Reference listed in RI:

Geotechnical Consultants, Inc, 1989

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Geotechnical Consultants, Inc, 1989

MARMAC

6415 Katella Avenue
Cypress, California 90630-5207
(714) 220-3200

LETTER OF TRANSMITTAL

TO: Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109-8099
ATTN: Elizabeth L. Stetz

DATE: December 12, 1989
JOB NO: 1472
PROJECT:

GENTLEMEN: WE ARE SENDING YOU:

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COPIES	NUMBER	DESCRIPTION
1		Interim Report - Evaluation of Groundwater
		Quality

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☐ For approval ☐ For your use ☐ As requested ☒ For review and comment ☐ _____

REMARKS:

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SIGNED: Roger J Schwing
Roger J Schwing

— MARMAC

INTERIM REPORT EVALUATION OF GROUNDWATER QUALITY UPGRADIENT OF JET PROPULSION LABORATORY PASADENA, CALIFORNIA

U.S. ARMY CORPS OF ENGINEERS
CONTRACT DACA09-87-D-0061

Prepared for MARMAC by:
Geotechnical Consultants, Inc.
October 1989

CITJPL/ACEP
18058

STUDY DESCRIPTION

INTRODUCTION

This report presents an interim summary of the work performed under Delivery Order 05 of Contract DACA09-87-D-0061 from the U.S. Army Corps of Engineers to evaluate groundwater quality immediately upgradient of the Jet Propulsion Laboratory (JPL), Pasadena, California.

As shown on Figure 1 - Location Map, the JPL facility is located approximately four miles northwest of Pasadena, and occupies a 150 acre site of hilly terrain flanking the west side of Arroyo Seco. Dating back to the previous ownership of the property by the Department of Defense, waste disposal practices attendant to operations at the facility for rocket propulsion research are not known. In the early 1980's, the City of Pasadena began detecting the presence of volatile organic compounds in several nearby municipal water wells located downgradient from JPL. As a consequence of this finding, the possibility of contaminant discharge from the JPL facility to the local groundwater regime has been raised by the City of Pasadena.

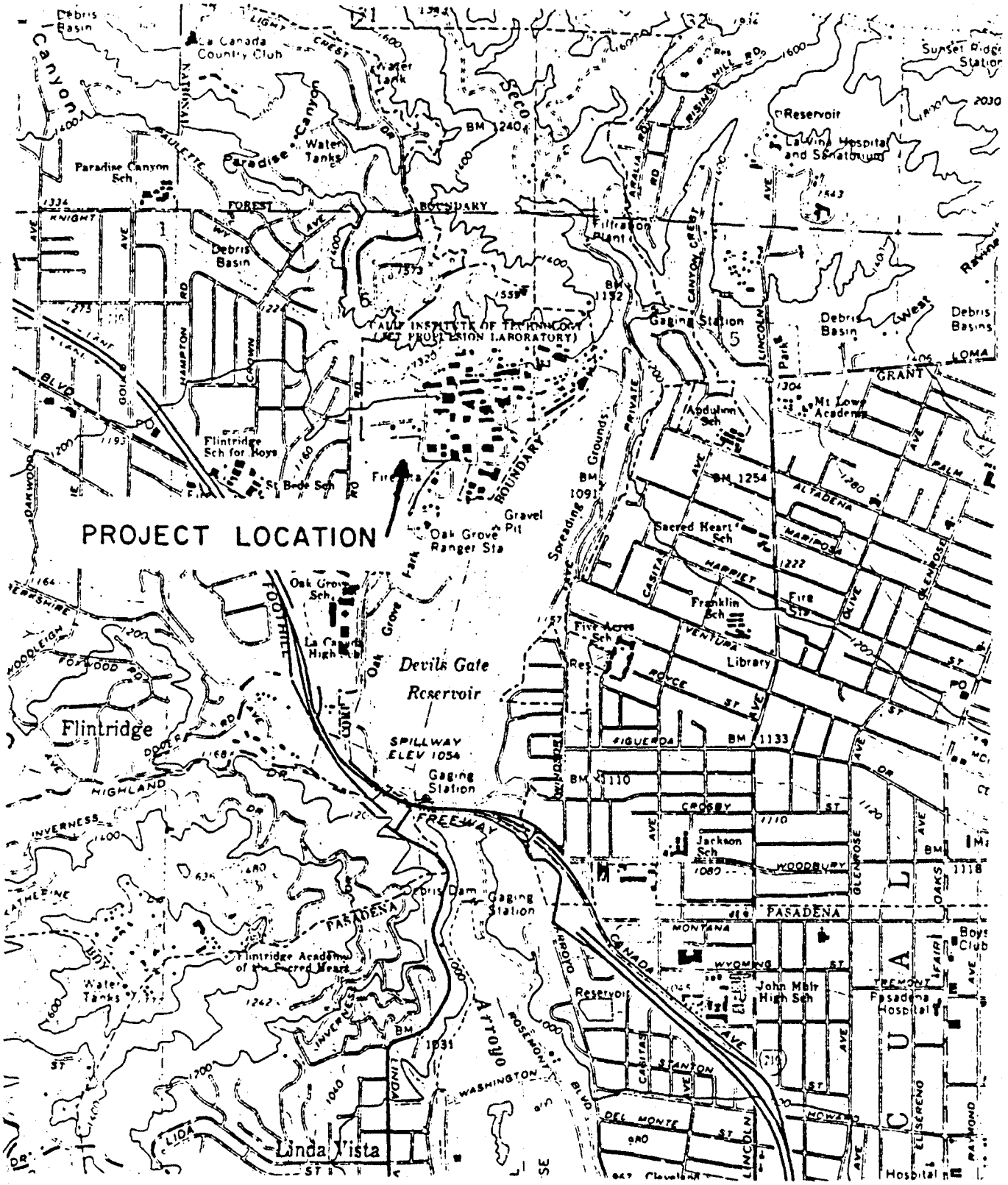
In preparing an assessment of suspected contaminant discharge and migration patterns, conditions upgradient of the target source must be defined for screening purposes. To this end, the work conducted under Delivery Order 05 is slated to begin the process of defining groundwater quality at locations proximate to, but outside the influence of JPL.

WORK PERFORMED

Through discussions with the Corps of Engineers, two drilling sites were selected for the installation of upgradient

FIGURE 1

LOCATION MAP



monitoring wells. Site selection was conditioned upon identifying locations that were accessible to truck-mounted drilling equipment, within or immediately adjacent to JPL property and positioned with reasonable certainty upgradient of the facility. Based on these factors, two monitoring well locations were determined as shown on Plate 1 - Site Plan.

The project drilling subcontractor, Beylik Drilling, Inc., mobilized at the jobsite on August 14, 1989 with an Ingersol Rand TH100 drill rig equipped for mud rotary drilling. Between August 14, and August 24, 1989, Monitoring Well (MW)-1 and MW-2 were drilled to depths of 162 feet and 179 feet, respectively. Electric logs were conducted in both bores to delineate saturated zone locations and supplement geologic logging efforts. Following the selection of well screen locations, cutting samples from the screened depth intervals were analyzed for grain-size distribution in order to design an appropriate slot size opening and gravel pack. For both wells installed under this contract a 0.020-inch slot opening and a Monterey No. 3 gravel pack were utilized. Field data generated during the course of well construction are presented in Appendix A. These include geologic logs, electric logs and as-built well completion schematics.

When both monitoring wells were fully installed, a Smeal 5T development rig was mobilized to evacuate drilling fluids and develop the wells. After an initial removal of sediment buildup at the bottom of the casing using a suction bailer, the screen interval was swabbed in one foot increments followed by bailing and/or pumping to clear the casing. Due to a lack of water inflow to MW-2, potable water was added to the well (and subsequently removed) in order to complete the development process.

The final element to field activities under Delivery Order No. 5 consisted of water quality sampling in both of the newly constructed monitoring wells (MW-1 and MW-2), and in an existing well (MH-01) owned by the City of Pasadena. As shown on Plate 1 - Site Plan, Monitoring Well MH-01 is located within the Arroyo Seco wash, and represents a groundwater sampling point downgradient from JPL. In preparation for sampling, the Smeal rig was utilized to purge the wells with a submersible pump. For Monitoring Wells MW-1 and MH-01, this work was completed in a routine fashion. Discharge volumes were recorded and field parameters of temperature, pH and electrical conductivity were monitored until stabilized values were achieved. These data are shown on the Field Data Water Quality Sampling sheets contained in Appendix A. In Monitoring Well MW-2, it was determined that inadequate free water was available within the sediments screened by this well to contribute a sufficient volume for sampling purposes, i.e., no water quality samples were obtained from this well.

With respect to MW-1 and MH-01, samples were collected on September 5, 1989 and submitted to Truesdail Laboratories, Inc. for analytical testing (EPA Method 624/625, et al.). A complete set of laboratory test findings is presented in Appendix B. Duplicate samples were also collected and shipped to the Corps of Engineers; however, test results were not available to us at the time of this report.

As a final item, Appendix C provides a description of the quality control procedures adhered to during the course of our field activities. These include both the decontamination routines employed during drilling and well construction, and the protocols followed to obtain representative water quality samples.

FINDINGS

GEOLOGIC SETTING

JPL is located at the base of the San Gabriel Mountains, an east-west trending tectonic block within the Transverse Ranges province. The mountain block was uplifted 13,000 feet during an abrupt middle Pleistocene orogeny which continues today. The San Gabriel Mountains are comprised of predominantly Precambrian and Cretaceous crystalline rock and are separated from the San Gabriel basin by an east-west striking fault system termed the Sierra Madre fault zone. Geologic investigations within the JPL facility have identified the Sierra Madre fault (and two branch faults) as a north dipping (45 degrees) reverse fault that commonly places crystalline basement over Pleistocene alluvium (Crook, et al., 1987). One fault branch lies approximately 200 feet north of Monitoring Well No. 2 and the main branch ("Bridge fault") is only 50 feet north of Monitoring Well No. 1.

The San Gabriel Valley is a broad structural basin infilled by a thick sequence of Pleistocene to Recent alluvial deposits discharged from the San Gabriel Mountains. JPL is largely developed on older alluvial fans formed by the Arroyo Seco. Deep boreholes and water wells in the JPL vicinity indicate 600 to 650 feet of alluvium overlies a granitic basement and may actually increase in thickness near the Sierra Madre fault zone (Crook, et al., 1987).

HYDROGEOLGIC SETTING

The alluvial sediments of the San Gabriel Valley form a major groundwater basin of which the northwest corner is termed the Raymond Basin. The Raymond Basin is divided into three

hydrogeologic subareas including the Monk Hill Basin which underlies JPL and adjacent areas west and east. Groundwater flows in a general southeasterly direction across the Monk Hill Basin with steep gradients present near the range front (200 to 600 feet per mile) (Raymond Basin Management Board, 1985). Recharge to the southern Monk Hill Basin occurs primarily at the Arroyo Seco spreading grounds and Devils Gate Dam.

The JPL facilities are located along the northerly margin of the Monk Hill Basin at the confluenence of multiple groundwater flow regimes. To the west of JPL, groundwater gradients are directed to the southeast, while on the east side of the facility groundwater flow is controlled through Arroyo Seco to the south-southwest. These patterns converge in the Devils Gate Dam area directly south of JPL. In addition, it is likely that subsurface inflow through the bedrock units north of JPL is impacting local groundwater configurations beneath the facility.

As a result of the recent monitoring well installations, one finding of particular note is the disparity in water level elevations between MW-1 and MH-01 in Arroyo Seco. Using U.S.G.S. topography for a rough appraisal of well head elevations, both of these wells are at approximate elevation 1115 feet. However, the depth to water in MH-01 was measured at 134.62 feet, while the depth to water in MW-1 was recorded at 39.04 feet (both measurements taken September 5, 1989). It is likely that Monitoring Well MW-1 either penetrated or is simply located upstream of a fault barrier related to the Sierra Madre fault zone, and the water level recorded therein is reflective of a rising water condition.

WATER QUALITY ANALYSES

The water quality samples obtained from MW-1 and MH-01 were tested for volatile and semi-volatile organics (EPA Method 624/625) total petroleum hydrocarbons (EPA Method 418.1), five target metals, pH and TDS. As previously noted, a complete set of laboratory test results is presented in Appendix B. In overview, neither well sample revealed evidence of organic contamination and/or elevated levels of the five target metals analyzed. The one significant finding (MEK 48.1 ug/l) was in the shipping blank accompanying the well samples. There is no rational explanation for this and as such, we do not consider the result meaningful.

CONCLUSIONS AND RECOMMENDATIONS

Based on the areal positioning of MW-1 with respect to the JPL facilities, coupled with the geologic findings obtained from drilling and well construction activities, we believe that Monitoring Well MW-1 is a legitimate upgradient sampling point to monitor groundwater inflow along Arroyo Seco. The flow mechanics through the Arroyo are apparently complicated by one or more fault barriers, and additional data would be required to clarify this condition. However, for the purposes of defining water quality in Arroyo Seco upgradient of the study area, the current work effort will suffice.

Monitoring Well MW-2 was drilled to the maximum depth specified in the project work plan of 175 feet. The electric log from this boring indicated several potential water bearing zones at depth; however, these zones have not yielded any significant quantity of free water to the completed well. With changing hydrologic conditions, MW-2 may provide a groundwater sampling point

in the future, and the well should be monitored periodically for water inflow. On a broader scale, upgradient groundwater quality to the west of JPL can be assessed using numerous existing wells in the La Canada-Flintridge area.

Based on the initial water quality test findings from MW-1 and MH-01, there is no immediate evidence of groundwater contamination either entering the study area along Arroyo Seco, or existing within the downgradient well (MH-01). Knowing that volatile organic compounds have previously been identified in MH-01, the current data should be viewed within a trend of analytical test findings; not as absolute values.

The second element of the Corps of Engineers contract to evaluate upgradient conditions at JPL (Delivery Order 06) calls for one additional monitoring well to be installed at the site. It is recommended that this well be located on the north side of the facility to intercept shallow subsurface inflow from the adjacent hillside. An accessible location such as the parking area behind Building 299 would be suitable. Although it is considered unlikely that offsite contaminant migration is impacting JPL from the northerly hillside, the addition of a monitoring well in this area should assist future investigators in defining groundwater discharge patterns from JPL.

Very truly yours,
GEOTECHNICAL CONSULTANTS, INC.

Charles C. Kendall
Senior Hydrogeologist
C.E.G. No. 1024

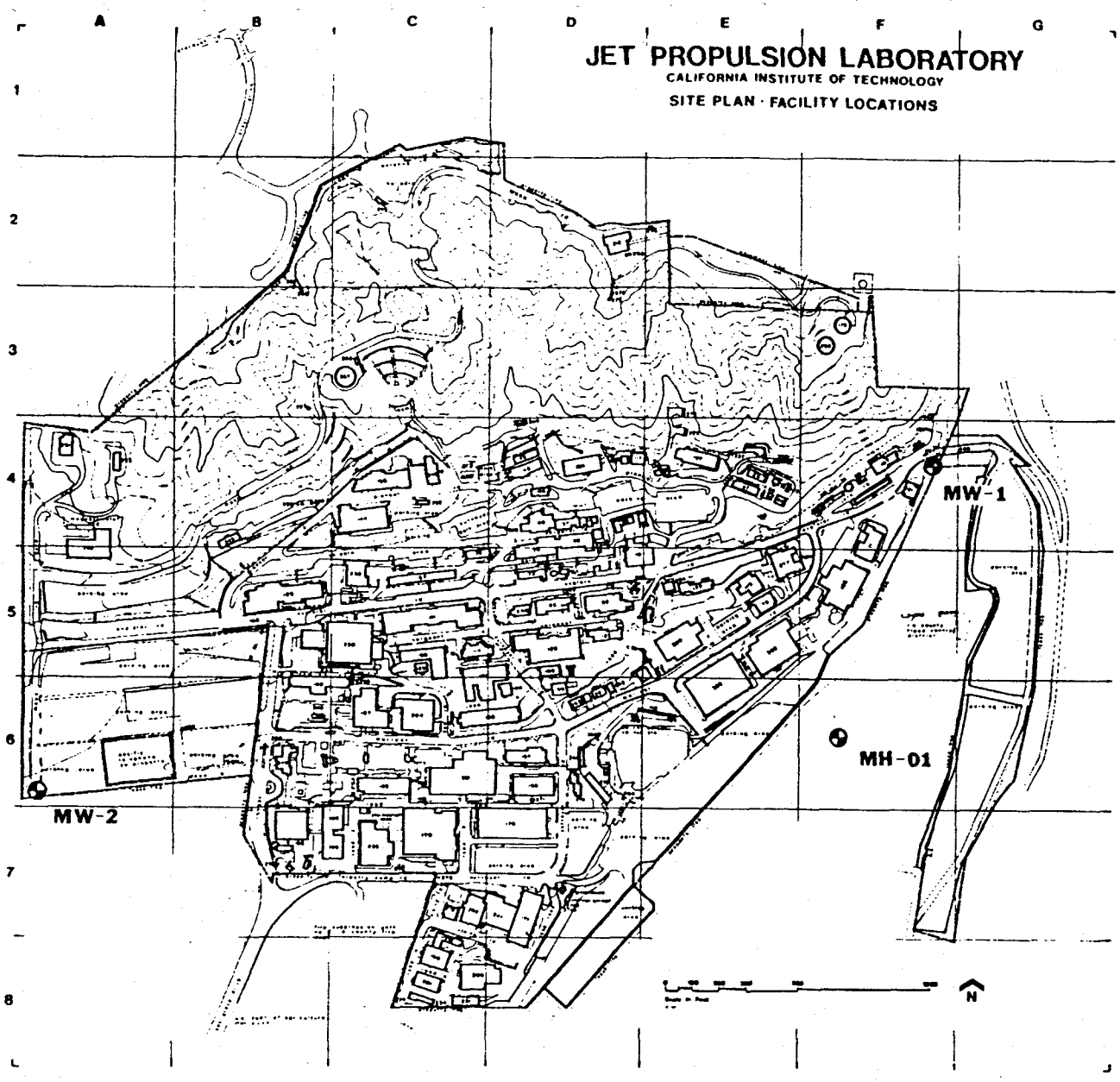
CCK/kmc

REFERENCES

Crook, Richard, Jr.;Allen, C.R.; Kamb, Barclay; Payne, C.M.; and Proctor, R.J., 1987, Quaternary Geology and Seismic Hazard of the Sierra Madre and Associated Faults, Western San Gabriel Mountains; *in*: Recent Reverse Faulting in the Transverse Ranges, California, U.S. Geological Survey Professional Paper 1339, p. 27-63.

MARMAC, October 1988, Work Plan, Upgradient Conditions Evaluation at Jet Propulsion Laboratory, Pasadena, California.

Raymond Basin Management Board, 1985, AB1803 Water Analysis Plan for the Raymond Basin.



SITE PLAN

PLATE I S88042

MW-1 Estimated Location of Monitoring Well

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APPENDIX A

COMPILATION OF FIELD RECORDS

PLATES A-1.1 AND A-1.2	LOG OF DRILL HOLE
PLATES A-1.1A AND A-1.2A	AS-BUILT WELL SCHEMATICS
PLATE A-2	LEGEND TO LOGS
PLATES A-3.1 AND A-3.2	FIELD DATA WATER QUALITY SAMPLING SHEETS
POCKET INSERT	ELECTRIC LOGS

JET PROPULSION LABORATORY
PASADENA, CALIFORNIA

S88042

CITJPL/ACEP
18068

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-1
DRILLING DATE: August 22, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1115 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE / REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
1110						"ALLUVIUM (Qal)" SILTY SAND (SM) with cobbles and boulders, light brown, dry, loose.						
10												
1100						set 10" conductor to 15 feet, end of shift 8/22/89.						
20						"ALLUVIUM (Qal)" SAND (SP) brown with white quartz and feldspar, medium to very coarse grained, angular with traces of clayey silt.						
1090												
30						cobbles.						
1080						▽boulders.						
40						"ALLUVIUM (Qal)" SILTY CLAY (CL) brown, soft, soluble, with very fine grained sand and lenses of cobbles.						
1070												
50						cobbles.						
1060												
60						"ALLUVIUM (Qal)" SAND (SP) brown, medium to coarse grained, angular with scattered gravel and cobbles.						
1050												

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-1
DRILLING DATE: August 22, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1115 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
70 / 1040						"ALLUVIUM (Qal)" SAND (SP) brown, medium to coarse grained, angular with scattered gravel and cobbles.						
80 / 1030						grading to fine to medium grained sand, with lenses of clayey silt.						
90 / 1020						becoming coarse to very coarse grained.						
100 / 1010						end of shift 8/23/89.						
110 / 1000						"ALLUVIUM (Qal)" CLAYEY SAND (SC) brown, very fine to coarse grained, large amount fines as seen in thickening mud, occasional cobbles.						
120 / 990						cobble lens.						
130						traces of weathered feldspar in CLAYEY SAND.						

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LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-1
DRILLING DATE: August 22, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1115 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
980						"ALLUVIUM (Qal)" CLAYEY SAND (SC) brown, very fine to coarse grained, large amount fines as seen in thickening mud, occasional cobbles.						
140												
970												
150						becoming finer grained.						
960												
160						becoming coarser grained.						
						Bottom of drill hole at 162 feet, on 8/24/89. Groundwater estimated at approximate depth of 85 feet based on electric log. Boring completed as Monitoring Well MW-1, water level measured September 5, 1989 at depth of 39.04 feet.						

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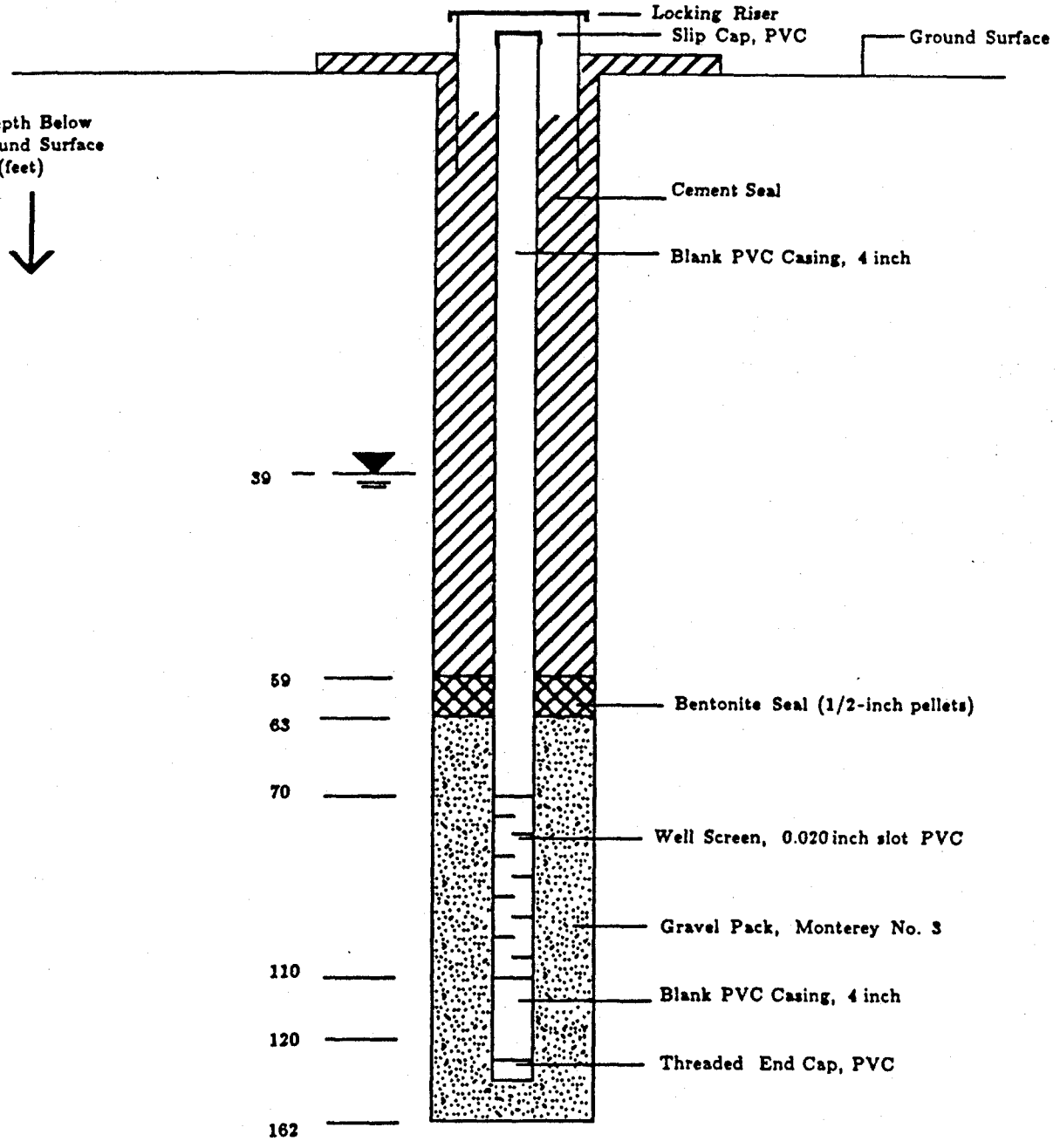
LEGEND TO LOGS ON PLATE A-2

AS BUILT WELL COMPLETION SCHEMATIC
MW-1



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18072

SHEET 1 OF 1 S88042 PLATE A-1.1a

GEO-HYDRO-DATA

INCORPORATED

ELECTRIC WELL LOG

COMPANY MARMAC

WELL MW-2

FIELD PASADENA

COUNTY LOS ANGELES STATE CALIFORNIA

LOCATION

Sec. 6 Twp. 1S Rge. 12W

TYPE LOG

IF, FF, 6' LATERAL

Permanent Datum GROUND LEVEL Elev. Elev.: K. B.

Log Measured From G.L. 0 Ft. Above Perm. Datum D. F.

Drilling Measured From GROUND LEVEL G. L. 1170

Date	17 Aug 89		
Run No.	one		
Depth — Driller	160 ft.	ft.	ft.
Depth — GHD	158 ft.	ft.	ft.
Btm. Log Inter.	158 ft.	ft.	ft.
Top Log Inter.	16 ft.	ft.	ft.
Casing — Driller	10 in. @ 17 ft.	in. @ ft.	in. @ ft.
Casing — GHD	ft.	ft.	ft.
Bit Size	9 7/8 in. to TD ft.	in. to ft.	in. to ft.
Bit Size	in. to ft.	in. to ft.	in. to ft.
Bit Size	in. to ft.	in. to ft.	in. to ft.
Type Fluid in Hole	gel		
Source of Sample	ditch		
PPM TDS	350		
Fluid Level	full ft.	ft.	ft.
Dens. / Visc.			
pH / Fluid Loss	cc	cc	cc
Rm @ Meas. Temp.	@ °F	@ °F	@ °F
Rmf @ Meas. Temp.	@ °F	@ °F	@ °F
Rmc @ Meas. Temp.	@ °F	@ °F	@ °F
Time Since Circ.	1 hr.	hr.	hr.
Logging Speed	30 ft/min.	ft/min.	ft/min.
Tool Type and No.	combo		
Unit No.	4		
Location	Chafter		
Invoice No.	6518		
Recorded By	Mike Alexander Assoc. Geologist		
Witnessed By	Ted Powers		
other			

P.O. Box 418 Tehachapi, California 93581 (805) 822-6875

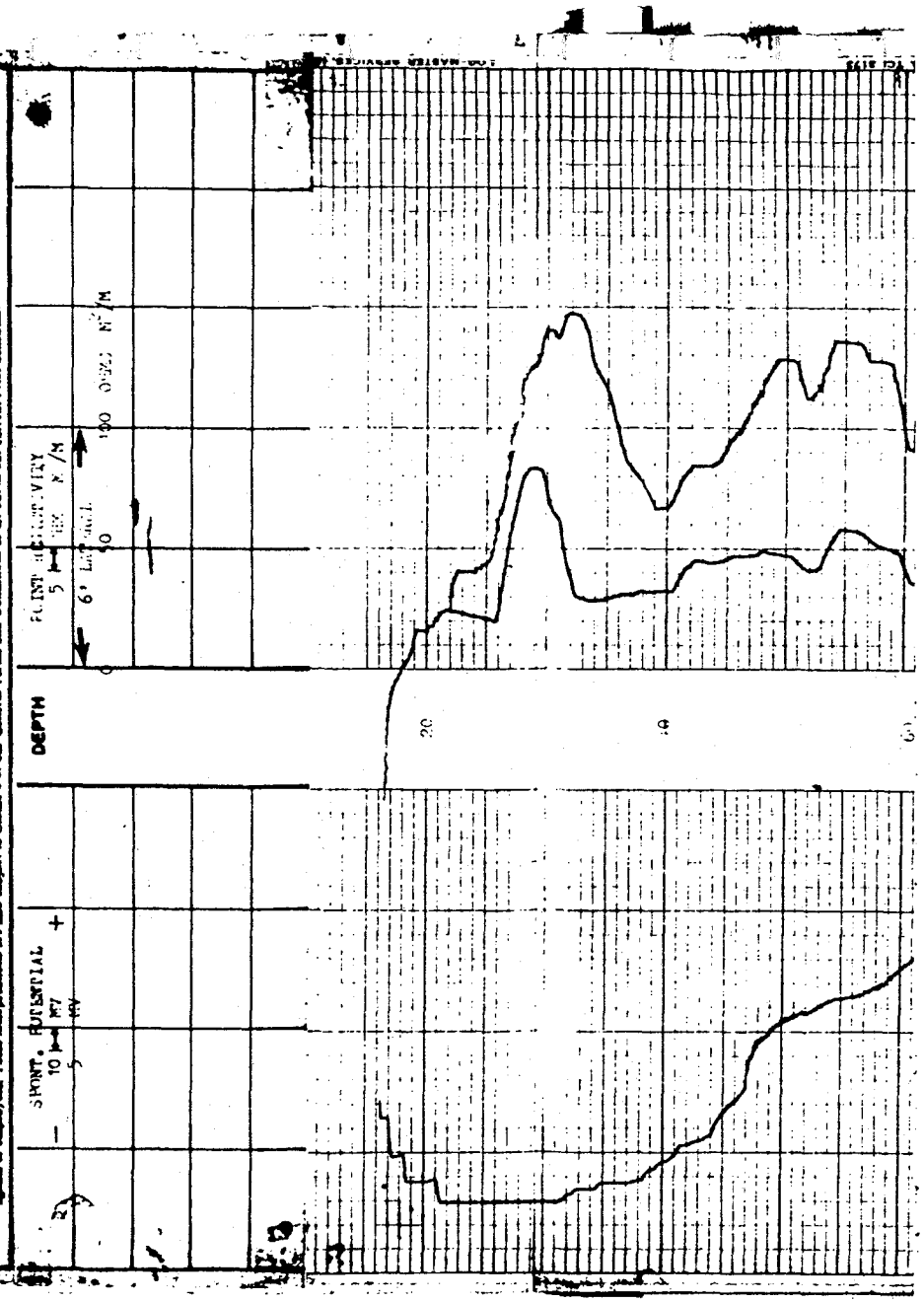
SCALE CHANGES

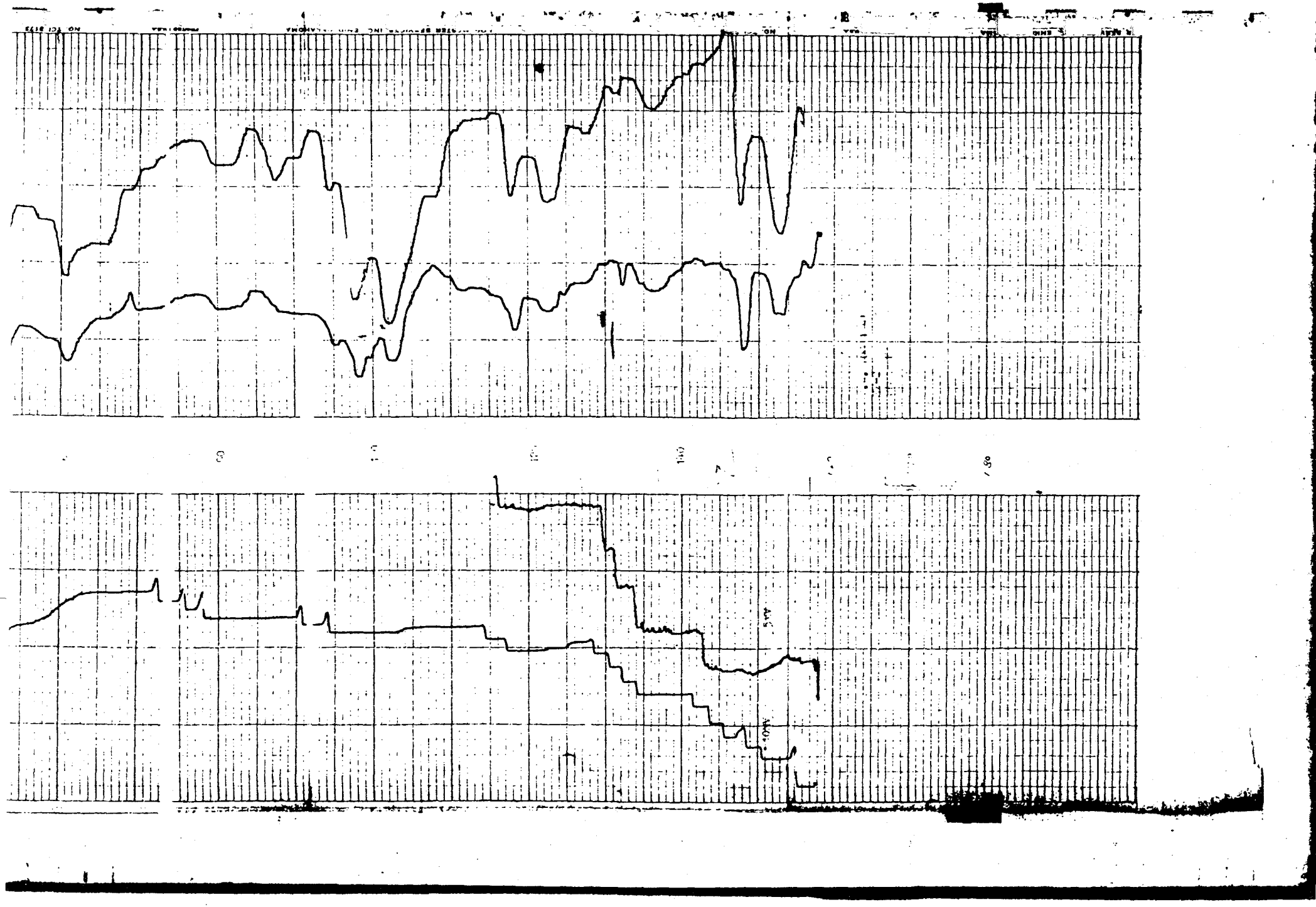
Type Log	Depth	Scale Up Hole	Scale Down Hole

REMARKS:

DRILL METHOD: STANDARD ROTARY

DRILLED BY: BEYLIK DRILLING LA HABRA, CA.





LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-2
DRILLING DATE: August 14, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1168 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE / REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
						Parking lot pavement, 4" over 8" base.						
						"ALLUVIUM (Qal)" SANDY SILT (ML) light brown, soft, dry, with moderate amount very fine grained sand and scattered rock fragments.						
						becomes damp at 5 feet.						
1160 10						cobbles at 8 feet.						
						set 10" conductor to 17 feet, end of shift 8/14/89.						
1150 20						"ALLUVIUM (Qal)" SAND (SP) multi-colored, predominantly very coarse grained and rounded, with appreciable fines or silt beds.						
						numerous cobbles below 22 feet, primarily granitic fragments, with fine to coarse sand.						
1140 30												
						"ALLUVIUM (Qal)" SAND (SP) multi colored, medium to very coarse grained, with scattered gravel.						
1130 40												
1120 50						thinned mud, end of shift 8/15/89.						
						CITJPL/ACEP 18075						
1110 60						increasing gravel.						
						numerous cobbles below 61 feet, predominantly granatic with sand. Clear and milky quartz, white and pink feldspar, rare green (metamorphic?), rock fragments, considerable fines as seen in thickening mud.						

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-2
DRILLING DATE: August 14, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1168 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE / REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
1100 / 70						"ALLUVIUM (Qal)" SAND (SP) with cobbles, multi-colored, medium to very coarse grained.						
1090 / 80						"ALLUVIUM (Qal)" SILT (ML) brown, micaceous, slightly clayey, with some very fine grained sand. Below 80 feet, becoming thinly interbedded as noted. cobbles, primarily granitic rock fragments, with fine-coarse sand and fines.						
1080 / 90						silt lenses.						
						cobbles, as above.						
1070 / 100						SILTY SAND (SM) brown, very fine sand with large amount of silt.						
						CLAYEY SAND (SC) brown, soft, with fine-coarse sand.						
1060 / 110						cobbles, granatic rock fragments with fine-coarse sand and silt lenses.						
1050 / 120						SILTY SAND (SM) brown, soft, slightly clayey with very fine to medium sand.						
1040 / 130												

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

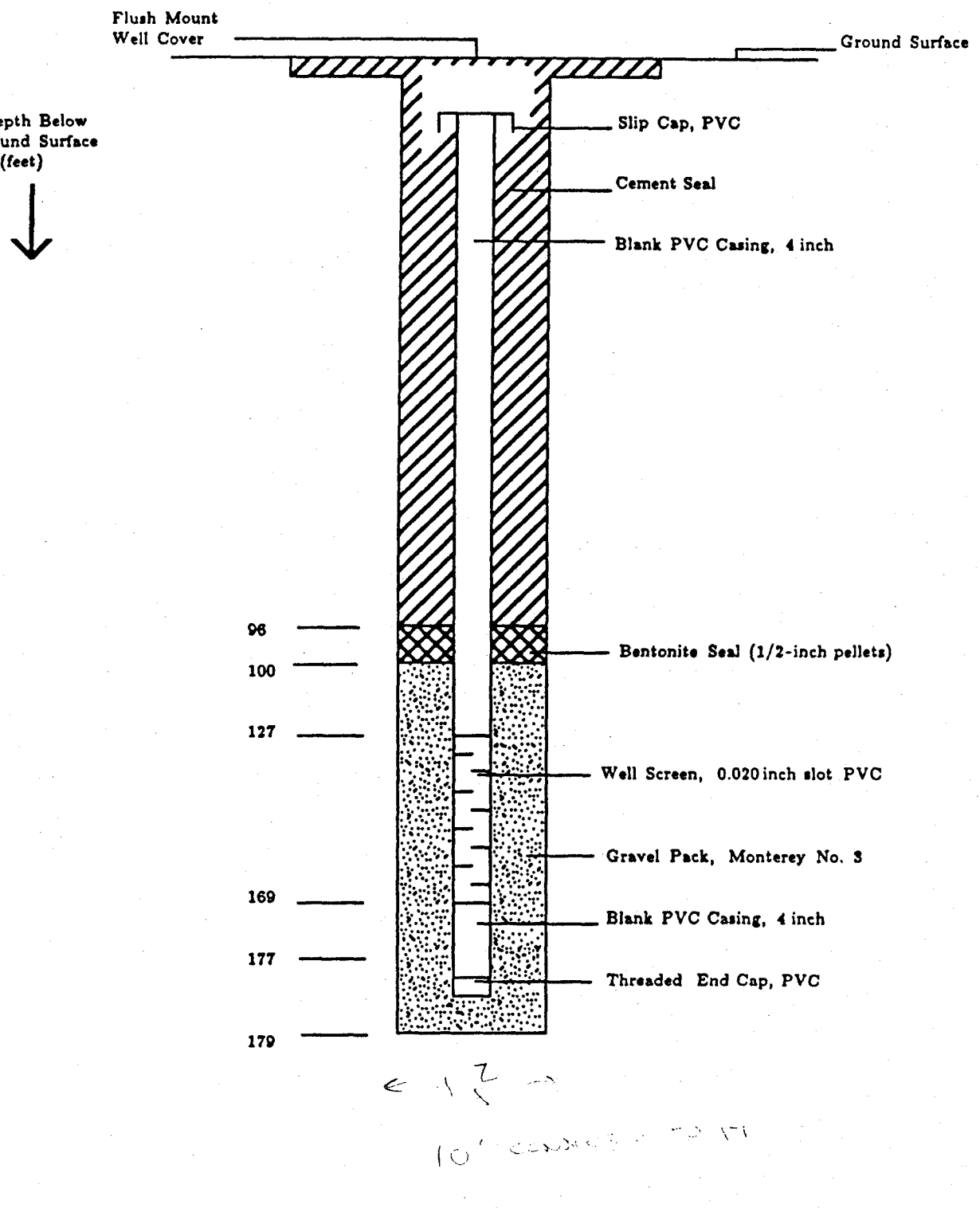
LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-2
DRILLING DATE: August 14, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1168 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
						Cobbles, primarily granitic rock fragments with traces of dark gray metamorphic (?) fragments, with fine to coarse grained sand and silt.						
						end of shift 8/16/89. SAND (SP) primarily quartz and feldspar, very fine to coarse grained, with some fines.						
1030												
140						Cobbles, granitic rock fragments with large amount of very fine to coarse grained sand and soluble clay as seen in thickening mud.						
1020												
150						CLAYEY SAND (SC) brown, fine to coarse grained sand with SILTY CLAY matrix.						
1010						Ran E-LOG to 158 feet.						
160						SAND (SP) white quartz and feldspar, medium to very coarse grained.						
						Cobbles, granitic rock fragments with medium to very coarse grained sand.						
1000												
170												
						SAND (SP) predominantly quartz and feldspar, medium to very coarse grained, with traces of mottled gray brown clay.						
990												
						Bottom of drill hole at 179 feet, on 8/17/89. Possible groundwater zones below depth 140 feet based on electric log. Boring completed as Monitoring Well MW-2. As of September 5, 1989 no free water has entered the well.						

LEGEND TO LOGS ON PLATE A-2

AS BUILT WELL COMPLETION SCHEMATIC
MW-2



SHEET 1 OF 1 S88042 PLATE A-1.2a

CITJPL/ACEP
18078

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION			GROUP SYMBOL	DESCRIPTION	GRAPHIC LOG
COARSE GRAINED SOILS Over 50% By Weight Coarser Than No. 200 Sieve Size	GRAVELLY SOILS OVER 50% OF COARSE FRACTION LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELLY SOILS LITTLE OR NO FINES	GW	WELL GRADED GRAVELS OR GRAVEL - SAND MIXTURES	
			GP	POORLY GRADED GRAVELS OR POORLY GRADED GRAVEL -SAND SILT MIXTURES	
		GRAVELLY SOILS WITH FINES OVER 12% FINES	GM	SILTY GRAVELS OR POORLY GRADED GRAVEL - SAND SILT MIXTURES	
			GC	CLAYEY GRAVELS OR POORLY GRADED GRAVEL - SAND - CLAY MIXTURES	
	SANDY SOILS OVER 50% OF COARSE FRACTION SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDY SOILS LITTLE OR NO FINES	SW	WELL GRADED SANDS OR GRAVELLY SANDS	
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS	
		SANDY SOILS WITH FINES OVER 12% FINES	SM	SILTY SANDS OR POORLY GRADED SAND - SILT MIXTURES	
			SC	CLAYEY SANDS OR POORLY GRADED SAND - CLAY MIXTURES	
FINE GRAINED SOILS Over 50% By Weight Finer Than No. 200 Sieve Size	SILTY AND CLAYEY SOILS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS SILTY/CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY	
			CL	INORGANIC CLAYS-LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTY OR LEAN CLAYS	
			OL	ORGANIC CLAYS OR ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTY AND CLAYEY SOILS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, OR ELASTIC SILTS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, OR FAT CLAYS	
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, OR ORGANIC SILTS	
HIGHLY ORGANIC SOILS			Pt	PEAT OR OTHER HIGHLY ORGANIC SOIL	

SAMPLE TYPES:

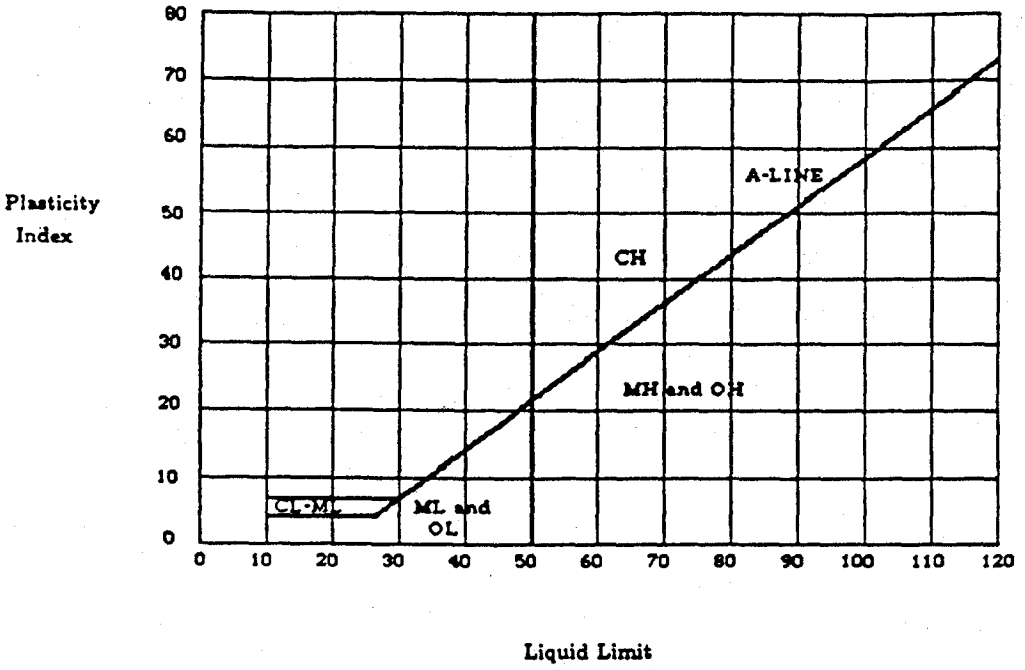
- UNDISTURBED SLEEVE
- DISTURBED
- UNSUCCESSFUL ATTEMPT
- STANDARD PENETRATION

WATER LEVEL

WATER INFLOW

CITJPL/ACEP
18079

PLASTICITY CHART - Used for Classification of Fine Grained Soils



BLOW COUNT - The number of blows required to drive the indicated sampler the last 12 inches of an 18 inch drive. The notation 100/9 indicates only 9 inches of penetration were achieved in 100 blows. Hammer weights and drop heights are shown below:

Symbol	Driving Weight (pounds)	Drop Height (inches)
7	_____	_____
(3)	_____	_____
[6]	_____	_____

Heavy Caving

Light Caving

CITJPL/ACEP 18080

ADDITIONAL TESTS -

UC : Unconfined Compression	WP : Water Pressure	PM : Permeability
TD : Triaxial Compression, Drained	PMt: Pressuremeter	EX : Expansion
TU : Triaxial Compression, Undrained	SE : Sand Equivalent	RS : Resistivity
	GJ : Goodman Jack	S : Swell
TDy: Triaxial Compression, Dynamic	SP : Specific Gravity	CL : Chloride
PH : Hydrogen Ion Concentration	CP : Compaction	SU : Sulphate
PA : Paleontologic, Analysis	C : Consolidation	
GS : Grain Size Distribution	DS : Direct Shear	

FIELD DATA
WATER QUALITY SAMPLING

Project: JPL Upgradient Monitoring Program Job No: S88042

Well I.D. No.: MW-1
Sample I.D. No.: MW-1

Water Level Data
Time: 8:00 a.m.
Depth to Water: 39.04 ft.
Reference Point: Top of Casing
Reference Elev.:
Static Water Level Elevation:

Well Purging
Time: 8:17 - 9:10 a.m.
Purge Method: Submersible Pump (@ 5 gpm)
Calculated Well Volume: 45 gallons
Actual Water Volume Discharged: 220 gallons

Sampling Date: September 5, 1989
Personnel: J. Thurber, Bill Goss (U.S. C.O.E.) Roger Schwing (MARMAC)

Sampling
Time: 9:30 - 10:30 a.m.
Method of Sampling: Teflon Bailer
Sample Containers: 40 ml. vial, 1 l. amber, 500 & 1000 ml poly, 2 l. amber
Special Provisions: HNO3 added to total metals only.

Analytical Laboratory
Samples Shipped Via: Courier
Destination: Truesdail Labs
Date and Time of Arrival: September 5, 1989; 6:12 p.m.
Received by:

Field Analysis

Time	8:57	9:01	9:04	9:06	9:07	9:09	9:10	
Volume Purged (gal)	150	160	175	185	190	200	220	
Temp. (C)	17.0	16.9	16.2	16.1	16.1	16.1	16.1	
pH	7.65	7.73	7.60	7.56	7.54	7.55	7.54	
Conductivity (micromhos/cm)	548	550	548	550	549	549	550	

NOTES: Trace of turbidity in final purge discharge. Duplicate samples collected at MW-1. Sample water contains trace of turbidity. Pump set at 143 feet, pumping level at 141 feet. Discharge contained in 55 gallon drums.

FIELD DATA
WATER QUALITY SAMPLING

Project: JPL Upgradient Monitoring Program Job No: S88042

Well I.D. No.: MW-401 MH-01 (City of Pasadena)
Sample I.D. No.: MW-401

Sampling Date: September 5, 1989
Personnel: J. Thurber, Bill Goss
(U.S. C.O.E.) Roger Schwing (MARMAC)

Water Level Data

Time: 10:46 a.m.
Depth to Water: 134.62 ft.
Reference Point: Top of Casing
Reference Elev.:
Static Water Level Elevation:

Sampling

Time: 1:05 - 1:45 p.m.
Method of Sampling: Teflon Bailer
Sample Containers: 40 ml. vial, 1 l. amber, 500 & 1000 ml poly, 2 l. amber
Special Provisions: HNO3 added to total metals only.

Well Purging

Time: 11:17 a.m. - 12:37 p.m.
Purge Method: Submersible Pump (@ 10 gpm)
Calculated Well Volume: 343 gallons
Actual Water Volume Discharged: 825 gallons

Analytical Laboratory

Samples Shipped Via: Courier
Destination: Truesdail Labs
Date and Time of Arrival: September 5, 1989; 6:12 p.m.
Received by:

Field Analysis

Time	12:12	12:18	12:21	12:24	12:28	12:32	12:35	
Volume Purged (gal)	550	610	640	670	710	750	780	
Temp. (C)	18.5	18.6	18.8	18.5	18.5	18.5	18.5	
pH	7.37	7.35	7.36	7.31	7.34	7.20	7.30	
Conductivity (micromhos/cm)	418	420	418	419	419	419	421	

NOTES: Total depth of casing 366.6 feet below top of casing. Pump set at 145 feet. Pumping level = 135.6 feet. Discharge is clear; contained in poly Baker tank (4000 gallon capacity).

CITJPL/ACEP
18082

APPENDIX B

ANALYTICAL TEST DATA

JET PROPULSION LABORATORY
PASADENA, CALIFORNIA

S88042

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Geotechnical Consultants
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE MW-1: JPL/Marmac

LABORATORY NO. 34572-1

INVESTIGATION

Base Neutrals Acid Extractables by GC/MS (EPA 625)

RESULTS

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Phenol	10 ug/l	ND
bis(2-Chloroethyl) ether	10 ug/l	ND
2-Chlorophenol	10 ug/l	ND
1,3-Dichlorobenzene	10 ug/l	ND
1,4-Dichlorobenzene	10 ug/l	ND
Benzyl Alcohol	20 ug/l	ND
1,2-Dichlorobenzene	10 ug/l	ND
2-Methylphenol	10 ug/l	ND
bis(2-Chloroisopropyl) ether	10 ug/l	ND
4-Methylphenol	10 ug/l	ND
N-Nitroso-Di-N-propylamine	10 ug/l	ND
Hexachloroethane	10 ug/l	ND
Nitrobenzene	10 ug/l	ND
Isophorone	10 ug/l	ND
2-Nitrophenol	10 ug/l	ND
2,4-Dimethylphenol	10 ug/l	ND
Benzoic Acid	50 ug/l	ND
bis(2-Chloroethyoxy)methane	10 ug/l	ND
2,4-Dichlorophenol	10 ug/l	ND
1,2,4-Trichlorobenzene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
18084

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Naphthalene	10 ug/l	ND
4-Chloroaniline	20 ug/l	ND
Hexachlorobutadiene	10 ug/l	ND
4-Chloro-3-methylphenol	20 ug/l	ND
2-Methylnaphthalene	10 ug/l	ND
Hexachlorocyclopentadiene	10 ug/l	ND
2,4,6-Trichlorophenol	10 ug/l	ND
2,4,5-Trichlorophenol	10 ug/l	ND
2-Chloronaphthalene	10 ug/l	ND
2-Nitroaniline	50 ug/l	ND
Dimethyl phthalate	10 ug/l	ND
Acenaphthylene	10 ug/l	ND
3-Nitroaniline	50 ug/l	ND
Acenaphthene	10 ug/l	ND
2,4-Dinitrophenol	50 ug/l	ND
4-Nitrophenol	50 ug/l	ND
Dibenzofuran	10 ug/l	ND
2,4-Dinitrotoluene	10 ug/l	ND
2,6-Dinitrotoluene	10 ug/l	ND
Diethylphthalate	10 ug/l	ND
4-Chlorophenyl phenyl ether	10 ug/l	ND
Fluorene	10 ug/l	ND
4-Nitroaniline	50 ug/l	ND
4,6-Dinitro-2-methylphenol	50 ug/l	ND
N-Nitrosodiphenylamine	10 ug/l	ND
4-Bromophenyl phenyl ether	10 ug/l	ND
Hexachlorobenzene	10 ug/l	ND
Pentachlorophenol	50 ug/l	ND
Phenanthrene	10 ug/l	ND
Anthracene	10 ug/l	ND
Di-n-butylphthalate	10 ug/l	ND
Fluoranthene	10 ug/l	ND
Pyrene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Butyl benzyl phthalate	10 ug/l	ND
3,3'-Dichlorobenzidine	20 ug/l	ND
Benzo(a)anthracene	10 ug/l	ND
bis(2-ethylhexyl)phthalate	10 ug/l	2.12
Chrysene	10 ug/l	ND
Di-n-octyl phthalate	10 ug/l	ND
Benzo(b)fluoranthene	10 ug/l	ND
Benzo(k)fluoranthene	10 ug/l	ND
Benzo(a)pyrene	10 ug/l	ND
Indeno(1,2,3-cd)pyrene	10 ug/l	ND
Dibenzo(a,h)anthracene	10 ug/l	ND
Benzo(g,h,i)perylene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett
Project Manager

CITJPL/ACEP
18086

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT **Geotechnical Consultants**
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE MW-1: JPL/Marmac

LABORATORY NO. 34572-1

INVESTIGATION

Purgeable Organics (Volatiles) by GC/MS (EPA 624)
Gas Chromatography - Mass Spectrometry

RESULTS

Constituent	Detection Limit* (ug/l)	Concentration** (Micrograms/Liter)
Acetone	3.0	ND
Benzene	3.0	ND
Bromodichloromethane	3.0	ND
Bromoform	3.0	ND
Bromomethane	3.0	ND
2-Butanone	3.0	ND
Carbon Disulfide	3.0	ND
Carbon Tetrachloride	3.0	ND
Chlorobenzene	3.0	ND
Chloroethane	3.0	ND
2-Chlorethyl vinyl ether	3.0	ND
Chloroform	3.0	ND
Chloromethane	3.0	ND
Dibromochloromethane	3.0	ND
1,1-Dichloroethane	3.0	ND
1,2-Dichloroethane	3.0	ND
1,1-Dichloroethene	3.0	ND
trans-1,2-Dichloroethene	3.0	ND
1,2-Dichloropropane	3.0	ND
cis-1,3-Dichloropropene	3.0	ND
trans-1,3-Dichloropropene	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
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Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Ethyl Benzene	3.0	ND
2-Hexanone	3.0	ND
4-Methyl-2-pentanone	3.0	ND
Methylene Chloride	3.0	ND
Styrene	3.0	ND
1,1,2,2-Tetrachloroethane	3.0	ND
Tetrachloroethene	3.0	ND
Toluene	3.0	ND
1,1,1-Trichloroethane	3.0	ND
1,1,2-Trichloroethane	3.0	ND
Trichloroethene	3.0	ND
Vinyl Acetate	3.0	ND
Vinyl Chloride	3.0	ND
Xylenes	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager

CITJPL/ACEP
18088

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Geotechnical Consultants
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE Three Water Samples: JPL/Marmac

LABORATORY NO. 34572

INVESTIGATION

Analysis as requested

RESULTS

Parameter	CONCENTRATION, MG/ML MW-1	MW-M401	MW-1 Duplicate
pH (150.1), Units	7.6	7.6	7.5
Specific Conductance, umhos/cm	518	435	526
Total Dissolved Solids	344	305	363
Total Arsenic (As, SMEWW 207A)	<0.005	<0.005	<0.005
Dissolved Arsenic (As, SMEWW 307A)	<0.005	<0.005	<0.005
Total Lead (Pb, 239.1)	<0.05	<0.05	<0.05
Dissolved Lead (Pb, 239.1)	<0.05	<0.05	<0.05
Total Mercury (Hg, 245.1)	<0.001	<0.001	<0.001
Dissolved Mercury (Hg, 245.1)	<0.001	<0.001	<0.001
Total Selenium (Se, SMEWW 323A)	<0.005	<0.005	<0.005
Dissolved Selenium (Se, SMEWW 323A)	<0.005	<0.005	<0.005
Total Silver (Ag,272.1)	<0.015	0.049	<0.015
Dissolved Silver (Ag, 272.1)	<0.015	<0.015	<0.015

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager

CITJPL/ACEP
18089

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Geotechnical Consultants
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE Three Water Samples: JPL/Marmac

LABORATORY NO. 34572

INVESTIGATION

Total Petroleum Hydrocarbons by (EPA 418.1)

RESULTS

Sample Identification	Concentration (mg/l)
MW-1	<1.0
MW-M401	<1.0
MW-1 Duplicate	<1.0

Total Petroleum Hydrocarbons (EPA 418.1): The total petroleum hydrocarbons analyzed in waters utilizes an infrared method (EPA 418.1). The method detection limit is 0.2 mg/l. All results have been blank corrected.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager

CITJPL/ACEP
18090

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH – DEVELOPMENT – TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Geotechnical Consultants
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE MW-M401: JPL/Marmac

LABORATORY NO. 34572-2

INVESTIGATION

Base Neutrals Acid Extractables by GC/MS (EPA 625)

RESULTS

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Phenol	10 ug/l	ND
bis(2-Chloroethyl) ether	10 ug/l	ND
2-Chlorophenol	10 ug/l	ND
1,3-Dichlorobenzene	10 ug/l	ND
1,4-Dichlorobenzene	10 ug/l	ND
Benzyl Alcohol	20 ug/l	ND
1,2-Dichlorobenzene	10 ug/l	ND
2-Methylphenol	10 ug/l	ND
bis(2-Chloroisopropyl) ether	10 ug/l	ND
4-Methylphenol	10 ug/l	ND
N-Nitroso-Di-N-propylamine	10 ug/l	ND
Hexachloroethane	10 ug/l	ND
Nitrobenzene	10 ug/l	ND
Isophorone	10 ug/l	ND
2-Nitrophenol	10 ug/l	ND
2,4-Dimethylphenol	10 ug/l	ND
Benzoic Acid	50 ug/l	ND
bis(2-Chloroethyoxy)methane	10 ug/l	ND
2,4-Dichlorophenol	10 ug/l	ND
1,2,4-Trichlorobenzene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

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18091

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Naphthalene	10 ug/l	ND
4-Chloroaniline	20 ug/l	ND
Hexachlorobutadiene	10 ug/l	ND
4-Chloro-3-methylphenol	20 ug/l	ND
2-Methylnaphthalene	10 ug/l	ND
Hexachlorocyclopentadiene	10 ug/l	ND
2,4,6-Trichlorophenol	10 ug/l	ND
2,4,5-Trichlorophenol	10 ug/l	ND
2-Chloronaphthalene	10 ug/l	ND
2-Nitroaniline	50 ug/l	ND
Dimethyl phthalate	10 ug/l	ND
Acenaphthylene	10 ug/l	ND
3-Nitroaniline	50 ug/l	ND
Acenaphthene	10 ug/l	ND
2,4-Dinitrophenol	50 ug/l	ND
4-Nitrophenol	50 ug/l	ND
Dibenzofuran	10 ug/l	ND
2,4-Dinitrotoluene	10 ug/l	ND
2,6-Dinitrotoluene	10 ug/l	ND
Diethylphthalate	10 ug/l	ND
4-Chlorophenyl phenyl ether	10 ug/l	ND
Fluorene	10 ug/l	ND
4-Nitroaniline	50 ug/l	ND
4,6-Dinitro-2-methylphenol	50 ug/l	ND
N-Nitrosodiphenylamine	10 ug/l	ND
4-Bromophenyl phenyl ether	10 ug/l	ND
Hexachlorobenzene	10 ug/l	ND
Pentachlorophenol	50 ug/l	ND
Phenanthrene	10 ug/l	ND
Anthracene	10 ug/l	ND
Di-n-butylphthalate	10 ug/l	ND
Fluoranthene	10 ug/l	ND
Pyrene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Butyl benzyl phthalate	10 ug/l	ND
3,3'-Dichlorobenzidine	20 ug/l	ND
Benzo(a)anthracene	10 ug/l	ND
bis(2-ethylhexyl)phthalate	10 ug/l	2.62
Chrysene	10 ug/l	ND
Di-n-octyl phthalate	10 ug/l	ND
Benzo(b)fluoranthene	10 ug/l	ND
Benzo(k)fluoranthene	10 ug/l	ND
Benzo(a)pyrene	10 ug/l	ND
Indeno(1,2,3-cd)pyrene	10 ug/l	ND
Dibenzo(a,h)anthracene	10 ug/l	ND
Benzo(g,h,i)perylene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett
Project Manager

CITJPL/ACEP
18093

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Geotechnical Consultants
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE MW-M401: JPL/Marmac

LABORATORY NO. 34572-2

INVESTIGATION

Purgeable Organics (Volatiles) by GC/MS (EPA 624)
Gas Chromatography - Mass Spectrometry

RESULTS

Constituent	Detection Limit* (ug/l)	Concentration** (Micrograms/Liter)
Acetone	3.0	ND
Benzene	3.0	ND
Bromodichloromethane	3.0	ND
Bromoform	3.0	ND
Bromomethane	3.0	ND
2-Butanone	3.0	ND
Carbon Disulfide	3.0	ND
Carbon Tetrachloride	3.0	ND
Chlorobenzene	3.0	ND
Chloroethane	3.0	ND
2-Chlorethyl vinyl ether	3.0	ND
Chloroform	3.0	ND
Chloromethane	3.0	ND
Dibromochloromethane	3.0	ND
1,1-Dichloroethane	3.0	ND
1,2-Dichloroethane	3.0	ND
1,1-Dichloroethene	3.0	ND
trans-1,2-Dichloroethene	3.0	ND
1,2-Dichloropropane	3.0	ND
cis-1,3-Dichloropropene	3.0	ND
trans-1,3-Dichloropropene	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
18094

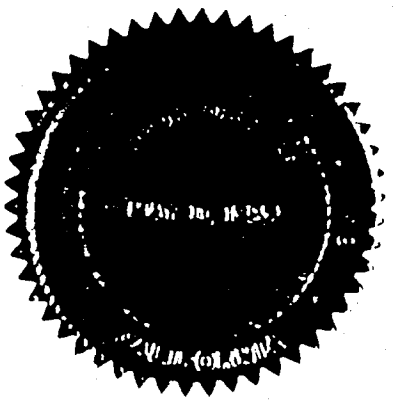
Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Ethyl Benzene	3.0	ND
2-Hexanone	3.0	ND
4-Methyl-2-pentanone	3.0	ND
Methylene Chloride	3.0	ND
Styrene	3.0	ND
1,1,2,2-Tetrachloroethane	3.0	ND
Tetrachloroethene	3.0	ND
Toluene	3.0	ND
1,1,1-Trichloroethane	3.0	ND
1,1,2-Trichloroethane	3.0	ND
Trichloroethene	3.0	ND
Vinyl Acetate	3.0	ND
Vinyl Chloride	3.0	ND
Xylenes	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager



CITJPL/ACEP
18095

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT **Geotechnical Consultants**
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE MW-1 Duplicate: JPL/Marmac

LABORATORY NO. 34572-6

INVESTIGATION

Base Neutrals Acid Extractables by GC/MS (EPA 625)

RESULTS

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Phenol	10 ug/l	ND
bis(2-Chloroethyl) ether	10 ug/l	ND
2-Chlorophenol	10 ug/l	ND
1,3-Dichlorobenzene	10 ug/l	ND
1,4-Dichlorobenzene	10 ug/l	ND
Benzyl Alcohol	20 ug/l	ND
1,2-Dichlorobenzene	10 ug/l	ND
2-Methylphenol	10 ug/l	ND
bis(2-Chloroisopropyl) ether	10 ug/l	ND
4-Methylphenol	10 ug/l	ND
N-Nitroso-Di-N-propylamine	10 ug/l	ND
Hexachloroethane	10 ug/l	ND
Nitrobenzene	10 ug/l	ND
Isophorone	10 ug/l	ND
2-Nitrophenol	10 ug/l	ND
2,4-Dimethylphenol	10 ug/l	ND
Benzoic Acid	50 ug/l	ND
bis(2-Chloroethyoxy)methane	10 ug/l	ND
2,4-Dichlorophenol	10 ug/l	ND
1,2,4-Trichlorobenzene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
18096

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Naphthalene	10 ug/l	ND
4-Chloroaniline	20 ug/l	ND
Hexachlorobutadiene	10 ug/l	ND
4-Chloro-3-methylphenol	20 ug/l	ND
2-Methylnaphthalene	10 ug/l	ND
Hexachlorocyclopentadiene	10 ug/l	ND
2,4,6-Trichlorophenol	10 ug/l	ND
2,4,5-Trichlorophenol	10 ug/l	ND
2-Chloronaphthalene	10 ug/l	ND
2-Nitroaniline	50 ug/l	ND
Dimethyl phthalate	10 ug/l	ND
Acenaphthylene	10 ug/l	ND
3-Nitroaniline	50 ug/l	ND
Acenaphthene	10 ug/l	ND
2,4-Dinitrophenol	50 ug/l	ND
4-Nitrophenol	50 ug/l	ND
Dibenzofuran	10 ug/l	ND
2,4-Dinitrotoluene	10 ug/l	ND
2,6-Dinitrotoluene	10 ug/l	ND
Diethylphthalate	10 ug/l	ND
4-Chlorophenyl phenyl ether	10 ug/l	ND
Fluorene	10 ug/l	ND
4-Nitroaniline	50 ug/l	ND
4,6-Dinitro-2-methylphenol	50 ug/l	ND
N-Nitrosodiphenylamine	10 ug/l	ND
4-Bromophenyl phenyl ether	10 ug/l	ND
Hexachlorobenzene	10 ug/l	ND
Pentachlorophenol	50 ug/l	ND
Phenanthrene	10 ug/l	ND
Anthracene	10 ug/l	ND
Di-n-butylphthalate	10 ug/l	ND
Fluoranthene	10 ug/l	ND
Pyrene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Butyl benzyl phthalate	10 ug/l	ND
3,3'-Dichlorobenzidine	20 ug/l	ND
Benzo(a)anthracene	10 ug/l	ND
bis(2-ethylhexyl)phthalate	10 ug/l	2.25
Chrysene	10 ug/l	ND
Di-n-octyl phthalate	10 ug/l	ND
Benzo(b)fluoranthene	10 ug/l	ND
Benzo(k)fluoranthene	10 ug/l	ND
Benzo(a)pyrene	10 ug/l	ND
Indeno(1,2,3-cd)pyrene	10 ug/l	ND
Dibenzo(a,h)anthracene	10 ug/l	ND
Benzo(g,h,i)perylene	10 ug/l	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett
Project Manager

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT **Geotechnical Consultants**
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE Travel Blank: JPL/Marmac

LABORATORY NO. 34572-3

INVESTIGATION

Purgeable Organics (Volatiles) by GC/MS (EPA 624)
Gas Chromatography - Mass Spectrometry

RESULTS

Constituent	Detection Limit* (ug/l)	Concentration** (Micrograms/Liter)
Acetone	3.0	ND
Benzene	3.0	ND
Bromodichloromethane	3.0	ND
Bromoform	3.0	ND
Bromomethane	3.0	ND
2-Butanone	3.0	ND
Carbon Disulfide	3.0	ND
Carbon Tetrachloride	3.0	ND
Chlorobenzene	3.0	ND
Chloroethane	3.0	ND
2-Chlorethyl vinyl ether	3.0	ND
Chloroform	3.0	ND
Chloromethane	3.0	ND
Dibromochloromethane	3.0	ND
1,1-Dichloroethane	3.0	ND
1,2-Dichloroethane	3.0	ND
1,1-Dichloroethene	3.0	ND
trans-1,2-Dichloroethene	3.0	ND
1,2-Dichloropropane	3.0	ND
cis-1,3-Dichloropropene	3.0	ND
trans-1,3-Dichloropropene	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
18099

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Ethyl Benzene	3.0	ND
2-Hexanone	3.0	ND
4-Methyl-2-pentanone	3.0	ND
Methylene Chloride	3.0	3.59
Styrene	3.0	ND
1,1,2,2-Tetrachloroethane	3.0	ND
Tetrachloroethene	3.0	ND
Toluene	3.0	ND
1,1,1-Trichloroethane	3.0	ND
1,1,2-Trichloroethane	3.0	ND
Trichloroethene	3.0	ND
Vinyl Acetate	3.0	ND
Vinyl Chloride	3.0	ND
Xylenes	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager

CITJPL/ACEP
18100

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT **Geotechnical Consultants**
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE Shipping Blank: JPL/Marmac

LABORATORY NO. 34572-5

INVESTIGATION

Purgeable Organics (Volatiles) by GC/MS (EPA 624)
Gas Chromatography - Mass Spectrometry

RESULTS

Constituent	Detection Limit* (ug/l)	Concentration** (Micrograms/Liter)
Acetone	3.0	ND
Benzene	3.0	ND
Bromodichloromethane	3.0	ND
Bromoform	3.0	ND
Bromomethane	3.0	ND
2-Butanone	40.0	48.1
Carbon Disulfide	3.0	ND
Carbon Tetrachloride	3.0	ND
Chlorobenzene	3.0	ND
Chloroethane	3.0	ND
2-Chlorethyl vinyl ether	3.0	ND
Chloroform	3.0	ND
Chloromethane	3.0	ND
Dibromochloromethane	3.0	ND
1,1-Dichloroethane	3.0	ND
1,2-Dichloroethane	3.0	ND
1,1-Dichloroethene	3.0	ND
trans-1,2-Dichloroethene	3.0	ND
1,2-Dichloropropane	3.0	ND
cis-1,3-Dichloropropene	3.0	ND
trans-1,3-Dichloropropene	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
18101

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Ethyl Benzene	3.0	ND
2-Hexanone	3.0	ND
4-Methyl-2-pentanone	3.0	ND
Methylene Chloride	3.0	3.93
Styrene	3.0	ND
1,1,2,2-Tetrachloroethane	3.0	ND
Tetrachloroethene	3.0	ND
Toluene	3.0	ND
1,1,1-Trichloroethane	3.0	ND
1,1,2-Trichloroethane	3.0	ND
Trichloroethene	3.0	ND
Vinyl Acetate	3.0	ND
Vinyl Chloride	3.0	ND
Xylenes	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager

CITJPL/ACEP
18102

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Geotechnical Consultants
1533 East Fourth Street
Santa Ana, California 92701
Attention: Chuck Kendall

DATE September 25, 1989

RECEIVED September 6, 1989

SAMPLE MW-1 Duplicate: JPL/Marmac

LABORATORY NO. 34572-6

INVESTIGATION

Purgeable Organics (Volatiles) by GC/MS (EPA 624)
Gas Chromatography - Mass Spectrometry

RESULTS

Constituent	Detection Limit* (ug/l)	Concentration** (Micrograms/Liter)
Acetone	3.0	ND
Benzene	3.0	ND
Bromodichloromethane	3.0	ND
Bromoform	3.0	ND
Bromomethane	3.0	ND
2-Butanone	3.0	ND
Carbon Disulfide	3.0	ND
Carbon Tetrachloride	3.0	ND
Chlorobenzene	3.0	ND
Chloroethane	3.0	ND
2-Chlorethyl vinyl ether	3.0	ND
Chloroform	3.0	ND
Chloromethane	3.0	ND
Dibromochloromethane	3.0	ND
1,1-Dichloroethane	3.0	ND
1,2-Dichloroethane	3.0	ND
1,1-Dichloroethene	3.0	ND
trans-1,2-Dichloroethene	3.0	ND
1,2-Dichloropropane	3.0	ND
cis-1,3-Dichloropropene	3.0	ND
trans-1,3-Dichloropropene	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

CITJPL/ACEP
18103

Constituent	Approximate Detection Limit*	Concentration** Micrograms/Liter
Ethyl Benzene	3.0	ND
2-Hexanone	3.0	ND
4-Methyl-2-pentanone	3.0	ND
Methylene Chloride	3.0	ND
Styrene	3.0	ND
1,1,2,2-Tetrachloroethane	3.0	ND
Tetrachloroethene	3.0	ND
Toluene	3.0	ND
1,1,1-Trichloroethane	3.0	ND
1,1,2-Trichloroethane	3.0	ND
Trichloroethene	3.0	ND
Vinyl Acetate	3.0	ND
Vinyl Chloride	3.0	ND
Xylenes	3.0	ND

* Detection limits may vary with the type of sample and with the concentrations of other species present.

** ND = Not detected, below detection limit.

Respectfully submitted,
TRUESDAIL LABORATORIES, INC.

Gregory W. Everett,
Project Manager

CITJPL/ACEP
18104

TRUESDAIL LABORATORIES, INC.

CHAIN-OF-CUSTODY RECORD

DATE Sept. 5, 1989 PAGE 1 OF 1

PROJECT NAME JPL / Marmac
REFERENCE
ADDRESS Pasadena
SAMPLERS (SIGNATURE) James Thurber

SAMPLE NO.	DATE	TIME	LOCATION	418.1	8240	Tot. Metals	Dis. Metals, EC, TDS, pH	8240 +10	8270 +10				NUMBER OF CONTAINERS	COMMENTS/ CONTAINER TYPE
MW-1	9/5/89	9:xx am	Mon. Well #1	X	X	X	X	X	X	X			8	
MW-M401	9/5/89	1:05 pm	City of Pasadena Mon Well	X	X	X	X	X	X	X			8	
Trip Blank					X								2	
Field Blank	9/5/89	9:00 am											2	Hold
Sampling Blank	9/5/89	2:15 pm			X								1	1 x 40 ml. vial
Duplicate MW-1	9/5/89	9:30 am	Mon. Well #1	X	X	X	X	X	X	X			8	

	RELINQUISHED BY	DATE	RELINQUISHED BY	DATE	RELINQUISHED BY	DATE
SIGNATURE	James Thurber	9/5/89				
PRINTED NAME	James Thurber	TIME		TIME		TIME
COMPANY	Geotechnical Consultants	6:15 p.m.				

	RECEIVED BY	DATE	RECEIVED BY	DATE	RECEIVED BY (LAB)	DATE
SIGNATURE					V. Navasartian	
PRINTED NAME		TIME		TIME	V. NAVASARTIAN	TIME
COMPANY					TCL	

TOTAL NUMBER OF CONTAINERS

SAMPLE CONDITIONS

RECEIVED ON ICE YES / NO

SEALED YES / NO

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS:

CITJPL/ACEP
18105

APPENDIX C

QA/QC FIELD PROCEDURES

DRILLING
MONITORING WELL CONSTRUCTION
MONITORING WELL DEVELOPMENT
WATER QUALITY SAMPLING

JET PROPULSION LABORATORY
PASADENA, CALIFORNIA

S88042

CITJPL/ACEP
18106

APPENDIX C
QA/QC
FIELD PROCEDURES

DRILLING

At both well sites, all drilling equipment was fully steam cleaned prior to the start of work. The bores for Monitoring Wells MW-1 and MW-2 were drilled with a mud rotary system using an Ingersol Rand TH100 tophead drive drill rig provided by Beylik Drilling, Inc. of La Habra, California. Following installation of a shallow conductor casing, drilling progressed with the fluid system circulated through a portable mud tank. Cutting samples were retrieved on a continuous basis and logged by an onsite geologist. When the target depth was achieved in both borings, electric logs were conducted to supplement the geologic logging effort and to identify probable saturation zones.

Following selection of a screen interval, cutting samples from the appropriate depths were subjected to sieve analyses in order to design a compatible gravel pack and slot size opening. For both wells, a Monterey No. 3 gravel pack and 0.020-inch slot screen were selected. At the completion of drilling, all cuttings and drilling fluids removed from the bores were contained in 55 gallon drums and/or 4,000 gallon poly tanks which were stored onsite.

MONITORING WELL CONSTRUCTION

Well casing consisted of steam cleaned 4-inch inside diameter schedule 40 PVC pipe with flush coupled threaded joints and a threaded PVC bottom plug. Both casing arrays consisted of a lower 10 foot section of blank casing (sediment trap), 40 feet of machine slotted screen and blank casing to ground surface. In preparation

for well construction, the drilling fluid was watered back. Casing sections were assembled in 20 foot lengths and lowered into the bore, with centralizers used for positioning. A temporary tremie pipe was then installed through the annulus for placement of gravel pack, bentonite pellet seal and cement. For MW-1, an 8-inch locking steel riser was installed as a surface completion. The top of MW-2 was completed with a flush-set traffic vault.

MONITORING WELL DEVELOPMENT

Both monitoring wells were developed with a Smeal 5T service rig provided by Beylik Drilling, Inc. After initially clearing all sediment from the bottom of the wells with a suction bailer, the screen intervals were swabbed in one foot intervals. Additional inflow of sediment was again removed with a suction bailer followed by continued evacuations of well water using a submersible pump. Hampered by a lack of well yield, MW-2 required the addition of potable water to complete the swabbing operation.

Throughout the well development process, discharge water was contained in 55 gallon drums that were sealed, labeled and stored onsite. All pumps, bailers and swabs utilized during this phase of the project were steam cleaned between wells to prevent cross contamination.

WATER QUALITY SAMPLING

Water quality samples were obtained at the completion of well development for MW-1 and following purging activities in existing Monitoring Well MH-01 (See Appendix A - Field Data Water Quality Sampling Sheets for details). No sampling was conducted in MW-2.

Water samples were obtained with a one litre capacity Teflon bailer which was dispensed directly into sample containers using a Teflon bottom-emptying device. VOC vials were sealed with a Teflon-lined cap, free of bubbles or head space, labeled and immediately placed in chilled storage along with the other sample containers. The sampling bailer and bottom-emptying device were cleaned by a TSP wash followed by a clear water - methanol - distilled water rinse prior to sampling each monitoring well. Attendant to sampling activities, field testing was conducted to define pH, temperature and electrical conductivity using a Hach ONE pH meter and Hach Model 44600 Conductivity and TDS meter. Test results for individual wells are presented in the Field Data Water Quality Sampling Sheets (Appendix A).