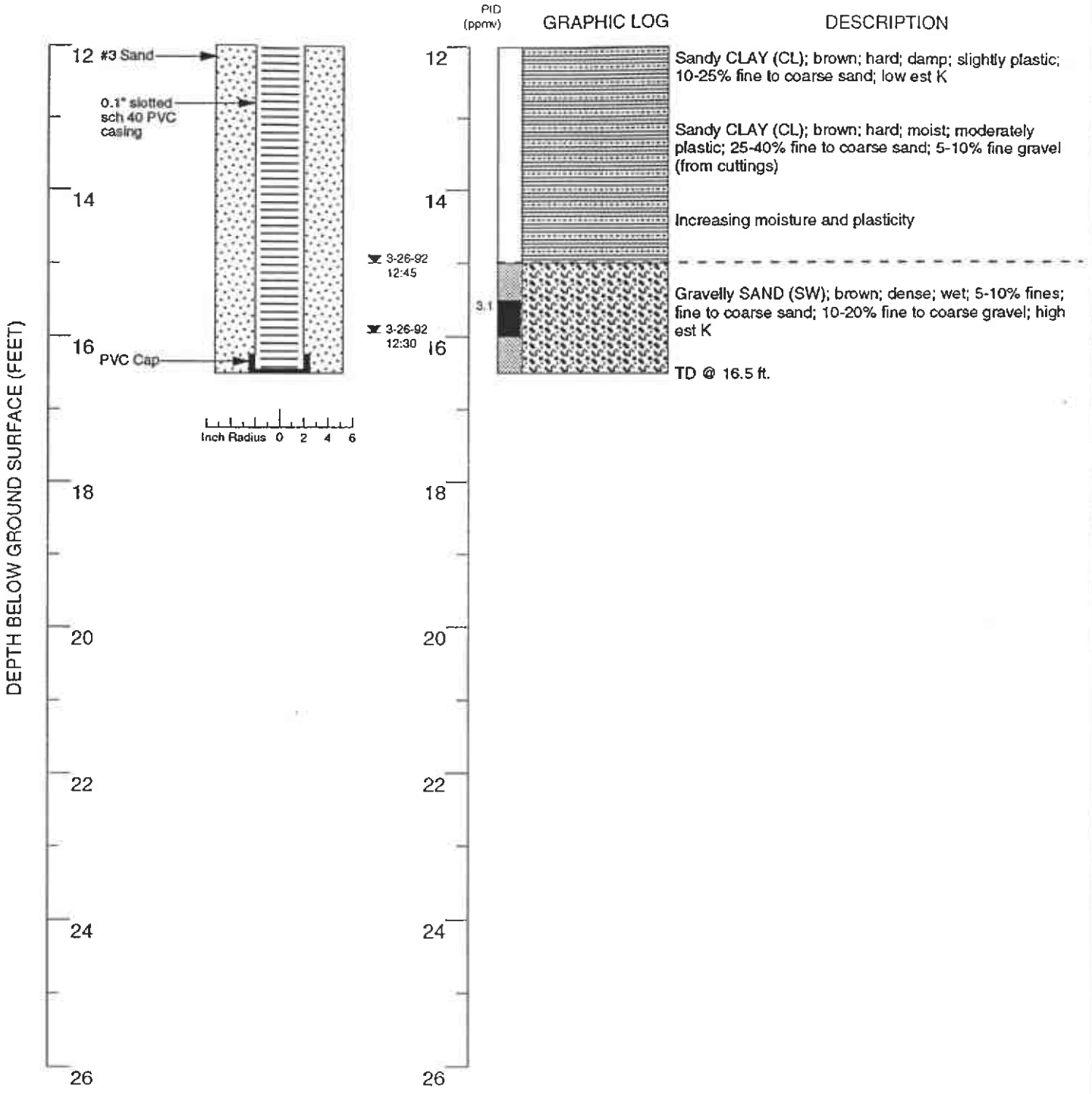
BP Service Station #11133
2220 98th Avenue
Oakland, California

VADOSE WELL

3

RESNA

32006.01



EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

All symbols and definitions may not be applicable

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational

- est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary
- NR — No recovery

Boring Log and Well Completion Details
VW-3 (Boring B-10)

BP Service Station #11133
2220 98th Avenue
Oakland, California

VADOSE WELL

3

RESNA

32006.01