JAMES C. SOPER, INC.
PHILIP M. JELLEY, INC.
JOHN L. McDONNELL, JR.
GERALD C. SMITH
LAWRENCE R. SHEPP
LLEWELLYN E. THOMPSON II
RICHARD T. WHITE
MICHAEL P. WALSH
J. BRITTAIN HABEGGER
VIRGINIA PALMER
STEPHEN M. JUDSON
STEPHEN M. WILLIAMS
BETTY J. ORVELL
JONATHAN W. REDDING
TIMOTHY W. MOPPIN
KRISTIN PACE
MICHAEL M. K. SEBREE
ANTONIA L. BROADDUS

FITZGERALD, ABBOTT & BEARDSLEY
ATTORNEYS AT LAW
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS
1221 BROADWAY, 21ST FLOOR
OAKLAND, CALIFORNIA 94612-1837
TELEPHONE: (415) 451-3300

R. M. FITZGERALD 1858-1934
CARL H. ABBOTT 1867-1933
CHARLES A. BEARDSLEY 1882-1963

STACY H. DOBRZENSKY
OF COUNSEL

TELECOPIER: (415) 451-1527

90 DEC 14 AM 12:08

December 12, 1990

Mr. Gil Wistar
Hazardous Materials Specialist
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Re: Connell Auto Center, 3090 Broadway, Oakland, CA

Dear Mr. Wistar:

We have completed the investigation of subsurface conditions at the Connell facility as outlined in SCI's revised work plan submitted to you on August 23, 1990, and discussed in my letter of September 12, 1990. The results of the investigation are discussed in the enclosed report dated December 7, 1990.

In light of the findings of additional subsurface contamination at the premises, we propose to install three groundwater monitoring wells downgradient of the facility, as shown on Plate 1, of the December 7, 1990 report. We hope that these wells will define the horizontal extent of the contamination. We request your approval of this phase of the investigation as soon as possible. We should have a report available within 60 days after drilling is commenced.

With respect to the excavated soil pile on the adjacent parking lot, we request that it be allowed to remain in place, pending completion of our delineation activities.

Thank you for your cooperation.

Very truly yours,

FITZGERALD, ABBOTT & BEARDSLEY

By Jonathan W. Redding
Jonathan W. Redding

JWR:lm

cc: Mr. Ron Upp (w/o encl.)
Mrs. W.A. Connell (w/o encl.)
Mr. Gordon L. Linden (w/o encl.)
Mrs. Irene Linden (w/o encl.)
Mr. and Mrs. George C. Hill, III (w/o encl.)

PRELIMINARY HYDROCARBON CONTAMINATION ASSESSMENT
CONNELL OLDSMOBILE
3093 BROADWAY
OAKLAND, CALIFORNIA
SCI 447.010

12-7-90

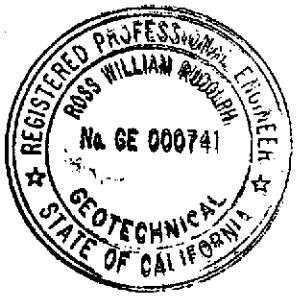
Prepared for:

Mr. Jonathan Redding
Fitzgerald, Abbott & Beardsley
1221 Broadway, 21st Floor
Oakland, California 94612-1837

By:

Jeriann N. Alexander
Civil Engineer 40469 (expires 3/31/91)

R. William Rudolph
Geotechnical Engineer 741 (expires 12/31/92)



Subsurface Consultants, Inc.
171 12th Street, Suite 201
Oakland, California 94607
(415) 268-0461

December 7, 1990

I INTRODUCTION

This report presents the results of a preliminary hydrocarbon contamination assessment conducted by Subsurface Consultants, Inc. (SCI) at the Connell Oldsmobile repair facility in Oakland, California. The facility is located at 3093 Broadway. However, the study area is situated on the south side of Hawthorne Avenue, as shown on the Site Plan, Plate 1.

On December 18, 1989, three underground fuel storage tanks containing gasoline, diesel and waste oil product were removed from the site. **Elevated levels of oil and grease, diesel, gasoline and fuel constituents (BTXE) were encountered in soil samples from beneath the tanks. Perched water within the excavation contained detectable concentrations of BTXE.** Analytical test results and tank removal activities are summarized more thoroughly in a letter dated March 22, 1990.

The purpose of this study was to (1) more thoroughly characterize the soil contamination problem and (2) evaluate impacts to groundwater. Prior to performing the study a work plan was submitted to the Alameda County Health Care Services Agency (ACHCSA) for their review. The plan was amended based on comments by Mr. Gil Wistar, the ACHSCA hazardous material specialist assigned to oversee site activities. In general, our scope of services consisted of (1) exploring subsurface conditions by drilling five test borings, (2) analyzing selected soil samples, (3) evaluating impacts to groundwater by completing a downgradient

test boring as a monitoring well and analyzing water from the well, (4) performing a level survey to establish elevations for the test borings and wells in the area, and (5) determining the groundwater flow direction and gradient.

II FIELD INVESTIGATION

Subsurface conditions were investigated by collecting soil samples from five test borings. One of the test borings was completed as a groundwater monitoring well. Test Borings 1 through 4 were drilled within the City of Oakland right-of-way; Monitoring Well 1 (MW-1) was situated inside the adjacent service building. Prior to drilling the borings within the right-of-way, obstruction and drilling permits were obtained. The location of the test borings and monitoring well are shown on the Site Plan.

A level survey was performed to determine the top of casing (TOC) elevation for MW-1, as well as three nearby wells which were installed by and are presently monitored by Levine-Fricke. The elevation reference is an arbitrary benchmark on the adjacent property. The depth to groundwater, below the top of the casing for MW-1, was measured by SCI with a well sounder. Water depths in the other wells were measured in a similar manner by a representative of Levine-Fricke.

Rigorous quality control and quality assurance protocol was followed during our field investigation. A detailed discussion of our field procedures is provided in Appendix A.

III ANALYTICAL TESTING

Selected soil samples from the test borings and a water sample from the MW-1 were analyzed by Curtis and Tompkins, Ltd., a laboratory certified by the DHS for hazardous waste and water testing. Chain-of-custody records accompanied all samples transmitted to the laboratory. Analytical test reports and chain-of-custody records are presented in Appendix B.

The samples were analyzed for those constituents previously detected during tank removal activities. The testing program included analyses for total volatile hydrocarbons (TVH), total oil and grease (TOG), total extractable hydrocarbons (TEH), and benzene, toluene, xylene, and ethylbenzene (BTXE). Water and soil samples from MW-1 boring were also analyzed for purgeable halocarbons (EPA 8010) because solvent odors were noted during drilling. The results of the analyses are presented in Tables 1 and 2. Sample preparation and analytical test methods for the analyses are summarized in Appendix B.

Table 1. Summary of Contaminants in Soil

Sample	TVH[1] (mg/kg)[6]	TEH[2] mg/kg	TOG[3] (mg/kg)	B[4] (ug/kg)[7]	T (ug/kg)	E (ug/kg)	X (ug/kg)	EPA 8010[5] (ug/kg)
1 @ 8.0	63	ND[8]	ND	17	ND	1000	1600	--[9]
1 @23.0'	2700	ND	ND	16000	120000	50000	220000	--
1 @33.0'	4	ND	ND	110	200	52	290	--
1 @43.0'	ND	ND	ND	6	22	7	41	--
2 @ 1.5'	--	--	ND	--	--	--	--	--
2 @ 3.0'	--	--	ND	--	--	--	--	--
2 @ 5.5'	--	--	ND	--	--	--	--	--
2 @10.5'	--	--	ND	--	--	--	--	--
2 @15.0'	ND	ND	ND	ND	ND	ND	25	--
2 @25.5'	ND	ND	ND	ND	11	ND	29	--
3 @15.5'	ND	ND	ND	ND	10	ND	25	--
3 @25.5'	8.8	ND	ND	ND	290	170	800	--
3 @35.5'	ND	ND	ND	ND	21	7.3	41	--
4 @14.0'	2.3	ND	ND	11	38	31	150	--
4 @24.5'	[redacted]	ND	ND	450	10000	770	30000	--
4 @34.5'	ND	ND	ND	6.1	29	6.7	37	--
MW1 @15.5'	[redacted]	1100	610	640	6500	3400	14000	ND
MW1 @30.5'	5500	ND	ND	16300	170000	98000	520000	ND
MW1 @34.5'	2.0	ND	ND	ND	2200	15	79	--

---

1 TVH = Total Volatile Hydrocarbons
2 TEH = Total Extractable Hydrocarbons
3 TOG = Total Oil and Grease
4 BTEX = Benzene, Toluene, Ethylbenzene, Xylene
5 EPA 8010 = Method includes the chemicals listed on the laboratory test reports
6 mg/kg = milligrams per kilogram
7 ug/kg = micrograms per kilogram
8 ND = None Detected, chemicals not present at concentrations above detection limits
9 -- = Test not performed

Table 2. Summary of Contaminants in Groundwater

MW1	Concentration (ug/L)[1]
TVH[2]	620,000
TEH[3]	ND[6]
TOG[4]	ND
Benzene	33,000
Toluene	50,000
Ethylbenzene	7,900
Xylene	41,000
1,2 DCA[5]	2,900

---

[1]ug/L = micrograms per liter

[2]TVH = Total Volatile Hydrocarbons

[3]TEH = Total Extractable Hydrocarbons

[4]TOG = Total Oil and Grease

[5]DCA = Dichloroethane

[6]ND = None Detected, chemicals not present at concentrations above detection limits.

IV SITE CONDITIONS

A. Surface Conditions

The Connell Oldsmobile repair facility is situated on the south side of Hawthorne Avenue, between Broadway and Webster Street. The facility consists of a high one-story building with a slab-on-grade floor. Asphalt and concrete-paved access ways extend along the west and south sides of the structure; sidewalks extend along the north and east sides. The previous tanks were located beneath the sidewalk adjacent to the north side of the facility, as shown on Plate 1.

The site was developed by cutting into the northeastern flank of a minor structural uplift on the Oakland alluvial plain, referred to as "Pill Hill." The groundsurface at the site slopes moderately down toward the east and south.

B. Soil Conditions

In general, the test borings reveal that the tank area is underlain by fill, up to about 4 or 5 feet thick. The clayey and sandy fill encountered in Test Borings 2, 3, and 4 likely represent materials placed behind the adjacent retaining wall during site development. Baserock fill placed in the excavation following tank removal were encountered in Test Boring 1.

The fill materials are underlain by interbedded alluvial deposits of the Temescal formation. The deposits consist of medium-stiff to stiff clayey soils, and medium-dense silty and clayey sands. The hydraulic conductivity of the soils encountered

in MW-1 appears to be about 1.6×10^{-4} cm/sec. This value was determined by performing a bail test within the well in the manner described in Appendix A.

C. Groundwater Conditions

Groundwater levels in MW-1 and within the three nearby wells were measured on October 3, 1990. The groundwater readings are presented in Table 3.

Table 3. Groundwater Elevations - October 3, 1990

Well	TOC Elev[1] (ft)	Groundwater Depth[2] (ft)	Groundwater Elev (ft)
MW1	94.48	26.40	68.08
LF 2[3]	91.19	21.34	69.85
LF 3	89.09	19.15	69.94
LF 4	90.65	22.19	68.46

[1] Reference datum, arbitrary benchmark selected by Levine Fricke
[2] Measured below TOC
[3] LF = Levine Fricke

Based on the groundwater data, groundwater appears to be flowing toward the south under a gradient of about 2 percent. The groundwater contours are shown on Plate 1.

Free floating gasoline was observed on the groundwater surface in MW-1 and in Test Borings 1 and 3. The actual thickness of product on the water surface is difficult to measure due to capillary forces which cause product to accumulate in wells. However, average product thickness in MW-1 has varied from about 0.75 to 1.5 inches.

V CONCLUSIONS AND RECOMMENDATIONS

A. Soil Contamination

Based on our studies to date, it appears that significant gasoline contamination exists in the soil near the previous tanks. Contaminated soils appear to extend from below the bottom of the previous tank excavations to the current groundwater surface. Elevated concentrations of gasoline, diesel and fuel constituents have been detected in soil up to 35 feet from the tank area, indicating that significant lateral migration has occurred toward the south.

B. Groundwater Contamination

Elevated concentrations of dissolved gasoline and its constituents have been detected in groundwater. Free floating gasoline has also been detected. We are currently uncertain of the lateral extent of the free and dissolved product plumes.

1,2 Dichloroethane (DCA) was also detected in the water. DCA is a common industrial solvent. We are currently uncertain of the source of DCA since it was not detected in the soil samples analyzed previously from below the tanks, nor was it detected in the unsaturated zone soils from MW-1. It is possible that the DCA source is off-site.

C. Recommendations

Additional studies should be conducted to define the limits of contamination. Specifically, the studies should include:

1. Determining the quality of groundwater upgradient of the site,
2. Defining the limits of the free and dissolved product plumes,
3. Determining the source of DCA, and
4. Defining the lateral and vertical extent of soil contamination.

Initially, we suggest that the next phase of investigation include 3 additional groundwater monitoring wells located further downgradient of the previous tank area. Proposed well locations are shown on the Site Plan.

The wells should be developed, purged and sampled in a manner similar to that described in Appendix A. The water samples and selected soil samples from the borings should be analyzed for TVH, TEH, BTXE and DCA. The results of the study should be summarized in a written report which addresses:

1. The presence of free and dissolved product,
2. The significance of contaminant levels with respect to state and local criteria, and
3. The scope of future studies.

Prior to implementing a new phase of work, we suggest that this report be submitted to Mr. Gilbert Wistar of the Alameda County Health Care Services Agency for his review and comment.

List of Attached Plates

Plate 1	Site Plan
Plates 2 through 6	Logs of Test Borings
Plate 7	Unified Soil Classification System
Plate 8	Particle Size Analysis

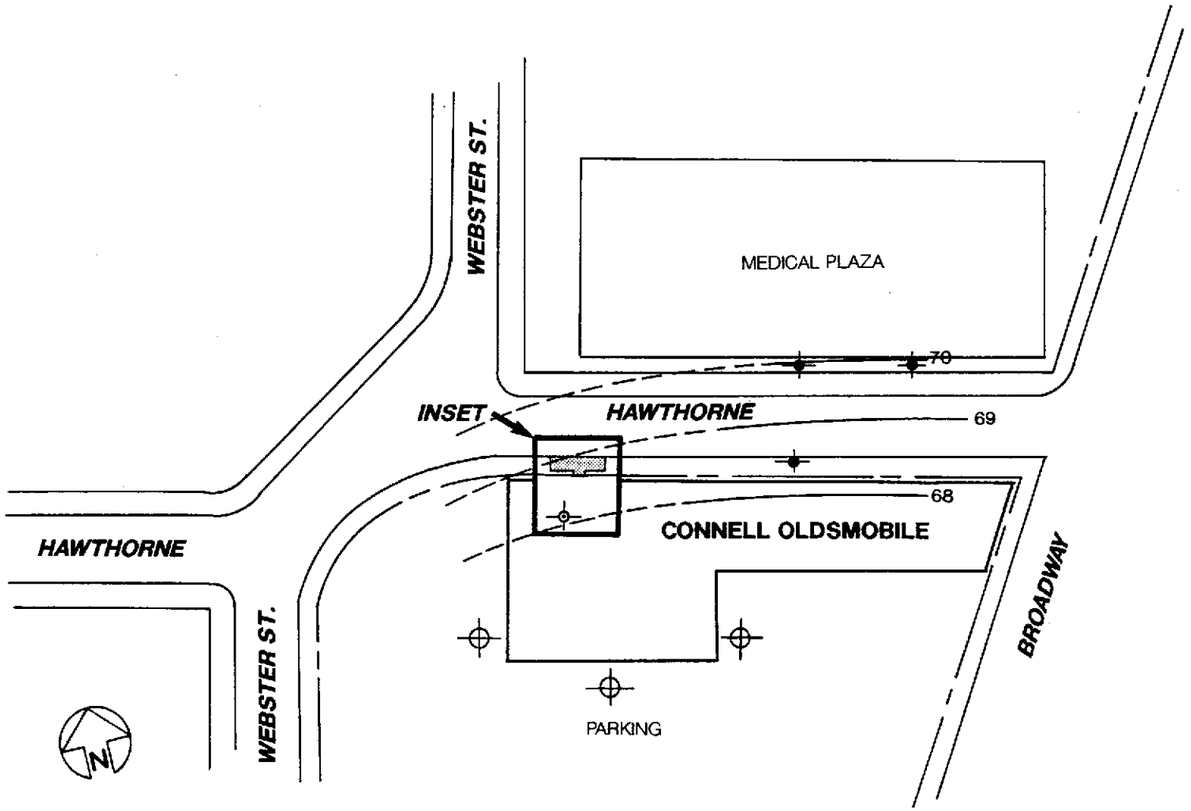
Appendix

A	Investigation Protocol
B	Analytical Testing

Distribution

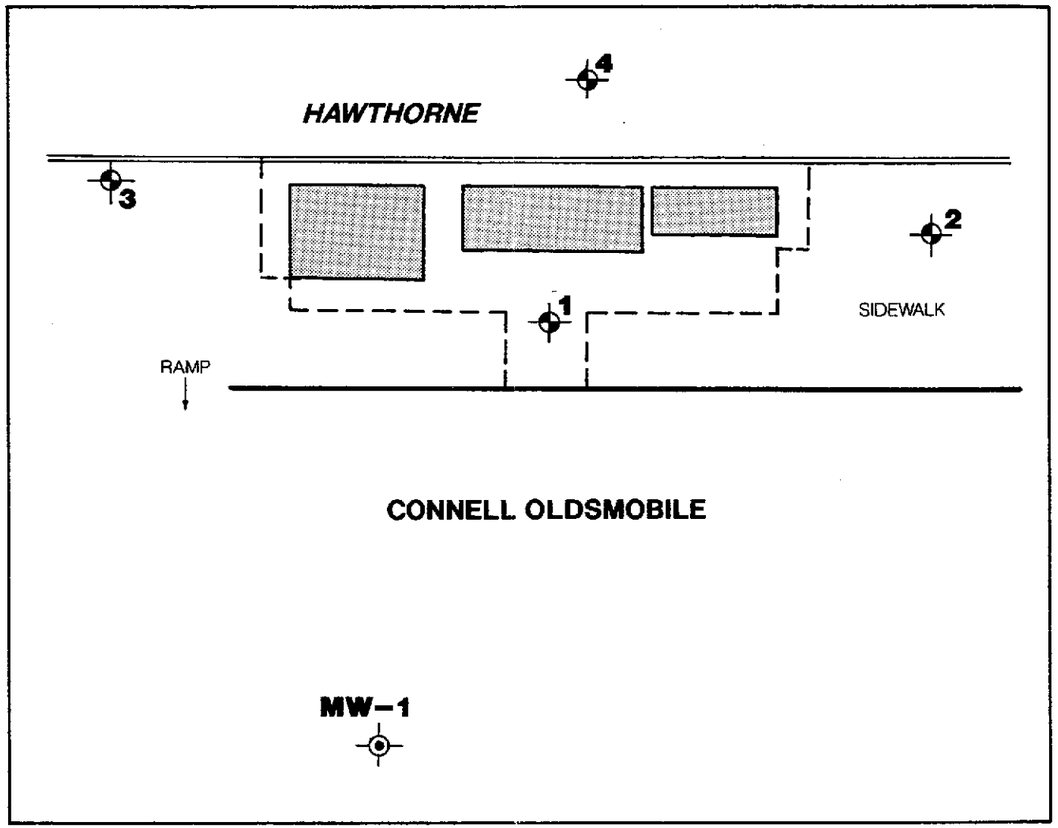
10 copies: Mr. Jonathan Redding
Fitzgerald, Abbott & Beardsley
1221 Broadway, 21st Floor
Oakland, California 94612-1837

JNA:RWR:JPB:ddh



APPROXIMATE SCALE (feet)

0 100 200

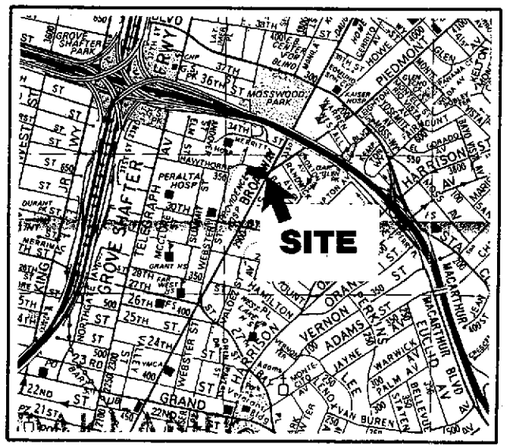


INSET

APPROXIMATE SCALE: 1" = 20'

- PROPOSED MONITORING WELL
- SCI MONITORING WELL
- LEVINE FRICKE MONITORING WELL
- SCI TEST BORING
- 69 GROUNDWATER ELEVATION
- PREVIOUS TANKS
- TANK EXCAVATION AREA

VICINITY MAP



SITE PLAN

Subsurface Consultants

CONNELL OLDSMOBILE – OAKLAND, CA

JOB NUMBER	DATE	APPROVED	PLATE
447.010	10/22/90		1

LOG OF TEST BORING 1

EQUIPMENT 8" Hollow Stem Auger
DATE DRILLED 9/27/90
ELEVATION 95.95* feet

LABORATORY TESTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	OVM (ppm)	DEPTH (FT)	SAMPLE	BLOWS PER FOOT	
				0			ASPHALTIC CONCRETE - 3" thick BASE ROCK - 4.5' thick
				5			BROWN SILTY CLAY (CL) medium stiff, moist color change to green and petroleum odor at 7 feet
			650	10		20	
							MOTTLED BROWN GRAVELLY SAND (SW) dense, moist, with minor clay content, strong petroleum odor
			8500	15		33	
			4500	20		40	YELLOW BROWN CLAYEY SILT (ML) stiff, moist, minor petroleum odor, with some sand lenses
			10,000	25		32	
			8800			23	GROUNDWATER LEVEL 10/1/90
			8600	30		25	
				35			color change to gray brown below 37 feet increase in clay and sand content
			800	40		29	
			2100	45		21	
			200	50		21	
				55			boring backfilled with neat cement grout and capped with hot asphalt
				60			
				65			
				70			
				75			
				80			

*Elevations referenced to an assumed datum of 100 feet at the location shown on the site plan.

Subsurface Consultants

CONNELL OLDSMOBILE - OAKLAND, CA

JOB NUMBER	DATE	APPROVED
447.010	10/17/90	

PLATE 2

LOG OF TEST BORING 2

EQUIPMENT 8" Hollow Stem Auger
DATE DRILLED 9/27/90
ELEVATION 94.48 feet

LABORATORY TESTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	OVM (ppm)	DEPTH (FT)	SAMPLE	BLOWS PER FOOT	
			90	0		12	ASPHALTIC CONCRETE - 3" thick MOTTLED BROWN SANDY SILTY CLAY (CL) medium stiff, moist (fill)
			50			8	MOTTLED GRAY SILTY CLAY (CL) medium stiff, moist
			100	5			
			200			16	
			165	10		38	
			9000	15		31*	BROWN CLAYEY SAND (SC) medium dense, moist, strong petroleum odor
			600	20		21	BROWN CLAYEY SILT (ML) medium stiff, moist, with some sand
			180	25		28*	GROUNDWATER LEVEL 10/1/90
				30		40	increase in sand content below 30 feet
			40	35		32	
				40			boring backfilled with neat cement grout and capped with hot asphalt

Subsurface Consultants

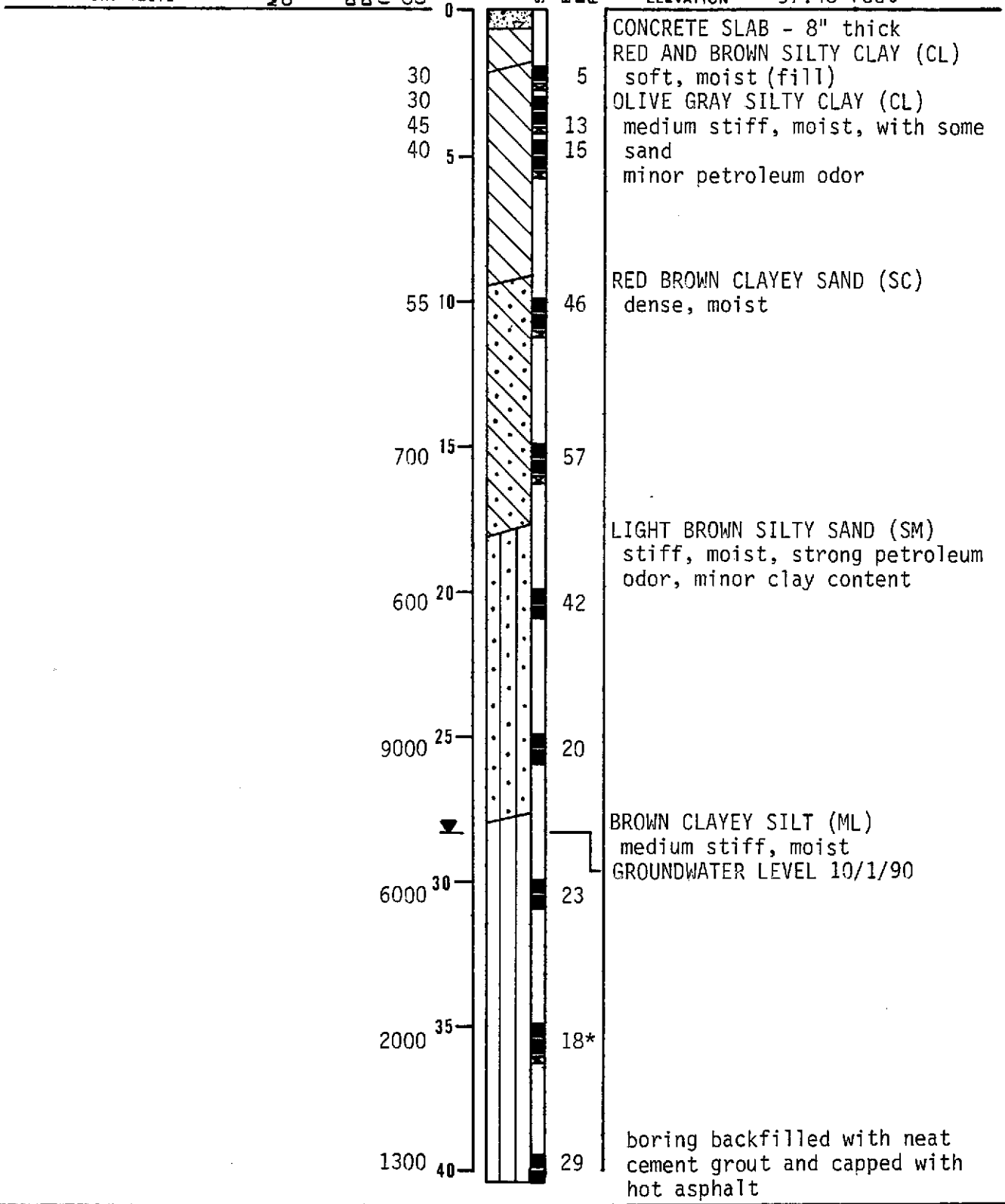
CONNELL OLDSMOBILE - OAKLAND, CA

JOB NUMBER 447.010 | DATE 10/17/90 | APPROVED

PLATE 3

LOG OF TEST BORING 3

EQUIPMENT 8" Hollow Stem Auger
DATE DRILLED 9/29/90
ELEVATION 97.48 feet



Subsurface Consultants

CONNELL OLDSMOBILE - OAKLAND, CA

JOB NUMBER	DATE	APPROVED
447.010	10/17/90	

PLATE 4

LOG OF TEST BORING 4

EQUIPMENT 8" Hollow Stem Auger
DATE DRILLED 9/28/90
ELEVATION 94.04 feet

LABORATORY TESTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	OVM (ppm)	DEPTH (FT)	SAMPLE	BLOWS PER FOOT	
				0			ASPHALTIC CONCRETE - 9" thick
							BLACK SILTY CLAY (CL)
			100			2	medium stiff, moist (fill)
							OLIVE GREEN SILTY CLAY (CL)
			30	5		13	medium stiff, moist
							GRAY GREEN CLAYEY SAND (SC)
							medium dense, moist, with some silt
			90	10		23	
							MOTTLED BROWN CLAYEY SILT (ML)
							stiff, moist
			10,000	15		38	
							BROWN CLAYEY SAND (SC)
			5000	20		22	medium dense, moist
							BROWN CLAYEY SILT (ML)
			9000	25		23	medium stiff, moist
			250	30		22	
							GROUNDWATER LEVEL DURING DRILLING
			30	35		17	boring backfilled with neat cement grout and capped with hot asphalt
				40			

Subsurface Consultants

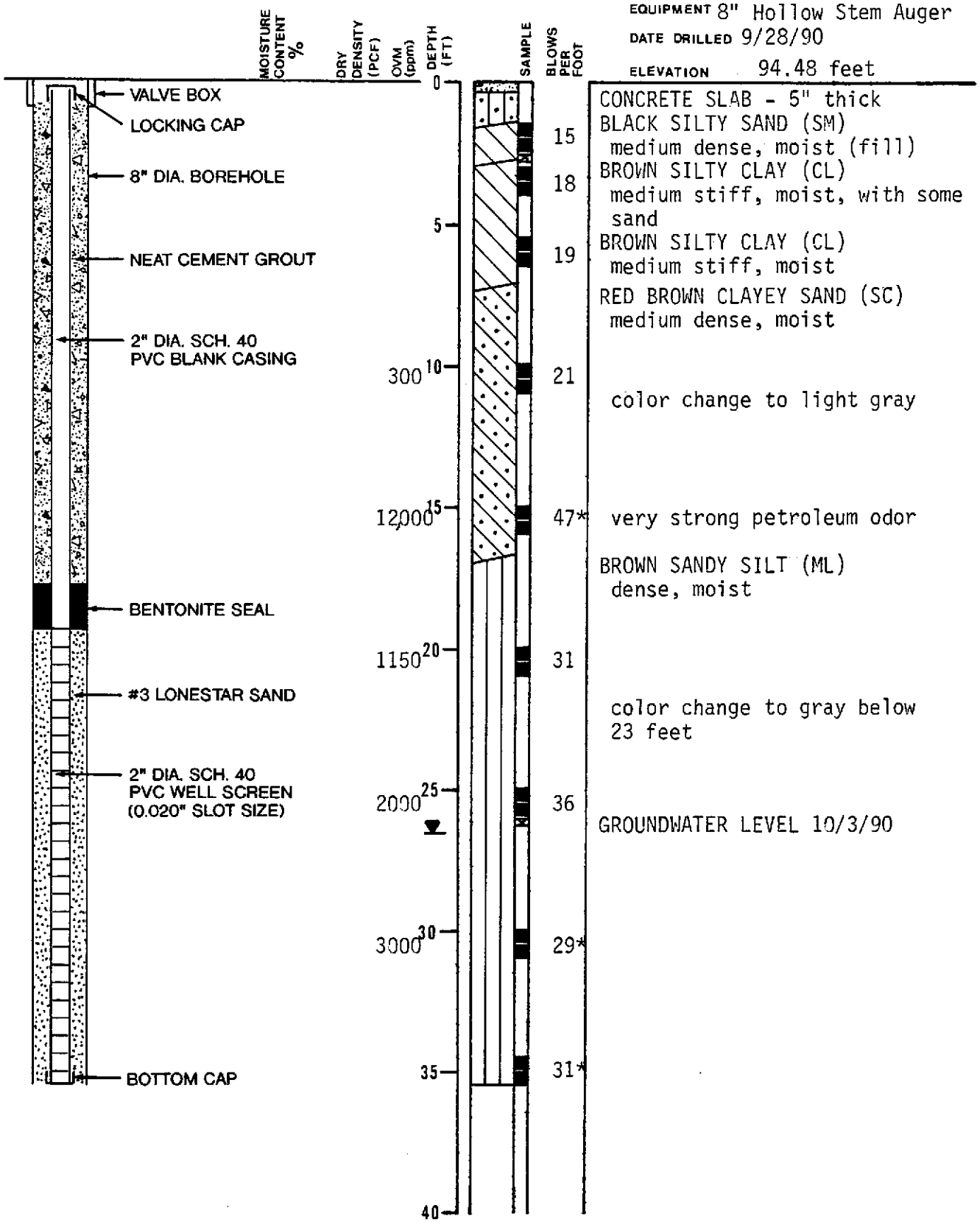
CONNELL OLDSMOBILE - OAKLAND, CA

JOB NUMBER 447.010 | DATE 10/17/90 | APPROVED

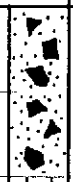
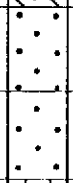
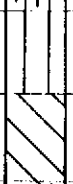
PLATE 5

LOG OF TEST BORING MW-1

EQUIPMENT 8" Hollow Stem Auger
DATE DRILLED 9/28/90
ELEVATION 94.48 feet



Subsurface Consultants	CONNELL OLDSMOBILE - OAKLAND, CA			PLATE
	JOB NUMBER 447.010	DATE 10/17/90	APPROVED	6

GENERAL SOIL CATEGORIES			SYMBOLS		TYPICAL SOIL TYPES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVEL More than half coarse fraction is larger than No. 4 sieve size	Clean Gravel with little or no fines	GW		Well Graded Gravel, Gravel-Sand Mixtures
			GP		Poorly Graded Gravel, Gravel-Sand Mixtures
		Gravel with more than 12% fines	GM		Silty Gravel, Poorly Graded Gravel-Sand-Silt Mixtures
			GC		Clayey Gravel, Poorly Graded Gravel-Sand-Clay Mixtures
	SAND More than half coarse fraction is smaller than No. 4 sieve size	Clean sand with little or no fines	SW		Well Graded Sand, Gravelly Sand
			SP		Poorly Graded Sand, Gravelly Sand
		Sand with more than 12% fines	SM		Silty Sand, Poorly Graded Sand-Silt Mixtures
			SC		Clayey Sand, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More than half is smaller than No. 200 sieve	SILT AND CLAY Liquid Limit Less than 50%		ML		Inorganic Silt and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sand, or Clayey Silt with Slight Plasticity
			CL		Inorganic Clay of Low to Medium Plasticity, Gravelly Clay, Sandy Clay, Silty Clay, Lean Clay
			OL		Organic Clay and Organic Silty Clay of Low Plasticity
	SILT AND CLAY Liquid Limit Greater than 50%		MH		Inorganic Silt, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silt
			CH		Inorganic Clay of High Plasticity, Fat Clay
			OH		Organic Clay of Medium to High Plasticity, Organic Silt
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils

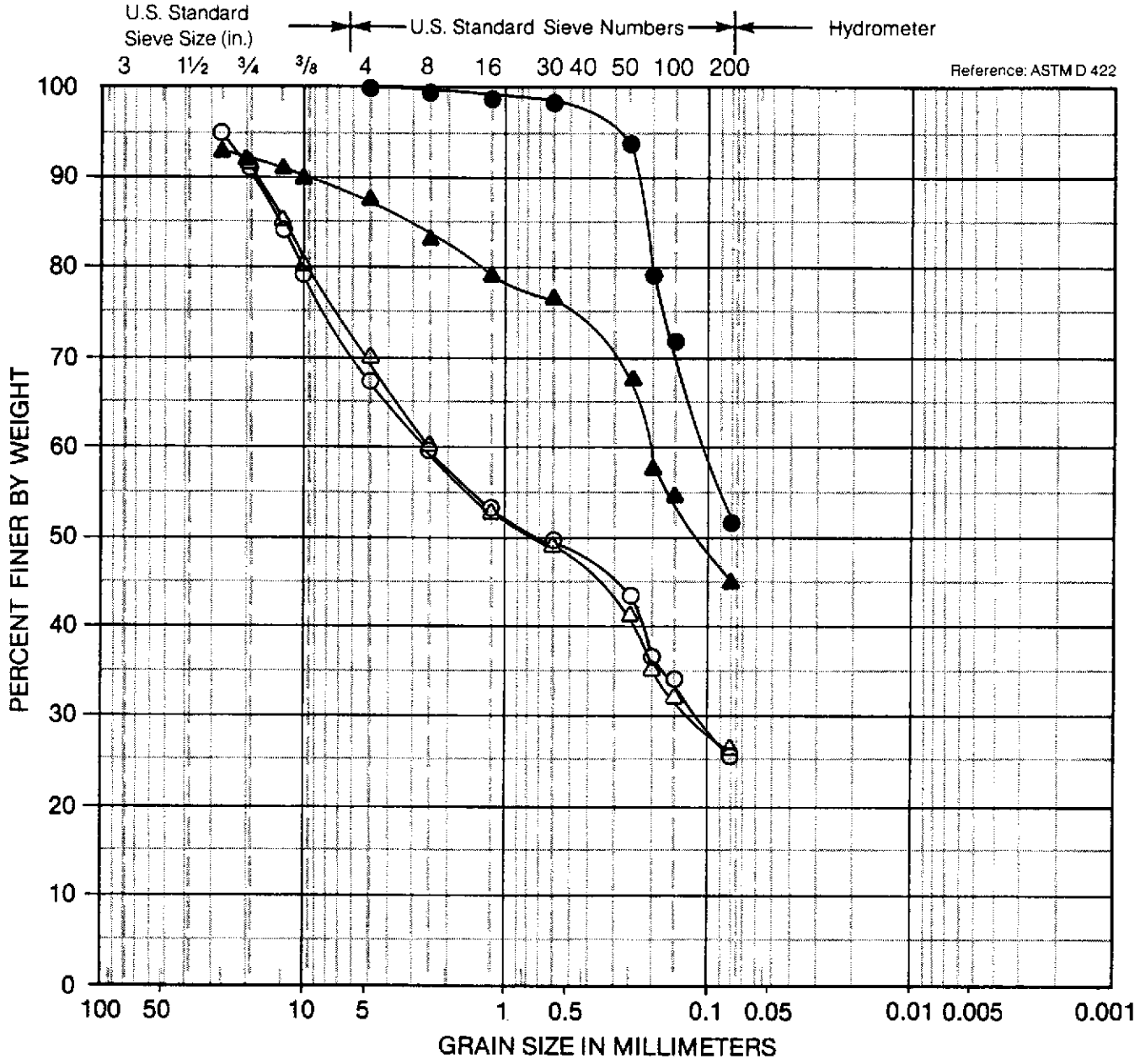
UNIFIED SOIL CLASSIFICATION SYSTEM

Subsurface Consultants

CONNELL OLDSMOBILE - OAKLAND, CA

JOB NUMBER	DATE	APPROVED
447.010	11/9/90	

PLATE 7



Symbol	Sample Source	Classification
●	Boring 1 @ 47.5'	SANDY CLAYEY SILT (ML)
▲	Boring 2 @ 14.5'	CLAYEY SAND (SC)
○	Boring 3 @ 15.0'	GRAVELLY CLAYEY SAND (SC)
△	Boring 5 @ 15.0'	GRAVELLY CLAYEY SAND (SC)

PARTICLE SIZE ANALYSIS

Subsurface Consultants

CONNELL OLDSMOBILE - OAKLAND, CA

JOB NUMBER 447.010 | DATE 10/17/90 | APPROVED

PLATE 8

Appendix A

Investigation Protocol

APPENDIX A
INVESTIGATION PROTOCOL

A. Test Borings

The test borings were drilled using a trailer-mounted drill rig equipped with 8-inch diameter hollow stem augers. Our field engineer observed drilling operations, prepared detailed logs of the test borings and obtained undisturbed samples of the materials encountered. Test boring logs are presented on Plates 2 through 6. Soils are classified in accordance with the Unified Soil Classification System described on Plate 7.

A California Drive Sampler having an outside diameter of 2.5 inches and an inside diameter of 2.0 inches was used to obtain soil samples. The number of blows required to drive the sampler the final 12 inches of each 18-inch penetration were recorded and are presented on the test borings logs. Drilling and sampling equipment was thoroughly steam-cleaned prior to each use to reduce the likelihood of cross-contamination between samples and/or borings.

Soil samples were retained in 2.0-inch diameter brass liners. Teflon sheeting was placed over the ends of the soil liners; the liners were subsequently capped and sealed with duct tape. The shoe sample from each drive was retained in a plastic bag and screened for volatile organics using an Organic Vapor Meter (OVM). OVM measurements are recorded on the logs of the test borings. The sealed liners were placed in ice-filled coolers and remained iced

until delivery to the analytical laboratory. Chain-of-custody records accompanied the samples.

Test Boring MW-1 was completed as a groundwater monitoring well, as detailed in the following section. The remaining test borings were backfilled with a cement-based grout. The borings were then capped with hot asphalt patch. Soil cuttings generated during drilling were stockpiled onsite adjacent to previous tank excavation spoils.

B. **Groundwater Monitoring Well**

At the completion of drilling a monitoring well was installed in Test Boring MW-1. A schematic of the well is shown on the test boring log. In general, the well consists of 2-inch diameter, Schedule 40 PVC pipe having flush-threaded joints. The pipe was steam-cleaned prior to being placed in the borehole.

The lower 15 feet of the well consists of machine-slotted well screen having 0.02-inch slots. The remaining portion of the well consists of blank pipe. The well was provided with a bottom cap and a locking top cap. The well screen is encased in a filter composed of Lonestar No. 3 washed sand. The filter sand was placed by carefully pouring it through the annulus between the hollow stem of the auger and the well casing. Periodically, the augers were raised to allow the sand to fill the annulus between the casing and the borehole. The filter extends from just below the bottom of the well to at least one foot above the top of the screened section. A one-foot thick bentonite pellet seal was placed above the sand filter. The annulus above the seal was backfilled with cement

grout. The grout mixture consists of portland cement mixed with clean water. It was placed in a manner similar to the sand filter. The monitoring well was completed below grade and is protected by a traffic-rated valve box clearly marked as "Monitoring Well".

The well was developed at least 24 hours after the grout seal was placed to allow for proper set up. Initially, the depth to water was measured below the top of the well casing using an electric sounder. The well was then developed by removing water with a steam-cleaned airlift pump until it had been evacuated. Approximately 30 gallons of water was removed. After the well was allowed to recharge to within 80 percent of its initial level, it was purged of about three gallons of water and then sampled with a precleaned dedicated Teflon sampling device. Well development and purge water were placed in a depression created on top of the stockpiled soil and allowed to evaporate. Well development and purge logs are attached.

Groundwater samples were retained in chilled, pre-cleaned containers supplied by the laboratory. The type of containers used is dependent on the type of analysis to be performed. A summary of containers used is presented below.

Groundwater Sample Containers

Analysis	Container	Field Preparation
TEH, EPA 8015 modified	Glass, liter	NA
TOG, SMWW 5520	Glass, liter	NA
Purgeable halocarbons and Aromatics EPA 8010/8020	Glass, 40 milliliters	NA

Water samples were placed in ice-filled coolers and remained iced until delivery to the analytical laboratory. Chain-of-custody records accompanied the samples to the laboratory.

C. **In-situ Hydraulic Conductivity Testing.**

The in-situ hydraulic conductivity of the alluvial materials encountered in well MW-1 was evaluated by conducting a "Bail Test" in the well. The bail test consisted of evacuating the water in the well and then recording the rate at which recharge occurred. The data was then interpreted using a method defined by Hvorslev (1951). Recovery data and calculations are attached.

D. **Product Thickness**

During the field investigation, free floating hydrocarbon product was encountered on the water surface in Test Borings 1, 3 and MW-1. The thickness of the product was measured as the difference between levels indicated on a steel tape using water and gasoline sensitive pastes. Product thicknesses varied from about 1/2 inch in Test Borings 1 and 3 to about 4.5 inches in MW-1.

However, we judge that these thicknesses may not be representative of actual conditions.

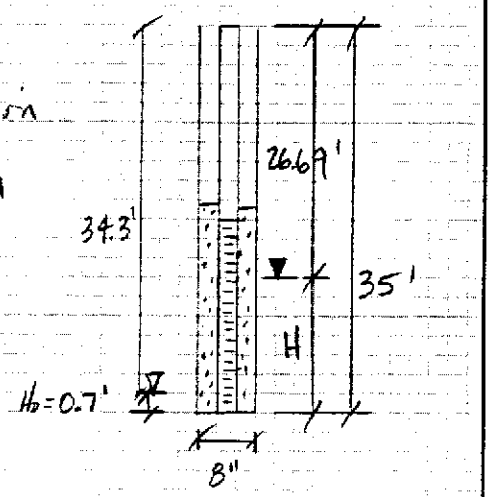
It is very difficult to accurately measure product thickness within a formation using a monitoring well due to capillary forces. An attempt was made to measure the "true" product thickness in MW-1 by removing the product and allowing it to recharge on 3 consecutive days. Product recharge occurred rapidly after removal. Product thicknesses varied from 0.75 to 1.5 inches, which in our opinion is likely more representative of actual conditions.

PERMEABILITY by Hvorslev Method (Bail Test)

Ref: Freeze & Cherry

1. Record recharge vs time following well evacuation

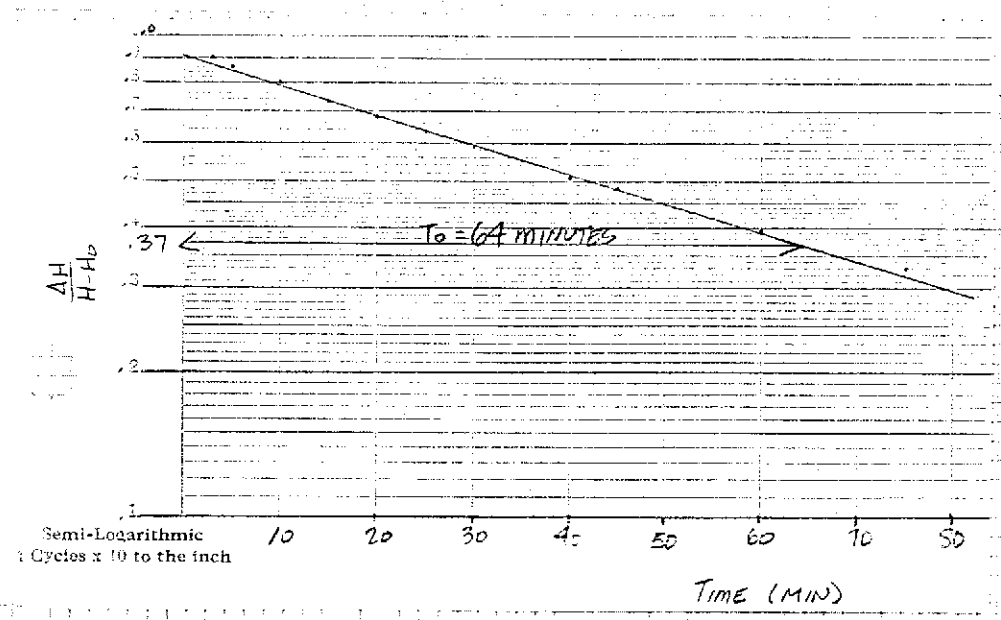
2. Plot $\frac{\Delta H \text{ incremented}}{H - H_o}$ vs time $H = 35 - 26.69 = 8.31$



Data

$\frac{\Delta H}{H - H_o} = \frac{8.31 - h}{8.31 - .7}$

t	depth	h=35-d	$\frac{\Delta H}{H-H_o}$
0	34.3	.7	0
3	33.55	1.45	0.90
5	33.25	1.75	0.86
10	32.75	2.25	0.80
15	32.25	2.75	0.73
20	31.90	3.1	0.68
25	31.50	3.5	0.63
30	31.15	3.85	0.59
35	30.85	4.15	0.55
40	30.60	4.4	0.51
45	30.25	4.65	0.48
60	29.70	5.2	0.395
75	28.75	5.8	0.32



Subsurface Consultants, Inc.
Geotechnical Engineering and Geologists
171 12th Street, Suite 201, Oakland, CA 94607
415-268-0461 · FAX 415-268-0137

Project: Connell Oldsmobile

Job Number: 447.010

Date: 11/6/90

Initial:

Permeability = $K = \frac{r^2 \ln (L/R)}{2L T_o}$

$r = 0.33'$
$L = 8.31'$
$R = 0.33'$
$T_o = 69 \text{ min} = 1.1 \text{ hr}$

$$K = \frac{(0.33)^2 \ln (8.31/0.33)}{2(8.31)(1.1)}$$

$$= 0.0192 \text{ ft/hr} \times \left(\frac{12 \text{ in}}{\text{ft}}\right)\left(\frac{2.54 \text{ cm}}{\text{in}}\right)\left(\frac{1 \text{ hr}}{60 \text{ min}}\right)\left(\frac{1 \text{ min}}{60 \text{ sec}}\right)$$

$$= 1.6 \times 10^{-4} \text{ cm/sec}$$

SILT - SILTY SAND RANGE

Subsurface Consultants, Inc.
Geotechnical Engineering and Geologists
171 12th Street, Suite 201, Oakland, CA 94607
415-268-0461 · FAX 415-268-0137

Project: Connell Oldsmobile
Job Number: 447.010 Date: 11/6/90
Initial: Sheet 2 of 2

Appendix B
Analytical Testing

APPENDIX B
ANALYTICAL TESTING

Analytical testing services were provided by Curtis & Tompkins, Ltd., a State of California Department of Health Services (DHS) certified laboratory for hazardous waste and water testing. The analytical tests were performed on individual samples. A summary of sample preparation and test methods are presented below.

Test Analysis	Sample Preparation Method	Analysis Method
Total Volatile Hydrocarbons	EPA 5030	EPA 8015 Mod.
Total Extractable Hydrocarbons	EPA 3550	EPA 8015 Mod.
Total Oil and Grease	EPA 3550	SMWW17:5520F
Purgeable Halocarbons	EPA 5030	EPA 8010
BTXE	EPA 5030	EPA 8020

In addition to the chemical analyses, grain size distribution tests were performed by SCI on selected samples. The tests included mechanical sieve and percent passing a #200 sieve determinations, performed in accordance with ASTM D-422. The results of the grain size distribution tests are presented on Plate 8.

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 10/05/90
DATE REPORTED: 10/19/90

LAB NUMBER: 101851

CLIENT: SUBSURFACE CONSULTANTS

REPORT ON: 19 SOIL SAMPLES AND 1 WATER SAMPLE

PROJECT #: 447.010
LOCATION: CONNELL OLDSMOBILE

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101851
CLIENT: SUBSURFACE CONSULTANTS
JOB #: 447.010
LOCATION: CONNELL OLDSMOBILE

DATE RECEIVED: 10/05/90
DATE EXTRACTED: 10/10/90
DATE ANALYZED: 10/19/90
DATE REPORTED: 10/19/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101851-1	1 @ 8.0	ND	ND	100
101851-2	1 @ 23.0	ND	ND	100
101851-3	1 @ 33.0	ND	ND	1.0
101851-4	1 @ 43.0	ND	ND	1.0
101851-9	2 @ 15.0	ND	ND	1.0
101851-10	2 @ 25.5	ND	ND	1.0
101851-11	3 @ 15.5	ND	ND	1.0
101851-12	3 @ 25.5	ND	ND	10
101851-13	3 @ 35.5	ND	ND	1.0
101851-14	4 @ 14.0	ND	ND	1.0
101851-15	4 @ 24.5	ND	ND	10
101851-16	4 @ 34.5	ND	ND	1.0
101851-17	5 @ 15.5	ND	[redacted]	100
101851-18	5 @ 30.5	ND	ND	100
101851-19	5 @ 34.5	ND	ND	1.0

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	7
RECOVERY, %	93

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101851
CLIENT: SUBSURFACE CONSULTANTS
JOB #: 447.010
LOCATION: CONNELL OLDSMOBILE

DATE RECEIVED: 10/05/90
DATE EXTRACTED: 10/10/90
DATE ANALYZED: 10/17/90
DATE REPORTED: 10/19/90

Extractable Petroleum Hydrocarbons in Aqueous Solutions
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (ug/L)	DIESEL RANGE (ug/L)	REPORTING LIMIT (ug/L)
101851-20	5	ND	ND	500

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	7
RECOVERY, %	82

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101851
CLIENT: SUBSURFACE CONSULTANTS
JOB NUMBER: 447.010
JOB LOCATION: CONNELL OLDSMOBILE

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/11/90
DATE REPORTED: 10/19/90

Total Volatile Hydrocarbons with BTXE in Soils & Wastes
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	CLIENT ID	TVH AS GASOLINE	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES
		(mg/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)
101851-1	1 @ 8.0	63	17	ND(10)	1,000	1,600
101851-2	1 @ 23.0	2,700	16,000	120,000	50,000	220,000
101851-3	1 @ 33.0	4.0	110	200	52	290
101851-4	1 @ 43.0	ND(1.0)	6.0	22	7.0	41
101851-9	2 @ 15.0	ND(1.0)	ND(5.0)	ND(5.0)	ND(5.0)	25
101851-10	2 @ 25.5	ND(1.0)	ND(5.0)	11	ND(5.0)	29
101851-11	3 @ 15.5	ND(1.0)	ND(5.0)	10	ND(5.0)	25
101851-12	3 @ 25.5	8.8	ND(5.0)	290	170	800
101851-13	3 @ 35.5	ND(1.0)	ND(5.0)	21	7.3	41
101851-14	4 @ 14.0	2.3	11	38	31	150
101851-15	4 @ 24.5	370	450	10,000	770	30,000
101851-16	4 @ 34.5	ND(1.0)	6.1	29	6.7	37
101851-17	5 @ 15.5	510	640	6,500	3,400	14,000
101851-18	5 @ 30.5	9,300	16,300	170,000	98,000	520,000
101851-19	5 @ 34.5	2.0	ND(5.0)	2,200	15	79

ND = NONE DETECTED AT OR ABOVE THE REPORTING LIMIT

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	93

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101851
CLIENT: SUBSURFACE CONSULTANTS
JOB NUMBER: 447.010
JOB LOCATION: CONNELL OLDSMOBILE

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/12/90
DATE REPORTED: 10/19/90

Total Volatile Hydrocarbons with BTXE in Aqueous Solutions
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	CLIENT ID	TVH AS GASOLINE	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES
		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
101851-20		620,000	33,000	50,000	7,900	41,000

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	90

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101851-17
CLIENT: SUBSURFACE CONSULTANTS
JOB #: 447.010 - CONNELL OLDSMOBILE
SAMPLE ID: 5 @ 15.5

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/10/90
DATE REPORTED: 10/19/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	200
bromomethane	ND	200
vinyl chloride	ND	200
chloroethane	ND	200
methylene chloride	ND	100
trichlorofluoromethane	ND	100
1,1-dichloroethene	ND	100
1,1-dichloroethane	ND	100
1,2-dichloroethene (total)	ND	100
chloroform	ND	100
freon 113	ND	100
1,2-dichloroethane	ND	100
1,1,1-trichloroethane	ND	100
carbon tetrachloride	ND	100
bromodichloromethane	ND	100
1,2-dichloropropane	ND	100
cis-1,3-dichloropropene	ND	100
trichloroethylene	ND	100
1,1,2-trichloroethane	ND	100
trans-1,3-dichloropropene	ND	100
dibromochloromethane	ND	100
2-chloroethylvinyl ether	ND	200
bromoform	ND	100
tetrachloroethylene	ND	100
1,1,2,2-tetrachloroethane	ND	100
chlorobenzene	ND	100
1,3-dichlorobenzene	ND	100
1,2-dichlorobenzene	ND	100
1,4-dichlorobenzene	ND	100

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	37
Spike: Average % Recovery	69

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101951-18
CLIENT: SUBSURFACE CONSULTANTS
JOB #: 447.010 - CONNELL OLDSMOBILE
SAMPLE ID: 5 @ 30.5

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/11/90
DATE REPORTED: 10/19/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	2000
bromomethane	ND	2000
vinyl chloride	ND	2000
chloroethane	ND	2000
methylene chloride	ND	1000
trichlorofluoromethane	ND	1000
1,1-dichloroethene	ND	1000
1,1-dichloroethane	ND	1000
1,2-dichloroethene (total)	ND	1000
chloroform	ND	1000
freon 113	ND	1000
1,2-dichloroethane	ND	1000
1,1,1-trichloroethane	ND	1000
carbon tetrachloride	ND	1000
bromodichloromethane	ND	1000
1,2-dichloropropane	ND	1000
cis-1,3-dichloropropene	ND	1000
trichloroethylene	ND	1000
1,1,2-trichloroethane	ND	1000
trans-1,3-dichloropropene	ND	1000
dibromochloromethane	ND	1000
2-chloroethylvinyl ether	ND	2000
bromoform	ND	1000
tetrachloroethylene	ND	1000
1,1,2,2-tetrachloroethane	ND	1000
chlorobenzene	ND	1000
1,3-dichlorobenzene	ND	1000
1,2-dichlorobenzene	ND	1000
1,4-dichlorobenzene	ND	1000

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	1
Spike: Average % Recovery	96

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101851-20
CLIENT: SUBSURFACE CONSULTANTS
PROJECT #: 447.010
SAMPLE ID: 5

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/11/90
DATE REPORTED: 10/19/90

EPA 8010
Purgeable Halocarbons in Water

Compound	Result ug/L	Reporting Limit ug/L
chloromethane	ND	200
bromomethane	ND	200
vinyl chloride	ND	200
chloroethane	ND	200
methylene chloride	ND	100
trichlorofluoromethane	ND	100
1,1-dichloroethene	ND	100
1,1-dichloroethane	ND	100
1,2-dichloroethene (total)	ND	100
chloroform	ND	100
freon 113	ND	100
1,2-dichloroethane	2,900	100
1,1,1-trichloroethane	ND	100
carbon tetrachloride	ND	100
bromodichloromethane	ND	100
1,2-dichloropropane	ND	100
cis-1,3-dichloropropene	ND	100
trichloroethylene	ND	100
1,1,2-trichloroethane	ND	100
trans-1,3-dichloropropene	ND	100
dibromochloromethane	ND	100
2-chloroethyl vinyl ether	ND	200
bromoform	ND	100
tetrachloroethene	ND	100
1,1,2,2-tetrachloroethane	ND	100
chlorobenzene	ND	100
1,3-dichlorobenzene	ND	100
1,2-dichlorobenzene	ND	100
1,4-dichlorobenzene	ND	100

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	6
RECOVERY, %	95

Curtis & Tompkins, Ltd.

LAB NUMBER: 101851
CLIENT: SUBSURFACE CONSULTANTS
PROJECT # : 447.010
LOCATION: CONNELL OLDSMOBILE

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/12/90
DATE REPORTED: 10/19/90

ANALYSIS: HYDROCARBON OIL AND GREASE
METHOD: SMWW 17:5520 E&F

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
101851-1	1 @ 8.0	ND	mg/Kg	50
101851-2	1 @ 23.0	ND	mg/Kg	50
101851-3	1 @ 33.0	ND	mg/Kg	50
101851-4	1 @ 43.0	ND	mg/Kg	50
101851-5	2 @ 1.5	ND	mg/Kg	50
101851-6	2 @ 3.0	ND	mg/Kg	50
101851-7	2 @ 5.5	ND	mg/Kg	50
101851-8	2 @ 10.5	ND	mg/Kg	50
101851-9	2 @ 15.0	ND	mg/Kg	50
101851-10	2 @ 25.5	ND	mg/Kg	50
101851-11	3 @ 15.5	ND	mg/Kg	50
101851-12	3 @ 25.5	ND	mg/Kg	50
101851-13	3 @ 35.5	ND	mg/Kg	50
101851-14	4 @ 14.0	ND	mg/Kg	50
101851-15	4 @ 24.5	ND	mg/Kg	50
101851-16	4 @ 34.5	ND	mg/Kg	50
101851-17	5 @ 15.5	[redacted]	mg/Kg	50
101851-18	5 @ 30.5	ND	mg/Kg	50
101851-19	5 @ 34.5	ND	mg/Kg	50

ND = Not detected at or above reporting limit

QA/QC SUMMARY

RPD, %	1
RECOVERY, %	81

Curtis & Tompkins, Ltd.

LAB NUMBER: 101851
CLIENT: SUBSURFACE CONSULTANTS
PROJECT # : 447.010

DATE RECEIVED: 10/05/90
DATE ANALYZED: 10/12/90
DATE REPORTED: 10/19/90

ANALYSIS: HYDROCARBON OIL AND GREASE
METHOD: SMWW 17:5520 B&F

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
101851-20	5	ND	mg/L	20

ND = Not detected at or above reporting limit

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	80

Subsurface Consultants

CHAIN OF CUSTODY RECORD
& ANALYTICAL TEST REQUEST

Project Name: Connell Oldsmobile

SCI Job Number: 447.010

Project Contact at SCI: J. Alexander

Sampled By: J. Wolfe

Analytical Laboratory: Curtis & Tompkins

Analytical Turnaround: Normal

	Sample ID	Sample Type[1]	Container Type[2]	Sampling Date	Hold	Analysis	Analytical Method
1	1@8.0	S	T	9/27/90		BTXE+TVH TEH, TOG	~ 5520
2	1@23.0	S	T	~		BTXE + TVH TEH, TOG	~ 5520
3	1@33.0	S	T	~		BTXE + TVH TEH, TOG	~ 5520
4	1@43.0	S	T	~		BTXE+TVH TEH, TOG	~ 5520
5	2@1.5	S	T	9/27/90		TOG	SM WW 5520
6	2@3.0	S	T	~		TOG	~ 5520
7	2@5.6	S	T	~		TOG	~ 5520
	2@10.5	S	T	~		TOG	~ 5520

* * * * * *

Released by: Dennis Aleyand Date: 10-5-90

Released by Courier: Date:

Received by Laboratory: Date:

Relinquished by Laboratory: Date: 10/5/90

Received by: Date:

[1] Sample Type: W = water, S = soil, O = other (specify)
[2] Container Type: V = VOA, P = plastic, G = glass, T = brass tube, O = other (specify)

Notes to Laboratory:
-Notify SCI if there are any anomalous peaks on GC or other scans
-Questions/clarifications...contact SCI at (415) 268-0461

Subsurface Consultants

CHAIN OF CUSTODY RECORD
& ANALYTICAL TEST REQUEST

Project Name: Connell Oldsmobile

SCI Job Number: 447.00

Project Contact at SCI: J. Alexander

Sampled By: J. Wolfe

Analytical Laboratory: Curtis & Tompkins

Analytical Turnaround: Normal

	Sample ID	Sample Type[1]	Container Type[2]	Sampling Date	Hold	Analysis	Analytical Method
9	2@15.0	S	T	9/27/90		TVH+BTXE TEH, TOG	SMWW 5520
10	2@25.5	✓	✓	✓		TVH + BTXE TEH, TOG	SMWW 5520
11	3@15.5	S	T	9/27/90		TVH+BTXE TEH, TOG	5520
12	3@25.5	✓	✓	✓		TVH+BTXE TEH, TOG	5520
13	3@35.5	✓	✓	✓		TVH + BTXE TEH, TOG	5520
14	4@14.0	S	T	9/28/90		TVH+BTXE TEH, TOG	5520
15	4@24.5	✓	✓	✓		TVH + BTXE TEH, TOG	5520
16	4@34.5	✓	✓	✓		TVH+BTXE TEH, TOG	5520

* * * * * *

Released by: Dennis Alexander Date: 10-5-90

Released by Courier: _____ Date: _____

Received by Laboratory: Mary J. Wilson Date: 10/5/90

Relinquished by Laboratory: _____ Date: _____

Received by: _____ Date: _____

[1] Sample Type: W = water, S = soil, O = other (specify)
[2] Container Type: V = VOA, P = plastic, G = glass, T = brass tube, O = other (specify)

Notes to Laboratory:
-Notify SCI if there are any anomalous peaks on GC or other scans
-Questions/clarifications...contact SCI at (415) 268-0461