

A Report Prepared for
Shell Oil Company
P. O. Box 4023
Concord, California 94524

QUARTERLY TECHNICAL REPORT
SECOND QUARTER 1991
SHELL SERVICE STATION
6039 COLLEGE AVENUE
OAKLAND, CALIFORNIA
SHELL WIC NO. 204-5508-330

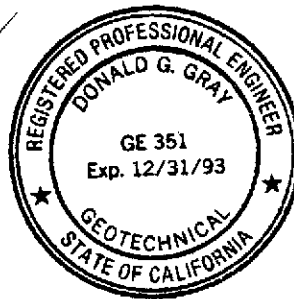
July 1/91

HLA Job No. 4022,233.03

by

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INTRODUCTION

This Quarterly Technical Report by Harding Lawson Associates (HLA) presents results of our continuing environmental investigation at and near the Shell Oil Company (Shell) service station at 6039 College Avenue in Oakland, California. The site location is shown on Plate 1. This report discusses the site history and investigation progress through the second quarter of 1991, along with anticipated activities for the third quarter of 1991.

HLA submitted a work plan (dated January 10, 1990) for a soil and groundwater investigation to the appropriate agencies. In addition, quarterly technical reports have been issued on April 13, July 10, and October 12, 1990, and January 9 and April 9, 1991.

SUMMARY OF PREVIOUS WORK

Preliminary Site Assessment

A Shell service station has occupied this property since 1940. As shown on Plate 2, underground fuel tanks have existed at different locations across the site. Table 1 summarizes the dates of tank installation and removal, and the types of fuel products held in the tanks.

Shell retained HLA to perform a site assessment after an unauthorized release from an underground storage tank (UST). According to the report filed with the Alameda County Department of Environmental Health on September 6, 1989, the source of the

release was a slight weep noted at the piping connection to the submersible pump for the tank holding premium gasoline.

We gathered information on site history from construction plot plans dated 1940, 1957, and 1978 provided by Shell. The station had a full service garage from 1940 to 1978. Plot plans indicate that until 1957, a waste oil tank was located adjacent to the old building, in the present location of the fuel tanks. The 1957 construction plot plan indicates an intent to replace the old waste oil tank with a larger tank, previously used to store fuel; however, no new location is indicated on the plan. The tank was most likely placed in the old excavation near the building, and removed when the present tanks were installed.

Three UST sites within 1/4 mile of the Shell station are listed in the San Francisco Regional Water Quality Control Board (SFRWQCB) Hazardous Substances Container Information Program. The tank locations and contents are listed in Table 2. Additional information on site history was presented in previous reports. Results of our previous soil and groundwater investigation activities are summarized below.

Soil Investigation

In January 1990, six soil borings were advanced to depths of 25 feet, or the top of the saturated zone, at locations shown in Plate 3. The soil borings were drilled and soil samples taken to evaluate lithologies in the vadose zone and near the groundwater surface, and to evaluate the presence and limits of detectable

concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH) in the soil. The borings were located in areas that were potential sources of hydrocarbons, as described below:

<u>Boring</u>	<u>Rationale</u>
B-1	Location of 1940 pump island
B-2	Location of 1940 and 1957 fuel tanks
B-3 and B-6	Location of former waste oil tank and present fuel tanks (near source)
B-4 and B-5	Location of 1957 pump islands and adjacent to present pump islands

The shallow subsurface materials encountered in our borings consist of sandy lean clays and silts, with occasional thin silty sand and gravel lenses. The sediments become saturated from 15 to 18 feet below land surface. The borings were grouted to the surface with a cement-bentonite grout.

Soil samples exhibiting the highest organic vapor readings were sealed and transported to an analytical laboratory, under chain-of-custody documentation, for analysis of BTEX and TPH as gasoline, using Environmental Protection Agency (EPA) Test Methods 8020 and 8015 (modified). Soil samples collected near the former waste oil tank were also analyzed for TPH as diesel fuel and motor oil (EPA Test Method 8015, modified); oil and grease (SM 503 D&E); halogenated volatile organic compounds (VOCs [EPA Test Method 8010]); and cadmium, chromium, zinc, and lead

(EPA Test Methods 6010 and 7421). Results of analyses are presented in Table 3.

Groundwater Investigation

Because the results of soil analyses indicated detectable concentrations of petroleum hydrocarbons in soils near the groundwater surface, a groundwater investigation was implemented in early February 1990. Four monitoring wells (MW-1 through MW-4) were installed at locations shown on Plate 4, and completed to a depth of 25 feet. The borehole for MW-1 was advanced to a depth of 50 feet to evaluate the deeper stratigraphy.

Soil samples were collected from the downgradient well borings (MW-2, MW-3, and MW-4) at depths of approximately 10, 15, and 20 feet. These samples were analyzed for BTEX (EPA Test Method 8020) and for TPH as gasoline, diesel fuel, and motor oil (EPA Test Method 8015, modified) to further delineate the lateral and vertical extent of petroleum hydrocarbons in soil. Soil samples collected from well borings near the former waste oil tank location (MW-3 and MW-4) were also analyzed for polychlorinated biphenyls (PCBs [EPA Test Method 8080]). Free-phase hydrocarbons were observed on the Sprague and Henwood (S&H) sampler at a depth of 20 feet during drilling of MW-4. Results of analyses on these soil samples are presented in Table 4.

Water levels in the wells were measured to the nearest 0.01 foot and the casing elevations were surveyed by HLA on February 15, 1990. Elevations are based on a temporary benchmark of

195.00 feet established at the northwest corner of the building on site. Groundwater level elevations are presented in Table 5.

On February 13, 1990, the wells were developed by removing approximately seven well volumes. Water from the wells was then sampled after purging three additional well volumes. Water samples were submitted for laboratory analysis of BTEX; TPH as gasoline, diesel fuel, and motor oil; organic lead (California LUFT Test Method*); and ethylene dibromide (EDB [EPA Test Method 8010]). A trip blank and a duplicate sample from MW-3 were also submitted for analyses. No free product was observed in the monitoring wells. Water samples from the wells were also obtained in May, September, and November of 1990, as well as March 1991. Results are presented in Table 6.

Although free product was not initially observed, approximately one-half inch was found in MW-4 in November 1990. This product was removed from MW-4 biweekly until March 1991, when only a product sheen was observed.

* Organic lead test method specified in "Leaking Underground Fuel Tank Field Manual", October 1989.

Hydrogeology

The shallow lithology at the site is summarized below:

<u>Soil</u>	<u>Approximate Depth (ft)</u>
Sandy silt	0 to 10
Sandy clay	10 to 15
Sandy silt	15 to 25
Interbedded clays, silts, and sand	25 to 50

Groundwater data for the site (Table 5) indicate that the general groundwater flow direction is to the south-southwest.

Chemical Results

In soil samples from the borings, cumulative BTEX concentrations were either not detected or were present at less than 15 parts per million (ppm [Tables 3 and 4]). In the samples from borings B-3 and B-6, individual concentrations of TPH as gasoline, diesel fuel, and motor oil ranged between 71 and 110,000 ppm. Total oil and grease concentrations in those samples varied from 91 to 1,100 ppm. No halogenated VOCs were detected. Metals tested were either not detected or appeared to be representative of naturally occurring background concentrations for typical soils*.

The soil samples from 15.5 feet in MW-3, and the samples from 15.5 and 20.5 feet in MW-4 contained concentrations of TPH

* Kabat-Pendias, A. and H. Pendias, 1984. Trace Elements in Soils and Plants. CRC Press, Inc., Boca Raton, Florida.

as gasoline, diesel fuel, and/or motor oil above 100 ppm. Concentrations of motor oil were the highest in those three samples, ranging from 1,800 ppm in MW-3 to 46,000 ppm in MW-4. Petroleum hydrocarbons were either not detected in the remaining soil samples or were below 30 ppm. Furthermore, PCBs were not detected in the soil samples from MW-3 and MW-4.

Neither organic lead nor EDB were detected in the February 1990 groundwater samples. As shown in Table 6, groundwater samples from MW-1 and MW-2 have historically shown low to non-detectable concentrations of TPH and BTEX compounds. Past results for water samples from MW-3 and MW-4 have shown detectable benzene concentrations ranging from 18 to 630 parts per billion (ppb) in MW-3, and from 64 to 330 ppb in MW-4. Varying concentrations of TPH have also been detected in water samples from MW-3 and MW-4, with the highest concentrations generally being in the motor oil range.

The TPH analyses for high boiling point hydrocarbons were quantified against a diesel and a motor oil standard. However, the laboratory has stated that the compound mixture present does not appear to be diesel or motor oil but may represent a degraded mixture of these compounds or some other substance. The presence of the heavier compounds may represent lubricants, grease, or oils that have become soluble in the presence of the lighter hydrocarbons.

ACCOMPLISHMENTS DURING THE SECOND QUARTER, 1991

Water Level Measurements

Groundwater levels were measured to the nearest 0.01 foot on June 3, 1991. Groundwater was approximately 16 to 18 feet below ground surface. In March 1991, water levels had risen approximately 3.5 feet since November, 1990, but currently are similar to original levels measured in February, 1990. A potentiometric surface map constructed using these data is shown in Plate 5. This map shows contours of equal groundwater elevation and the general groundwater flow direction estimated from the groundwater elevations in wells MW-1, MW-2, and MW-3 (these well locations form the largest well triangle on the site). The predominant groundwater flow direction appears to be southwest and is consistent with previous flow directions estimated since February, 1990.

Groundwater Sampling

Water from wells MW-1 through MW-4 was sampled on June 3, 1991, after purging three well volumes. A thin film of separate-phase product was observed in the MW-4, and was removed prior to purging and sampling. Groundwater samples were submitted for laboratory analysis of BTEX and TPH as gasoline, diesel fuel and motor oil. Results are summarized in Table 6 and the laboratory report and chain-of-custody appear in the appendix.

Chemical Results

The groundwater samples from MW-1 and MW-2 continued to show no detectable concentrations of BTEX or TPH. The sample from MW-3 contained 260 ppb benzene and cumulative concentrations of TPH totaling 2,390 ppb. Groundwater from MW-4 contained 240 ppb benzene and 1,770 ppb TPH. The distribution of benzene and cumulative TPH in groundwater is shown on Plates 6 and 7, respectively. BTEX and TPH concentrations in groundwater from MW-3 and MW-4 have decreased since the previous quarter.

As indicated in the laboratory analysis report, petroleum hydrocarbons detected in water from MW-3 appear to be characteristic of weathered gasoline. Data suggest that the hydrocarbons found in water from MW-4 are a mixture of gasoline and a heavier petroleum product such as diesel fuel. TPH as motor oil was not present above the analytical detection limit of 500 ppb in water from MW-3 or MW-4.

ANTICIPATED ACTIVITIES FOR THE THIRD QUARTER, 1991

During the third quarter of 1991, HLA intends to perform the following activities at the subject Shell service station:

- Install one off-site monitoring well (shown on Plate 4) to further evaluate the lateral and vertical extent of petroleum hydrocarbons in the soil and groundwater;
- Sample water from new and existing monitoring wells quarterly for BTEX; TPH as gasoline, as diesel fuel, and as motor oil;
- Sample free product, if detected in sufficient quantity in MW-4, and submit it to the chemical testing laboratory to identify the type of fuel product. If

What happened to the wells?

detected, separate-phase product will be removed from the well by bailing.

HLA anticipates placing the well at the approximate location shown on Plate 4. However, the location may be modified depending on site access and permit constraints.

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Table 1. Site History and Tank Inventory

<u>Year Constructed/ Removed</u>	<u>Underground* Tanks</u>	<u>Contents</u>	<u>Structures*</u>
1940/1957	3 1,000-gallon 1 550-gallon 1 110-gallon	Leaded gasoline Leaded gasoline Waste oil	Full service garage and one pump island
1957/1978	3 5,000-gallon 1 1,000-gallon	Leaded gasoline Waste oil	Full service garage and two pump islands with canopies
Unknown, but between 1957 and 1978/1978	1 8,000-gallon	Leaded or Unleaded gasoline	Same as above
1978/NR	3 10,000-gallon fiberglass	Unleaded gasoline	Cashier counter and Mini- Mart, two pump islands with canopies

* Approximate locations shown on Plate 2

NR Not removed, currently in operation

Table 2. Underground Storage Tanks
within 1/4 Mile of
6039 College Avenue Shell

<u>Location</u>	<u>Number of Tanks</u>	<u>Material in Tanks</u>
1. Union 76 6201 Claremont Avenue	4	Unleaded and Premium unleaded Gasoline Waste oil Oil/water Mix
2. Chevron 5800 College Avenue	4	Unknown
3. Dreyers Grand Ice Cream 5929 College Avenue	1	Diesel fuel

Table 3. Soil Analytical Results - Borings
 Shell 6039 College Avenue
 Concentrations in Parts Per Million (ppm)

Sample Depth	B-1-22.5'	B-2-18'	B-2-24'	B-3-19'	B-3-21'	B-4-18.5'	B-4-25'	B-5-22'	B-5-23'	B-6-19.5'	B-6-22.5'
Approx. GW Depth	21'	22'	22'	18'	18'	20'	20'	19'	19'	18'	18'
Sample Date	01/04/90	01/05/90	01/05/90	01/05/90	01/05/90	01/04/90	01/04/90	01/04/90	01/04/90	01/05/90	01/05/90
Parameter											
/Method											
Benzene	ND @ 0.05	0.62	ND @ 0.05	0.24	0.19	0.57	ND @ 0.05	ND @ 0.05	ND @ 0.05	0.28	ND @ 0.05
Toluene	ND @ 0.1	ND @ 0.1	ND @ 0.1	0.18	ND @ 0.1	0.11	ND @ 0.1	ND @ 0.1	ND @ 0.1	ND @ 0.1	ND @ 0.1
Ethylbenzene	ND @ 0.1	0.48	ND @ 0.1	4.1	0.53	0.65	ND @ 0.1	ND @ 0.1	ND @ 0.1	1.3	ND @ 0.1
Xylenes	ND @ 0.1	1.2	ND @ 0.1	9.8	0.68	1.3	ND @ 0.1	ND @ 0.1	ND @ 0.1	2.1	ND @ 0.1
/EPA 8020											
TPH as Gasoline	8.1	130	1.8	610	71	170	ND @ 1	ND @ 1	4.4	260	ND @ 1
TPH as Motor Oil	---	---	---	110000	14000	---	---	---	---	12000	320
TPH as Diesel	---	---	---	5900	750	---	---	---	---	600	16
/EPA 8015											
Oil and Grease	---	---	---	810	380	---	---	---	---	1100	91
/SM 503 D&E											
Halogenated VOCs	---	---	---	ND @ 0.5	ND @ 0.5	---	---	---	---	ND @ 0.05	ND @ 0.005
/EPA 8010				to 2.5	to 0.25					to 0.25	to 0.025
Cadmium	---	---	---	ND @ 0.5	ND @ 0.5	---	---	---	---	ND @ 0.5	ND @ 0.5
Chromium	---	---	---	48	61	---	---	---	---	86	73
Zinc	---	---	---	51	54	---	---	---	---	52	60
/EPA 6010											
Lead/EPA 7241	---	---	---	13	7.6	---	---	---	---	8.1	9.2

--- = Analysis not performed on sample

ND = Not present above the stated detection limit

Table 4. Soil Analytical Results - Well Borings
 Shell 6039 College Avenue, Oakland
 Concentrations in parts per million (ppm)

Sample/Depth	MW-2-11'	MW-2-15.5'	MW-2-20.5'	MW-3-10'	MW-3-15.5'	MW-3-20.5'	MW-4-10.5'	MW-4-15.5'	MW-4-20.5'
Approx. GW Depth	17'	17'	17'	16'	16'	16'	17'	17'	17'
Sample Date	2/08/90	2/08/90	2/08/90	2/07/90	2/07/90	2/07/90	2/07/90	2/07/90	2/07/90
<hr/>									
Parameter /Method									
<hr/>									
Benzene	ND @ 0.05	ND @ 0.05	ND @ 0.05	ND @ 0.05	1.1	ND @ 0.05	ND @ 0.05	0.31	0.06
Toluene	ND @ 0.1	ND @ 0.1	ND @ 0.1	ND @ 0.1	0.7	ND @ 0.1	ND @ 0.11	0.34	ND @ 0.1
Ethylbenzene	ND @ 0.1	ND @ 0.1	ND @ 0.1	ND @ 0.1	3.1	ND @ 0.1	ND @ 0.1	0.92	0.46
Xylenes	ND @ 0.1	ND @ 0.1	ND @ 0.1	0.11	1.9	ND @ 0.1	ND @ 0.1	2.6	0.57
/EPA 8020									
TPH as Gasoline	ND @ 1	ND @ 1	ND @ 1	12	230	28	ND @ 1	140	72
TPH as Motor Oil	ND @ 10	ND @ 1	ND @ 10	ND @ 10	1,800	ND @ 10	ND @ 1	6,400	46,000
TPH as Diesel	ND @ 1	ND @ 1	1.1	4.4	200	9.9	1.2	61	2200
/EPA 8015									
PCBs/EPA 8080	---	---	---	ND @ 0.05	ND @ 0.05	ND @ 0.05	ND @ 0.05	ND @ 0.05	ND @ 0.05

--- = Analysis not performed on sample

ND = Not present above the stated detection limit

Table 5. Groundwater Elevations

Well	Top of Casing Elevations*	Depth to Groundwater (feet)							
		<u>2/15/90</u>	<u>4/19/90</u>	<u>5/14/90</u>	<u>6/21/90</u>	<u>9/12/90</u>	<u>11/27/90</u>	<u>03/08/91</u>	<u>06/03/91</u>
MW-1	195.89	17.73	18.51	18.92	18.21	19.81	20.39	16.85	17.82
MW-2	194.27	16.90	17.69	18.01	17.39	19.00	19.44	15.96	17.00
MW-3	192.52	15.81	16.57	16.97	16.27	18.78	18.27	14.86	15.84
MW-4	193.37	16.73	17.48	17.88	17.18	17.85	19.16	15.77	16.77

Well	Casing Elevations*	Groundwater Elevations							
		<u>2/15/90</u>	<u>4/19/90</u>	<u>5/14/90</u>	<u>6/21/90</u>	<u>9/12/90</u>	<u>11/27/90</u>	<u>03/08/91</u>	<u>06/03/91</u>
MW-1	195.89	178.16	177.38	176.97	177.68	176.08	175.50	179.04	178.07
MW-2	194.27	177.37	176.58	176.26	176.88	175.27	174.83	178.31	177.27
MW-3	192.52	176.71	175.95	175.55	176.25	173.74	174.25	177.66	176.68
MW-4	193.37	176.65	175.89	175.49	176.19	175.52	174.21	177.60	176.60

* Based on an arbitrary benchmark of 195.00 feet

Table 6. Groundwater Analytical Results
 Shell 6039 College Avenue, Oakland
 Concentrations in Parts Per Billion (ppb)

Sample No.	Sample Date	EPA 8020				EPA 8015 - Modified		
		Benzene	Toluene	Ethyl-Benzene	Xylenes	Total Petroleum Hydrocarbons		
						Gasoline	Diesel	Motor Oil
MW-1	02/13/90	ND @ 0.3	0.67	0.37	3.2	95	650	770
	05/14/90	0.70	0.57	0.71	3.5	95	ND @ 50	770
	09/12/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	84	ND @ 50
	11/27/90	NS	NS	NS	NS	NS	NS	NS
	03/08/91	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 50	50	ND @ 50
	06/03/91	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 50	ND @ 50	ND @ 500
MW-2	02/13/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	560	ND @ 50
	05/14/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	ND @ 50	ND @ 50
	09/12/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	ND @ 50	ND @ 50
	11/27/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	ND @ 50	ND @ 50
	03/08/91	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 50	ND @ 50	ND @ 500
	06/03/91	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 50	ND @ 50	ND @ 500
MW-3	02/13/90	320	29	110	33	4,700	3,100	3,000
	05/14/90	130	8.6	40	17	1,400	620	40,000
	09/12/90	58	5.8	16	15	2,000	1,500	19,000
	11/27/90	18	1.5	8.7	2.5	540	240	460
	03/08/91	630	33	270	18	3,400	2,100	ND @ 500
	06/03/91	260	13	98	24	1,700	690*	ND @ 500

--- = Analysis not performed on sample

ND = Not present above the stated detection limit

-D = Duplicate sample

NS = Not sampled

* = Laboratory reports that these compounds appear to be the less volatile constituents of gasoline.

** = Compounds are within the chromatographic range for gasoline but are not characteristic of the standard gasoline pattern.

*** = Results include compounds apparently due to gasoline as well as those due to diesel.

Table 6. (Continued)

Sample No.	Sample Date	EPA 8020				EPA 8015 - Modified		
		Benzene	Toluene	Ethyl-Benzene	Xylenes	Total Petroleum Hydrocarbons		
						Gasoline	Diesel	Motor Oil
MW-3-D	02/13/90	380	8.6	160	57	4,600	4,500	8,300
	05/14/90	120	31	38	13	820	660	10,000
MW-4	02/13/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	1,200	3,000
	05/14/90	160	7	1.9	3.1	650	350	12,000
	09/12/90	91	1.1	0.75	0.79	440	260	2,600
	11/27/90	64	1.2	0.80	2.7	470	2,400	1,000
	03/08/91	330	3.5	88	5.8	1,100	2,600	15,000
	06/03/91	240	2.3	1.6	2.3	670**	1,100***	ND @ 500
MW-4-D	09/12/90	85	1.0	0.71	0.81	520	1,100	16,000
Trip Blank	02/13/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	--	--
	05/14/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	--	--
	09/12/90	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 0.3	ND @ 30	--	--
	03/08/91	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 0.5	ND @ 50	--	--

--- = Analysis not performed on sample

ND = Not present above the stated detection limit

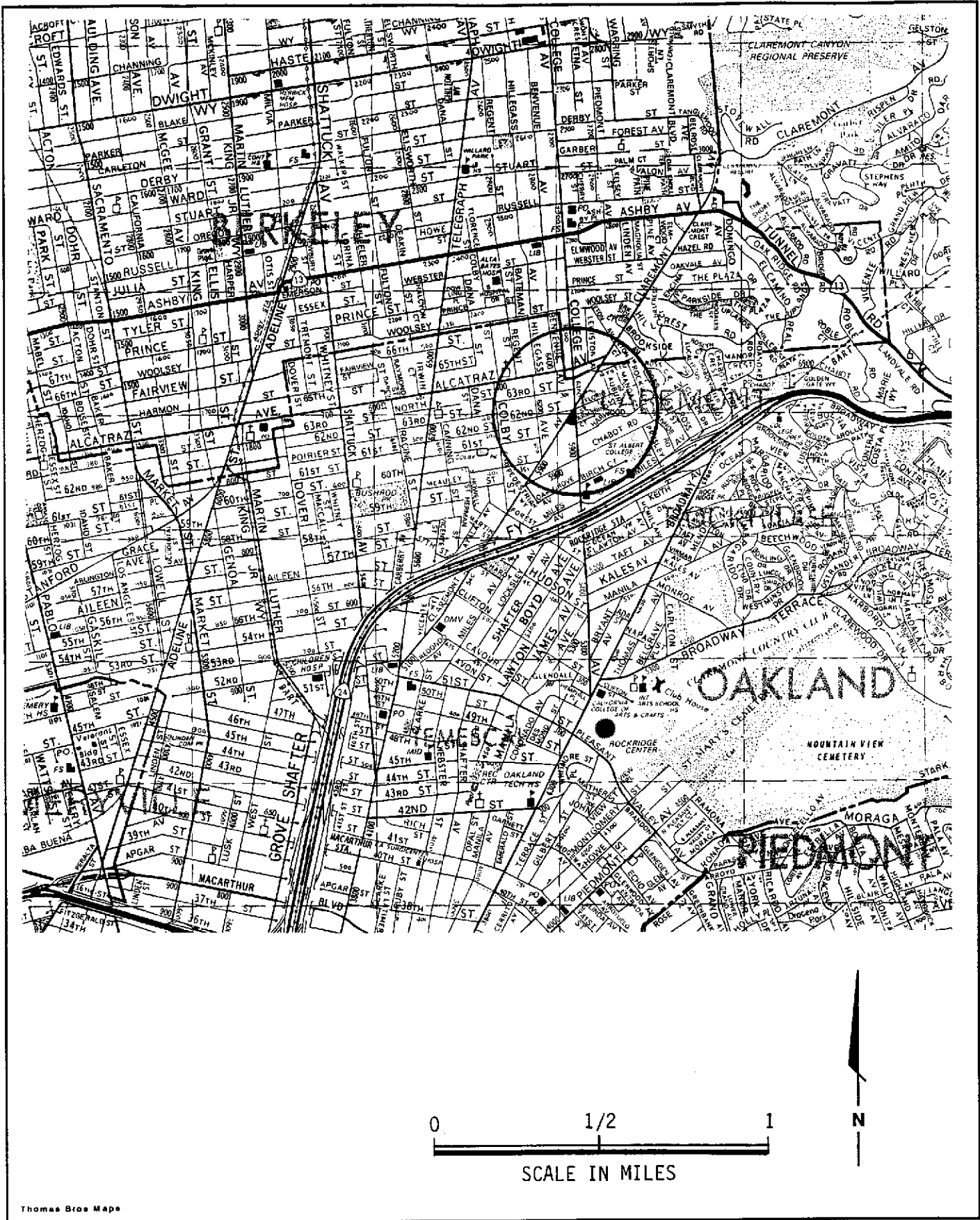
-D = Duplicate sample

NS = Not sampled

* = Laboratory reports that these compounds appear to be the less volatile constituents of gasoline.

** = Compounds are within the chromatographic range for gasoline but are not characteristic of the standard gasoline pattern.

*** = Results include compounds apparently due to gasoline as well as those due to diesel.



Thomas Bros Maps



Harding Lawson Associates
 Engineering and
 Environmental Services

DRAWN S. Patel
 JOB NUMBER 4022,233.03

Site Location Map
 Shell Service Station
 6039 College Avenue
 Oakland, California

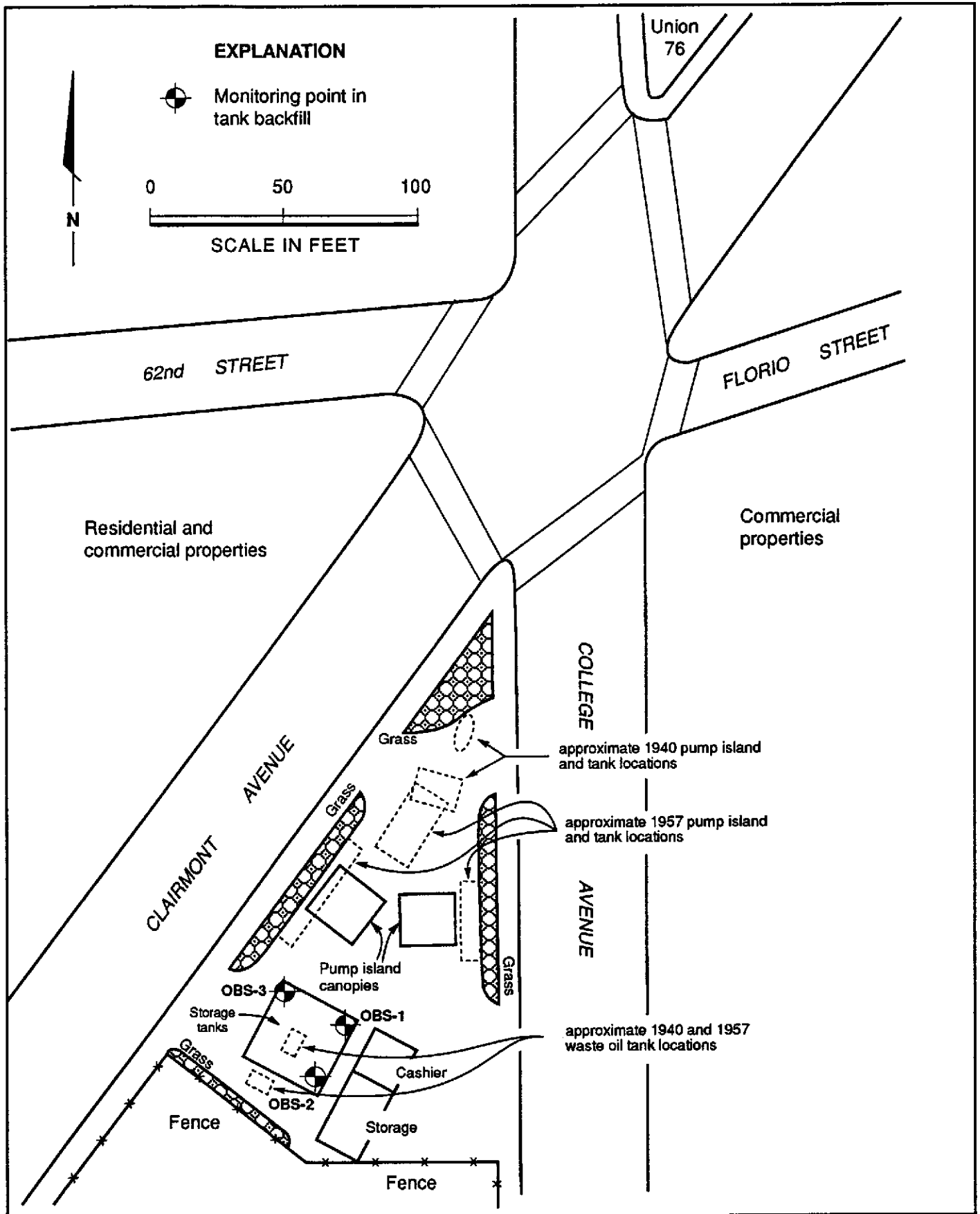
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DATE 11/89

REVISED DATE 01/04/91

PLATE

1



Harding Lawson Associates
Engineering and Environmental Services

Site Plan Map
Shell Service Station
6039 College Avenue
Oakland, California

PLATE

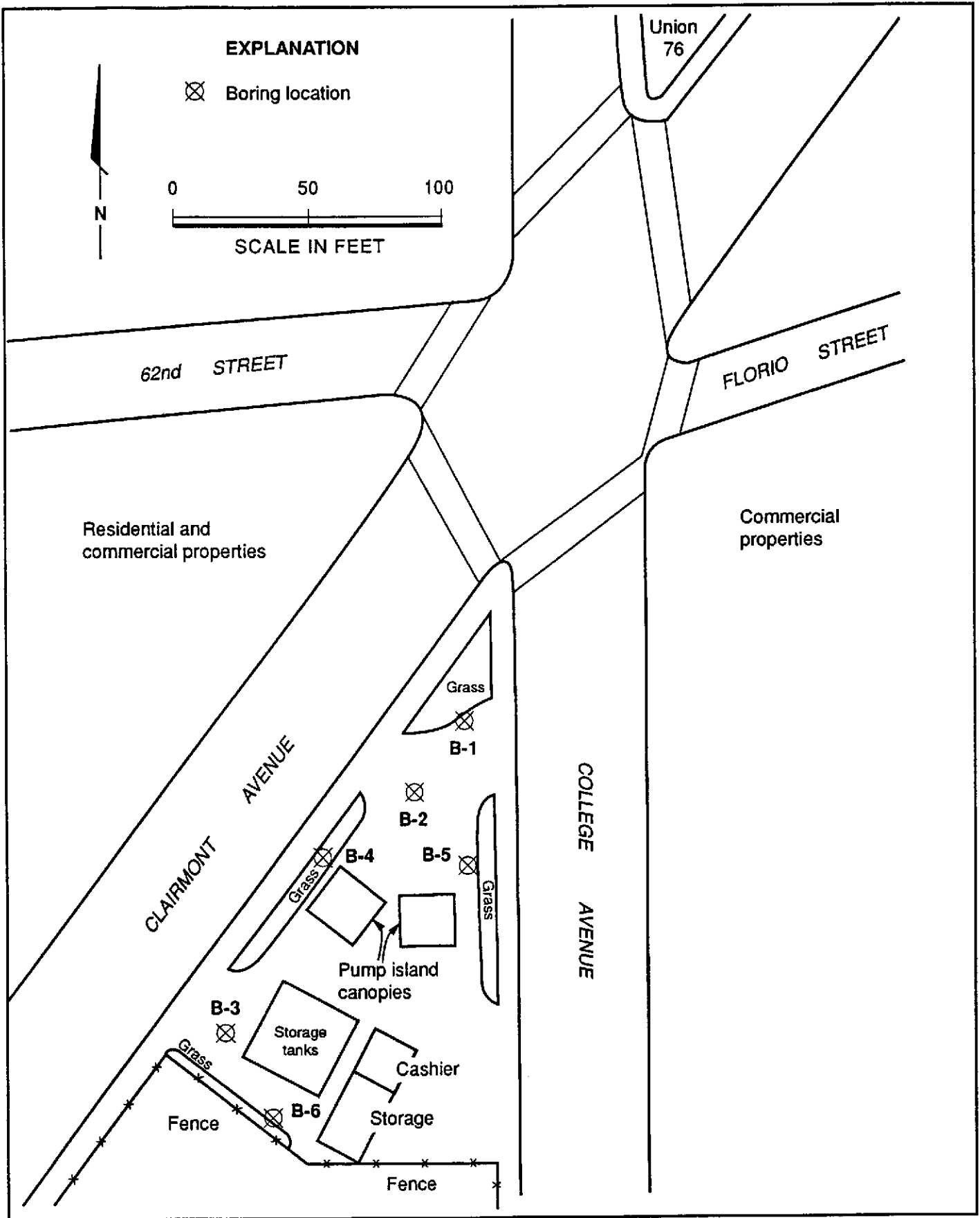
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DRAWN S. Patel
JOB NUMBER 4022,233.03

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DATE 11/89

REVISED DATE 04/04/91



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 Environmental Services

Soil Boring Locations
 Shell Service Station
 6039 College Avenue
 Oakland, California

PLATE

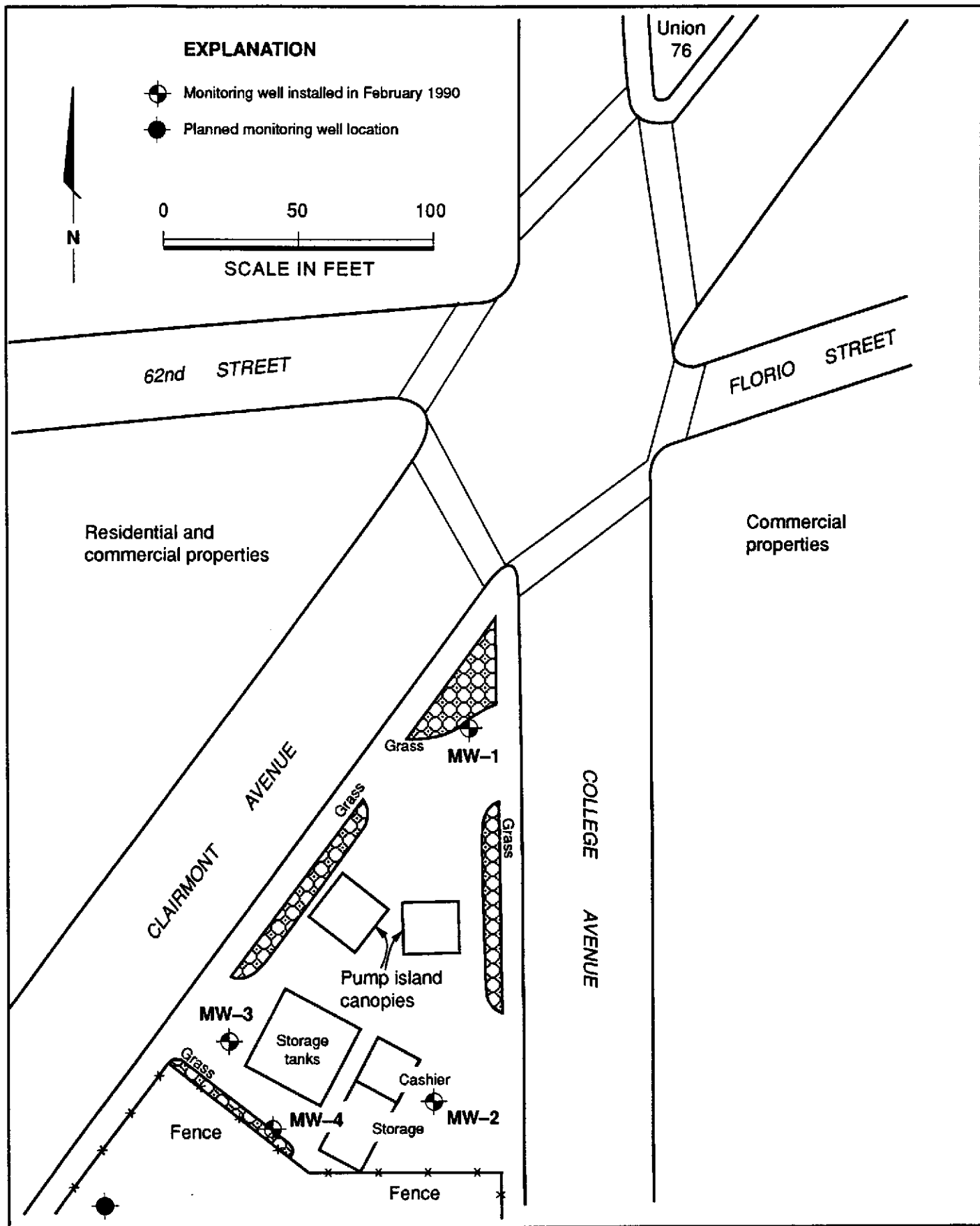
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DRAWN S. Patel
 JOB NUMBER 4022,233.03

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DATE 7/90

REVISED DATE 01/04/91



Harding Lawson Associates
Engineering and Environmental Services

Monitoring Well Locations
Shell Service Station
6039 College Avenue
Oakland, California

PLATE

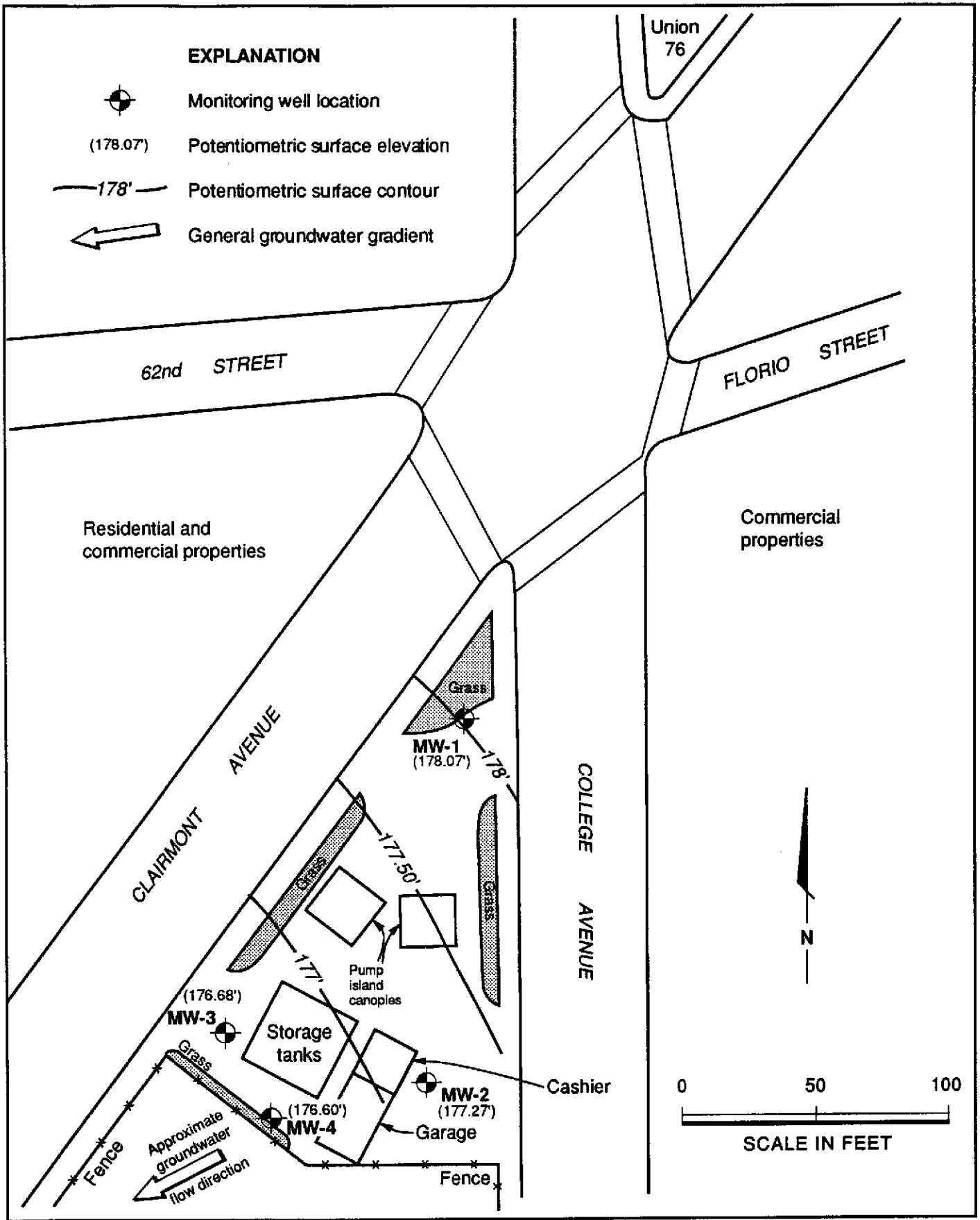
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DRAWN S. Patel
JOB NUMBER 4022,233.03

APPROVED
[Signature]

DATE 11/89

REVISED DATE 06/27/91



Harding Lawson Associates
 Engineering and Environmental Services

Potentiometric Surface Shallow Sediments - June 1991
 Shell Service Station
 6039 College Avenue
 Oakland, California

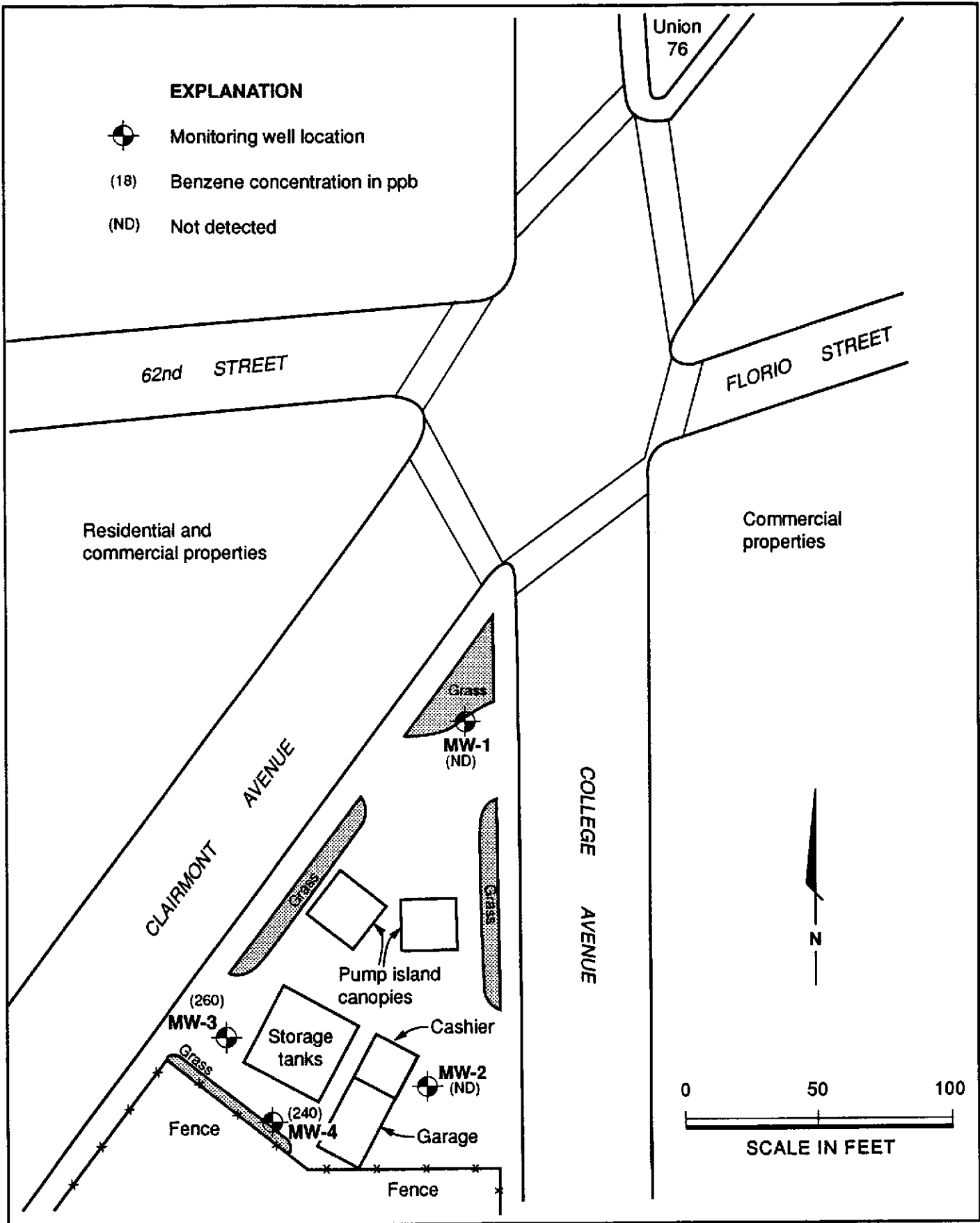
PLATE

5

DRAWN: RHC
 JOB NUMBER: 4022,233.03

APPROVED: *[Signature]*

DATE: 12/90
 REVISED DATE: 06/27/91



Harding Lawson Associates
 Engineering and
 Environmental Services

Distribution of Benzene in Groundwater
 June, 1991
 Shell Service Station
 6039 College Avenue
 Oakland, California

PLATE

6


DRAWN RHC
 JOB NUMBER 4022,233.03

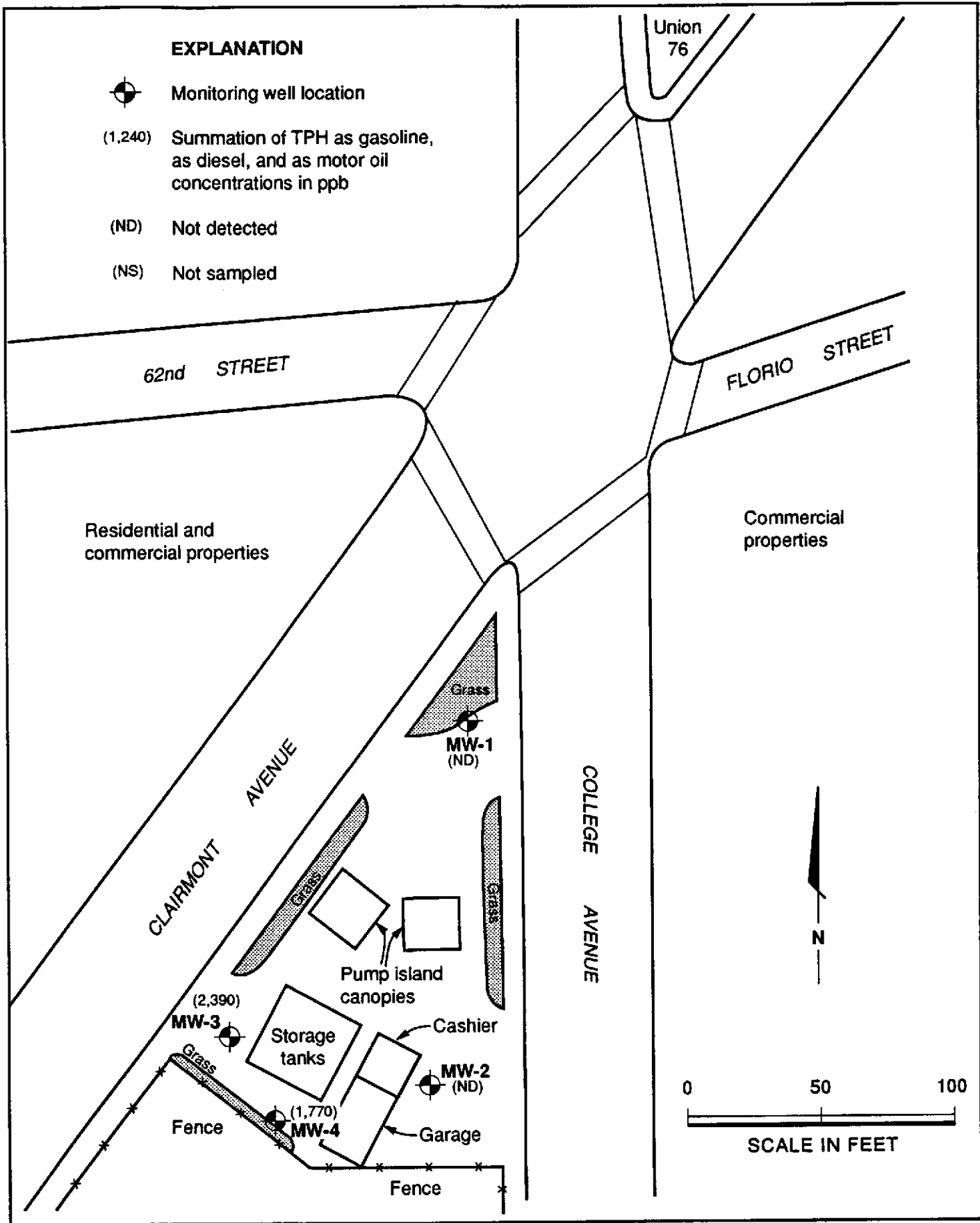
APPROVED
[Signature]

DATE 12/90

REVISED DATE 6/27/91

EXPLANATION

-  Monitoring well location
- (1,240) Summation of TPH as gasoline, as diesel, and as motor oil concentrations in ppb
- (ND) Not detected
- (NS) Not sampled



Distribution of TPH in Groundwater
 June, 1991
 Shell Service Station
 6039 College Avenue
 Oakland, California

PLATE

7



Harding Lawson Associates
 Engineering and
 Environmental Services

DRAWN: RHC
 JOB NUMBER: 4022,233.03

APPROVED


DATE: 12/90
 REVISED DATE: 6/91



CERTIFICATE OF ANALYSIS

Shell Oil Company
Harding Lawson Associates
1355 Willow Way, Suite 109
Concord, CA 94520
Dorinda Holloway

Date: 06/26/91

Work Order: T1-06-041

P.O. Number: MOH 880-021 Vendor #I0002402

This is the Certificate of Analysis for the following samples:

Client Work ID: 4022,233.03 6039College Av,Ok, CORRECTED REPORT
Date Received: 06/05/91
Number of Samples: 4
Sample Type: aqueous

TABLE OF CONTENTS FOR ANALYTICAL RESULTS

<u>PAGES</u>	<u>LABORATORY #</u>	<u>SAMPLE IDENTIFICATION</u>
2	T1-06-041-01	MW-1
3	T1-06-041-02	MW-2
4	T1-06-041-03	MW-3
6	T1-06-041-04	MW-4
10	T1-06-041-05	Quality Control

Reviewed and Approved:


Suzanna Veaudry
Project Manager

American Council of Independent Laboratories
International Association of Environmental Testing Laboratories
American Association for Laboratory Accreditation

Company: Shell Oil Company, CORRECTED REPORT
 Date: 06/26/91
 Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: MW-1
 SAMPLE DATE: 06/03/91
 LAB SAMPLE ID: T106041-01
 SAMPLE MATRIX: aqueous
 RECEIPT CONDITION: Cool pH <2 LBH
 RECEIPT CONDITION: Cool pH >2 HBH

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		06/11/91
Low Boiling Hydrocarbons	Mod.8015		06/11/91
High Boiling Hydrocarbons	Mod.8015	06/11/91	06/13/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.05	None
BTEX		
Benzene	0.0005	None
Toluene	0.0005	None
Ethylbenzene	0.0005	None
Xylenes (total)	0.0005	None
High Boiling Hydrocarbons		
calculated as Diesel	0.05	None
calculated as Oil	0.5	None

SURROGATES	% REC
1,3-Dichlorobenzene (Gasoline)	101.
1,3-Dichlorobenzene (BTEX)	99.
nC32 (Diesel)	89.

Company: Shell Oil Company, CORRECTED REPORT
 Date: 06/26/91
 Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: MW-2
 SAMPLE DATE: 06/03/91
 LAB SAMPLE ID: T106041-02
 SAMPLE MATRIX: aqueous
 RECEIPT CONDITION: Cool pH <2 LBH
 RECEIPT CONDITION: Cool pH >2 HBH

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		06/11/91
Low Boiling Hydrocarbons	Mod.8015		06/11/91
High Boiling Hydrocarbons	Mod.8015	06/11/91	06/13/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.05	None
BTEX		
Benzene	0.0005	None
Toluene	0.0005	None
Ethylbenzene	0.0005	None
Xylenes (total)	0.0005	None
High Boiling Hydrocarbons		
calculated as Diesel	0.05	None
calculated as Oil	0.5	None

SURROGATES	% REC
1,3-Dichlorobenzene (Gasoline)	103.
1,3-Dichlorobenzene (BTEX)	99.
nC32 (Diesel)	80.

Company: Shell Oil Company, CORRECTED REPORT
 Date: 06/26/91
 Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: MW-3
 SAMPLE DATE: 06/03/91
 LAB SAMPLE ID: T106041-03
 SAMPLE MATRIX: aqueous
 RECEIPT CONDITION: Cool pH <2 LBH
 RECEIPT CONDITION: Cool pH >2 HBH

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		06/10/91
Low Boiling Hydrocarbons	Mod.8015		06/10/91
High Boiling Hydrocarbons	Mod.8015	06/11/91	06/13/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.25	1.7
BTEX		
Benzene	0.0025	0.26
Toluene	0.0025	0.013
Ethylbenzene	0.0025	0.098
Xylenes (total)	0.0025	0.024
High Boiling Hydrocarbons calculated as Diesel	0.05	0.69 #
calculated as Oil	0.5	None

SURROGATES	% REC
1,3-Dichlorobenzene (Gasoline)	111.
1,3-Dichlorobenzene (BTEX)	106.
nC32 (Diesel)	75.

Comments:

Compounds detected and calculated as diesel appear to be the less volatile constituents of gasoline.

Company: Shell Oil Company, CORRECTED REPORT

Date: 06/26/91

Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: MW-4

SAMPLE DATE: 06/03/91

LAB SAMPLE ID: T106041-04

SAMPLE MATRIX: aqueous

RECEIPT CONDITION: Cool pH <2 LBH

RECEIPT CONDITION: Cool pH >2 HBH

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		06/12/91
Low Boiling Hydrocarbons	Mod.8015		06/12/91
High Boiling Hydrocarbons	Mod.8015	06/11/91	06/13/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.1	0.67 &
BTEX		
Benzene	0.001	0.24
Toluene	0.001	0.0023
Ethylbenzene	0.001	0.0016
Xylenes (total)	0.001	0.0023
High Boiling Hydrocarbons calculated as Diesel	0.05	1.1 +
calculated as Oil	0.5	None

SURROGATES	% REC
1,3-Dichlorobenzene (Gasoline)	110.
1,3-Dichlorobenzene (BTEX)	94.
nC32 (Diesel)	83.

Comments:

+ Results include compounds apparently due to gasoline as well as those due to diesel.

& Compounds detected and calculated as low boiling hydrocarbons consist of compounds eluting within the chromatographic range of gasoline, but are not characteristic of the standard gasoline standard pattern.

Company: Shell Oil Company, CORRECTED REPORT
 Date: 06/26/91
 Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Spike and Spike Duplicates

SAMPLE ID: Quality Control
 SAMPLE DATE: not spec
 LAB SAMPLE ID: T106041-05A
 EXTRACTION DATE: 06/11/91
 ANALYSIS DATE: 06/13/91
 ANALYSIS METHOD: Mod.8015

QUALITY CONTROL REPORT

Laboratory Spike(LS) and Laboratory Spike Duplicate(LSD) Analyses

RESULTS in Micrograms per Liter

PARAMETER	Sample Amt	Spike Amt	LS Result	LSD Result	LS %Rec	LSD %Rec	RPD
Diesel	None	2500.	2354.	2239.	94.	90.	4.
SURROGATES					LS %Rec	LSD %Rec	
nC32					78.	55.	

Company: Shell Oil Company, CORRECTED REPORT
Date: 06/26/91
Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Spike and Spike Duplicates

SAMPLE ID: Quality Control
SAMPLE DATE: not spec
LAB SAMPLE ID: T106041-05A
EXTRACTION DATE:
ANALYSIS DATE: 06/06/91
ANALYSIS METHOD: Mod.8015

QUALITY CONTROL REPORT

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Analyses

RESULTS in Micrograms per Liter

PARAMETER	Sample Amt	Spike Amt	MS Result	MSD Result	MS %Rec	MSD %Rec	RPD
Gasoline	ND<50	500.	485.	477.	97.	95.	2.
SURROGATES					MS %Rec	MSD %Rec	
1,3 Dichlorobenzene					112.	111.	

Company: Shell Oil Company, CORRECTED REPORT
 Date: 06/26/91
 Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Spike and Spike Duplicates

SAMPLE ID: Quality Control
 SAMPLE DATE: not spec
 LAB SAMPLE ID: T106041-05B
 EXTRACTION DATE:
 ANALYSIS DATE: 06/11/91
 ANALYSIS METHOD: Mod.8015

QUALITY CONTROL REPORT

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Analyses

RESULTS in Micrograms per Liter

PARAMETER	Sample Amt	Spike Amt	MS Result	MSD Result	MS %Rec	MSD %Rec	RPD
Gasoline	ND<50	500.	407.	402.	81.	80.	1.
SURROGATES					MS %Rec	MSD %Rec	
1,3-Dichlorobenzene					111.	110.	

Company: Shell Oil Company, CORRECTED REPORT
 Date: 06/26/91
 Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST NAME: Spike and Spike Duplicates

SAMPLE ID: Quality Control
 SAMPLE DATE: not spec
 LAB SAMPLE ID: T106041-05C
 EXTRACTION DATE:
 ANALYSIS DATE: 06/12/91
 ANALYSIS METHOD: Mod.8015

QUALITY CONTROL REPORT

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Analyses

RESULTS in Micrograms per Liter

PARAMETER	Sample Amt	Spike Amt	MS Result	MSD Result	MS %Rec	MSD %Rec	RPD
Gasoline	ND<50	500.	303.	313.	61.	63.	3.
SURROGATES					MS %Rec	MSD %Rec	
1,3-Dichlorobenzene					104.	105.	

Company: Shell Oil Company, CORRECTED REPORT
Date: 06/26/91
Client Work ID: 4022,233.03 6039College Av,Ok

Work Order: T1-06-041

TEST CODE TPEND TEST NAME TPH High Boiling by (8015)

The method of analysis for high boiling hydrocarbons s taken from the LUFT field manual. Samples are extracted with solvent and examined by gas chromatography using a flame ionization detector. Results in soils are corrected for moisture content and are reported on a dry soil basis unless otherwise noted.

TEST CODE TPHVB TEST NAME TPH Gas,BTEX by 8015/8020

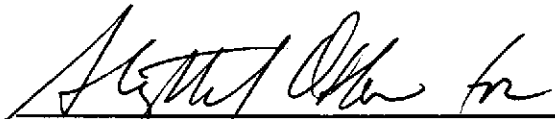
The method of analysis for low boiling hydrocarbons is taken from EPA Methods modified 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector in series with a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline. Results in soils are corrected for moisture content and are reported on a dry soil basis unless otherwise noted.

DISTRIBUTION

- 1 copy: Shell Oil Company
East Bay Retail District
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Concord, California 94520
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- 1 copy: Shell Oil Company
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- 1 copy: Alameda County Environmental
Health Department
80 Swan Way, Room 200
Oakland, California 94621
Attention: Mr. Ed Howell

DCH/DGG/pkp 031722B/R47

QUALITY CONTROL REVIEWER



Terence J. McManus
Associate Environmental Scientist