MARDO - Should we wait for excav. until we see results of addl. 3 wells

KAPREALIAN ENGINEERING, INC.
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KEI-P88-1203.R7
May 31, 1990

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

Attention: Mr. Ron Bock

RE: Preliminary Ground Water Investigation at
Unocal Service Station #3135
845 - 66th Avenue
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-P88-1203.P1 dated January 15, 1990. The purpose of the investigation was to determine the ground water flow direction, and to begin to 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.

Logging, preparation of Boring Logs and supervision of installation and development of three monitoring wells.

Soil sampling.

Ground water monitoring, purging and sampling.

Laboratory analyses.

Data analysis, interpretation and report preparation.

SITE DESCRIPTION AND BACKGROUND

The subject site is presently used as a gasoline station. A Location Map and three Site Plans are attached to this report.

KEI's work at the site began on December 8, 1988 during modifications to the pump island located along San Leandro Street. Three soil samples were collected from undisturbed soil at depths ranging from 2.0 to 3.0 feet. The 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). Laboratory analyses indicated non-detectable levels of all constituents for all three samples. This work was previously presented in KEI's report (KEI-J88-1203.R1) dated December 16, 1988.

KEI returned to the site on November 29, 1989 when two 10,000 gallon underground fuel storage tanks, and one 280 gallon waste oil tank were removed from the site. The gasoline tanks and the waste oil tank were made of steel and no apparent cracks or holes were observed in any of the tanks.

Water was initially encountered in the fuel tank pit at a depth of approximately 10.5 feet, thus prohibiting the collection of any soil samples from immediately beneath the tanks. Six soil samples, labeled SW1 through SW6, were collected from the sidewalls of the fuel tank pit approximately 18 to 30-inches above the water table. One soil sample, labeled WO1, was collected from beneath the waste oil tank at a depth of 8.5 feet. The area beneath the waste oil tank was then excavated to ground water and two sidewall soil samples, labeled SWA and SWB, were collected from the waste oil tank pit sidewalls approximately 12-inches above the water table. Sample point locations are as shown on the attached Site Plan, Figure 2.

All soil samples were analyzed by Sequoia Analytical Laboratory in Redwood City, California. All of the fuel tank pit sidewall samples were analyzed for TPH as gasoline and BTX&E. Analytical results showed TPH as gasoline ranging from non-detectable to 32 ppm, with benzene ranging from non-detectable to 1.2 ppm. The waste oil tank bottom and sidewall samples were analyzed for TPH as gasoline, BTX&E, TPH as diesel, total oil and grease (TOG), EPA 8010 constituents, and the metals cadmium, chromium, lead and zinc. Analyses of the waste oil samples indicate less than 50 ppm TOG, non-detectable levels of BTX&E, TPH as diesel and EPA 8010 constituents, and less than 5.0 ppm TPH as gasoline for all three samples. Metals concentrations are as indicated in Table 4, attached.

KEI collected eleven pipe trench samples, labeled D1 through D6, and P1 through P5, at depths ranging from 3.5 to 6.0 feet on November 29, and December 5 and 29, 1989. Upon review of the laboratory analyses for sample P2, KEI returned to the site on January 9, 1990, to collect additional soil samples. Following the trench excavation to a depth of 12 feet, one sample, labeled P2(12), was collected at a depth of 12 feet, and two samples, labeled SWP2E and SWP2W, were taken at a depth of 11.0 feet from the easterly and westerly sidewalls of the trench adjacent to

sample point location P2(12). KEI completed the pipe trench sampling on January 10, 1990 when two samples, labeled P6 and P7, were collected at depths of 3.0 and 4.0 feet, respectively. Pipe trench sample point locations are as shown on the attached Site Plan, Figure 3. Laboratory analyses of the pipe trench sample indicated TPH as gasoline levels ranging from non-detectable to 20 ppm, with non-detectable to 0.13 ppm benzene for all samples except sample P2, which showed TPH as gasoline at 3,800 ppm and benzene at 6.1 ppm. Following the additional excavation in the area of sample point P2, laboratory analyses of samples P2(12), SWP2E and SWP2W indicated non-detectable levels of TPH as gasoline and benzene for samples P2(12) and SWP2W, while sample SWP2E showed TPH as gasoline at 20 ppm with non-detectable levels of benzene. Laboratory results are summarized in Table 4.

After fuel tank pit soil sampling was completed, approximately 5,000 gallons of ground water were pumped from the fuel tank pit. On December 5, 1989, one water sample, labeled W1, was collected from the fuel tank pit. The water sample was analyzed for TPH as gasoline, BTX&E and EPA 8010 constituents. Analyses of the water sample indicated 7,900 ppb TPH as gasoline, 850 ppb benzene, and non-detectable levels of EPA 8010 constituents. Laboratory results are summarized in Table 5. For more detailed information, refer to KEI's report (KEI-J88-1203.R2) dated January 15, 1990.

Based on the analytical results and in accordance with the guidelines established by the RWQCB, KEI recommended the installation of three monitoring wells at the site to begin to define the extent of the soil and ground water contamination, and to determine the ground water flow direction.

FIELD ACTIVITIES

On April 26 and 27, 1990, three two-inch diameter monitoring wells, designated as MW1, MW2 and MW3, were installed at the site. During drilling, an attempt was made to install MW2 near the pump island, however due to drill bit refusal and difficulties encountered, two exploratory borings (designated as EB1 and EB2) were drilled, and MW2 was installed at the location indicated on the attached Site Plan, Figure 1. The wells were drilled, constructed and completed in accordance with the guidelines of the Regional Water Quality Control Board (RWQCB) and County well standards. The exploratory borings were backfilled to the surface with neat cement.

The subsurface materials penetrated and details of the construction of the wells are described in the attached Boring Logs.

The three wells were drilled and completed to total depths ranging from 22 to 23 feet. The exploratory borings were drilled and/or sampled to depths of 8-1/2 and 10-1/2 feet. Ground water was encountered at depths ranging from 9-1/2 to 14-1/2 feet beneath the surface during drilling. Soil samples were taken at a maximum spacing of 5 foot intervals, obvious areas of contamination, changes in lithology and at the ground water/soil interface, beginning at a depth of approximately 5 feet below grade until ground water was encountered. The undisturbed soil samples were taken by driving a California-modified split-spoon sampler ahead of the drilling augers. The two-inch diameter brass liners holding the samples were sealed with aluminum foil, plastic caps and tape, and stored in a cooled ice chest for delivery to a certified laboratory. Each well casing was installed with a watertight cap and padlock. A round, watertight, flush-mounted well cover was cemented in place over each well casing.

The wells were developed on May 3 and 4, 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. 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.

The wells were sampled on May 11, 1990. Prior to sampling, monitoring data were collected and water samples were then collected using a clean Teflon bailer. 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 Redwood City, California. All samples were accompanied by properly executed Chain of Custody documentation. Samples were analyzed for TPH as gasoline by EPA method 5030 in conjunction with modified 8015, and BTX&E by EPA method 8020. In addition, sample EB2(9) collected from boring EB2 was analyzed for TPH as diesel by EPA method 3550 in conjunction with 8015, and for TOG by EPA 418.1 with clean up.

Analytical results of the soil samples, collected from the borings for monitoring wells (MW1 and MW3), indicate non-detectable levels of TPH as gasoline in all soil samples. Analytical results of the soil samples, collected from monitoring well MW2,

indicate levels of TPH as gasoline ranging from 2.2 to 6.8 ppm. However, analyses of the soil samples collected from EB2 indicated levels of TPH as gasoline ranging from 2,400 to 12,000 ppm. In sample EB2(9), TPH as diesel was detected at 1,400 ppm and TOG at 7,000 ppm. Benzene was detected in all soil samples collected from MW1, MW2 and MW3, except for samples MW2(10) and MW2(12), and the levels ranged from 0.0075 to 0.012 ppm. However, benzene was detected in samples EB2(7) and EB2(9) at concentrations of 5.0 ppm and 84 ppm, respectively.

Analytical results of the ground water samples collected from monitoring wells MW1 and MW2 indicate levels of TPH as gasoline ranging from 22,000 to 65,000 ppb. Benzene was detected in samples MW1 and MW2 and levels ranged from 590 to 3,300 ppb. Analyses of the ground water sample collected from MW3 showed non-detectable levels of all constituents analyzed. Results of the soil analyses are summarized in Table 2, and the water analyses in Table 3. 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 8.41 to 11.81 feet below the surface. Ground water flow direction appeared to be toward the northeast on May 11, 1990, (based on water level data collected from the three monitoring wells prior to pumping).

Based on review of regional geologic maps (U.S. Geological Survey Professional paper 943, "Flatland Deposits - Their Geology and Engineering Properties and their Importance to Comprehensive Planning", 1979), the subject site is underlain by relatively unconsolidated alluvial deposits described as fine-grained alluvium (Qhaf) typically consisting of clay and silt materials. In addition, the site is closely adjacent to a mapped geologic contact with Bay Mud (Qhbm) to the west.

Based on inspection of the tank pit excavation, the site is underlain by artificial fill materials to a depth of about 7.5 feet below grade. The fill materials are underlain by about 1.5 feet of adobe topsoil materials, which appears to in turn be underlain by light brown sandy silt containing a trace of fine gravel and light brown very fine-grained sand.

The results of our subsurface study indicate the site is underlain by artificial fill materials to depths of about 7 to 8 feet in the vicinity of wells MW1, MW2 and MW3. Locally, the fill materials extend to depths of at least 8.5 and 10.5 feet in the vicinity of borings EB1 and EB2 (maximum depth explored). The

fill materials are generally underlain by a 1-1/2 to 2 foot thick bed of silt which is in turn underlain by a persistent coarse-grained sequence of clayey to sandy gravel interbedded with clayey to silty sand to the maximum depth explored (23 feet).

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results, KEI recommends implementation of a monitoring and sampling program. The wells should be monitored on a monthly basis and should be purged and sampled on a quarterly basis. The proposed program should be conducted for a period of 12 months. Results of the monitoring program will be documented and evaluated after each monitoring and sampling event. Recommendations for altering or terminating the program will be made as needed. In addition, KEI recommends the installation of three additional monitoring wells to further define the extent of ground water contamination. Also, the vicinity of exploratory borings EB1 and EB2 should be excavated to approximately the depth of the ground water table at the area outlined on the attached Site Plan, Figure 1, because of the relatively high levels of TPH as gasoline, TPH as diesel and BTX&E detected in the soil samples. Our proposal for this work is attached for your review and consideration.

DISTRIBUTION

Copies of this report should be sent to the Alameda County Water District, and to 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.

Don R. Braun
Certified Engineering Geologist

License No. 1310
Exp. Date 6/30/90

Mardo Kaprealian
President

jad

Attachments: Tables 1, 2, 3, 4 & 5
Location Map
Site Plans - Figures 1, 2 & 3
Boring Logs
Laboratory Results
Chain of Custody documentation
Proposal

KEI-P88-1203.R7
May 31, 1990

TABLE 1

SUMMARY OF GROUND WATER MONITORING AND DEVELOPMENT DATA

Well #	Depth to Water (feet)	Product Thickness	Sheen	Gallons Pumped
(Monitored and Sampled on May 11, 1990)				
MW1	11.81	0	None	15
MW2	10.36	0	None	15
MW3	8.41	0	None	15
(Monitored and Developed on May 3 and 4, 1990)				
MW1	11.70	0	None	80
MW2	10.20	0	None	110
MW3	8.35	0	None	90

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May 31, 1990

TABLE 2

SUMMARY OF LABORATORY ANALYSES
SOIL

(Collected on April 26 and 27, 1990)

Sample Number	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
MW1(5)	5	ND	0.012	0.16	ND	ND
MW1(10)	10	ND	0.0094	0.024	ND	ND
MW1(14)	14	ND	0.0075	0.031	ND	ND
MW2(5)	5	2.4	0.075	0.0071	ND	ND
MW2(10)	10	2.2	ND	0.017	0.018	0.0088
MW2(12)	12	6.8	ND	0.028	0.015	0.10
MW3(5)	5	ND	0.0094	0.048	ND	ND
MW3(10)	10	ND	0.0088	0.015	ND	ND
EB2(7)	7	2,400	5.0	16	230	62
EB2(9)*	9	12,000	84	12	860	360
Detection Limits		1.0	0.0050	0.0050	0.0050	0.0050

* TPH as diesel was 1,400 ppm, and TOG was 7,000 ppm.

ND = Non-detectable.

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

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TABLE 3

SUMMARY OF LABORATORY ANALYSES
WATER

(Collected on May 11, 1990)

Sample Number	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethylbenzene
MW1	22,000	590	42	3,600	1,200
MW2	65,000	3,300	3,300	12,000	4,100
MW3	ND	ND	ND	ND	ND
Detection Limits	30	0.3	0.3	0.3	0.3

ND = Non-detectable.

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

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TABLE 4

SUMMARY OF LABORATORY ANALYSES
SOIL

(Samples Collected on November 29, and
December 5 & 29, 1989)

Sample	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
SW1	9.0	--	1.6	ND	ND	ND	ND
SW2	9.0	--	3.8	ND	ND	ND	ND
SW3	9.0	--	5.6	ND	ND	2.3	0.42
SW4	9.0	--	32	1.2	ND	1.0	2.1
SW5	9.0	--	4.8	0.20	ND	0.11	ND
SW6	8.0	--	ND	ND	ND	ND	ND
D1	3.5	--	ND	ND	ND	ND	ND
D2	3.5	--	1.5	0.08	ND	ND	ND
D3	3.5	--	6.6	0.14	ND	0.31	ND
D4	3.5	--	7.4	0.11	ND	0.1	ND
D5	3.5	--	1.9	ND	ND	ND	ND
D6	3.5	--	2.0	ND	0.17	0.25	ND
P1	6.0	--	15	0.086	ND	8.5	0.18
P2	5.5	--	3,800	6.1	290	750	140
P2(12)	12.0	--	ND	ND	ND	ND	ND
P3	5.0	--	11	0.13	ND	1.3	0.18
P4	4.5	--	1.4	ND	ND	0.23	ND
P5	4.5	--	ND	ND	ND	ND	ND
P6	3.0	--	ND	ND	ND	ND	ND
P7	4.0	--	ND	ND	ND	ND	ND
SWP2E	11.0	--	2	ND	0.16	3.1	0.50
SWP2W	11.0	--	ND	ND	ND	ND	ND
WO1*	8.5	ND	1.6	ND	ND	ND	ND

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TABLE 4 (Continued)

SUMMARY OF LABORATORY ANALYSES
SOIL

(Samples Collected on November 29, and
December 5 & 29, 1989)

Sample	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
SWA**	9.5	ND	2.1	ND	ND	ND	ND
SWB***	9.5	ND	3.9	ND	ND	ND	ND
Detection Limits		1.0	1.0	0.05	0.1	0.1	0.1

* TOG was <50 ppm, and all 8010 constituents were non-detectable. Metal concentrations were as follows: cadmium non-detectable, chromium 20 ppm, lead 75 ppm, and zinc 65 ppm.

** TOG was <50 ppm, and all 8010 constituents were non-detectable. Metals concentrations were as follows: cadmium non-detectable, chromium 20 ppm, lead 5.9 ppm and zinc 44 ppm.

*** TOG was <50 ppm and all 8010 constituents were non-detectable. Metals concentrations were as follows: cadmium non-detectable, chromium 15 ppm, lead 5.0 ppm, an zinc 39 ppm.

ND = Non-detectable.

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

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May 31, 1990

TABLE 5

SUMMARY OF LABORATORY ANALYSES
WATER

(Samples Collected on December 5, 1989)

Sample #	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethylbenzene
W1	7,900	850	150	720	ND
Detection Limits	30.0	0.3	0.3	0.3	0.3

NOTE: All 8010 constituents were non-detectable.

ND = Non-detectable.

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

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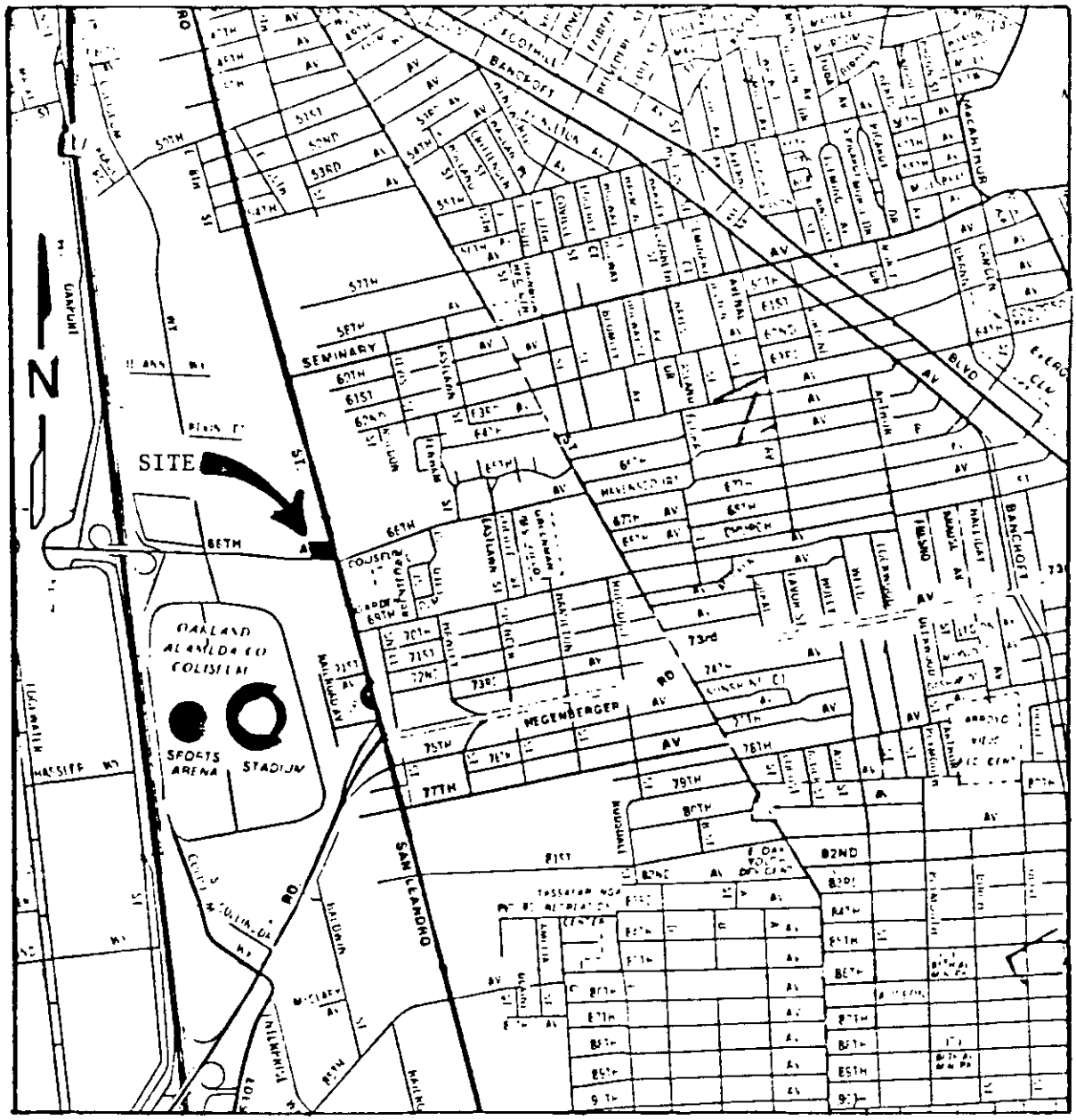

LOCATION MAP

Unocal S/S #3135
845 - 66th Avenue
Oakland, CA

KAPREALIAN ENGINEERING, INC.
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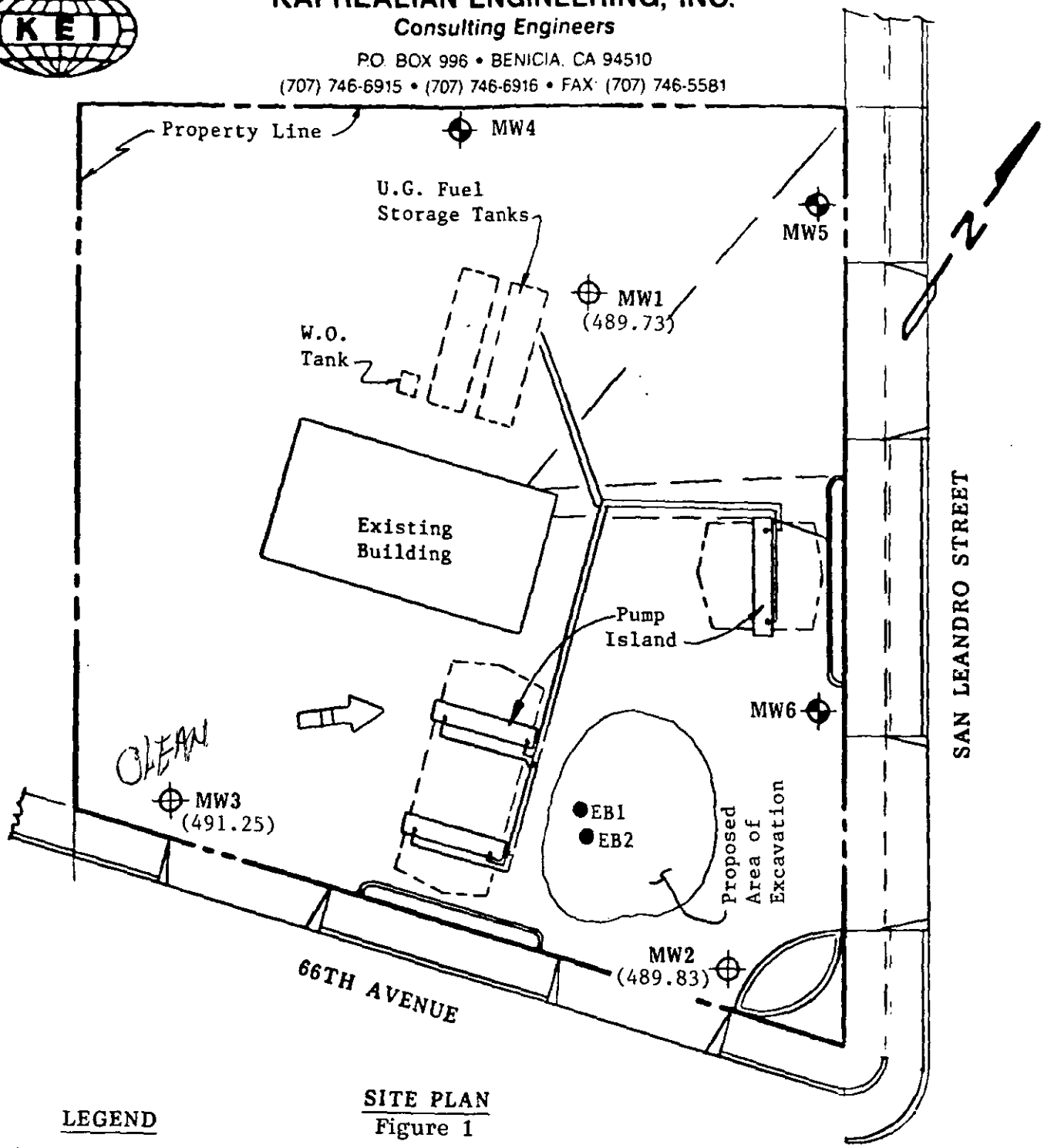

SITE PLAN
Figure 1

LEGEND

- Monitoring Well (Proposed)
- Monitoring Well (Existing)
- Exploratory Boring
- ( ) Ground Water Elevation in feet
- Ground Water Flow Direction

NOTE: Elevations are based on an assumed benchmark of 500.00 feet by Kier & Wright Surveyors.

0 30 60
Approx. Scale feet

Unocal Service Station #3135
845 - 66th Avenue
Oakland, California

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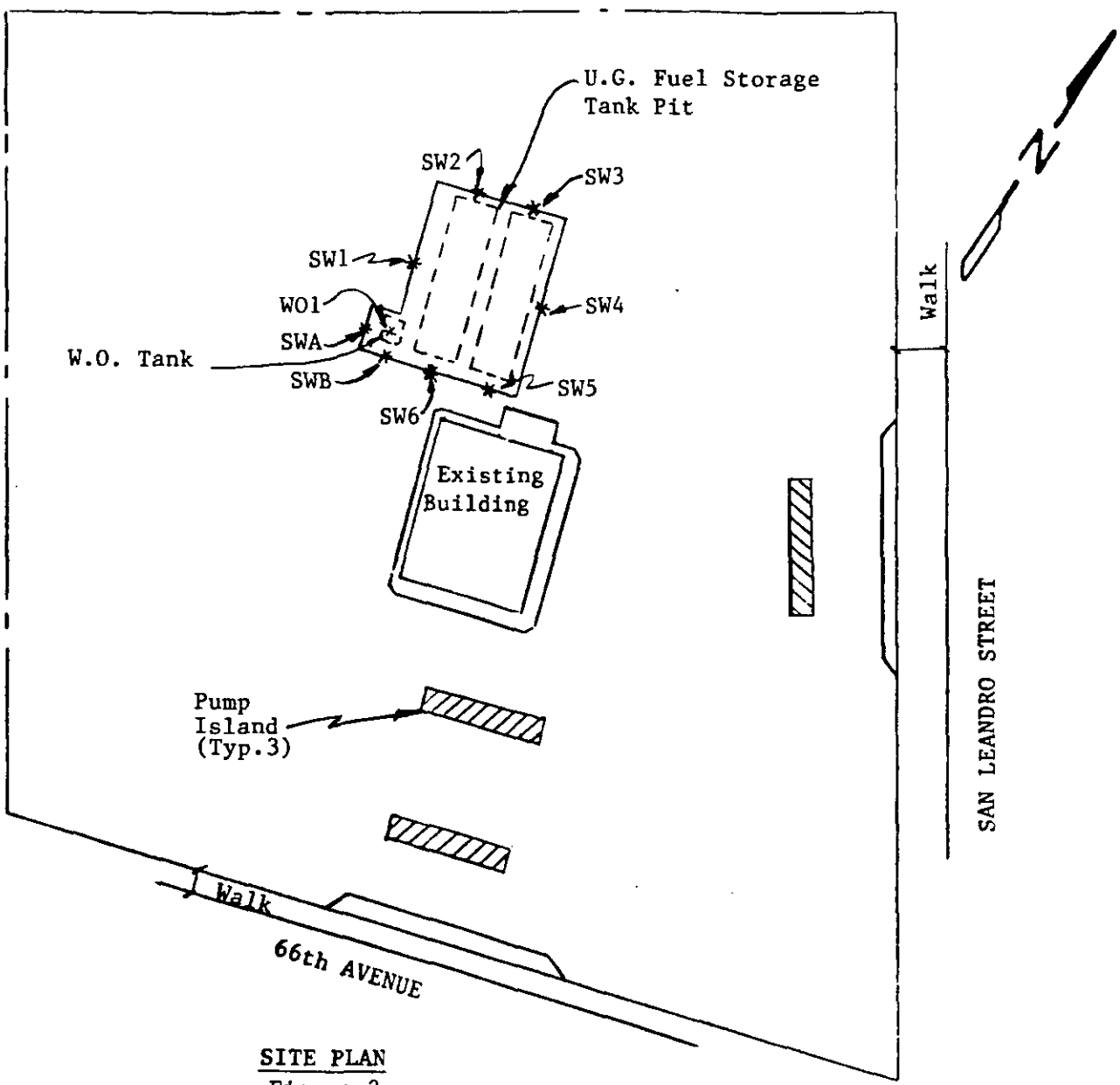

SITE PLAN
Figure 2

LEGEND

* Sample Point Location

Unocal SS #3135
845 66th AVENUE
OAKLAND, CALIFORNIA

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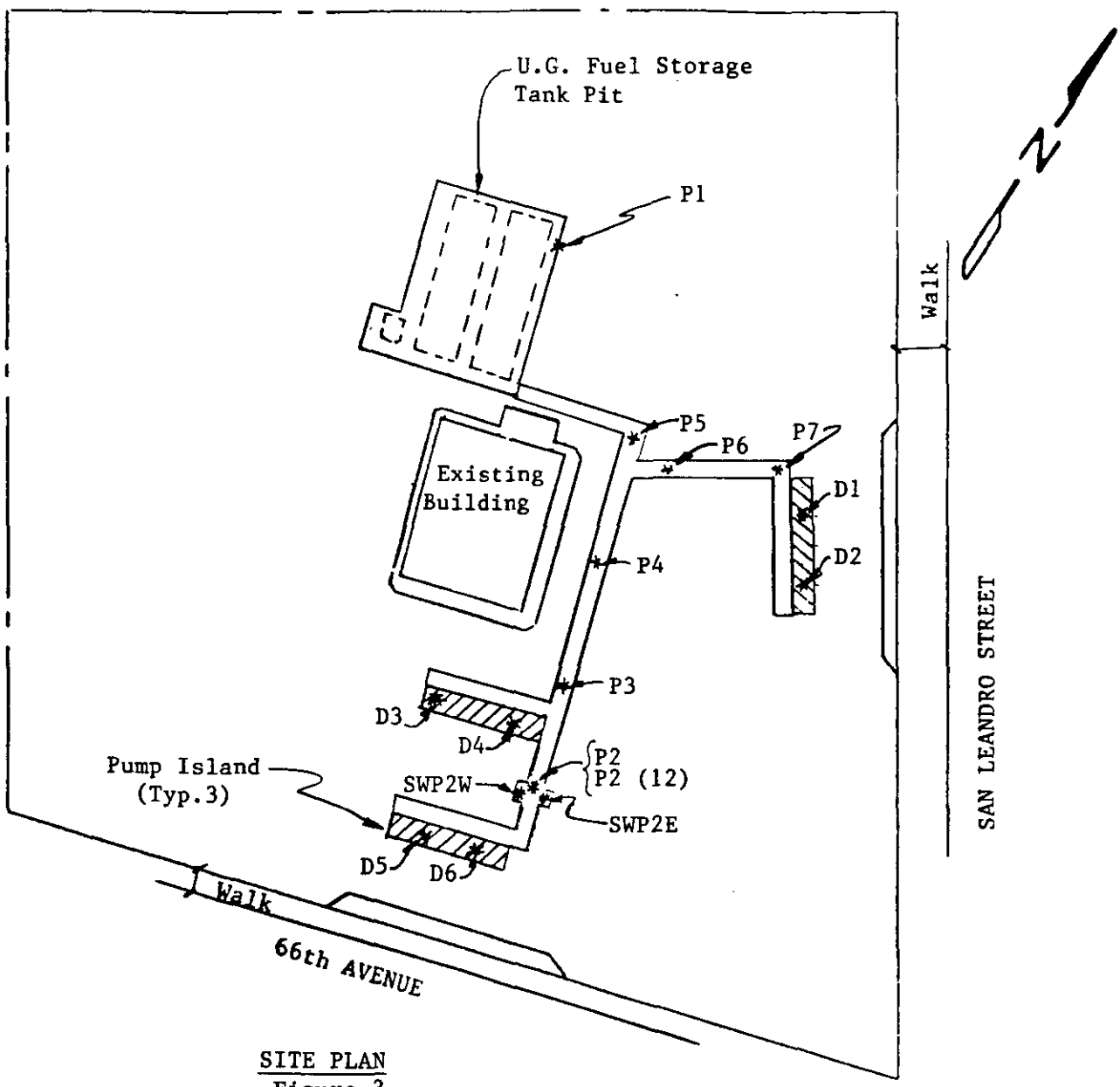


SITE PLAN
Figure 3

0 30 60
Approx. Scale feet

LEGEND

* Sample Point Location

Unocal SS #3135
845 66th AVENUE
OAKLAND, CALIFORNIA

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P88-1203	9" 2"	D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/26/90
Boring No. EB1	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Stratigraphy USCS	Description
		0		A. C. Pavement Sand and gravel: fill.
4/6/6		5	SP	Fill: sand and gravel, very dark grayish brown, very moist, gravel to >6" diameter.
				AUGER REFUSAL - Concrete Obstruction?
		10		
		15		
		20		TOTAL DEPTH: 8.5'

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P88-1203	9" 2"	D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/26/90
Boring No. EB2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		A. C. Pavement Clay, sand and gravel: fill.
5/3/4		5	SP	Fill consisting of sand and gravel, gap graded, sand is medium-grained, dark greenish gray, gravel to >6" diameter, sand is locally free of gravel, loose to dense.
4/16/15				
7/20/21	▼	10		Color change at 9.5 feet to very dark gray, wet.
		15		
		20		TOTAL DEPTH DRILLED: 9' TOTAL DEPTH SAMPLED: 10.5'

BORING LOG

Project No. KEI-P88-1203	Boring & Casing Diameter 9" 2"	Logged By D.L.
Project Name Unocal Oakland - 66th Ave.	Well Head Elevation N/A	Date Drilled 4/26/90
Boring No. MW1	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		A. C. Pavement Clay, sand and gravel: fill.
			GC	Fill: Clayey gravel with sand, gravel to 1 1/2" diameter, dense, moist, black. Gravel to 4" diameter, minor debris.
50-5 3/4"		5		Clayey gravel with sand, gravel to 1/2" diameter, medium dense, moist, dark olive.
				BASE OF FILL
5/7/7			MH	Clayey silt, 5-10% coarse sand, stiff, moist, black.
			GC/ SC	Clayey gravel with sand, gravel to 5/8" diameter, 15-20% clay, dense, moist, dark greenish gray, occasionally grading to clayey sand, with gravel, dark yellowish brown below 10.5 feet.
11/15/19		10		
13/16/20			SC	Clayey sand, with silt, predominantly fine-grained, very dense, moist, olive gray and dark gray, mottled. mottled.
	▼			
7/10/14		15	SM	Silty sand, trace clay, sand is fine-grained, medium dense, wet, dark olive gray.
			GP-GC	Poorly graded gravel with clay and sand, very dense, wet, olive brown.
15/30/21		20		

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P88-1203	9" 2"	D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/26/90
Boring No. MW1	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
			GP-GC	Poorly graded gravel with clay and sand, very dense, wet, olive brown.
		25		
		30		
		35		
		40		TOTAL DEPTH: 23'

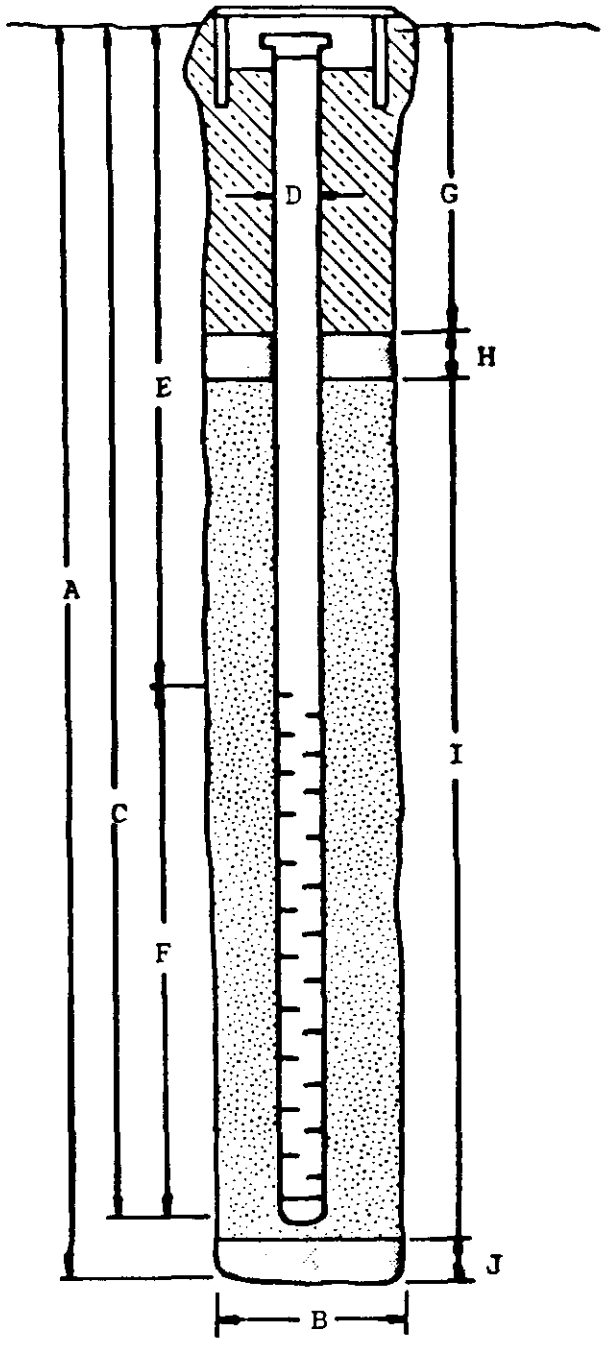
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland - 66th Avenue BORING/WELL NO. MW1

PROJECT NUMBER: KEI-P88-1203

WELL PERMIT NO.: 90096

Flush-mounted Well Cover



A. Total Depth: 23'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 23'

Material: Schedule 40 PVC

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

E. Depth to Perforations: 5'

F. Perforated Length: 18'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Concrete

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 19'

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-P88-1203	9" 2"	D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/27/90
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		A. C. Pavement Sand and gravel: fill.
			GC	Fill: Clayey gravel with sand, medium dense, moist, black, with bricks.
6/7/8		5	CH	Clay, 5-10% sand and gravel to 1/4" diameter, trace silt, stiff, moist, black.
				Base of Fill?
4/7/10			CL/ CH	Clay with silt, 5-10% fine-grained sand, stiff, moist, dark greenish gray and olive, mottled.
7/14/20		10	GC	Clayey gravel with sand, gravel to 1/2" diameter, dense, moist, olive and olive brown, mottled.
9/20/18	▼		SP-SM	Poorly graded sand with silt, sand is medium grained, dense, wet, olive brown.
7/14/21		15	GC/ SC	Clayey gravel with sand, gravel to 1" diameter, 15-20% clay, occasionally grading to clayey sand with gravel, dense, wet, olive brown.
			GW	Well graded gravel with sand, trace-10% fines, gravel to 1-1/2" diameter, dense, wet, olive brown.
		20		

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P88-1203	9" 2"	D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/27/90
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Stratigraphy USCS		Description
			GW		Well graded gravel with sand, dense, wet, olive brown.
		25			
		30			
		35			
		40			TOTAL DEPTH: 23'

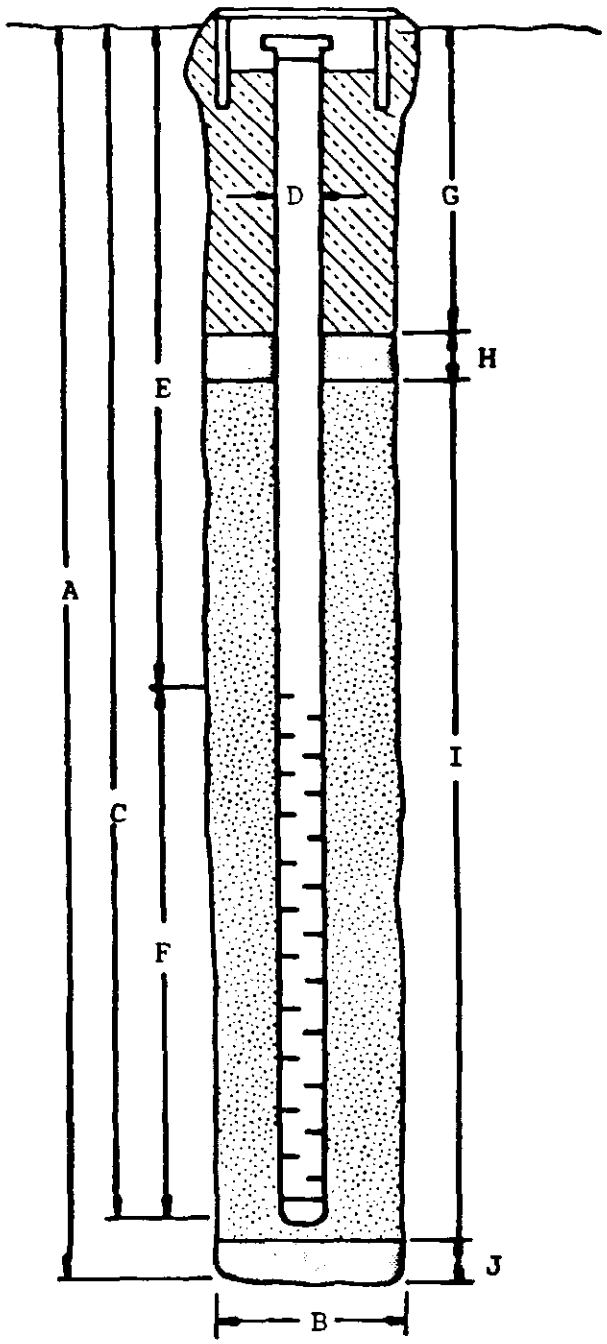
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland - 66th Avenue BORING/WELL NO. MW2

PROJECT NUMBER: KEI-P88-1203

WELL PERMIT NO.: 90096

Flush-mounted Well Cover



A. Total Depth: 23'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 23'

Material: Schedule 40 PVC

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

E. Depth to Perforations: 5'

F. Perforated Length: 18'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Concrete

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 21'

Pack Material: CISCO White Silica Sand

Size: 8/20

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-P88-1203	9" 2"	D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/26/90
Boring No. MW3	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Stratigraphy USCS	Description
		0		A. C. Pavement Clay, sand and gravel, black, with bricks: fill.
4/4/7		5	GC	Fill: Clayey gravel with sand, firm to stiff, moist to very moist, black. Base of Fill?
			SC	Clayey sand, trace gravel, sand is coarse-to fine-grained, 30-35% clay, gravel to 1/8" diameter, medium dense, moist, dark yellowish brown.
9/12/12	▼	10	SM	Silty sand, 5-10% clay, sand is medium to fine-grained, medium dense, very moist to wet, dark grayish brown and yellowish brown, streaked.
7/30/31		15	GP-GC	Poorly graded gravel with clay and sand, gravel to 3/4" diameter, very dense, wet, dark yellowish brown.
50-5 1/2"		20	GW	Well graded gravel with sand, 5% fines, gravel to 1-3/4" diameter, very dense, wet, dark yellowish brown

BORING LOG

Project No. KEI-P88-1203	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal Oakland - 66th Ave.	**Well Head Elevation** N/A	**Date Drilled** 4/26/90
Boring No. MW3	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
			GW	Well graded gravel with sand, very dense, wet, dark yellowish brown.
		25		
		30		
		35		
		40		TOTAL DEPTH: 22'

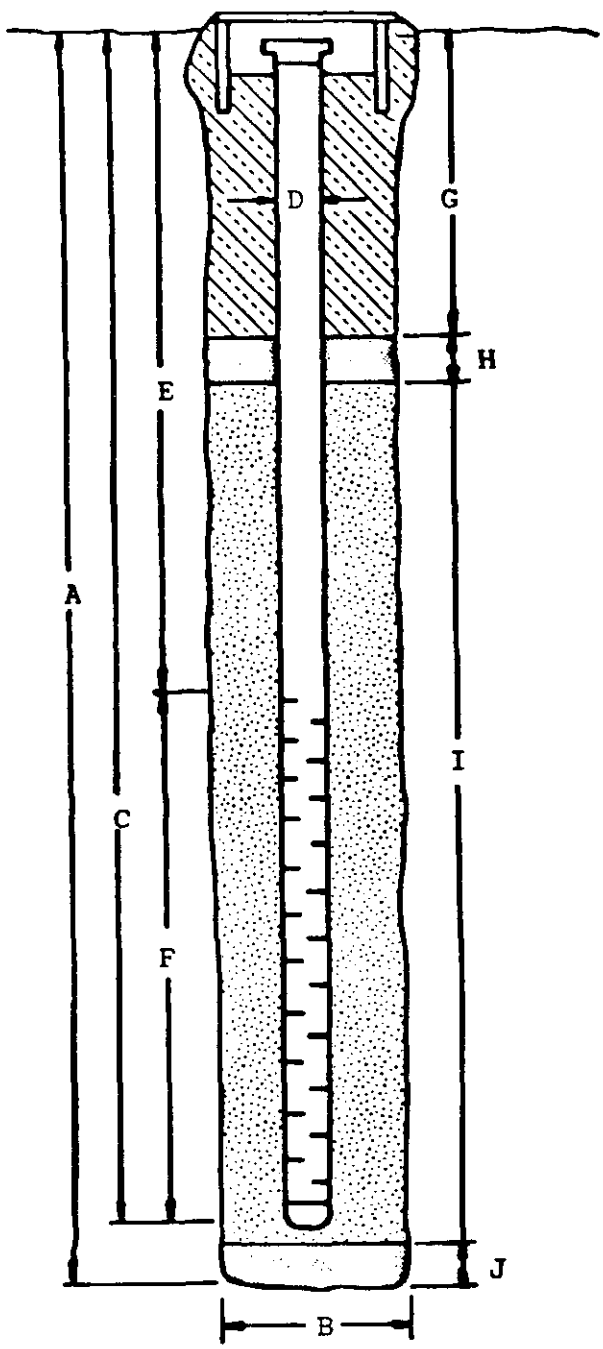
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland - 66th Avenue BORING/WELL NO. MW3

PROJECT NUMBER: KEI-P88-1203

WELL PERMIT NO.: 90096

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: 4'

F. Perforated Length: 18'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 1.5'

Seal Material: Concrete

H. Seal: 1.5'

Seal Material: Bentonite

I. Gravel Pack: 19'

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

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Kaprealian Engineering, Inc.	Client Project ID:	Unocal #3135,Oakland,845 66th Ave.	Sampled:	Apr 26, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Apr 27, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	May 7, 1990
Attention: Mardo Kaprealian, P.E.	First Sample #:	004-4051	Reported:	May 11, 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)
004-4051	EB2-7	2,400	5.0	16	62	230
004-4052	EB2-9	12,000	84	12	360	860
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
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Kaprealian Engineering, Inc.	Client Project ID:	Unocal #3135,Oakland,845 66th Ave.	Sampled:	Apr 26, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Apr 27, 1990
Benicia, CA 94510	Analysis Method:	EPA 3550/8015	Extracted:	May 7, 1990
Attention: Mardo Kapreallan, P.E.	First Sample #:	004-4052	Analyzed:	May 8, 1990
			Reported:	May 11, 1990

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
004-4052	EB2-9	1,400

Detection Limits:	**1.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Kaprealian Engineering, Inc.	Client Project ID:	Unocal #3135,Oakland,845 66th Ave.	Sampled:	Apr 26, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Apr 27, 1990
Benicia, CA 94510	Analysis Method:	EPA 418.1 (I.R. with clean-up)	Extracted:	May 10, 1990
Attention: Mardo Kaprealian, P.E.	First Sample #:	004-4052	Analyzed:	May 11, 1990
			Reported:	May 11, 1990

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
004-4052	EB2-9	7,000

Detection Limits:	1.0

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: [signature]

WITNESSING AGENCY:

SITE NAME & ADDRESS: UNOCAL #3135 / OAKLAND
845 66TH AVENUE

TURN AROUND TIME: REGULAR

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPH-D	BTEX	TPH-G	OIL & GREASE	REMARKS
EB1-(S)	4-26-96		X		X		1	SEE SAMPLE ID NO.	X		X		HOLD
EB2-(T)	4-26-96		X		X		1		X		X		0044051
EB2-(G)	4-26-96		X		X		1		X	X	X	X	0044052

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature] (KEI)	4-27-96 2:00PM	[signature]
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature) 4/27 V.A. Herrera 3:10

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? NO
4. Were samples in appropriate containers and properly packaged? YES

V.A. Herrera — Signature; _____ — Title; 4-27 — Date

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Kaprealian Engineering, Inc.	Client Project ID:	Unocal #3135, Oakland, 845 66th Av	Sampled:	Apr 26-27, 1990
P.O. Box 996	Matrix Descript:	Soil	Received:	Apr 27, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	May 4, 1990
Attention: Mardo Kaprealian, P.E.	First Sample #:	004-4034	Reported:	May 9, 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)
004-4034	MW1-(5)	N.D.	0.012	0.16	N.D.	N.D.
004-4035	MW1-(10)	N.D.	0.0094	0.024	N.D.	N.D.
004-4036	MW1-(14)	N.D.	0.0075	0.031	N.D.	N.D.
004-4037	MW2-(5)	2.4	0.075	0.0071	N.D.	N.D.
004-4038	MW2-(10)	2.2	N.D.	0.017	0.0088	0.018
004-4039	MW2-(12)	6.8	N.D.	0.028	0.10	0.015
004-4040	MW3-(5)	N.D.	0.0094	0.048	N.D.	N.D.
004-4041	MW3-(10)	N.D.	0.0088	0.015	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
Project Manager

Please Note:
Amended report on 5/11/90.

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: [signature]

WITNESSING AGENCY:

SITE NAME & ADDRESS: VINCAL #3135 / OAKLAND 845 66TH AVENUE

ANALYSES REQUESTED: TPH-D, TPH-G

TURN AROUND TIME: REGULAR

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	REMARKS
MW1-(5)	4-26-90		X		X		1	SEE SAMPLE ID MAP	0044034
MW1-(10)	4-26-90		X		X		1		0044035
MW1-(14)	4-26-90		X		X		1		0044036
MW2-(5)	4-27-90		X		X		1		0044037
MW2-(10)	4-27-90		X		X		1		0044038
MW2-(12)	4-27-90		X		X		1		0044039
MW3-(5)	4-26-90		X		X		1		0044040
MW3-(10)	4-26-90		X		X		1		0044041

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature] (KEI)	4-27-90 2:00PM	[signature]
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[illegible] by: (Signature)	Date/Time	Received by: (Signature) 4-27 V.A. Herrera 3:10

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? NO
4. Were samples in appropriate containers and properly packaged? YES

V.A. Herrera — Signature | _____ — Title | 4-27 — Date

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, 845 66th Ave.	Sampled:	May 11, 1990
P.O. Box 996	Matrix Descript:	Water	Received:	May 11, 1990
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	May 11, 1990
Attention: Mardo Kaprealian, P.E.	First Sample #:	005-1706 A-B	Reported:	May 15, 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)
0051706 A-B	MW1	22,000	590	42	1,200	3,600
0051707 A-B	MW2	65,000	3,300	3,300	4,100	12,000
0051708 A-B	MW3	N.D.	N.D.	N.D.	N.D.	N.D.
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

Belinda C. Vega
Project Manager

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: RAY (KEI)

WITNESSING AGENCY:

SITE NAME & ADDRESS: UNOCAL OAKLAND 345 66TH AVE.

ANALYSES REQUESTED: TPH G; BTX E

TURN AROUND TIME: 1 Week

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	REMARKS
MW1	5-11-90	14:00		X	X		2VOA		
MW2	"	"		X	X		"		
MW3	"	"		X	X		"		
		"							

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Ray (KEI)	5-11-90	14:35
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? ✓

DAV — Signature; SK — Title; 5/11/90 — Date