KAPREALIAN ENGINEERING, INC.
Consulting Engineers
P.O. BOX 996 • BENICIA, CA 94510
(707) 746-6915 • (707) 746-6916 • FAX: (707) 746-5581

91 JAN 14 PM 3:04

January 10, 1991

Alameda County Health Care Services
80 Swan Way, Room 200
Oakland, CA 94621

Attention: Mr. Gil Wistar

RE: Unocal Service Station #0746
3943 Broadway
Oakland, California

Dear Mr. Wistar:

Per the request of Mr. Ron Bock of Unocal Corporation, enclosed please find our report and proposal, both dated December 17, 1990, for the above referenced site.

Should you have any questions, please feel free to call our office at (707) 746-6915.

Sincerely,

Kaprealian Engineering, Inc.

Judy A. Dewey

jad\82

Enclosure

cc: Ron Bock, Unocal Corporation

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Consulting Engineers
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KEI-P89-0805.R6
December 17, 1990

Unocal Corporation
2000 Crow Canyon Place, #400
P.O. Box 5155
San Ramon, California 94583

Attention: Mr. Ron Bock

RE: Continuing Ground Water Investigation at
Unocal Service Station #0746
3943 Broadway
Oakland, California

Dear Mr. Bock:

This report presents the results of Kaprealian Engineering, Inc's. (KEI) soil and ground water investigation for the referenced site in accordance with proposal KEI-P89-0805.P4 dated March 16, 1990. The purpose of the investigation was to further define the ground water flow direction, and to further determine the degree and extent of ground water contamination at the site. The scope of the work performed by KEI consisted of the following:

Coordination with regulatory agencies.

Geologic logging of four borings for the installation of four monitoring wells.

Soil sampling.

Ground water monitoring, purging and sampling of nine monitoring wells.

Laboratory analyses.

Data analysis, interpretation and report preparation.

SITE DESCRIPTION AND BACKGROUND

The subject site is presently used as a gasoline station. The site is situated on gently sloping south-southwest trending topography, and is located at the southwest corner of the intersection of Broadway and 40th Street in Oakland, California. A Location Map, Site Vicinity Map, and two Site Plans are attached to this report.

KEI's work at the site began on August 16, 1989 when KEI was asked to collect soil samples following the removal of two underground fuel storage tanks and one 280 gallon waste oil tank at the site. The fuel tanks consisted of one 10,000 gallon unleaded tank and one 10,000 gallon super unleaded tank. The tanks were made of steel and no apparent holes or cracks were observed in any of the tanks. Water was encountered in the fuel tank pit at a depth of about 10 feet, thus prohibiting the collection of any soil samples from immediately beneath the tanks. Six soil samples, designated as SW1 through SW6, were collected from the sidewalls of the gasoline tank pit approximately six inches above the water table. One soil sample was collected from the bottom of the waste oil tank excavation at a depth of 8 feet. Soil sample point locations are shown on the attached Site Plan, Figure 2.

On August 17, 1989, approximately 1,500 gallons of ground water was pumped from the fuel tank pit. One water sample, labeled W1, was then collected from the fuel tank pit.

To accommodate the installation of new, larger tanks, additional soil was excavated approximately 14 feet laterally along the north wall of the tank pit, in the vicinity of sample points SW1 and SW2. On August 18, 1989, KEI returned to the site to collect five additional soil samples. One soil sample, labeled SW2(R), was collected from the north sidewall of the fuel tank pit after additional excavation at a depth of 9.5 feet. Also, on August 18, 1989, four soil samples were collected from the product pipe trenches at depths ranging from 5 to 6.5 feet. After soil sampling, the pipe trenches were excavated to the sample depths. Collection points for the soil samples are shown on the attached Site Plan, Figure 2.

KEI again returned to the site on August 24, 1989 to collect an additional ground water sample. After approximately 5,000 gallons of contaminated ground water was pumped from the fuel tank pit, one ground water sample, labeled W2, was collected.

All soil and water samples were analyzed by Sequoia Analytical Laboratory in Redwood City, California, for total petroleum hydrocarbons (TPH) as gasoline, and benzene, toluene, xylenes and ethylbenzene (BTX&E). The soil sample from beneath the waste oil tank was analyzed for TPH as gasoline, BTX&E, TPH as diesel, total oil and grease (TOG), and EPA method 8010 constituents.

Analytical results of soil samples from the fuel tank pit indicated non-detectable levels of TPH as gasoline and BTX&E for all samples except samples SW1 and SW2, which showed levels of TPH as gasoline at 13 ppm and 290 ppm, respectively. However, the entire area of sample points SW1 and SW2 was excavated as described above, and the

new sample SW2(R), showed non-detectable levels of TPH as gasoline and BTX&E. Analytical results of the soil sample collected from the waste oil tank pit showed non-detectable levels of all constituents analyzed, except for TPH as gasoline at 1.6 ppm and toluene at 1.3 ppm. Analytical results of soil samples collected from pipe trenches showed levels of TPH as gasoline ranging from 3.8 ppm to 36 ppm, and benzene ranging from non-detectable to 0.52 ppm. However, the analytical results of ground water samples from the tank pit (W1) showed 4,700 ppb of TPH as gasoline, 180 ppb of benzene (after purging 1,500 gallons), while W2 showed 1,200 ppb of TPH as gasoline, and 12 ppb of benzene (after purging 5,000 gallons). Analytical results of the soil samples are summarized in Table 5, and water samples in Table 6. Documentation of soil sample collection and sample analytical results are presented in KEI's report (KEI-J89-0805.R1) dated August 30, 1989. To comply with the requirements of the regulatory agencies and based on the analytical results, KEI proposed installation of three monitoring wells.

On October 17, 1989, three two-inch diameter monitoring wells, designated as MW1, MW2 and MW3 on the attached Site Plan, Figure 1, were installed at the site. The three wells were drilled and completed to total depths ranging from 20 to 22.5 feet. Ground water was encountered at depths ranging from 11 to 13 feet beneath the surface during drilling. Soil samples were taken at 5 foot intervals beginning at 5 feet below grade until ground water was encountered. The wells were sampled on November 1, 1989. Analytical results for the soil samples are summarized in Table 3, and water in Table 2. Based on analytical results of the soil and ground water samples, KEI recommended the installation of three additional monitoring wells to further define the extent of contamination. The details of the monitoring well installation activities and recommendation for further work are presented in KEI's report (KEI-P89-0805.R4) dated November 30, 1989.

On January 26, 1990, two two-inch diameter monitoring wells (designated as MW4 and MW5 on the attached Site Plan, Figure 1) were installed at the site. A third proposed monitoring well could not be installed because of underground utilities and an on-site storage shed. The two wells were drilled and completed to total depths each of 20 feet. Ground water was encountered at depths of approximately 12.5 feet beneath the surface during drilling. These wells were developed on February 9, 1990, and all wells were sampled on February 15, 1990. No free product or sheen was noted in any of the wells.

Water and soil samples were analyzed at Sequoia Analytical Laboratory in Redwood City, California. Samples were analyzed for TPH as gasoline by EPA method 5030 in conjunction with modified

The wells were developed on October 26, 1990. Prior to development, the wells were checked for depth to water table using an electronic sounder, presence of free product (using paste tape) and sheen. No free product or sheen was noted in any of the wells during development. After recording the monitoring data, the wells were purged with a surface pump until the evacuated water was clear and free of suspended sediment. Monitoring and well development data are summarized in Table 1.

Monitoring wells MW1 through MW5 were monitored in September and October, and all wells were sampled on November 7, 1990. Prior to sampling, monitoring data were collected and water samples were then collected using a clean Teflon bailer. During monitoring and sampling on November 7, 1990, a sheen was observed in wells MW3 and MW5. The samples were decanted into clean glass VOA vials, sealed with Teflon-lined screw caps, and labeled and stored on ice until delivery to a certified laboratory.

ANALYTICAL RESULTS

Water and selected soil samples were analyzed at Sequoia Analytical Laboratory in Concord, California. All samples analyzed were accompanied by properly executed Chain of Custody documentation. The samples were analyzed for TPH as gasoline by EPA method 5030 in conjunction with modified 8015, and BTX&E by EPA method 8020.

The analytical results of the soil samples show non-detectable levels of TPH as gasoline and benzene in all analyzed samples, except in MW7(5), MW9(10) and MW9(12), which showed TPH as gasoline levels of 11 ppm, 84 ppm and 120 ppm, respectively, with benzene levels detected only in samples MW9(10) and MW9(12) at 0.32 ppm and 0.19 ppm, respectively. The analytical results of the ground water samples, collected from all nine wells, showed non-detectable levels of TPH as gasoline and BTX&E in wells MW1, MW2, MW6 and MW7, except in MW1, TPH as gasoline was detected at a level of 45 ppb. In wells MW3, MW4, MW5, MW8 and MW9, TPH as gasoline was detected at levels of 42,000 ppb, 180 ppb, 20,000 ppb, 4,700 ppb and 480 ppb, respectively; with benzene detected at levels of 1,400 ppb, 1.5 ppb, 640 ppb, 28 ppb and 7.8 ppb, respectively. For toluene, xylenes and ethylbenzene results, see Table 2. Results of the soil analyses are summarized in Table 3, and water analyses in Table 2. Copies of the laboratory analyses and Chain of Custody documentation are attached to this report.

HYDROLOGY AND GEOLOGY

The water table stabilized in the monitoring wells at depths ranging from 8.51 to 12.01 feet below the surface. Ground water flow direction appeared to be toward the southwest on October 26, 1990, (based on water level data collected from the nine monitoring

wells prior to development of the new wells). The average hydraulic gradient at the site is approximately 0.018.

Based on review of regional geologic maps (U.S. Geological Survey Miscellaneous Geologic Investigations Map I-239 "Areal and Engineering Geology of the Oakland West Quadrangle, California" by D.H. Radbruch, 1957), the site is underlain by Quaternary-age alluvium fan deposits (Temescal Formation), which typically consists of lenses of clayey gravel, sandy silty clay and sand-clay-silt mixtures. Specifically, the subsurface earth materials at the site, based on our previous subsurface exploration activities, consist predominantly of clayey silt and silty clay to gravelly clay with local lenses of well graded sand or gravel, and clayey sand or gravel. The lenses of coarse grained soils are generally less than about 2 feet thick. Artificial fill materials were encountered at the surface of this site varying from about 2 to 2.5 feet thick in the vicinity of wells MW4 and MW5.

The results of our most recent subsurface study indicates the site and immediate vicinity is underlain by artificial fill materials extending to depths below grade ranging from about 2-1/4 to 5-3/4 feet. The fill materials are inturn underlain by silty clay materials extending to depths below grade ranging from about 7-1/4 to 11-1/2 feet and which are about 4-3/4 to 6-1/2 feet in thickness. This silty clay zone is inturn underlain by a coarse-grained sequence consisting predominantly of clayey gravel (except in MW7 where clayey sand and a well graded gravel lens were also encountered). This coarse-grained zone extends to depths below grade ranging from 10 to 15-1/2 feet and ranging in thickness from approximately 3-1/2 to 4 feet. Ground water was encountered during drilling within this coarse-grained sequence in all borings except MW6. The coarse-grained sequence is inturn underlain by a fine-grained zone consisting of gravelly or sandy clay, silty clay, or clayey silt extending to the maximum depth explored (22 feet).

DISCUSSION AND RECOMMENDATIONS

The analytical results of the most recent ground water samples collected indicate that the ground water underlying the southern corner of the site (wells MW3, MW4 and MW5) and extending off-site (downgradient wells MW8 and MW9) are contaminated with TPH as gasoline and BTX&E. Upgradient wells (MW1, MW2, MW6 and MW7) are generally free of contamination, except for TPH as gasoline, which was detected at 45 ppb in MW1.

As stated above, current water level data indicates that the ground water flow direction is to the southwest. Thus, the closest location available for installing any additional monitoring wells downgradient of well MW9 is approximately 350 feet away on 38th

Street. Based on water quality data from well MW9, which is located approximately 100 feet downgradient of MW5, levels of TPH as gasoline decreased from 20,000 ppb in well MW5 to 480 ppb in well MW9, and levels of benzene decreased from 640 ppb in well MW5 to 7.8 ppb in well MW9. Therefore, the need for a monitoring well located downgradient of MW9 does not appear to be warranted at this time.

Based on the analytical results, KEI recommends continuation of the monthly monitoring and quarterly sampling program for an additional quarter in order to confirm both the ground water flow direction and water quality downgradient of the site (wells MW8 and MW9). All wells would be monitored and sampled as part of the program. The need for any additional monitoring wells which may be appropriate, and any recommendations for clean-up will be made subsequent to review of the quarterly monitoring and sampling data.

In addition, until a ground water clean-up remediation system can be implemented, KEI recommends that wells MW3, MW5 and MW8 be purged of a minimum of 55 gallons on a weekly basis. Our proposal for this work is attached for your review and consideration.

DISTRIBUTION

Copies of this report should be sent to Mr. Gil Wistar of the Alameda Health Care Services, and to Mr. Lester Feldman of the RWQCB, San Francisco Bay Region.

LIMITATIONS

Soil deposits and rock formations may vary in thickness, lithology, saturation, strength and other properties across any site. In addition, environmental changes, either naturally-occurring or artificially-induced, may cause changes in the extent and concentration of any contaminants. Our studies assume that the field and laboratory data are reasonably representative of the site as a whole, and assume that subsurface conditions are reasonably conducive to interpolation and extrapolation.

The results of this study are based on the data obtained from the field and laboratory analyses obtained from a state certified laboratory. We have analyzed this data using what we believe to be currently applicable engineering techniques and principles in the Northern California region. We make no warranty, either expressed or implied, regarding the above, including laboratory analyses, except that our services have been performed in accordance with generally accepted professional principles and practices existing for such work.

Should you have any questions regarding this report, please do not hesitate to call me at (707) 746-6915.

Sincerely,

Kaprealian Engineering, Inc.

Thomas J. Berkins
Environmental Engineer

Don R. Braun
Certified Engineering Geologist

License No. 1310
Exp. Date 6/30/92

Mardo Kaprealian
President

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Attachments: Tables 1 through 6
Location Map
Site Vicinity Map
Site Plans - Figures 1 & 2
Boring Logs
Laboratory Results
Chain of Custody documentation
Proposal

KEI-P89-0805.R6
December 17, 1990

TABLE 1

SUMMARY OF GROUND WATER MONITORING AND PURGING DATA

Well #	Depth to Water (feet)	Product Thickness	Sheen	Gallons Pumped
(Monitored and Sampled on November 7, 1990)				
MW1	8.86	0	None	15
MW2	10.11	0	None	15
MW3	10.83	0	Trace	31
MW4	10.94	0	None	8
MW5	10.58	0	Trace	55
MW6	8.51	0	None	15
MW7	9.48	0	None	15
MW8	12.01	0	None	15
MW9	11.89	0	None	15
(Monitored and Developed on October 26, 1990)				
MW1*	8.28	0	None	0
MW2*	9.81	0	None	0
MW3*	10.79	0	None	0
MW4*	11.36	0	None	0
MW5*	10.60	0	None	0
MW6	7.30	0	None	70
MW7	9.23	0	None	100
MW8	11.97	0	None	80
MW9	11.89	0	None	85
(Monitored on October 10, 1990)				
MW1	8.80	0	None	0
MW2	10.16	0	None	0
MW3	10.75	0	None	55
MW4	11.27	0	None	15
MW5	10.49	0	None	55
(Monitored on September 13, 1990)				
MW1	8.68	0	None	0
MW2	10.12	0	None	0
MW3	10.62	0	Trace	55
MW4	11.11	0	None	15
MW5	10.36	0	None	55

* Monitored only

KEI-P89-0805.R6
December 17, 1990

TABLE 2

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Well #	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
11/07/90	MW1	45	ND	ND	ND	ND
	MW2	ND	ND	ND	ND	ND
	MW3	42,000	1,400	5,000	7,500	1,800
	MW4	180	1.5	0.37	26	6.3
	MW5	20,000	640	1,100	3,000	670
	MW6	ND	ND	ND	ND	ND
	MW7	ND	ND	ND	ND	ND
	MW8	4,700	28	38	7,200	86
	MW9	480	7.8	1.2	47	13
8/16/90	MW1	ND	ND	ND	ND	ND
	MW2	ND	ND	6.7	ND	ND
	MW3	6,800	600	660	160	760
	MW4	3,600	480	17	260	230
	MW5	16,000	1,400	1,900	660	2,800
2/15/90	MW1	170	7.9	ND	2.8	2.2
	MW2	ND	ND	ND	ND	ND
	MW3	20,000	1,700	2,100	3,100	750
	MW4	150	8.0	8.0	45	10
	MW5	24,000	1,500	1,700	3,600	260
11/01/89	MW1	ND	ND	ND	0.30	ND
	MW2	200	ND	ND	1.2	3.0
	MW3	13,000	57	48	120	1.7
Detection Limits		30	0.3	0.3	0.3	0.3

ND = Non-detectable.

Results in parts per billion (ppb), unless otherwise indicated.

KEI-P89-0805.R6
December 17, 1990

TABLE 3

SUMMARY OF LABORATORY ANALYSES
SOIL

(Collected on October 23, 1990)

Sample Number	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
MW6(5)	5	ND	ND	ND	ND	ND
MW6(9)	9	ND	ND	ND	0.010	ND
MW6(11.5)	11.5	ND	ND	ND	ND	ND
MW7(5)	5	11	ND	ND	0.032	0.0064
MW7(8.5)	8.5	ND	ND	ND	0.019	ND
MW7(11.5)	11.5	ND	ND	ND	0.036	ND
MW8(5)	5	ND	ND	ND	ND	ND
MW8(10)	10	ND	ND	ND	0.0080	ND
MW9(5.5)	5.5	ND	ND	ND	ND	ND
MW9(10)	10	84	0.32	0.27	0.51	0.63
MW9(12)	12	120	0.19	0.11	0.69	0.14
Detection Limits		1.0	0.0050	0.0050	0.0050	0.0050

ND = Non-detectable.

Results in parts per million (ppm), unless otherwise indicated.

KEI-P89-0805.R6
December 17, 1990

TABLE 4

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample Number	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
(Collected on October 17, 1989)						
MW1(5)	5	8.5	ND	ND	0.14	ND
MW1(10)	10	ND	ND	ND	ND	ND
MW2(5)	5	ND	ND	ND	ND	ND
MW2(10)	10	ND	ND	ND	ND	ND
MW2(12.5)	12.5	ND	ND	ND	ND	ND
MW3(5)	5	3.1	0.068	ND	ND	ND
MW3(10)	10	69	0.89	2.6	7.9	2.0
MW3(11)	11	1,100	16	85	150	35
(Collected on January 26, 1990)						
MW4(5)	5	22	0.059	ND	ND	ND
MW4(7)	7	2.5	ND	ND	ND	ND
MW4(10)	10	250	1.2	0.66	20	1.4
MW4(11)	11	280	1.0	4.0	36	7.6
MW5(5)	5	25	0.21	ND	ND	ND
MW5(7.5)	7.5	46	0.25	0.28	0.20	0.46
MW5(10)	10	140	1.5	1.7	10	4.0
MW5(11.5)	11.5	370	1.8	14	51	11
Detection Limits		1.0	0.05	0.1	0.1	0.1

ND = Non-detectable.

Results in parts per million (ppm), unless otherwise indicated.

KEI-P89-0805.R6
December 17, 1990

TABLE 5

SUMMARY OF LABORATORY ANALYSES
SOIL

(Collected on August 16, 17, 18 & 24, 1989)

Sample #	Depth (feet)	TPH as Gasoline	TPH as Diesel	Benzene	Toluene	Xylenes	Ethyl-benzene
SW1	9.5	13	--	ND	0.13	0.39	0.15
SW2	9.5	290	--	0.82	8.7	44	7.6
SW2(R)	9.5	ND	--	ND	ND	ND	ND
SW3	9.5	ND	--	ND	ND	ND	ND
SW4	9.5	ND	--	ND	ND	ND	ND
SW5	9.5	ND	--	ND	ND	ND	ND
SW6	9.5	ND	--	ND	ND	ND	ND
P1	6.5	6.1	--	ND	ND	ND	ND
P2	6.5	36	--	0.52	4.4	8.0	1.4
P3	5	20	--	0.30	2.5	5.6	1.1
P4	5	3.8	--	0.11	0.19	0.23	0.1
WO1*	8	1.6	ND	ND	1.3	ND	ND
Detection Limits		1.0	1.0	0.05	0.1	0.1	0.1

* TOG and EPA method 8010 constituents were non-detectable.

-- Indicates analysis not performed.

ND = Non-detectable.

Results in parts per million (ppm), unless otherwise indicated.

KEI-P89-0805.R6
December 17, 1990

TABLE 6

SUMMARY OF LABORATORY ANALYSES
WATER

Sample #	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethylbenzene
W1	4,700	180	420	860	150
W2*	1,200	12	10	88	5.9
Detection Limits	30	0.3	0.3	0.3	0.3

* Sample (W2) was collected after pumping 5,000 gallons of ground water from the fuel tank pit.

Results in parts per billion (ppb), unless otherwise indicated.

KAPREALIAN ENGINEERING, INC.
Consulting Engineers
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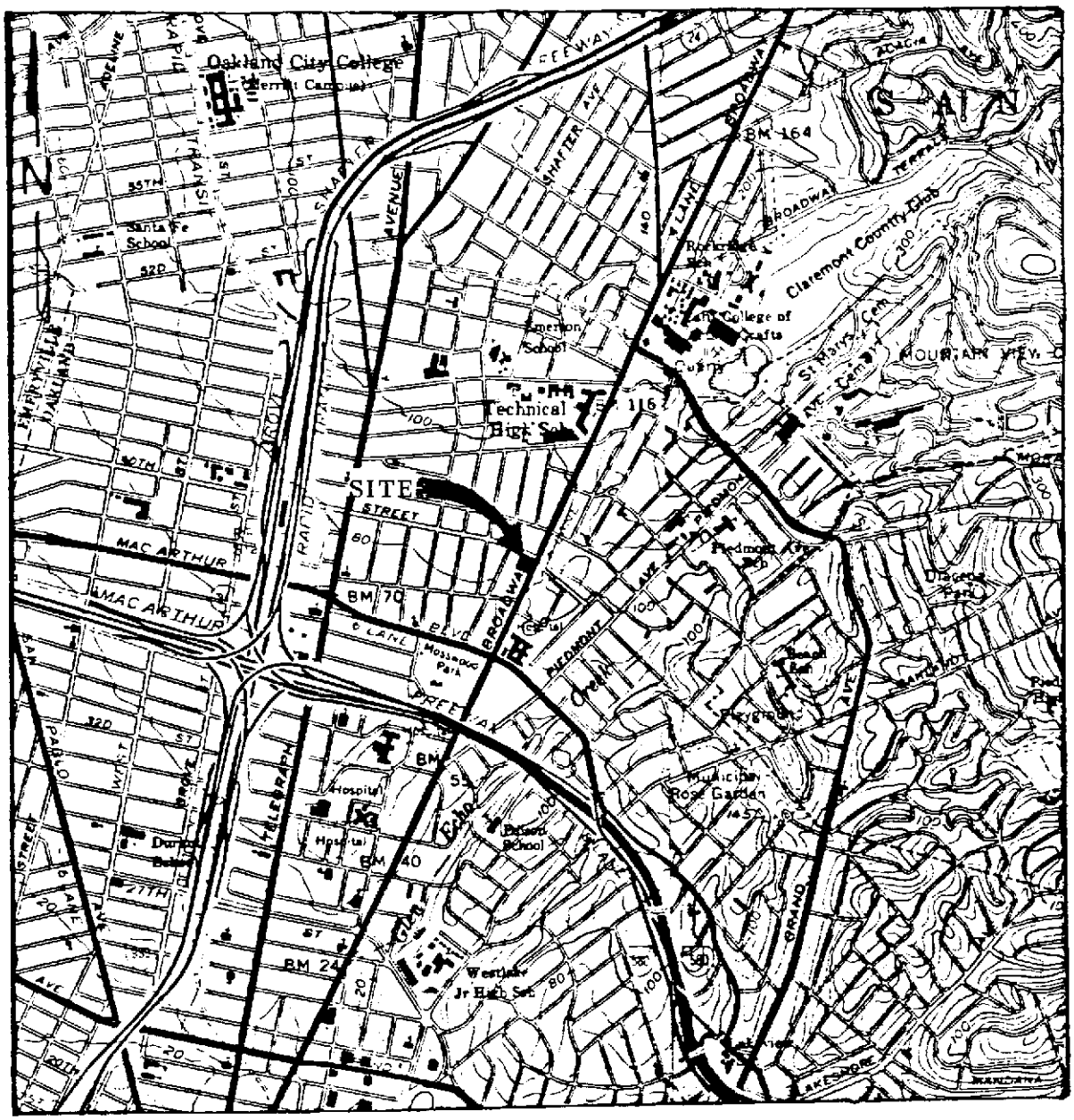


LOCATION MAP

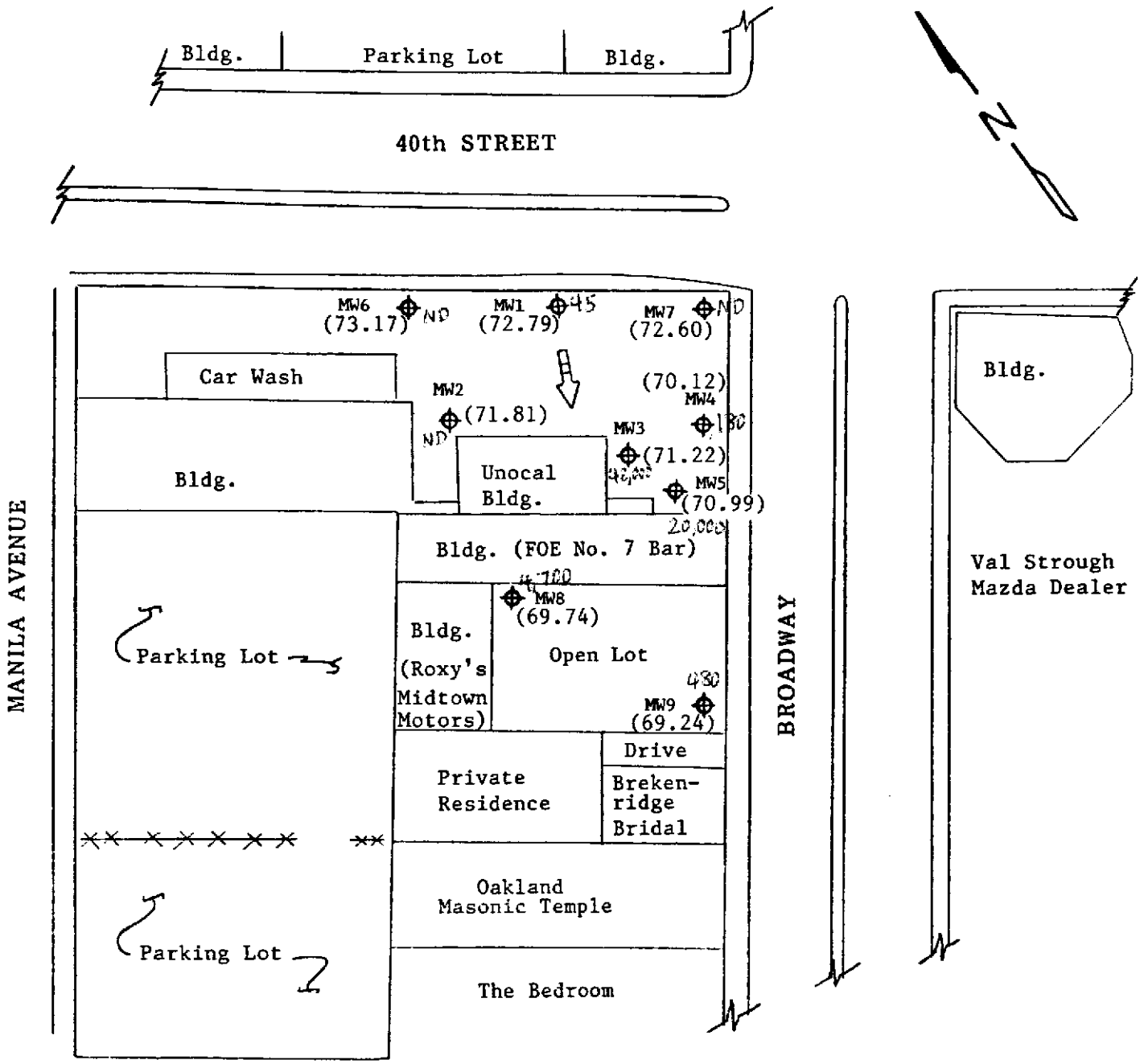
Unocal S/S #0746
3943 Broadway
Oakland, CA

KAPREALIAN ENGINEERING, INC.

Consulting Engineers

PO. BOX 996 • BENICIA, CA 94510

(707) 746-6915 • (707) 746-6916 • FAX: (707) 746-5581



SITE VICINITY MAP

0 60 120

Approx. Scale feet

LEGEND

⊕ Monitoring Well (existing)

( ) Elevation of Ground Water Table in feet above Mean Sea Level on 10/26/90.

⇨ Direction of Ground Water Flow

Unocal S/S #0746
3943 Broadway
Oakland, California

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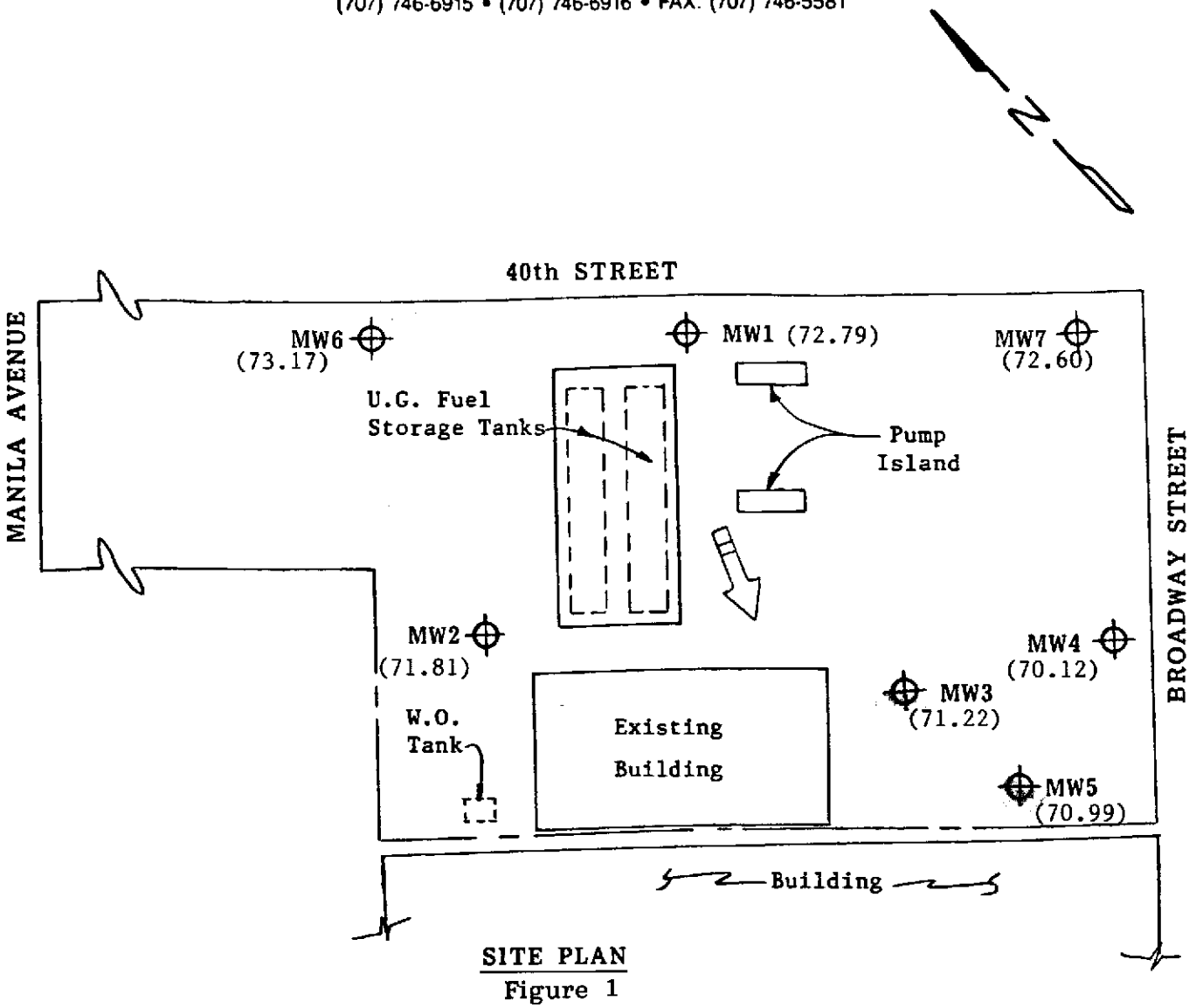

SITE PLAN
Figure 1

LEGEND

Monitoring Well (Existing)

( ) Ground water surface elevation in feet above Mean Sea Level on 10/26/90.

Direction of ground water flow

0 30 60
Approx. Scale feet

Unocal Service Station #0746
3943 Broadway Street
Oakland, California

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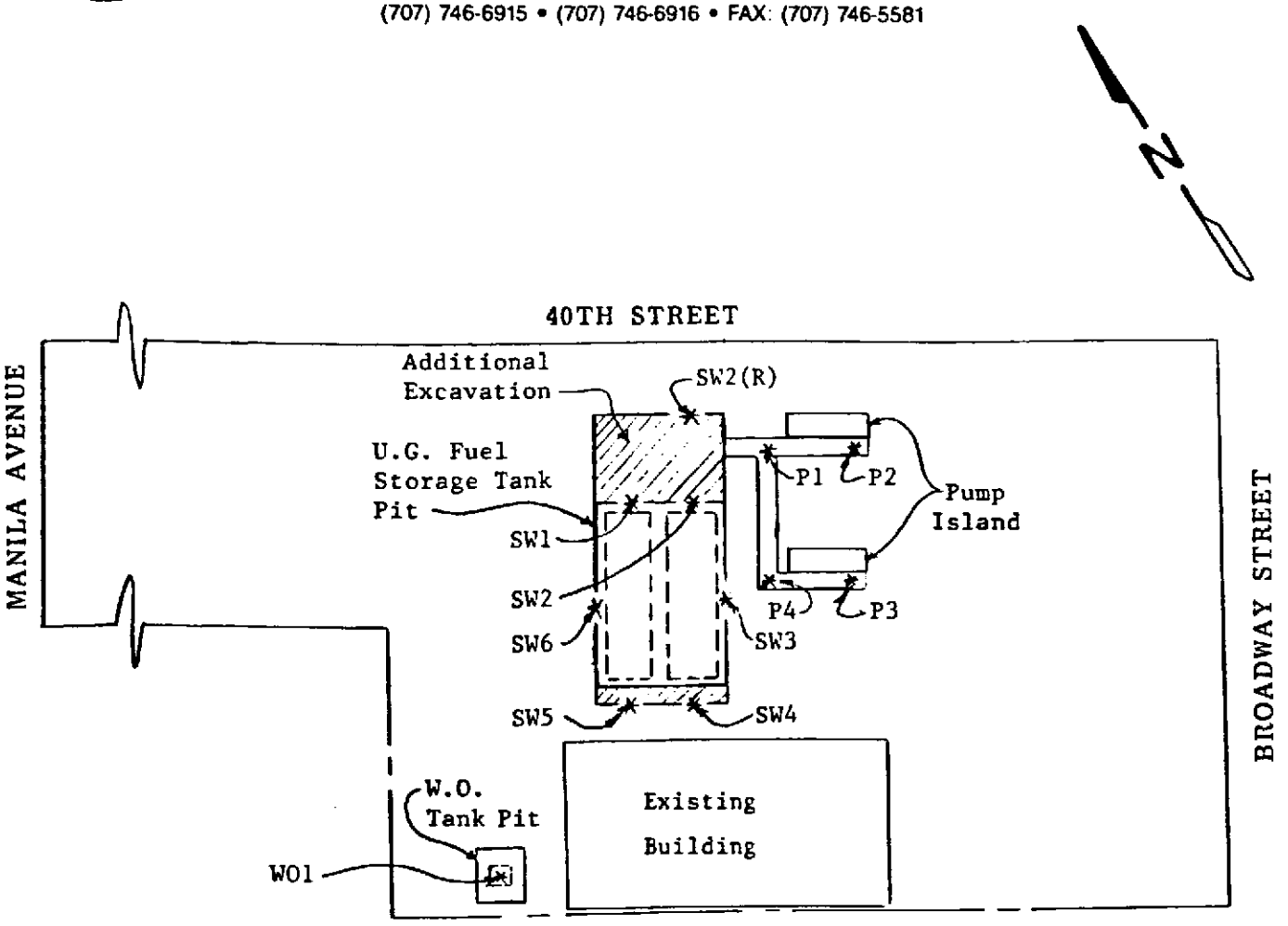


SITE PLAN
Figure 2

0 30 60
Approx. scale feet

LEGEND

* Sample Point Location

Unocal S/S #0746
3943 Broadway Street
Oakland, CA

BORING LOG

Project No. KEI-P89-0805	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W. DRB
Project Name Unocal 3943 Broadway, Oaklnd	**Well Head Elevation** N/A	**Date Drilled** 10/22/90
Boring No. MW6	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		Asphalt over sand and gravel base.
			CL/ CH	Silty clay, trace fine sand, moist, stiff, orange brown. Base of Fill Materials
			CH	Silty clay, trace fine sand, moist, moist, firm, black.
4/9/13		5	CL/ CH	Clay, 5% silt, trace rootlets, moist, very stiff, dark grayish brown, trace gravel to 3/8" diameter.
8/10/15			GC	Clayey gravel, trace sand, subangular gravel to 1-1/8" diameter, moist, very stiff, dark grayish brown, trace orange brown.
		10		
5/6/12	▼		CL/ CH	Clay, trace gravel to 3/8" diameter, trace very fine sand, trace organic matter, moist to very moist, very stiff, light yellowish brown with trace pale olive mottling.
4/7/11		15		Clay, 5% silt, trace organic matter, trace caliche, slightly moist, very moist, very stiff, light yellowish brown.
			ML/ MH	Clayey silt, trace sand, saturated, very stiff, light yellowish brown light yellowish brown mottled with orange brown and light greenish gray.
5/8/14		20		TOTAL DEPTH: 20

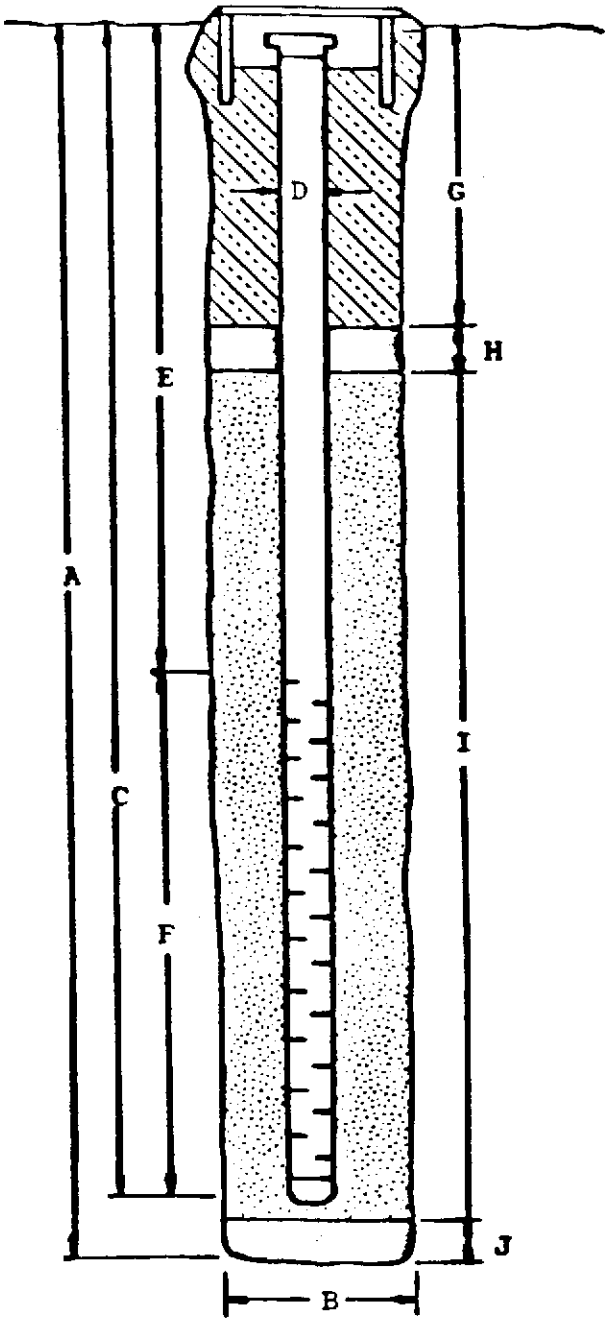
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - 3943 Broadway St., Oakland BORING/WELL NO. MW6

PROJECT NUMBER: KEI-P89-0805

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 20'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 20'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 15'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 16'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

BORING LOG

Project No. KEI-P89-0805	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W.
Project Name Unocal 3943 Broadway, Oaklnd	**Well Head Elevation** N/A	**Date Drilled** 10/22/90
Boring No. MW7	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		Asphalt over sand and gravel base with cobbles to 6" diameter.
			CL/ CH	Silty clay with gravel, trace sand, gravel to 1-1/4" diameter, moist, firm, brown.
				Clay, 5-10% fine sand, trace silt, moist, stiff, dark yellowish brown.
				Base of fill?
3/4/5		5	CH	Silty clay, highly organic, trace subangular gravel to 1" diameter, moist, firm to stiff, moist, black.
5/10/12			CL/ CH	Clay, trace rootlets, trace silt, trace sand, moist, very stiff, olive brown.
		10	SC	Clayey sand, trace gravel to 3/8" dia., fine to medium grained, very moist, medium dense, bluish gray.
	▼		GW	Sandy gravel, 5% clay, trace rootlets, gravel to 1" diameter, saturated, medium dense, yellowish brown.
6/9/15			GC	Clayey gravel with sand, slight odor, gravel to 1" diameter, saturated, medium dense, bluish gray.
		15	ML/ MH	Clayey silt, 5% very fine sand, trace organic matter, stiff to very stiff, very moist to saturated, pale olive mottled with light olive brown.
4/7/9		20		TOTAL DEPTH: 20'

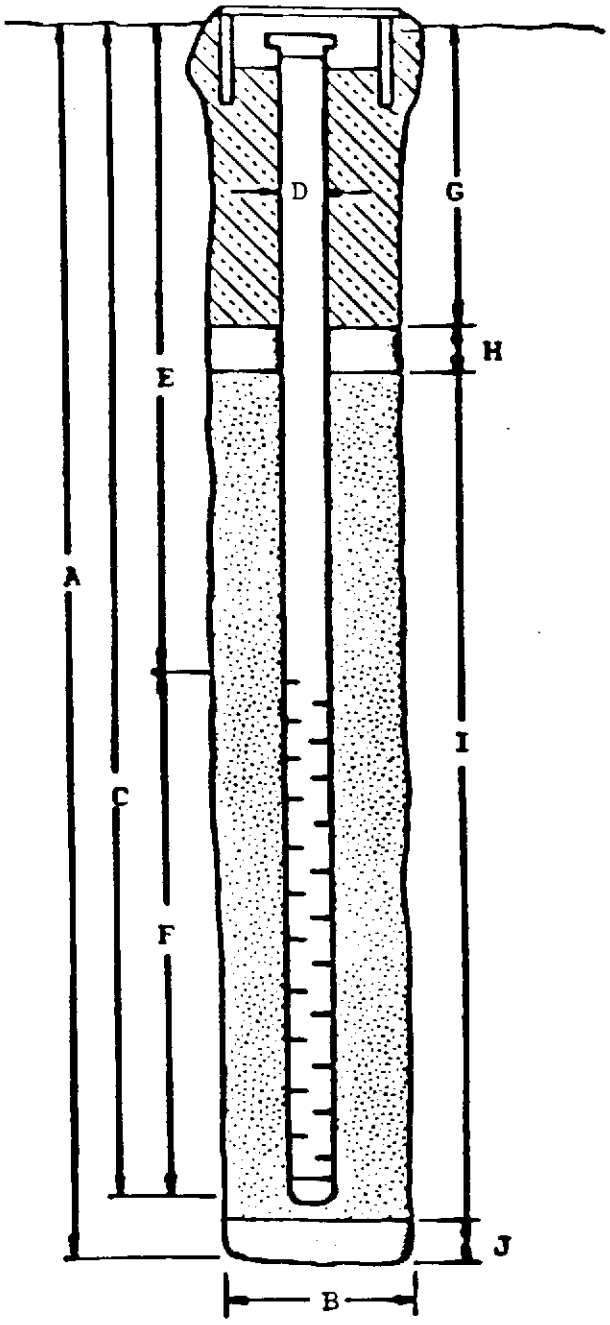
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - 3943 Broadway St, Oakland BORING/WELL NO. MW7

PROJECT NUMBER: KEI-P89-0805

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 20'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 20'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 15'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 16'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P89-0805	9" 2"	W.W./J.E. DRB
Project Name Unocal 3943 Broadway, Oaklnd	**Well Head Elevation** N/A	**Date Drilled** 10/22/90
Boring No. MW8	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI - Dave Yager

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		6" concrete slab over sand and gravel.
				Clayey gravel with concrete cobbles, moist, reddish brown.
				Base of fill materials.
3/3/5		5	CL/ CH	Silty clay, trace organic matter, trace gravel, stiff, very dark brown to black, moist.
12/13/15		10	GC	Clayey gravel, highly weathered sand-stone, trace sand, medium dense, mottled, light brown to dark brown, very moist to wet.
5/10/13		15	CL/ CH	Gravelly clay, gravel is subrounded to rounded, very stiff, trace sand, gray to light brown, grading to sandy clay, moist.
5/9/14		20		Sandy clay, trace gravel, very stiff light brown, moist.

B O R I N G L O G

Project No. KEI-P89-0805	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W./J.E. DRB
Project Name Unocal 3943 Broadway, Oaklnd	**Well Head Elevation** N/A	**Date Drilled** 10/22/90
Boring No. MW8	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI - Dave Yager

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
			CL/ CH	Sandy clay, trace gravel, very stiff, moist, light brown.
		25		
		30		
		35		
		40		TOTAL DEPTH: 22'

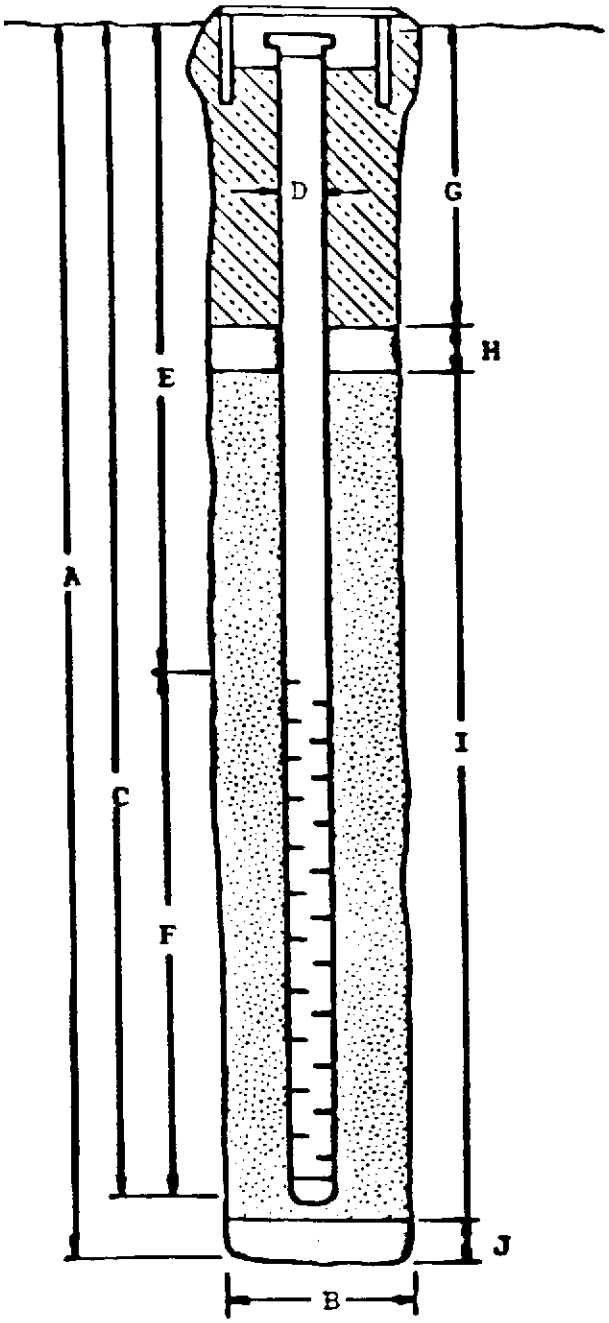
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal, 3943 Broadway St., Oakland BORING/WELL NO. MW8

PROJECT NUMBER: KEI-P89-0805

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 22'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 22'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 17'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 18'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

BORING LOG

Project No. KEI-P89-0805	**Boring & Casing Diameter** 9" 2"	**Logged By** W.W.
Project Name Unocal 3943 Broadway, Oaklnd	**Well Head Elevation** N/A	**Date Drilled** 10/23/90
Boring No. MW9	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		Asphalt over sand and gravel baserock.
			GC	Clayey gravel with asphalt and concrete cobbles, moist, brown.
3/4/6		5	MH	Clayey silt, 5% fine sand, trace coarse sand, very moist, stiff, pale brown. Base of fill material.
			CL/ CH	Silty clay, trace fine sand, trace gravel to 3/8" diameter, moist, stiff, very dark brown to black, trace of red iron oxide staining.
5/9/14		10		Clay, trace silt and sand, trace organic matter, moist, very stiff, slight odor, dark grayish brown mottled with dark yellowish brown.
5/9/12	▼		GC	Clayey gravel with sand, gravel to 3/4" diameter, some highly weathered, trace organic matter, strong odor, very moist to saturated, greenish gray and bluish gray.
		15		
			CL/ CH	Sandy clay, trace silt, trace gravel to 3/8" diameter, very moist, very stiff, pale olive to pale yellow.
6/9/15		20		

B O R I N G L O G

Project No. KEI-P89-0805	Boring & Casing Diameter 9" 2"	Logged By W.W.
Project Name Unocal 3943 Broadway, Oaklnd	Well Head Elevation N/A	Date Drilled 10/23/90
Boring No. MW9	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
			CL/ CH	Sandy clay, trace silt, trace gravel to 3/8" diameter, very moist, very stiff, pale olive to pale yellow.
		25		
		30		
		35		
		40		TOTAL DEPTH: 22'

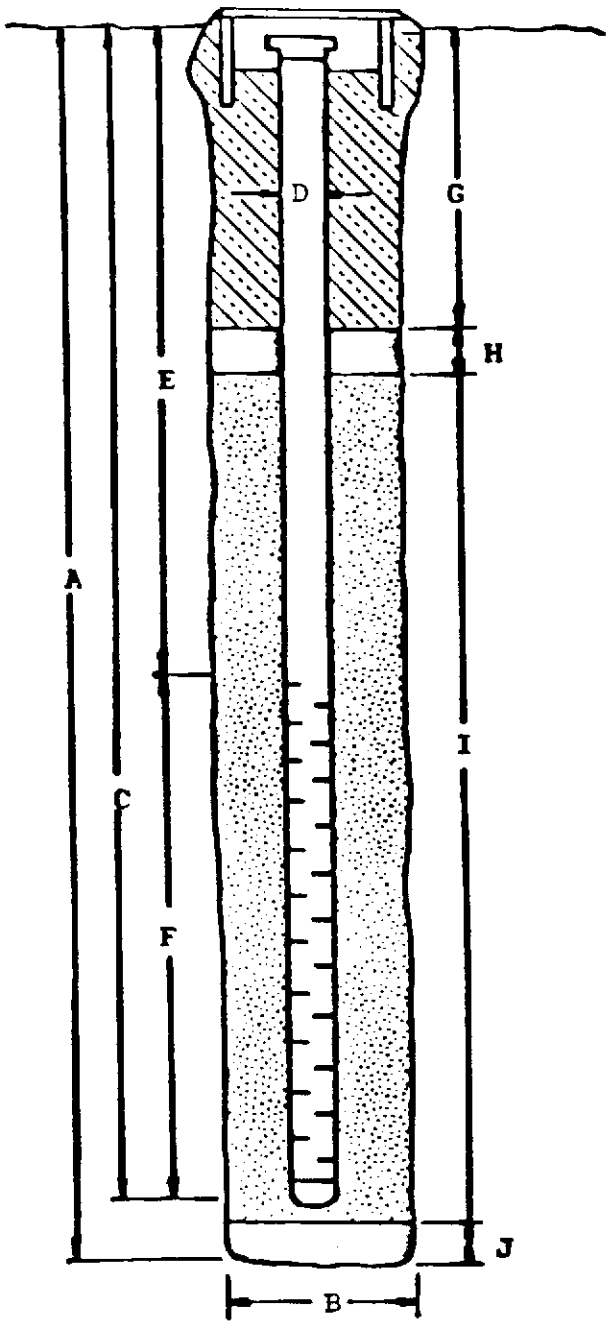
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal, 3943 Broadway St., Oakland BORING/WELL NO. MW9

PROJECT NUMBER: KEI-P89-0805

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 22'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 22'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 17'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 18'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 3943 Broadway St., Oakland	Sampled:	Oct 23, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Oct 24, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Oct 24, 1990
Attention: Mardo Kaprealian, P.E.	First Sample #:	010-0641	Reported:	Oct 25, 1990

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
010-0641	MW6-(5)	N.D.	N.D.	N.D.	N.D.	N.D.
010-0642	MW6-(9)	N.D.	N.D.	N.D.	N.D.	0.010
010-0643	MW6-(11.5)	N.D.	N.D.	N.D.	N.D.	N.D.
010-0644	MW7-(5)	11	N.D.	N.D.	0.0064	0.032
010-0645	MW7-(8.5)	N.D.	N.D.	N.D.	N.D.	0.019
010-0646	MW7-(11.5)	N.D.	N.D.	N.D.	N.D.	0.036
010-0647	MW8-(5)	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

Please Note:
The above samples do not appear to contain gasoline.

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 3943 Broadway St., Oakland	Sampled:	Oct 23, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Oct 24, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	10/24-10/29/90
Attention: Mardo Kaprealian, P.E.	First Sample #:	010-0648	Reported:	Oct 25, 1990

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
010-0648	MW8-(10)	N.D.	N.D.	N.D.	N.D.	0.0080
010-0649	MW9-(5.5)	N.D.	N.D.	N.D.	N.D.	N.D.
010-0571	MW9-(10)	84	0.32	0.27	0.63	0.51
010-0572	MW9-(12)	120	0.19	0.11	0.14	0.69
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 3943 Broadway St., Oakland	Sampled:	Oct 23, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Oct 24, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	10/24-10/29/90
Attention: Mardo Kaprealian, P.E.	First Sample #:	010-0648	Reported:	Oct 25, 1990

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
010-0648	MW8-(10)	N.D.	N.D.	N.D.	N.D.	0.0080
010-0649	MW9-(5.5)	N.D.	N.D.	N.D.	N.D.	N.D.
010-0571	MW9-(10)	84	0.32	0.27	0.63	0.51
010-0572	MW9-(12)	120	0.19	0.11	0.14	0.69
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Laboratory Director

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

MW6-(5)
MW7-(5)
MW7-(8.5)
MW7-(11.5)
MW8-(5)
MW8-(10)
MW9-(5.5)
MW9-(10)
MW9-(12)
MW6-(5)
MW6-(11.5)

SAMPLER: Wade Weston
WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal- Oakland.
3943 Broadway ST.

ANALYSES REQUE

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPH-G	BTXE	
MW6-(5)	10/22/90		✓		✓		1	See Sample I.D.*	✓	✓	0100641
MW6-(9)	"		✓		✓		1		✓	✓	642
MW6-(11.5)	"		✓		✓		1		✓	✓	643
MW7-(5)	"		✓		✓		1		✓	✓	644
MW7-(8.5)	"		✓		✓		1		✓	✓	645
MW7-(11.5)	"		✓		✓		1		✓	✓	646
MW8-(5)	"		✓		✓		1		✓	✓	647
MW8-(10)	"		✓		✓		1		✓	✓	648
MW9-(5.5)	10/23/90		✓		✓		1		✓	✓	649

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Wade Weston	102490 9:40	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? ✓
2. Will samples remain refrigerated until analyzed? ✓
3. Did any samples received for analysis have head space? NO
4. Were samples in appropriate containers and properly packaged? ✓

Signature	Title	Date
[illegible]	SR	10/24

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: Wade Weston
WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal - Oakland
3943 Broadway St.

ANALYSES REQUESTED

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPH-G	BTXE	REMARKS
MW9-(10)	10/13/94		✓		✓		1	See Sample I.D. #	✓	✓	
MW9-(12)	"		✓		✓		1	" " " "	✓	✓	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Wade Weston	10-24-94 5:40	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? ✓
2. Will samples remain refrigerated until analysed? ✓
3. Did any samples received for analysis have head space? NO
4. Were samples in appropriate containers and properly packaged? ✓

Signature: [illegible] Title: SR Date: 10/24

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: Wade Weston
WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal - Oakland. 3913 Broadway ST.

ANALYSES REQUESTED: TPH-G; BTXE

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	REMARKS
MW6-(5)	10/22/90		✓		✓		1	See Sample I.D.*	0100641
MW6-(9)	"		✓		✓		1		642
MW6-(11.5)	"		✓		✓		1		643
MW7-(5)	"		✓		✓		1		644
MW7-(8.5)	"		✓		✓		1		645
MW7-(11.5)	"		✓		✓		1		646
MW6-(5)	"		✓		✓		1		647
MW8-(10)	"		✓		✓		1		648
MW9-(5.5)	10/23/90		✓		✓		1		649

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Wade Weston	10/24/90 9:40	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? ✓
2. Will samples remain refrigerated until analyzed? ✓
3. Did any samples received for analysis have head space? NO
4. Were samples in appropriate containers and properly packaged? ✓

Signature	Title	Date
JW	SR	10/24

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: Wade Weston

WITNESSING AGENCY

SITE NAME & ADDRESS: Unocal - Oakland
3943 Broadway St.

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPH-G	BTXE	REMARKS
MW9-(10)	10/23/90		✓		✓		1	See Sample I.D. #	✓	✓	0100571
MW9-(12)	"		✓		✓		1	" " " "	✓	✓	572

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Wade Weston	10-24-9 5:40	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
ished by: (Signature)	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? ✓
2. Will samples remain refrigerated until analyzed? ✓
3. Did any samples received for analysis have head space? NO
4. Were samples in appropriate containers and properly packaged? ✓

Signature SR Title 10/24 Date

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(415) 686-9600 • FAX (415) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 3943 Broadway, Oakland	Sampled: Nov 7, 1990
P.O. Box 996	Matrix Descript:	Water	Received: Nov 7, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed: Nov 17, 1990
Attention: Mardo Kaprealian, P.E.	First Sample #:	011-0348 A-B	Reported: Nov 19, 1990

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
011-0348 A-B	MW-1	45	N.D.	N.D.	N.D.	N.D.
011-0349 A-B	MW-2	N.D.	N.D.	N.D.	N.D.	N.D.
011-0350 A-B	MW-3	42,000	1,400	5,000	1,800	7,500
011-0351 A-B	MW-4	180	1.5	0.37	6.3	26
011-0352 A-B	MW-5	20,000	640	1,100	670	3,000
011-0353 A-B	MW-6	N.D.	N.D.	N.D.	N.D.	N.D.
011-0354 A-B	MW-7	N.D.	N.D.	N.D.	N.D.	N.D.
011-0355 A-B	MW-8	4,700	28	38	86	7,200
011-0356 A-B	MW-9	480	7.8	1.2	13	47
Detection Limits:		**30**	**0.30**	**0.30**	**0.30**	**0.30**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Julia R. Malerstein
Project Manager

110348.KEI <1>

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: RAY (KET)

WITNESSING AGENCY:

SITE NAME & ADDRESS: UNOCAL OAKLAND, 3943 BROADWAY

ANALYSES REQUESTED: TPHG, BTXE

TURN AROUND TIME: REGULAR

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPHG	BTXE	REMARKS
MW1	11-7	17:00		X	X				X	X	
MW2	"	"		X	X				X	X	
MW3	"	"		X	X				X	X	
MW4	"	"		X	X				X	X	
MW5	"	"		X	X				X	X	
MW6	"	"		X	X				X	X	
MW7	"	"		X	X				X	X	
MW8	"	"		X	X				X	X	
MW9	"	"		X	X				X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Ray (KET)	11-7-90	18:20
	11/7/90 1820	

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? yes
2. Will samples remain refrigerated until analyzed? yes
3. Did any samples received for analysis have head space? NA
4. Were samples in appropriate containers and properly packaged? yes

BS — Signature; Logger — Title; 11/7/90 — Date