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Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008-5452

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1	Supplemental Subsurface Contamination Assessment, Upper Yard, Edmonds Fuel Terminal and Burlington Northern Railroad Properties, GeoEngineers, February 22, 1993 report

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COMMENTS: Barbara - As requested, here is a copy of the 1993 GeoEngineers report.

CC: Joe Comstock w/o enclosure
UNOCAL

BY: Linda Dawson

Supplemental Subsurface Contamination Assessment Upper Yard, Edmonds Fuel Terminal and Burlington Northern Railroad Properties Edmonds, Washington

February 22, 1993

For
Unocal

GeoEngineers

February 22, 1993

Geotechnical,
Geoenvironmental and
Geologic Services

Unocal
P. O. Box 76
Seattle, Washington 98111

Attention: Mr. Joe Comstock

Enclosed are two copies of our report, "Supplemental Subsurface Contamination Assessment - Upper Yard," which evaluates possible soil and ground water contamination in the eastern portion of the upper yard at the Edmonds Fuel Terminal. Our services were authorized by Mr. Dick Osburn in February 1991 under the terms of Blanket Contract No. DTB1065A.

We appreciate the opportunity to be of continued service to Unocal. Please call if you have any questions regarding this report or if we may be of additional service.

Yours very truly,

GeoEngineers, Inc.

James A. Miller, P.E.
Principal

DCC:JAM:ira
Document ID: 0161289R.R

File No. 0161-289-R04

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TABLES

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SUPPLEMENTAL SUBSURFACE CONTAMINATION ASSESSMENT UPPER YARD, EDMONDS FUEL TERMINAL AND BURLINGTON NORTHERN RAILROAD PROPERTIES EDMONDS, WASHINGTON FOR UNOCAL

INTRODUCTION

This report presents the results of our subsurface soil explorations in the Upper Yard of Unocal's Edmonds Fuel Terminal and on adjacent property owned by BNRR (Burlington Northern Railroad). GeoEngineers has conducted several site assessment studies of the portion of the Edmonds Fuel Terminal located east of the BNRR rail line. The services described in this report are part of our continuing assessment of remaining portions of the terminal site and our initial study of possible off-site migration of contamination to the adjacent BNRR property. The site and vicinity are shown in Figure 1.

The fuel terminal site consists of an Upper Yard and a Lower Yard. The Upper Yard contains the petroleum bulk storage tanks and the Lower Yard contains the truck loading racks, office buildings, a transport garage and associated warehouse, an oil/water separator and the storm water detention pond. One or more USTs (underground storage tanks) are located in the vicinity of the transport garage. The BNRR property subject to this study is immediately adjacent to the northwest border of the Lower Yard. The general facility layout at the site is shown in Figure 2.

GeoEngineers completed a draft site assessment report on the western portion of the Upper Yard on March 25, 1988. Other reports on other aspects of petroleum-related contamination at the Edmonds Fuel Terminal have been issued by GeoEngineers since 1986.

SCOPE OF SERVICES

The purpose of this study is to explore subsurface conditions in the eastern portion of the terminal's Upper Yard and the adjacent BNRR property, and to evaluate possible soil and ground water contamination at these locations. Our specific scope of services includes the following:

1. Excavate four test pits, three adjacent to underground storage tanks at the transport garage and one in the vicinity of tanks 3716 and 3717. Obtain one or more soil samples from each test pit for field screening.
2. Drill five power borings in the eastern portion of the Upper Yard. Obtain soil samples at 5-foot intervals from each boring for field screening.
3. Install a 2-inch-diameter monitoring well in each Upper Yard boring. Develop and purge each monitoring well. Measure the combustible vapor concentration in each well headspace.

4. Drill 15 hand-auger borings spaced around the Upper Yard, near the warehouse and in the far western portion of the Lower Yard. Collect two soil samples from each boring for field screening.
5. Drill three power borings off-site on BNRR property and construct a monitoring well in each boring. Obtain soil samples at 5-foot intervals for field screening.
6. Field screen each soil sample using visual examination, headspace vapor screening and water sheen screening procedures. Based on the results of the field screening, select at least two soil samples from each boring and one soil sample from each test pit for chemical analysis.
7. Analyze 45 soil samples for fuel hydrocarbons by modified EPA Method 8015. Analyze 20 selected soil samples for TPH (total petroleum hydrocarbons) by EPA Method 418.1. Analyze four selected soil samples for total lead by EPA Method 3050/7421. Analyze 20 selected soil samples for BETX (benzene, ethylbenzene, toluene, and xylenes) by EPA Method 8020.
8. Collect one ground water sample from each of the eight new monitoring wells and from monitoring wells MW-1U, MW-2U and MW-4U, which were installed in 1988. Analyze each water sample for BETX by EPA Method 8020 and for fuel hydrocarbons by modified EPA Method 8015. Analyze one water sample from MW-9U, MW-11U, and MW-13U for TPH by EPA Method 418.1.
9. Survey the ground surface and top of casing elevations of each monitoring well referenced to an existing benchmark on the top of the concrete wall below tank 2605.
10. Interpret field and analytical data and provide conclusions and recommendations.

SOIL AND GROUND WATER CLEANUP CRITERIA

MTCA (Model Toxics Cleanup Act) establishes requirements for assessment and cleanup of sites with regulated compounds in soil and ground water. MTCA regulations are included in Chapter 173-340 WAC.

MTCA provides three methods (Methods A, B and C) for establishing cleanup levels for soil and ground water. Method A levels generally are intended for "routine" cleanup actions that involve relatively few hazardous substances. Cleanup of ground water is not normally considered routine; however, Ecology has established that Method A cleanup levels are appropriate for sites with petroleum-related contaminants, even if contaminated ground water is present at those sites. Method A cleanup levels for ground water and soil are specified in the tables of WAC 173-340-720 and WAC 173-340-740 and are summarized on the following page.

Analyte	Cleanup Level for Soil (mg/kg)	Cleanup Level for Water (μg/l)
Petroleum Hydrocarbons (gasoline)	100	1,000
Petroleum Hydrocarbons (diesel and other)	200	1,000
Benzene	0.5	5
Ethylbenzene	20	30
Toluene	40	40
Xylenes	20	20
Lead	250	5

Note: mg/kg = milligrams per kilogram; μg/l = micrograms per liter

Method B is the standard method for establishing risk-based cleanup levels for soil and ground water at nonroutine sites. Method B cleanup levels are site-specific and are based on applicable state and federal laws and/or the risk equations specified in WAC 173-340-720 and WAC 173-340-740. Method B cleanup levels may be more stringent than Method A levels for sites with numerous contaminants or more than one contaminated medium.

Method C cleanup levels apply to sites where compliance with Method A or Method B may be impossible to achieve or compliance may cause greater environmental harm.

Based on the site conditions, our observations and our understanding of Ecology's interpretation of the MTCA regulations, we have used the Method A cleanup levels for discussion purposes in this study. This is not meant to imply that Method B or Method C cleanup levels are not applicable to the site.

SITE CONDITIONS

GENERAL

The Upper Yard was constructed on a northwest-facing hillside that overlooks Puget Sound. The storage tanks have been excavated into the hillside at several different levels. The elevation of the Upper Yard ranges between 90 and 150 feet above sea level. All of the tanks are surrounded either by earthen berms or by a combination of berms and concrete containment walls.

SUBSURFACE SOIL CONDITIONS

Subsurface soil conditions were explored beneath the eastern portion of the Upper Yard area by drilling 5 power borings (MW-7U, MW-9U, MW-11U, MW-10U, and MW-13U); drilling 13 hand-auger borings (HA-13 through HA-25); and excavating 4 test pits (TP-26 through TP-29). The power borings were drilled to depths ranging from approximately 18.5 to 90.0 feet below ground surface. Subsurface soil conditions were explored on BNRR property by drilling three power borings (MW-27, MW-28, and MW-29) to depths of approximately 15 to 18.5 feet. The approximate locations of the power borings, hand-auger borings and test pits are shown in Figure 3. The field program was conducted between April 29 and May 8, 1991. Details of the field exploration program are presented in Appendix A.

The borings encountered fill overlying interbedded glacial and interglacial sediments. The surficial fill is approximately 1 to 5 feet thick at the exploration locations in the tank, service garage and warehouse areas. Surficial fill is approximately 8 feet thick at the boring locations on BNRR property. Native soil consists of medium dense to very dense interlayered beds of fine sand, fine to medium sand with silt, silty fine to medium sand and silt with sand.

GROUND WATER

Ground water was encountered in all power borings except MW-9U. In MW-9U a zone of perched water was encountered from approximately 2 feet to 7 feet below ground surface. Auger refusal was encountered in MW-9U at 64 feet before reaching the regional ground water level. The remaining power borings encountered ground water at depths ranging from 7 feet in MW-29, on BNRR property, to approximately 75 feet in MW-7U, in the upper area of the tank farm.

Ground water seepage was observed in all hand auger borings except HA-23, HA-24 and HA-25. When ground water was observed during hand augering, it was encountered at depths ranging from 2.0 to 2.5 feet and continued to the final depths of the borings. These shallow ground water zones appear to be perched above the deeper regional ground water table encountered by the power borings.

Based on our field measurements, ground water appears to flow north toward the stormwater detention pond or east toward the wetland that borders the northeastern edge of the site. Ground water flow patterns are complex in the Upper Yard. There are potentially three flow directions in different areas. The number and depths of monitoring wells were not sufficient to define the different flow patterns. For this reason, ground water contours are not presented in this report.

SUBSURFACE CONTAMINATION

GENERAL

Possible subsurface contamination at the exploration locations was evaluated by field observations and chemical analysis of soil and ground water samples. Decisions concerning

where to locate the subsurface explorations, and selection of analyses were based on records of tank contents, discussions with Unocal personnel and field screening results. Tables 1 and 2 summarize the analytical results for soil and ground water samples collected during the study. Analytical results are also displayed in Figure 4. The display boxes show the variations of petroleum-related hydrocarbon concentrations with depth at the exploration locations. Field screening methods and details of the field exploration program are discussed in Appendix A. Laboratory data sheets and chain-of-custody records are included in Appendix B.

SOIL ANALYTICAL RESULTS

The field screening results indicated low concentrations of petroleum-related hydrocarbons in soil samples obtained from most locations within the eastern portion of the tank area. One or more soil samples collected from each power boring produced slight, moderate, or heavy water sheens during field screening. Of the samples with sheens, none had headspace vapor measurements exceeding 100 ppm (parts per million), with the exception of soil samples obtained from borings MW-28, HA-16, and HA-22. The highest headspace vapor measurements (up to 400 ppm) were found in soil samples obtained MW-28, located on BNRR property. Soil sample locations with significantly higher sheen screening results were MW-9U (heavy sheen), MW-10U (moderate sheen), the drainage ditch near the garage (heavy sheen), HA-16 (heavy sheen), HA-21 (moderate sheen), HA-22 (heavy sheen), and HA-23 (moderate sheen).

Field screening and chemical analytical results for soil samples collected at specific areas are summarized as follows:

Tank 4120

Soil samples obtained from the borings in the vicinity of tank 4120 (HA-16 and MW-9U) showed signs of significant petroleum-related hydrocarbon contamination during field screening. Heavy sheens were detected in soil samples from 2 feet and 5.5 feet in HA-16, although headspace vapors were 200 ppm or less. Soil field screened from the 2.5-foot depth from MW-9U, located on the opposite side of tank 4120, also produced a heavy sheen. A petroleum product-like fluid was observed in this soil sample. The headspace vapor measurement on this sample was less than 100 ppm, indicating the presence of a relatively nonvolatile petroleum product. The soil sample from 7.5 feet in MW-9U produced a slight sheen. Soil samples from MW-9U and HA-16 were analyzed in various combinations for fuel hydrocarbons, BETX and TPH. The results support the findings of the field screening: petroleum-related hydrocarbon contamination is limited to the upper 7.5 feet below ground surface at the boring locations. Fuel hydrocarbon concentrations (as diesel fuel) detected in the soil samples obtained from MW-9U were 19,000 mg/kg in the 2.5-foot sample and less than the detection limit of 5 mg/kg in the 7.5-foot sample. Fuel hydrocarbon concentrations (as gasoline) detected in soil samples from the same boring decreased from 2,700 mg/kg in the 2.5-foot sample to less than 5 mg/kg in the 7.5-foot sample. Fuel hydrocarbon concentrations reported for the soil samples obtained from HA-16 also decreased with depth. Total petroleum hydrocarbon concentrations in soil samples

obtained from HA-16 increased in depth, from 460 mg/kg in the 2.5-foot sample to 21,000 mg/kg in the 5.5-foot sample. Whether this indicates an actual increase or is because of sample nonhomogenety is unknown. TPH and fuel hydrocarbon concentrations exceeded 200 mg/kg at the bottom of HA-16 (5.5 feet).

Tanks 3716 and 3717

Field screening results from explorations adjacent to tanks 3716 and 3717, which included HA-15, HA-26, TP-29 and MW-7U, showed only minor indications of petroleum hydrocarbons. Chemical analysis of the soil samples from these explorations confirmed the field screening results. One soil sample, obtained from a depth of 1 foot from TP-29, had a TPH concentration of 11 mg/kg. Fuel hydrocarbons and TPH were not detected in the remaining samples from these borings and the test pit.

Tanks 2909, 218, F410, and 2912

Petroleum-related contamination was not detected in soil samples obtained from hand-auger borings HA-17, HA-18, HA-19 and HA-20 and power boring MW-11U. A slight sheen was detected in the soil sample obtained at the 6-foot depth from HA-19; petroleum-related hydrocarbons were not detected in this soil sample.

The soil sample obtained from power boring MW-10U at the 5-foot depth indicated a moderate sheen and a headspace vapor concentration of less than 100 ppm during field screening. All other samples from MW-10U produced no sheen or slight sheens with headspace vapor concentrations of less than 100 ppm. Soil samples obtained from the 5-foot and 17.5-foot depths in MW-10U were analyzed for fuel hydrocarbons and total petroleum hydrocarbons. Fuel hydrocarbons (identified as diesel) were detected in the upper sample at a concentration of 6,700 mg/kg. Fuel hydrocarbons were not detected in the lower sample (Figure 4).

Soil samples from HA-27, located adjacent to the product lines that run west of tank 2912, were obtained from 4- and 6-foot depths. The 4-foot sample produced a slight sheen and a headspace vapor concentration of less than 100 ppm. The 6-foot sample produced no sheen and a headspace vapor concentration of less than 100 ppm. BETX was not detected in these samples.

Transport Garage

Two sediment samples were obtained for field screening and chemical analysis from the drainage ditch that runs northwest from the south side of the transport garage. A sample of water standing in the ditch was also obtained for sheen screening. A moderate to heavy sheen was observed on water standing in the ditch. The sediment sample obtained from 0.5 feet produced a heavy sheen, while the 1.5-foot sample produced no sheen. Both samples were analyzed for BETX and the results indicated a xylene concentration of 0.046 mg/kg in the 0.5-foot sample. BETX was not detected in the sample from 1.5 feet.

Explorations near the Transport Garage include TP-26, TP-27, TP-28 and MW-13U. Field screening of soil samples from the test pits showed petroleum-related contamination in this area.

Although none of the samples produced a headspace vapor concentration greater than 100 ppm, soil samples from TP-27 and TP-28 produced moderate water sheens. One sample from each test pit was analyzed for fuel hydrocarbons and TPH. Fuel hydrocarbons were not detected in these samples. TPH concentrations detected in soil samples obtained from TP-26 and TP-27 ranged from 11 to 53 mg/kg. A TPH concentration of 420 mg/kg was detected in the soil sample from TP-28. A slight sheen was detected in the soil sample obtained from the 17.5-foot depth of MW-13U. Soil samples obtained from the 2.5- and 17.5-foot depths from this boring were analyzed for BETX and fuel hydrocarbons; neither BETX nor fuel hydrocarbons were detected in these samples.

Warehouse

Two hand auger borings, HA-13 and HA-14, were completed in the warehouse building by sawing through the wood floor, drilling 1 foot deep into the soil beneath the floor, and collecting one soil sample from each boring. Slight sheens and headspace vapor concentrations of less than 100 ppm were measured during field screening of the two samples. The soil sample from each boring was submitted for fuel hydrocarbon analysis. Fuel hydrocarbons were not detected in these samples.

BNRR Property

On BNRR property, field screening of soil samples obtained from MW-27, MW-28 and MW-29 during drilling indicated low to moderate concentrations of petroleum-related hydrocarbons. Headspace vapor concentrations of up to 400 ppm (MW-28) and slight sheens (MW-27 and MW-29) were measured. Soil samples from these three borings were tested for fuel hydrocarbons, TPH, and/or BETX. Samples obtained from 2.5 and 7.5 feet were analyzed for TPH; samples from 12.5-feet were analyzed for BETX. The 12.5-foot sample from MW-28 was also analyzed for total lead. Fuel hydrocarbons, BETX, TPH and lead were not detected in these samples.

Western Portion of the Upper Yard

Three additional hand auger borings were drilled in the western portion of the Upper Yard to help confirm the results of our 1988 study. Field screening of soil samples from HA-21, HA-22 and HA-23, resulted in moderate to heavy water sheens and headspace vapor concentrations of up to 210 ppm.

Soil samples from HA-21, HA-22 and HA-23 were analyzed for fuel hydrocarbons and/or TPH. Samples from HA-23 were also analyzed for BETX. The samples from the 1-foot depth in HA-21, HA-22 and HA-23 had fuel hydrocarbon (diesel) concentrations of 2,700 mg/kg, 260 mg/kg, and 19,000 mg/kg respectively. These samples also had fuel hydrocarbon (gasoline) concentrations of 310 mg/kg, <5 mg/kg, and 1,300 mg/kg, respectively. Samples from the

bottoms of these borings (5 to 10 feet) had fuel hydrocarbons, TPH and BETX concentrations less than MTCA Method A cleanup levels (Figure 4). Chemical analysis indicates a diesel-like contaminant is most prevalent at these locations, although gasoline-like fuel hydrocarbons at concentrations greater than MTCA Method A cleanup levels were detected at HA-21 and HA-23.

Figure 4 summarizes the analytical results for the 1988 study as well as for the current study.

Western Area of Lower Yard

Two hand auger borings, HA-24 and HA-25, were completed on Unocal property in the wooded area between the upland tank farm area and the BNRR main line. This small area of the Lower Yard had not previously been explored. Field screening of soil samples from these two borings indicated slight water sheens and headspace vapor concentrations less than 100 ppm.

The 1-foot-deep soil sample from HA-24 and the 2-foot-deep soil sample from HA-25 were analyzed for fuel hydrocarbons and TPH. The sample from HA-25 was also analyzed for total lead, purgeable halocarbons (by EPA method 8010) and PCBs (polychlorinated biphenyls) by EPA method 8080. The sample from HA-24 had a fuel hydrocarbon concentration of 160 mg/kg, characterized as a hydrocarbon heavier than diesel, and a TPH concentration of 3,100 mg/kg. The sample from HA-25 had a concentration of fuel hydrocarbons of 1,200 mg/kg (also characterized as heavier than diesel) and a TPH concentration of 11,000 mg/kg. The TPH concentrations in samples obtained from HA-24 and HA-25 and the fuel hydrocarbon concentration in the sample from HA-25 exceed the MTCA Method A cleanup level of 200 mg/kg. Purgeable halocarbon analysis indicated a methylene chloride concentration of 0.22 mg/kg in the HA-25 sample, a value that is less than the MTCA cleanup level for soil of 0.5 mg/kg. We believe the methylene chloride reported for the sample is a laboratory contaminant. PCBs and lead were not detected.

GROUND WATER ANALYTICAL RESULTS

One ground water sample was obtained from each of the eight monitoring wells except MW-9U. Auger refusal prevented drilling MW-9U to a sufficient depth to reach the regional water table. Water samples were also collected from monitoring wells MW-1U, MW-3U and MW-4U, which were installed in 1988. All water samples were analyzed for BETX and fuel hydrocarbons. Water samples from MW-11U and MW-13U were also analyzed for TPH. The analytical results for the ground water samples are summarized in Table 2.

Fuel hydrocarbons were not detected in any of the water samples. Xylenes were detected in the ground water sample from MW-10U at a concentration of 0.8 μg/l. Ethylbenzene, toluene and xylenes was detected in the ground water sample from MW-28. BETX were not detected in the other ground water samples. TPH concentrations detected in water samples from MW-11U and MW-13U were 2.3 mg/l and 2.2 mg/l, respectively. These concentrations exceed the MTCA Method A cleanup level of 1 mg/l (1,000 μg/l) for TPH.

DISCUSSION

The Edmonds Fuel Terminal was a major fuel storage and transshipment facility for nearly 70 years. Minor and major spills or other releases of petroleum products occurred during normal operation of the facility.

In the vicinity of diesel fuel tank 4120, petroleum hydrocarbon contamination (diesel and gasoline) was detected in soil samples obtained from depths of up to 5.5 feet below ground surface but was not detected at 7.5 feet. According to Unocal personnel, a major release of 20,000 gallons of diesel fuel occurred from tank 4120. The date of this spill is unknown. The fuel reportedly was cleaned up quickly. There was, however, an opportunity for some of the fuel to enter the ground. A gasoline storage tank, number 2913, was also located within the bermed area with tank 4120, but it has been dismantled and removed.

Soil samples collected in the most westerly portion of the study area, between the toe of the bluff and the BNRR main line, contained fuel hydrocarbon and TPH contamination in the upper 1 to 2 feet of soil. The hydrocarbons were identified as being heavier than diesel fuel and may consist of the roofing tar that was produced at the site in the past. Roofing tar samples obtained from other portions of this site and analyzed by modified EPA Method 8015 had gas chromatogram patterns similar to those for the soil samples collected from this portion of the site.

The analytical data for water samples collected from MW-11U and MW-13U show that ground water beneath the central portion of the Upper Yard and the Transport Garage contains TPH concentrations greater than MTCA Method A cleanup levels. The source of petroleum-related hydrocarbons in the vicinity of the Transport Garage may be located at a higher elevation in the central portion of the Upper Yard. It could also be localized soil contamination in the vicinity of the Transport Garage resulting from past vehicle maintenance activities. TPH was detected at concentrations greater than MTCA Method A cleanup levels in soil samples obtained from TP-28, located immediately east of the Transport Garage. Zones of contamination that were not intersected by our explorations could exist in this area.

The source of the elevated TPH in ground water at MW-11U is unknown. Soil samples obtained from HA-12, HA-17, and MW-11U were not contaminated with petroleum-related hydrocarbons, suggesting an upgradient source.

Elevated TPH and fuel hydrocarbon concentrations detected in soil samples obtained from MW-10U. GeoEngineers is not aware of any petroleum product releases in this area.

Little evidence of off-site migration of petroleum-related contamination was detected at the three monitoring wells installed on BNRR property (MW-27, MW-28, and MW-29). The area of the Lower Yard adjacent to the BNRR property was filled in order to construct the terminal facilities. Variable soil types and permeability are evident in this area. It is possible that relatively permeable sand zones exist in the fill. Free product or contaminated ground water could migrate through these sandy zones from the terminal property to the BNRR property. If the three monitoring wells on BNRR property did not intersect these channels, then evidence of contaminant migration would not have been detected. These wells were, however, positioned as close as possible (approximately 50 feet) to known areas of contamination.

CONCLUSIONS

This report presents the results of supplemental explorations for soil and ground water contamination in the Upper Yard, Edmonds Terminal and on portions of BNRR property adjacent to the site. The results confirm and extend the findings of our March 25, 1988 draft report on the western portion of the Upper Yard.

Petroleum-related soil contamination was detected in the Upper Yard study area. The contamination generally appears to be isolated within containment berms or dikes, although there are some areas where contaminated soil and/or ground water was found outside the bermed areas. In general, the extent of soil contamination in the Upper Yard is less than expected for a fuel terminal with a history of 70 years of operation.

The lateral extent of elevated TPH concentrations in soil encountered near the transport garage is not known. Ground water samples indicate that a zone of contaminated soil, not intersected by our explorations, may exist near this location.

GeoEngineers has not fully characterized the lateral extent of contamination detected during previous studies on Unocal property adjacent to the BNRR property (in the vicinity of MW-27, MW-28, and MW-29). It appears that hydrocarbon contamination present in the Lower Yard has not migrated onto BNRR property in the areas that we studied. Field screening of soil samples obtained from the borings on BNRR property indicated only slight contamination from petroleum-related hydrocarbons. Petroleum-related hydrocarbons were not detected in the soil samples collected from the borings on BNRR property.

Ground water samples obtained from the Upper Yard were largely free of hydrocarbon contamination, with the exception of TPH detected in MW-11U and MW-13U and low concentrations of BETX found in MW-10U and MW-28. The TPH in these wells may indicate the presence of soil contamination that was not intersected by our explorations or contamination that was transported downgradient from higher elevations in the Upper Yard.

RECOMMENDATIONS

Further delineation of the extent of petroleum hydrocarbon contamination in the Upper Yard can most easily be accomplished after product storage tank removal. We recommend that several deep test trenches be excavated in the Upper Yard to examine the soil profile for possible lenses and pockets of soil contamination that may have been missed by our explorations. Field screening methods and laboratory analyses would be used to define the limits of soil contamination found in the test trenches.

LIMITATIONS

We have prepared this report for use by Unocal. This report may be made available to prospective buyers of the property, to regulatory agencies, to BNRR and to other parties as approved by Unocal. This report is not intended for use by other than the listed parties and the information contained herein is not applicable to other sites.

Our interpretations of subsurface conditions are based on data from limited explorations at the site. It is always possible that contamination may exist in areas of the site that were not explored.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No other conditions, express or implied, should be understood.

Respectfully submitted,

GeoEngineers, Inc.

Daniel C. Crevensten, P.E.
Project Manager

James A. Miller, P.E.
Principal

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Document ID: 0161289R.R

TABLE 1 (Page 1 of 3)
EDMONDS FUEL TERMINAL - UPPER YARD
SUMMARY OF SOIL ANALYTICAL DATA

Sample Number	Date Sampled	Sample Depth (feet)	Field Screening Results[1]		BETX (EPA Method 8020) (mg/kg)				Fuel Hydrocarbons (Modified EPA Method 8015) (mg/kg)		Total Petroleum Hydrocarbons (EPA Method 418.1) (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X	Gasoline	Diesel	
Power Borings											
MW-7U-3	04/29/91	12.5	<100	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW7U-16	04/29/91	77.5	<100	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW9U-1	04/30/91	2.5	<100	HS	<0.025	0.44	0.085	3.3	2,700	19,000	30,000
MW9U-2	04/30/91	7.5	<100	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW9U-4	04/30/91	17.5	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW9U-12	05/01/91	57.5	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW-10U-1B	05/02/91	5.0	<100	MS	--	--	--	--	550	6,700	10,000
MW-10U-4	05/02/91	17.5	<100	SS	--	--	--	--	<5	<5	--
MW-11U-1	05/01/91	2.5	<100	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW-11U-9	05/01/91	41.5	<100	SS	--	--	--	--	<5	<5	--
MW-13U-1	04/29/92	2.5	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW-13U-4	04/29/91	17.5	<100	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW-27-1	05/03/91	2.5	<100	SS	--	--	--	--	<5	<5	<5
MW-27-3	05/03/91	12.5	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW-28-2	05/03/91	7.5	200	NS	--	--	--	--	<5	<5	<5
MW-28-3[2]	05/03/91	12.5	400	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
MW-29-2	05/03/91	7.5	<100	SS	--	--	--	--	<5	<5	<5
MW-29-3	05/03/91	12.5	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	--
Drainage Ditch											
Garage Ditch 0.5	03/08/91	0.5	--	HS	<0.040	<0.040	<0.040	0.049	--	--	--
Garage Ditch 1.5	05/08/91	1.5	--	NS	<0.025	<0.025	<0.025	<0.025	--	--	--

Notes appear on page 3 of 3.

TABLE 1 (Page 2 of 3)

Sample Number	Date Sampled	Sample Depth (feet)	Field Screening Results[1]		BETX (EPA Method 8020) (mg/kg)				Fuel Hydrocarbons (Modified EPA Method 8015) (mg/kg)		Total Petroleum Hydrocarbons (EPA Method 418.1) (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X	Gasoline	Diesel	
Hand Augers Borings											
HA-13	05/03/91	1.0	<100	SS	–	–	–	–	<5	<5	–
HA-14	05/03/91	1.0	<100	NS	–	–	–	–	<5	<5	–
HA-15	04/29/91	3.0	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	–
HA-16	04/30/91	2.0	200	HS	–	–	–	–	1,500	9,300	460
HA-16	04/30/91	5.5	100	HS	–	–	–	–	390	1,800	21,000
HA-17	05/01/91	2.5	<100	NS	–	–	–	–	<5	<5	–
HA-18	05/01/91	2.0	<100	NS	–	–	–	–	<5	<5	–
HA-19[2]	05/01/91	6.0	<100	SS	<0.025	<0.025	<0.025	<0.025	<5	<5	–
HA-19	05/01/91	9.0	<100	NS	–	–	–	–	<5	<5	–
HA-20	05/01/91	1.0	<100	SS	–	–	–	–	<5	<5	–
HA-20	05/01/91	5.0	<100	NS	–	–	–	–	<5	<5	–
HA-21	05/02/91	1.0	100	MS	–	–	–	–	310	2,700	–
HA-21	05/02/91	5.0	<100	NS	–	–	–	–	<5	<5	–
HA-22	05/02/91	3.0	210	HS	–	–	–	–	<5	260	570
HA-22	05/02/91	9.0	110	MS	–	–	–	–	<5	150	–
HA-22	05/02/91	10.0	–	SS	–	–	–	–	7	90	–
HA-23	05/03/91	1.0	<100	MS	<0.025	0.55	0.33	2.0	1,300	19,000	22,000
HA-23	05/03/91	5.5	<100	NS	<0.025	<0.025	<0.025	<0.025	<5	<5	56
HA-24	04/30/91	1.0	<100	SS	–	–	–	–	14	160	3,100
HA-25[2,3]	04/30/91	2.0	<100	SS	–	–	–	–	<10	1,200	11,000
HA-26	04/30/91	2.0	<100	NS	–	–	–	–	<5	<5	–
HA-26	05/02/91	5.0	<100	NS	–	–	–	–	<5	<5	–
HA-27	05/08/91	4.0	<100	SS	<0.025	<0.025	<0.025	<0.025	–	–	–
HA-27	05/08/91	6.0	<100	NS	<0.025	<0.025	<0.025	<0.025	–	–	–

Notes appear on page 3 of 3.

TABLE 1 (Page 3 of 3)

Sample Number	Date Sampled	Sample Depth (feet)	Field Screening Results[1]		BETX (EPA Method 8020) (mg/kg)				Fuel Hydrocarbons (Modified EPA Method 8015) (mg/kg)		Total Petroleum Hydrocarbons (EPA Method 418.1) (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X	Gasoline	Diesel	
Test Pits											
TP-26	04/29/91	6.4	<100	NS	–	–	–	–	<5	<5	11
TP-27	04/29/91	7.0	100	MS	–	–	–	–	<5	<5	46
TP-27	04/29/91	10.0	<100	SS	–	–	–	–	<5	<5	53
TP-28	04/29/91	1.0	<100	MS	–	–	–	–	<5	<5	420
TP-29[2]	04/29/91	1.0	100	SS	–	–	–	–	<5	<5	11

Notes:

[1]See Appendix A for field screening methods. NS = no sheen, SS = slight sheen, MS = moderate sheen, HS = heavy sheen.

[2]Samples HA-19, 6.0'; TP-29, 1.0'; HA-25, 2.0' and MW-28, 12.5' were also analyzed for lead by EPA Method 7420. Concentrations of lead in these samples were less than the detection limit of 10 mg/kg.

[3]Sample HA-25, 2.0' was also analyzed for volatile organic compounds by EPA Method 8010. Methylene chloride was detected at a concentration of 0.22 mg/kg which is less than the cleanup level of 0.5 mg/kg. HA-25, 2.0' was also analyzed for PCBs (polychlorinated biphenyls) by EPA Method 8080. PCB concentrations were less than detection limits of 0.033 mg/kg.

B = benzene, E = ethylbenzene, T = toluene, X = total xylenes

ppm = parts per million

mg/kg = milligrams per kilogram

'–' = not tested

TABLE 2
EDMONDS FUEL TERMINAL - UPPER YARD
SUMMARY OF GROUND WATER ANALYTICAL DATA

Monitoring Well Number	Date Sampled	Well Casing Vapors[1] (ppm)	BETX (EPA Method 8020) (µg/l)				Fuel Hydrocarbons (Modified EPA Method 8015) (mg/l)		Total Petroleum Hydrocarbons (EPA Method 418.1) (mg/l)
			B	E	T	X	Gasoline	Diesel	
MW-1U	05/07/91	<100	<0.5	<0.5	<0.5	<0.5	<1	<1	–
MW-2U	05/07/91	<100	<0.5	<0.5	<0.5	<0.5	<1	<1	–
MW-4U	05/07/91	150	<0.5	<0.5	<0.5	<0.5	<1	<1	–
MW-7U	05/08/91	3,000	<0.5	<0.5	<0.5	<0.5	<1	<1	–
MW-10U	05/08/91	320	<0.5	<0.5	<0.5	0.8	<1	<1	–
MW-11U	05/08/91	120	<0.5	<0.5	<0.5	<0.5	<1	<1	2.3
MW-13U	05/08/91	<100	<0.5	<0.5	<0.5	<0.5	<1	<1	2.2
MW-27	05/08/91	<100	<0.5	<0.5	<0.5	<0.5	<1	<1	–
MW-28	05/08/91	250	<0.5	0.9	0.7	1.4	<1	<1	–
MW-29	05/08/91	<100	0.5	<0.5	<0.5	<0.5	<1	<1	–

Notes:

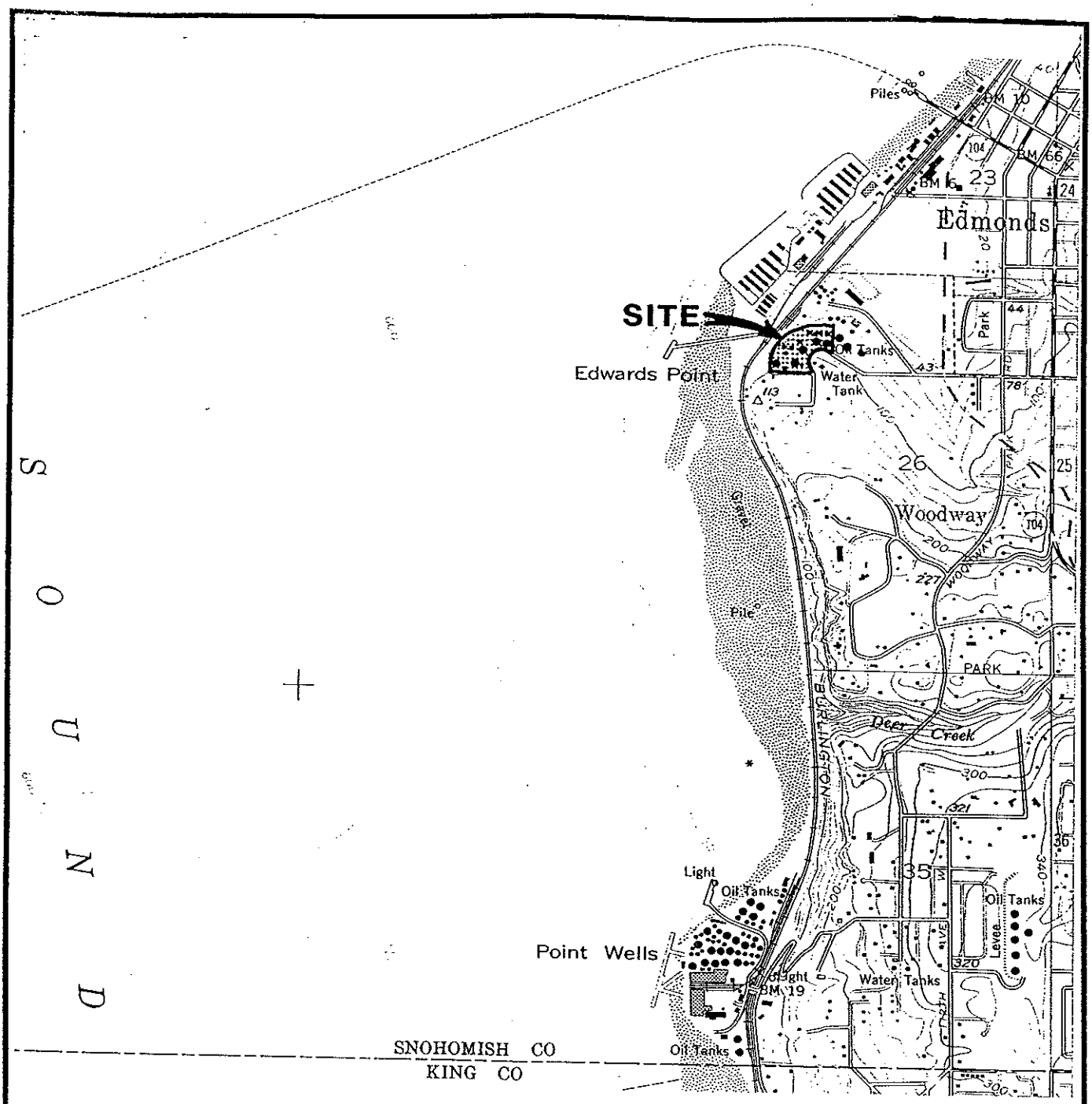
[1]See Appendix A for well casing vapor measurement procedures.

B = benzene, E = ethylbenzene, T = toluene, X = total xylenes

ppm = parts per million

µg/l = micrograms per liter

mg/l = milligrams per liter



REFERENCE: USGS 7.5' TOPOGRAPHIC QUADRANGLE MAP "EDMONDS WEST, WA."

GeoEngineers Incorporated

VICINITY MAP

FIGURE 1

LEGEND

SYMBOL	DESCRIPTION
— — —	PROPERTY LINE

N

TO PUGET SOUND

DITCH

OUTFALL POND (LINED)

STORM WATER DETENTION POND

DRAINAGE DITCH

OIL/WATER SEPARATOR

TIDAL BASIN

PIPEWAY

LAB

OFFICE

RAILCAR LOADING SPUR (REMOVED)

LOAD RACK

OFFICE

TRANSPORT GARAGE

ADDITIVE TANK AREA

PIPEWAY

WAREHOUSE

PIPEWAY

TOE OF BLUFF

TO FUEL DOCK

MAIN ENTRANCE

BEESON ROAD

FENCE

BURLINGTON NORTHERN RAILROAD MAIN LINE

UPPER YARD STUDY AREA

Geo Engineers

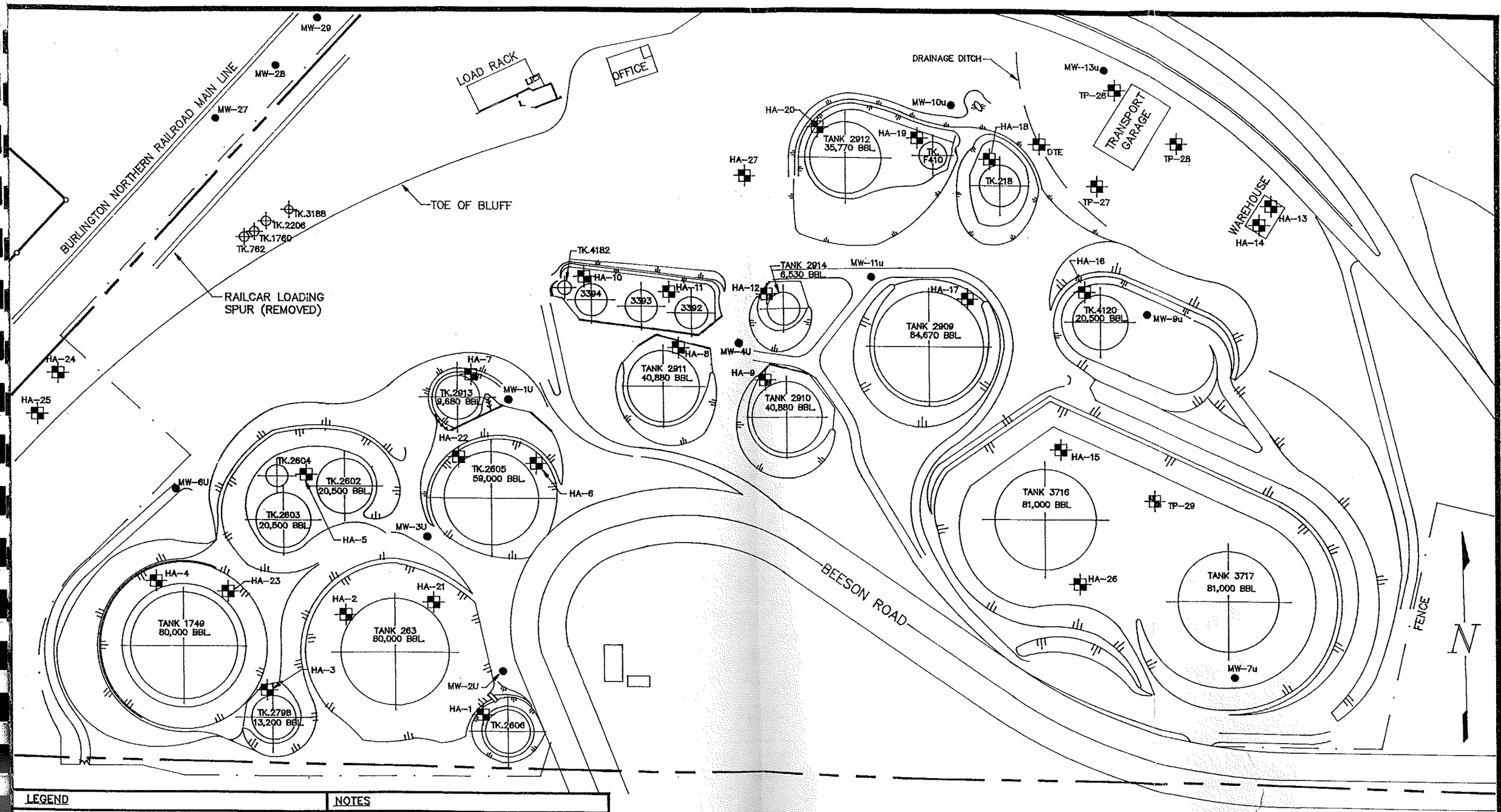
BASE MAP BY: Charles A. Gove & Assoc. Inc.

Scale: 1" = 200'

UNOCAL EDMONDS FUEL TERMINAL
UPPER YARD INVESTIGATION AREA

FIGURE 2

90079GA.DWG | JOB#-90079 | 0161-289-B04 | DEH:JTM | 6-13-91



LEGEND	
SYMBOL	DESCRIPTION
MW-1 ●	GEI MONITOR WELL LOCATION AND NUMBER
TP-5 ⊕	TEST PIT LOCATION AND NUMBER
HA-1 ⊕	HAND AUGER BORING LOCATION AND NUMBER
DTE ⊕	DRAINAGE DITCH SAMPLING LOCATION
———	PROPERTY LINE

NOTES

1. MONITOR WELLS 1u, 2u, 3u, 4u AND 6u; HAND AUGERS 1 THRU 12 WERE COMPLETED BETWEEN 2/11/88 AND 2/18/88. ALL OTHERS COMPLETED BETWEEN 4/28/91 AND 5/8/91.

Geo Engineers

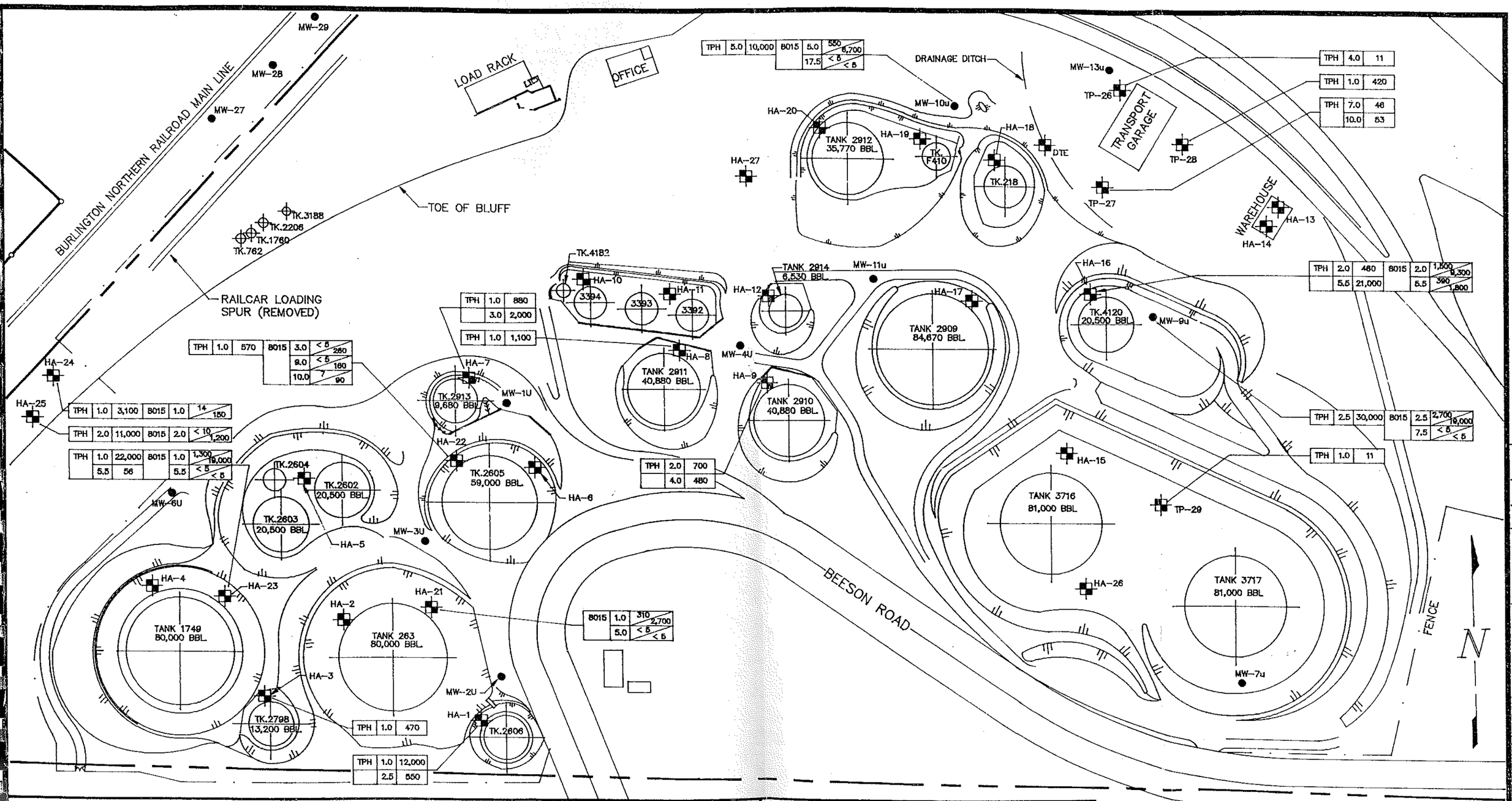
BASE MAP BY: Charles A. Gove & Assoc. Inc.

Scale: 1" = 100'

UNOCAL EDMONDS FUEL TERMINAL
EXPLORATION LOCATIONS – UPPER YARD

FIGURE 3

90079-2.DWG | JOB#-90079 | 0161-289-B04 | DEH:JTM | 6-13-91



LEGEND

TPH 2.0 700 8015 5.0 1,900/10,000 17.5 550/6,700

- TPH = TOTAL PETROLEUM HYDROCARBON BY EPA METHOD 418.1
- 2.0 = DEPTH OF SAMPLE (FEET)
- 700 = TPH VALUE AT GIVEN DEPTH
- 550; 6,700 = FUEL HYDROCARBON CONCENTRATIONS (MG/KG) AS GASOLINE (550) & DIESEL (6,700) AT GIVEN DEPTHS
- 5.0; 17.5 = SAMPLE DEPTHS (FEET)
- 8015 = FUEL HYDROCARBONS BY MODIFIED E.P.A. METHOD 8015

SYMBOL	DESCRIPTION
MW-1 ●	GEI MONITOR WELL LOCATION AND NUMBER
TP-5	TEST PIT LOCATION AND NUMBER
HA-1	HAND AUGER BORING LOCATION AND NUMBER
DTE	DRAINAGE DITCH SOIL SAMPLE LOCATION
— — —	PROPERTY LINE

NOTES

1. TPH AND 8015 CONCENTRATIONS LESS THAN DETECTABLE LIMITS ARE NOT PRESENTED ON THIS FIGURE EXCEPT TO SHOW A CHANGE IN CONCENTRATION WITH DEPTH. SEE TABLE 1.

Geo Engineers

BASE MAP BY: Charles A. Gove & Assoc. Inc.

Scale: 1" = 100'

UNOCAL EDMONDS FUEL TERMINAL SUBSURFACE SOIL CONTAMINATION

FIGURE 4

90079-3.DWG | JOB#-90079 | 0161-289-B04 | DEH:JTM | 2/19/93

APPENDIX A

APPENDIX A

SUBSURFACE EXPLORATION AND SOIL SAMPLING PROGRAM

Subsurface soil conditions at the Edmonds Fuel Terminal were explored using power borings, test pits and hand-auger borings. Explorations were completed between April 29 and May 8, 1991.

POWER BORINGS

Eight power borings were completed using truck-mounted, hollow-stem auger equipment at the approximate locations shown in Figure 3. The borings were completed between April 29 and May 3, 1991 to depths ranging from 15 to 90 feet below ground surface using equipment owned and operated by GeoBoring and Development Incorporated. The drilling equipment was cleaned with a hot-water pressure washer prior to drilling each boring.

Soil samples were obtained from each boring at approximate 5-foot depth intervals using a Dames & Moore split-barrel sampler (2.4-inch ID [inside diameter]). The sampler was driven 18 inches by a 300-pound hammer falling a vertical distance of approximately 30 inches. The sampler was washed prior to each sampling attempt in a TSP (trisodium phosphate) solution and rinsed with tap water, followed by a distilled water rinse. The number of blows needed to advance the sampler the final 12 inches or other specified interval is indicated to the left of the corresponding sample notations on the boring logs.

At least one soil sample was selected from each boring for chemical analysis. Samples that were tested are denoted in our boring logs with "CA." Chain-of-custody procedures were followed when transporting the soil samples to the laboratory. Results of sample analyses are summarized in Table 1 and included in Appendix B.

Soil cuttings from borings MW-27, MW-28, MW-29, located on BNRR property, were placed on plastic sheeting and transported to the soil stockpile in the Lower Yard of the fuel terminal. Soil cuttings from the remaining borings were placed on plastic sheeting adjacent to each boring location at the request of Mr. Jim Clark of Unocal. We understand that the soil cuttings were later moved to the soil stockpile in the Lower Yard by Unocal employees.

HAND-AUGER BORINGS

Fifteen hand-auger borings were completed at the approximate locations shown in Figure 3. The borings were completed between April 29 and May 8, 1991 to depths ranging from 3 to 10 feet. The auger equipment was cleaned with a TSP wash, fresh water rinse and a distilled water rinse prior to each boring attempt.

At least one sample was selected from each boring for field screening and chemical analysis. Samples that were tested are denoted in the boring logs with "CA." Chain-of-custody procedures were followed when transporting the soil samples to the laboratory.

Soil cuttings were used to backfill all of the hand-auger borings except for HA-16, which was backfilled using bentonite chips. The soil cuttings from HA-16 were stockpiled with the cuttings from MW-9U.

TEST PITS

Four test pits were completed at the approximate locations shown in Figure 3. The test pits were completed on April 29, 1991 using a backhoe operated by Glacier Environmental, Inc. The test pits were completed to depths ranging from 5 to 10 feet. Soil samples were collected every 2 feet or when soil characteristics changed. Soil samples were obtained either directly from the test pit wall or floor or from the backhoe bucket, using a hand shovel. Samples obtained from the backhoe bucket were taken from the portions of soil that did not come in direct contact with the bucket. The hand shovel was washed with a TSP solution and rinsed with distilled water prior to each sampling attempt. The test pits were immediately backfilled with the excavated soil and compacted with a portable compactor after sampling and logging.

DRAINAGE DITCH SAMPLES

Two soil samples were collected from the drainage ditch that runs from the south end of the transport garage to the northwest. The ditch has a length of approximately 150 feet and eventually intersects a storm drain. The approximate location of the soil samples is shown in Figure 4. The samples were collected with a shovel that was first washed in TSP solution and rinsed with distilled water. Samples were collected from 0.5 and 1.5 feet below the bottom surface of the ditch.

FIELD SCREENING OF SOIL SAMPLES

A GeoEngineers representative field screened soil samples obtained from the power borings, hand-auger borings and test pits. Field screening results are used as a general guideline to delineate areas of potential petroleum-related contamination. In addition, screening results are used to aid in the selection of soil samples for chemical analysis. The screening methods used include (1) visual, (2) water sheen, and (3) headspace vapor screening using a Bacharach TLV Sniffer calibrated to hexane. The results of headspace and sheen screening are included on the boring logs and in Table 1.

Visual screening consists of inspecting the soil for the stains indicative of fuel-related contamination. Visual screening is generally more effective when contamination is related to heavy petroleum hydrocarbons such as motor oil, or when hydrocarbon concentrations are high. Water sheen screening and headspace vapor screening are more sensitive methods that have been effective in detecting contamination at concentrations less than regulatory cleanup guidelines.

Water sheen screening involves placing soil in water and observing the water surface for signs of sheen. Sheen classifications are as follows:

No Sheen (NS)	No visible sheen on the water surface.
Slight Sheen (SS)	Light, colorless dull sheen; spread is irregular, not rapid; dissipates rapidly.
Moderate Sheen (MS)	Light to heavy sheen, may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on water surface.
Heavy Sheen (HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen.

Headspace vapor screening involves placing a soil sample in a plastic sample bag. The sample bag is sealed and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a Bacharach TLV Sniffer is then inserted in the bag and the TLV Sniffer measures the concentration of combustible vapors present within the sample bag headspace. The TLV Sniffer, which is calibrated to a hexane standard, indicates combustible vapor concentrations in ppm (parts per million). The instrument is designed to detect combustible hydrocarbons at concentrations ranging between 100 ppm and 10,000 ppm.

Field screening results are site-specific. The results vary with temperature, moisture content, soil lithology, organic content, and type of contaminant.

MONITORING WELL CONSTRUCTION

Two-inch-diameter, Schedule 40 PVC (polyvinyl chloride) pipe was installed in each power boring at the completion of drilling. The lower portion of the PVC pipe is machine-slotted (0.02-inch slot width) to allow entry of hydrocarbon vapors and ground water into the well casings. Medium sand was placed in the borehole annulus surrounding the slotted portion of the PVC pipe. Monitoring well construction is described in Figures A-18 through A-25.

The well screens were developed by removing at least 5 gallons of water from each well with a stainless steel bailer. Well development water was poured in storm sewer drains on the site. All water flowing through the storm sewer system is treated in an oil/water separator prior to discharge to an unnamed creek,

We determined the elevations of the well casings to the nearest 0.01 foot with an engineer's level on May 10 and June 14, 1991. An elevation of 128.53 feet at the top casing rim of MW-4 was used as the initial elevation for the survey. Well MW-4 was installed in February 18, 1988 and its elevation was referenced to an assumed 100-foot datum. It was necessary to add 50 feet to the original assumed datum of 100 feet for this report to maintain positive ground surface elevations in the lower areas of the Upper Yard and on BNRR property. Elevations referenced to the 150-foot datum are included on the monitor well logs.

HYDROCARBON VAPOR CONCENTRATIONS

Hydrocarbon vapor concentrations were measured in each monitoring well casing on May 7, 1991. Vapor concentrations in ppm were measured with a 2-inch PVC slip cap with a tube attached to a Bacharach TLV Sniffer. The TLV Sniffer was calibrated to a hexane standard. The field data are presented in Table 2 of this report.

GROUND WATER ELEVATIONS

Depths to ground water were measured using an electronic water level indicator. The electronic water level indicator was washed in a TSP wash, and rinsed in fresh water and distilled water prior to each measurement. Ground water elevations were calculated by subtracting the water table depth from the casing rim elevations with a correction for the amount of casing stick-down below ground surface. Water table positions measured on May 7, 1991 are shown on the boring logs.

GROUND WATER SAMPLING PROGRAM

Ground water samples were obtained from monitor wells MW-1U, MW-2U, MW-4U, MW-7U, MW-10U, MW-11U, MW-13U, MW-27, MW-28, and MW-29 by GeoEngineers on May 7 and May 8, 1991. The water samples were collected with a plastic disposable bailer after at least three well volumes of water were removed from each well casing. Conductivity of ground water was monitored during purging using a Whatman pocket conductivity meter. Conductivity readings were recorded after each gallon of water was bailed, and the wells were sampled after conductivity levels stabilized. A new bailer and new nylon line were used for each sampling attempt. Water bailed from the monitor wells during development and sampling was poured into storm sewer drains.

The water samples were transferred to septum vials, 250-milliliter bottles, or 1-liter bottles in the field and kept cool during transport to the testing laboratory. Hydrochloric acid (a preservative) was present in the septum vials and 1-liter bottles at the time of sampling. Chain-of-custody procedures were followed during transport of the samples to the laboratory.

TEST DATA

HAND BORING HA-13

Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
						Surface Elevation (ft.):
					SP	Brown fine to medium sand with a trace of silt (loose, moist)
SS	40	CA				
NS	20					
NS	20					

Boring completed at 4.25 feet on 05/03/91
Ground water encountered from 2.0 to 4.25 feet
Loose sand caving into hole limited depth to 4.25 feet

DEPTH IN FEET

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

0 5 10 15

Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF HAND BORING

FIGURE A-3

0161-289-H04 tak 1.3

TEST DATA

HAND BORING HA-14

Depth (ft.)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
							Surface Elevation (ft.):
0						SP	Brown fine to medium sand with a trace of silt (loose, moist)
1	NS	30	CA				
2	NS	20					
3	NS	20					
4	NS	20					
5							Hand boring completed at 4.5 feet on 05/03/91 Ground water observed from 2.5 to 4.5 feet Loose sand caving into hole limited depth to 4.5 feet

DEPTH IN FEET

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

0 5 10 15

Note: See Figure A-2 for explanation of symbols

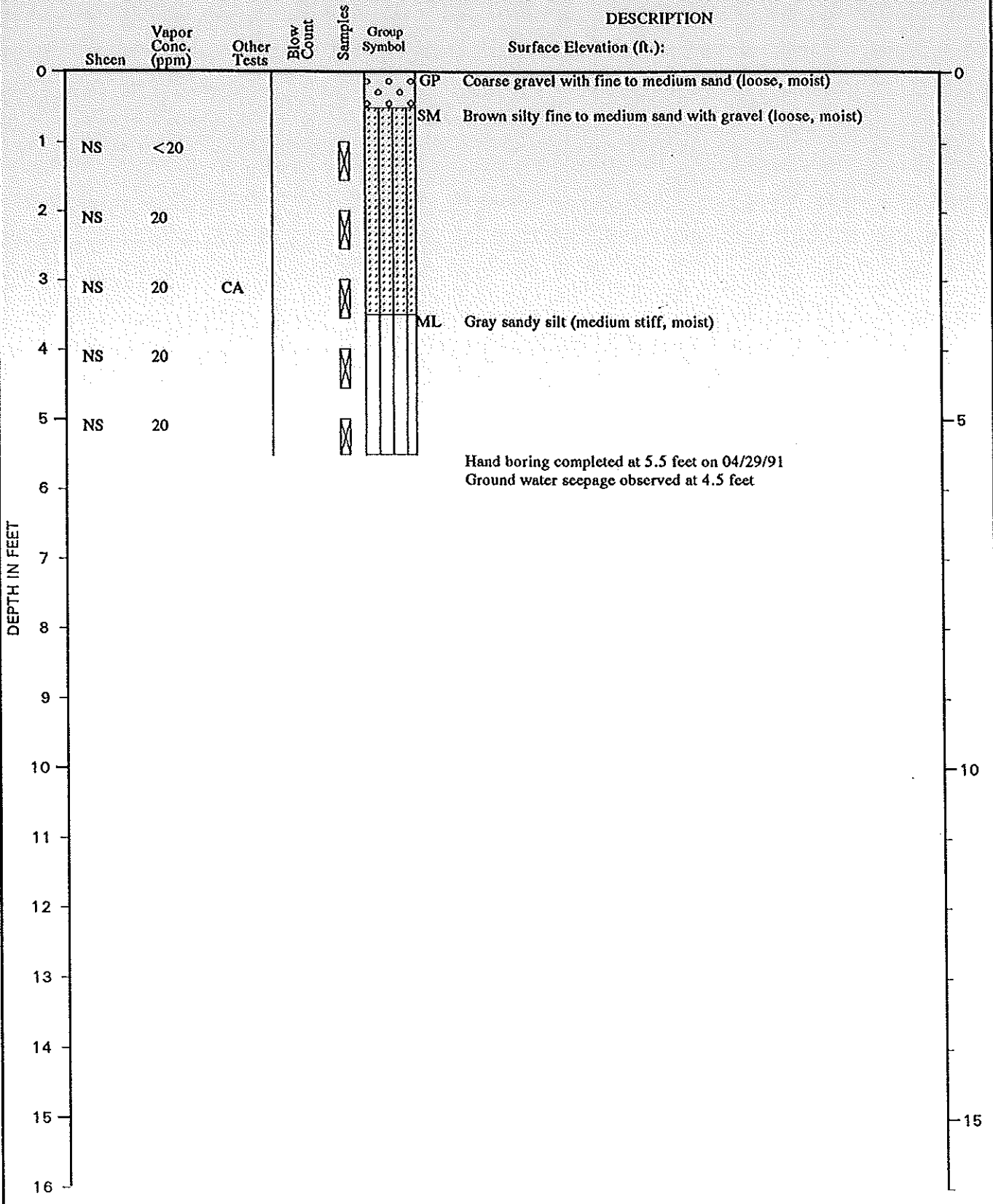
GeoEngineers

LOG OF HAND BORING

FIGURE A-4

TEST DATA

HAND BORING HA-15



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF HAND BORING

FIGURE A-5

TEST DATA

HAND BORING HA-16

DEPTH IN FEET	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						SW	Brown fine to coarse sand with occasional gravel and a trace of silt (loose, moist)
1	SS	70					
2	HS	200	CA				Grades to gray
3	HS	200					Grades to medium dense, wet
4	HS	200					
5	HS	100	CA				
6							Hand boring completed at 5.8 feet on 04/30/91 Ground water observed between 2.5 and 5.8 feet
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF HAND BORING

FIGURE A-6

HAND BORING HA-17

TEST DATA						DESCRIPTION
Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Surface Elevation (ft.):
					SM	Brown silty fine to coarse sand with gravel (medium dense, moist)
SS	50					
NS	40					
NS	40	CA				

Hand boring completed at 3.0 feet on 05/01/91
Ground water observed from 2.0 to 3.0 feet
Refusal at 3.0 feet because of large cobbles

DEPTH IN FEET

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

0 5 10 15

Note: See Figure A-2 for explanation of symbols

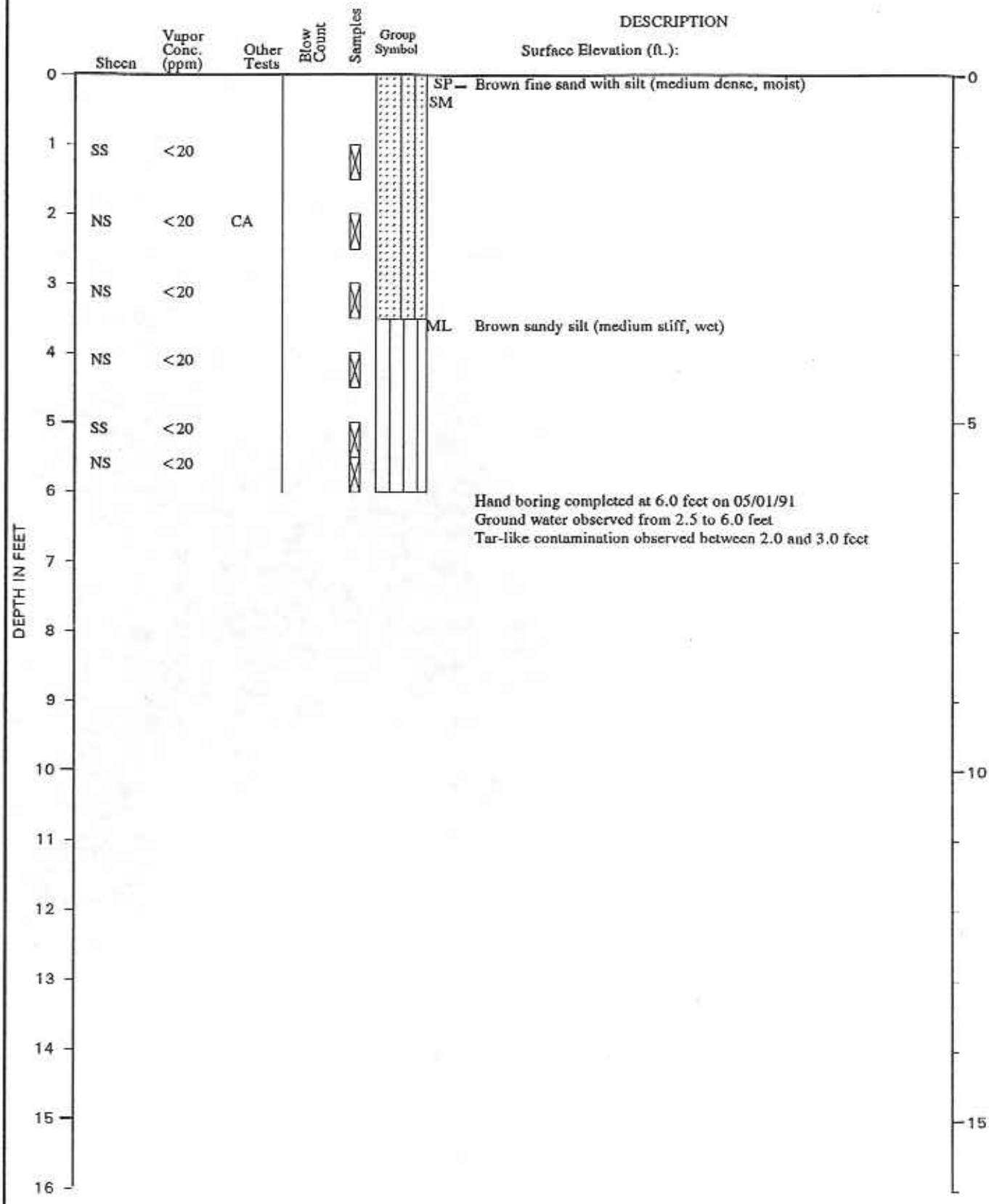
Geo Engineers

LOG OF HAND BORING

FIGURE A-7

TEST DATA

HAND BORING HA-18



Note: See Figure A-2 for explanation of symbols

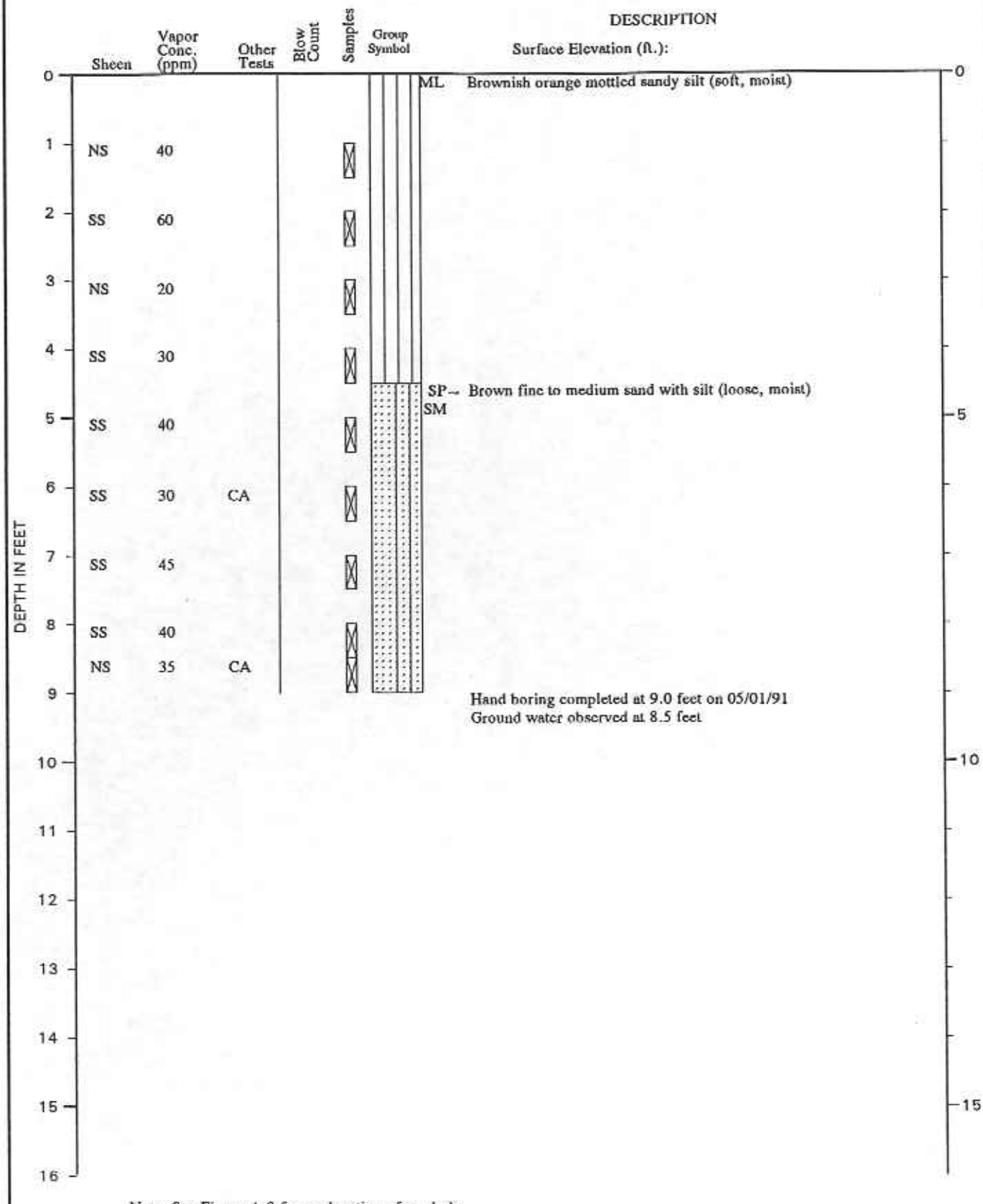
GeoEngineers

LOG OF HAND BORING

FIGURE A-8

TEST DATA

HAND BORING HA-19



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF HAND BORING

FIGURE A-9

TEST DATA

HAND BORING HA-20

Depth (ft.)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.):)
0						SP– SM	Brown fine to medium sand with silt (loose, moist)
1	SS	35	CA				
2	NS	45					
3	SS	30					
4	SS	20					
5	SS	30	CA				
6	NS	25					

Hand boring completed at 6.0 feet on 05/01/91
Ground water observed from 2.0 to 6.0 feet

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

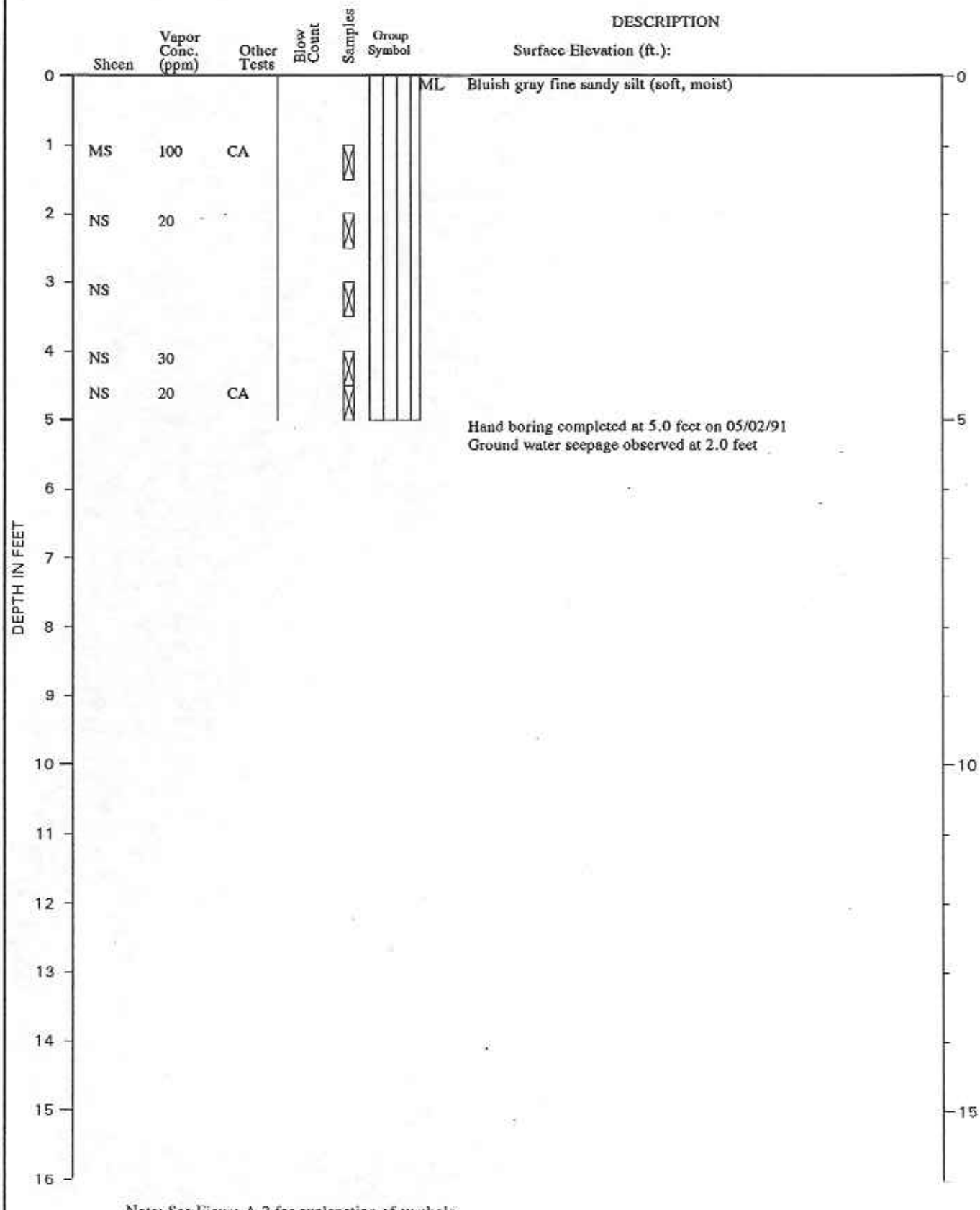
GeoEngineers

LOG OF HAND BORING

FIGURE A-10

TEST DATA

HAND BORING HA-21



Note: See Figure A-2 for explanation of symbols

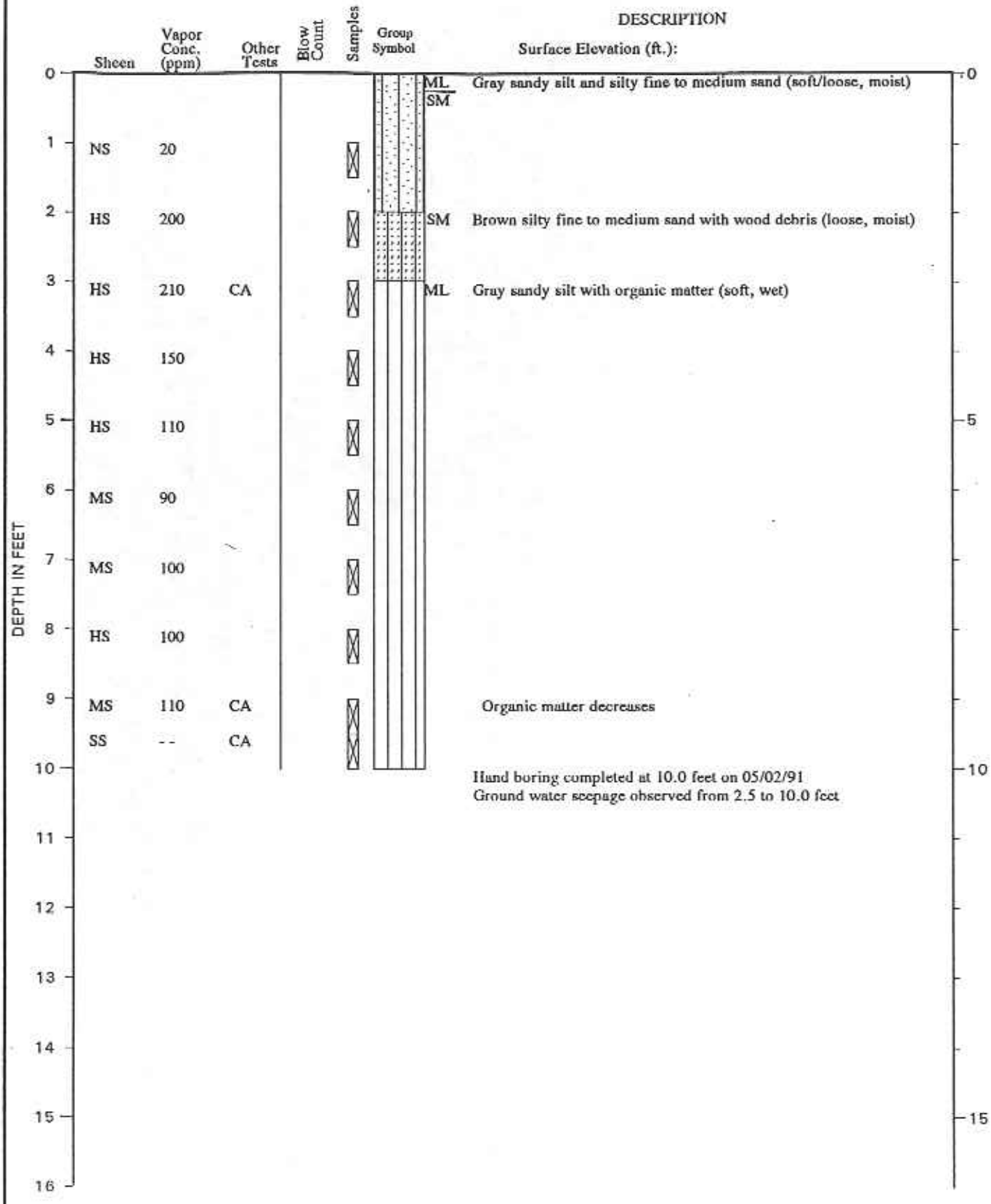
GeoEngineers

LOG OF HAND BORING

FIGURE A-11

TEST DATA

HAND BORING HA-22



Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF HAND BORING

FIGURE A-12

TEST DATA

HAND BORING HA-23

DEPTH IN FEET	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
							Surface Elevation (ft.):
0						ML	Brown silt with sand and organic matter (soft, moist)
1	MS	20	CA				
2	SS	20					
3	NS	20					
4	SS	10					
5	NS	10	CA				
6							Hand boring completed 5.5 feet on 05/03/91
7							Ground water not encountered
8							Contaminated water from leaking tank valve was entering hand boring
9							
10							
11							
12							
13							
14							
15							
16							

Note: See Figure A-2 for explanation of symbols

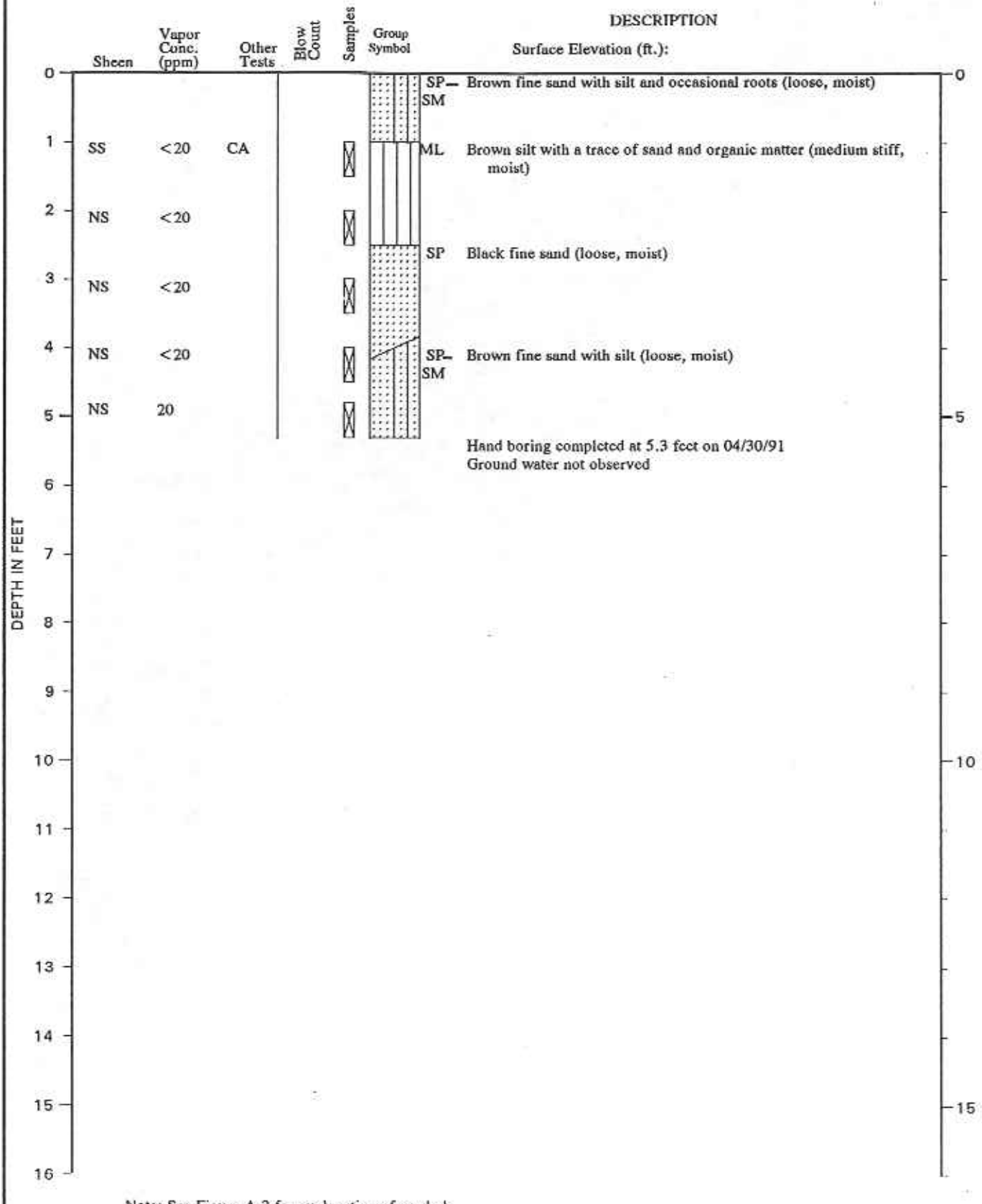
Geo Engineers

LOG OF HAND BORING

FIGURE A-13

TEST DATA

HAND BORING HA-24



Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF HAND BORING

FIGURE A-14

HAND BORING HA-25

TEST DATA: Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.):)
					SP-SM	Brown fine sand with silt and organic matter (loose, moist)
NS	<20					
SS	50	CA			SP	Brown fine sand with a trace of silt (loose, moist)
NS	40					
NS	40				SP-SM	Brown fine sand with silt and organic matter (loose, moist)
						Hand boring completed at 4.0 feet on 04/30/91 Ground water not observed

DEPTH IN FEET

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

0 5 10 15

Note: See Figure A-2 for explanation of symbols

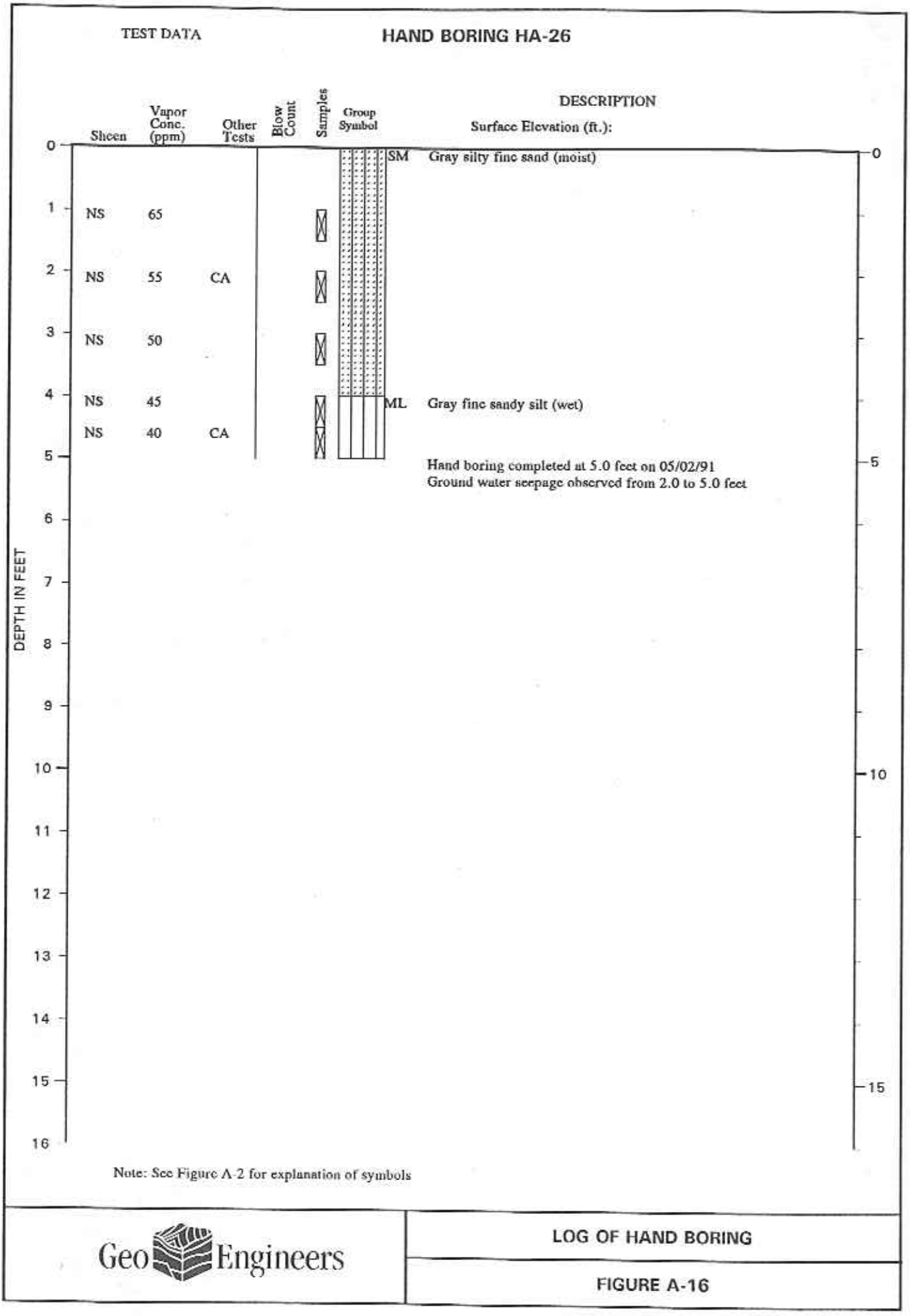
Geo Engineers

LOG OF HAND BORING

FIGURE A-15

:MDW:DEH:CMS 10/22/92

0161-269-R04 Tsk 1.3



Note: See Figure A-2 for explanation of symbols

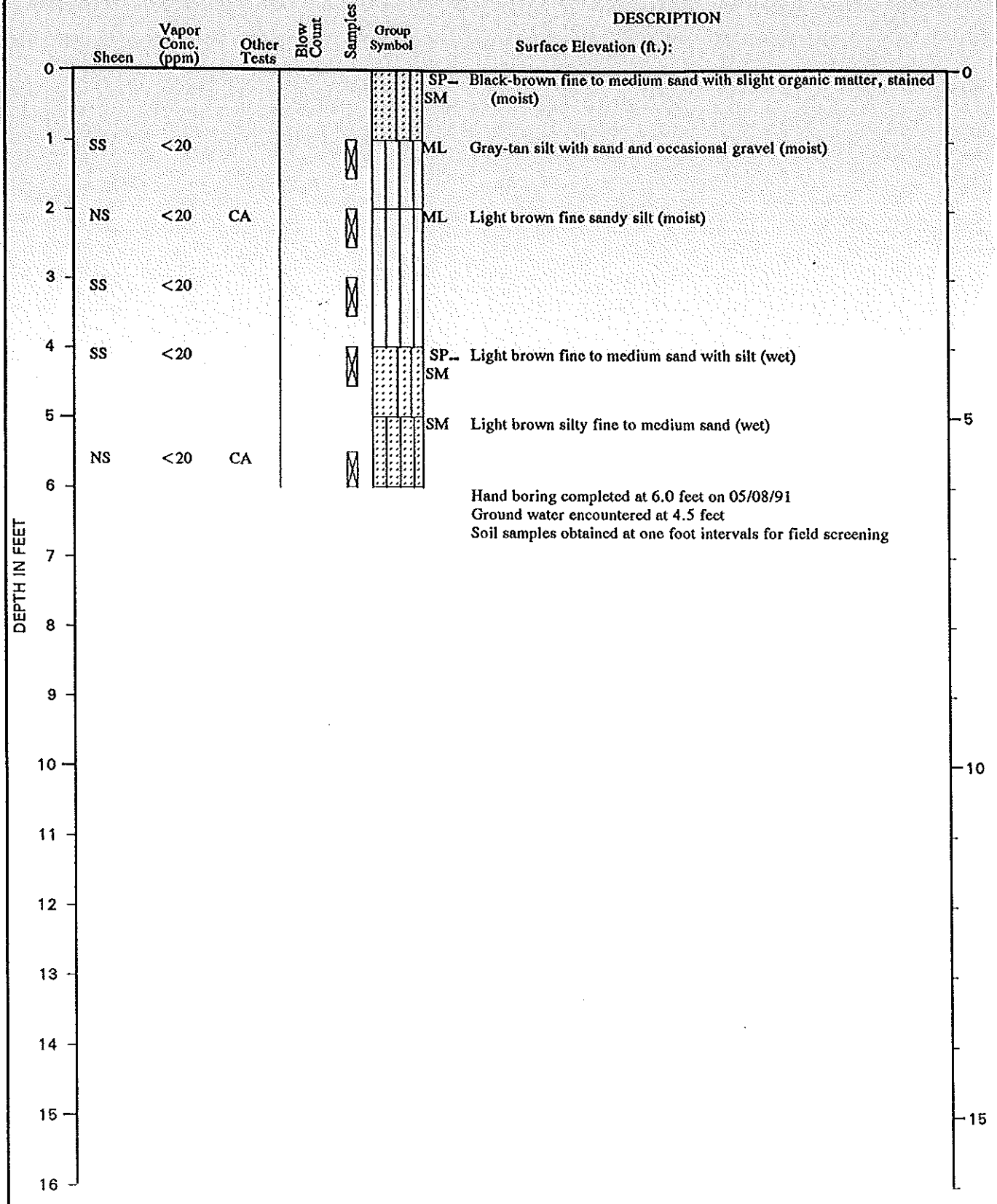
Geo Engineers

LOG OF HAND BORING

FIGURE A-16

TEST DATA

HAND BORING HA-27



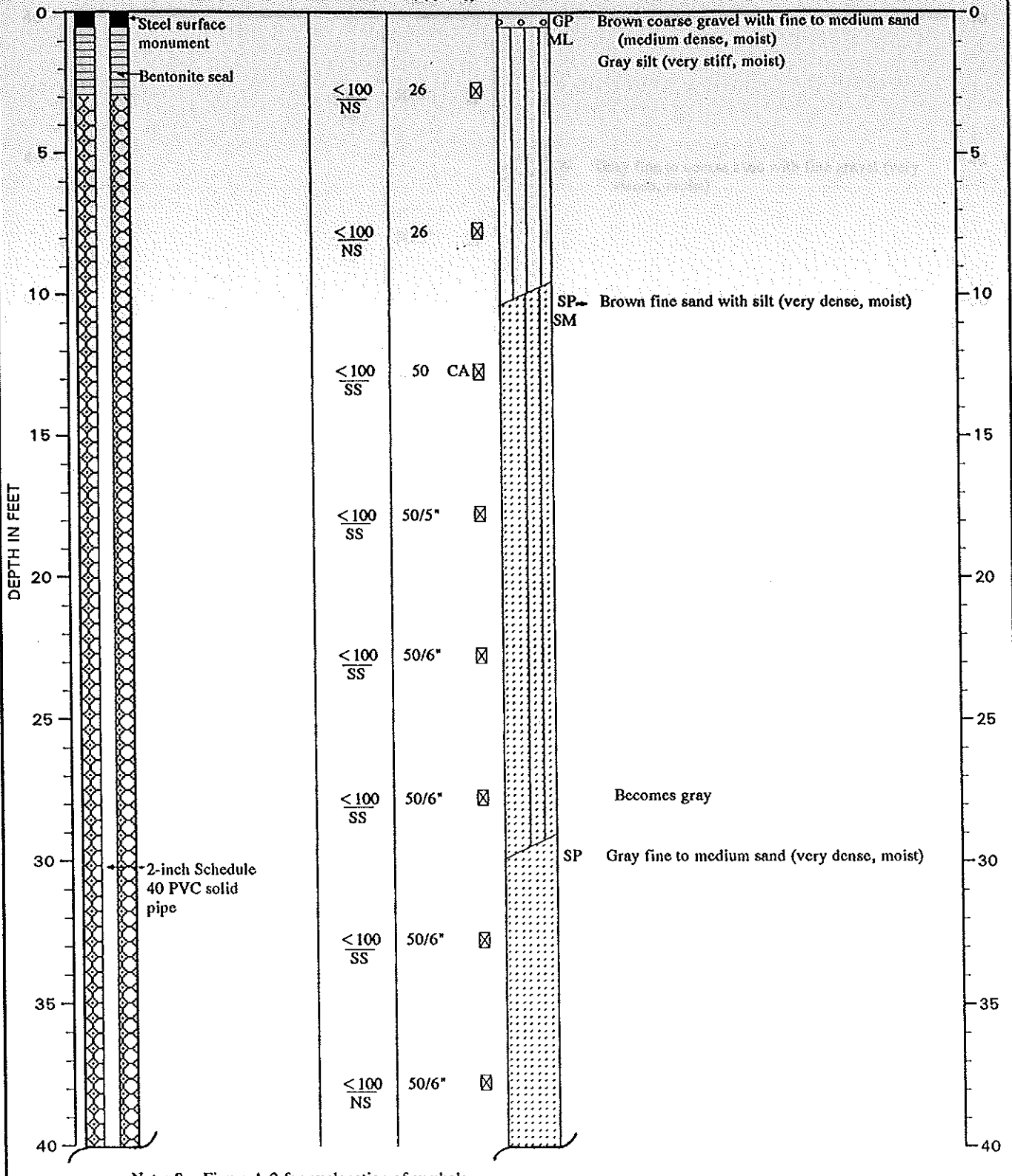
Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF HAND BORING

FIGURE A-17

MONITORING WELL NO. MW-7(U)



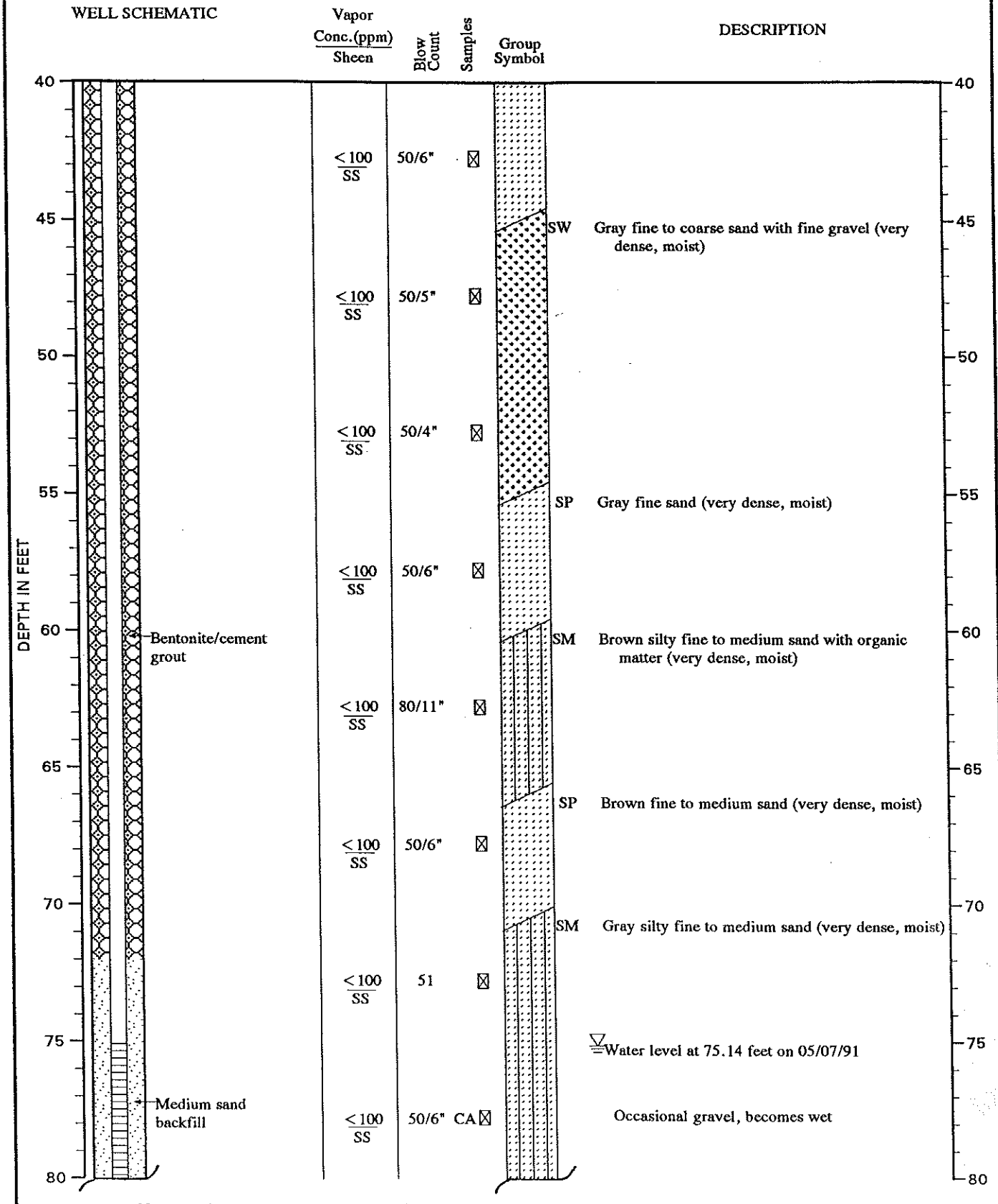
Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-18

MONITORING WELL NO. MW-7(U)
(Continued)



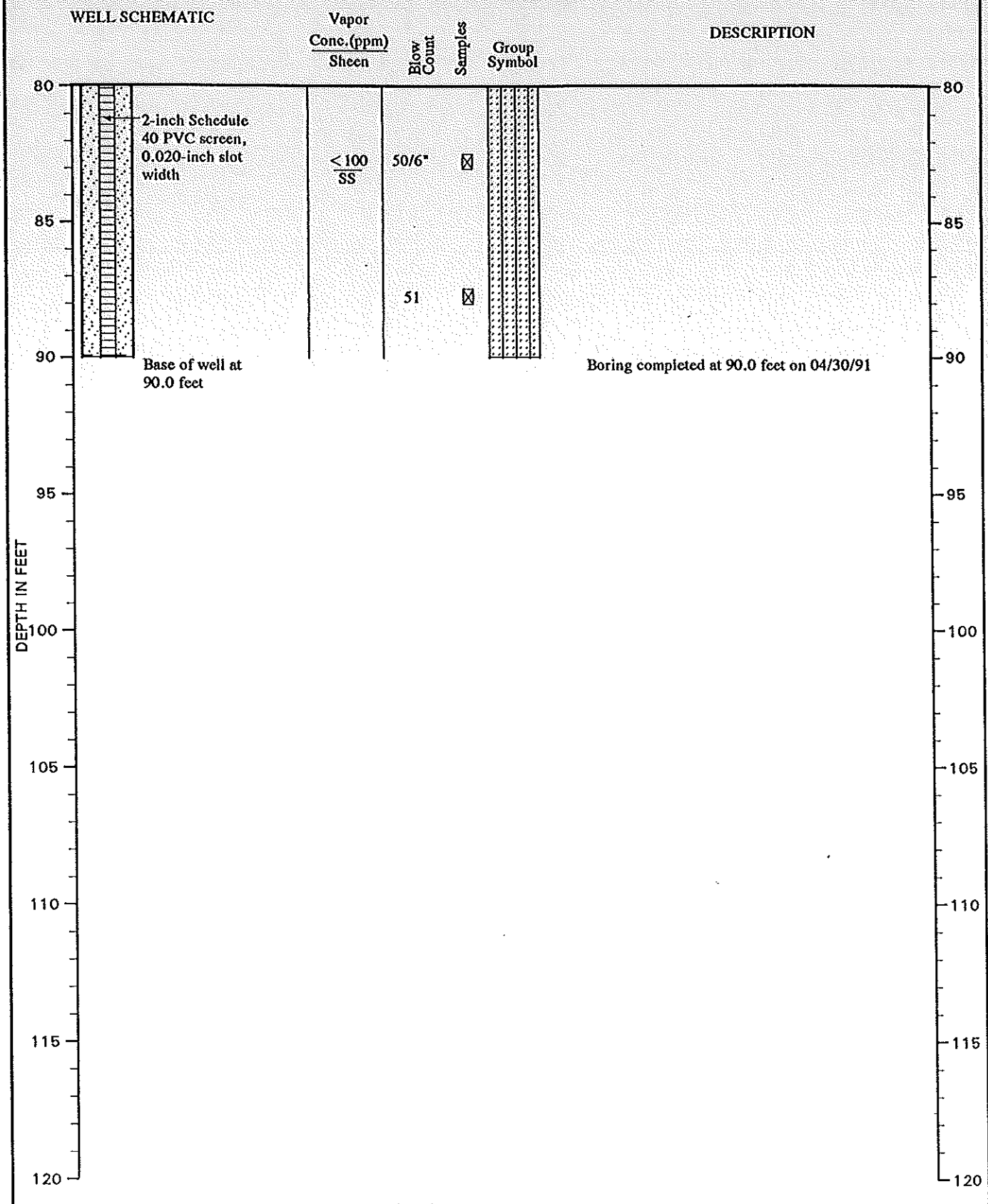
Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-18

MONITORING WELL NO. MW-7(U)
(Continued)



Note: See Figure A-2 for explanation of symbols

Geo Engineers

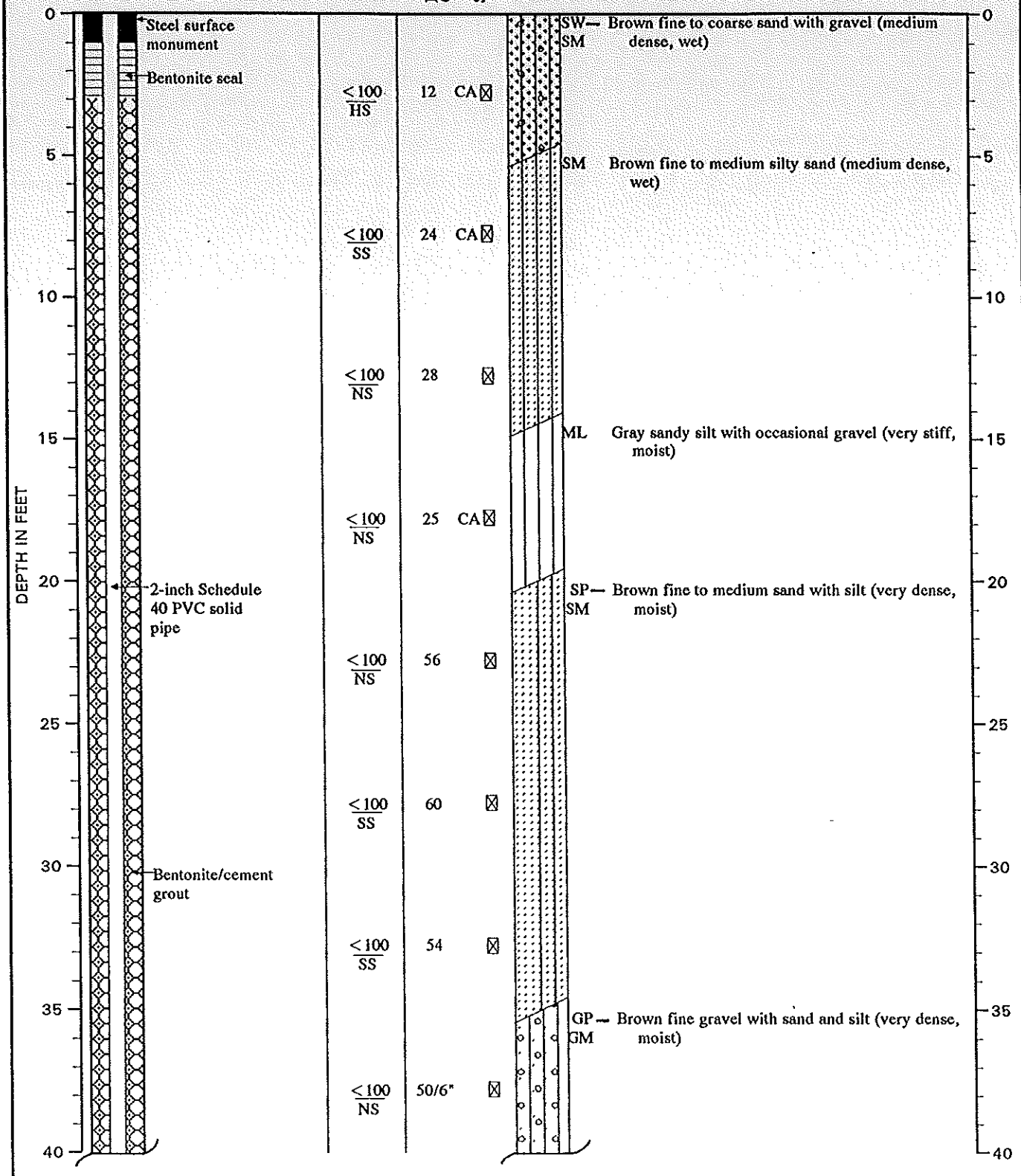
LOG OF MONITORING WELL

FIGURE A-18

MONITORING WELL NO. MW-9(U)

WELL SCHEMATIC

Casing Elevation (ft.): 99.29
Casing Stickup (ft.): -0.26



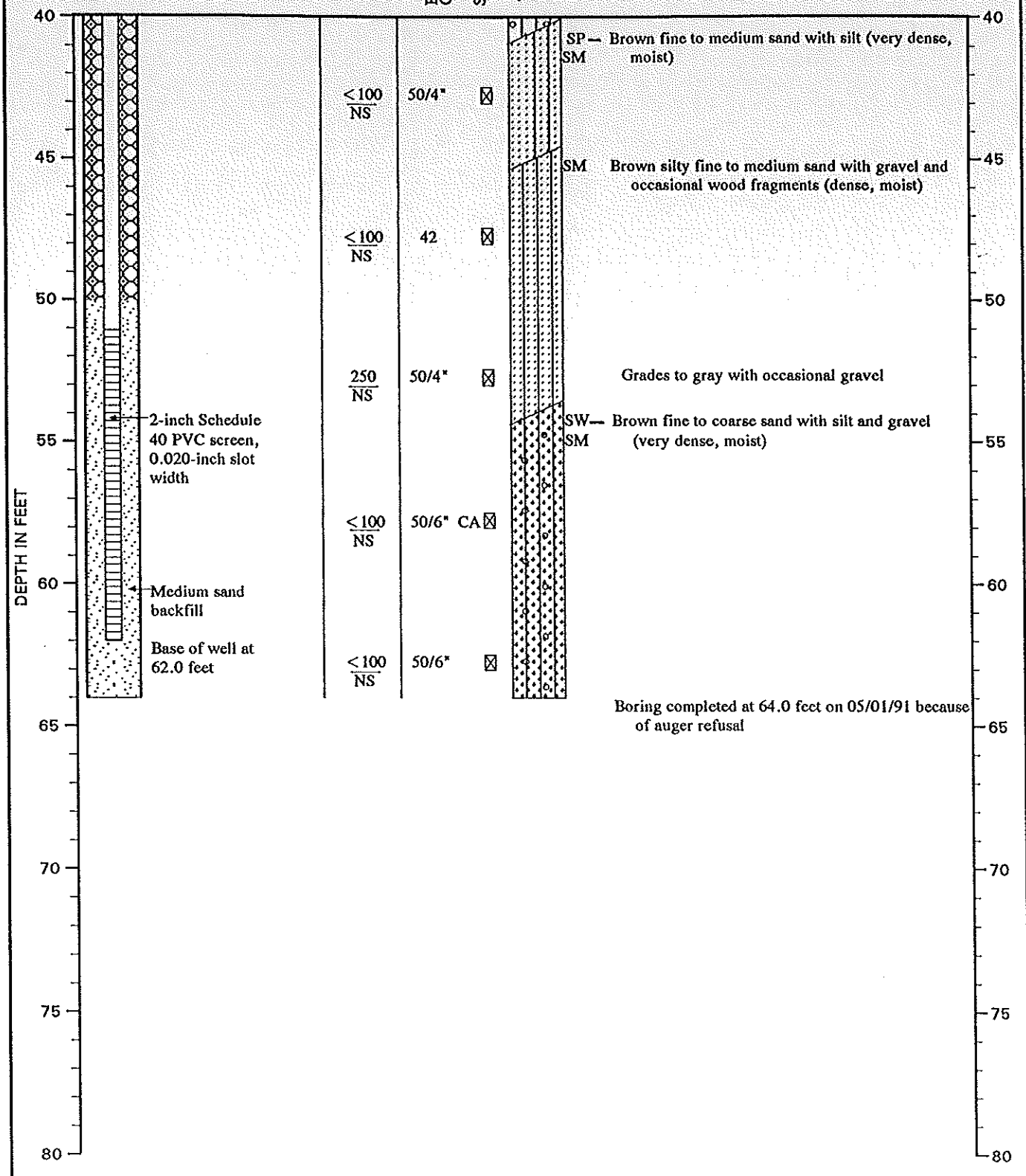
Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-19

MONITORING WELL NO. MW-9(U)
(Continued)



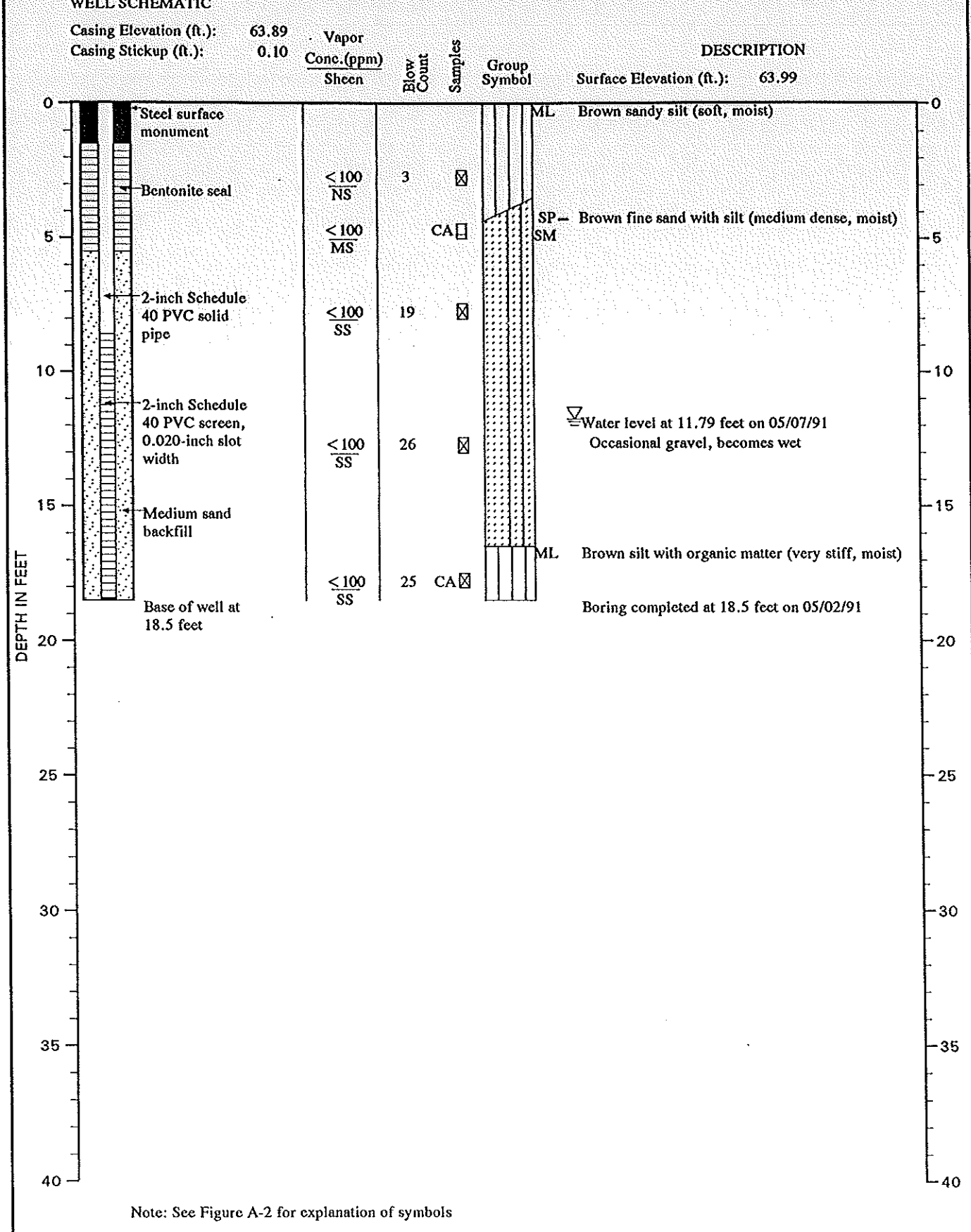
Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-19

MONITORING WELL NO. MW-10(U)



Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF MONITORING WELL

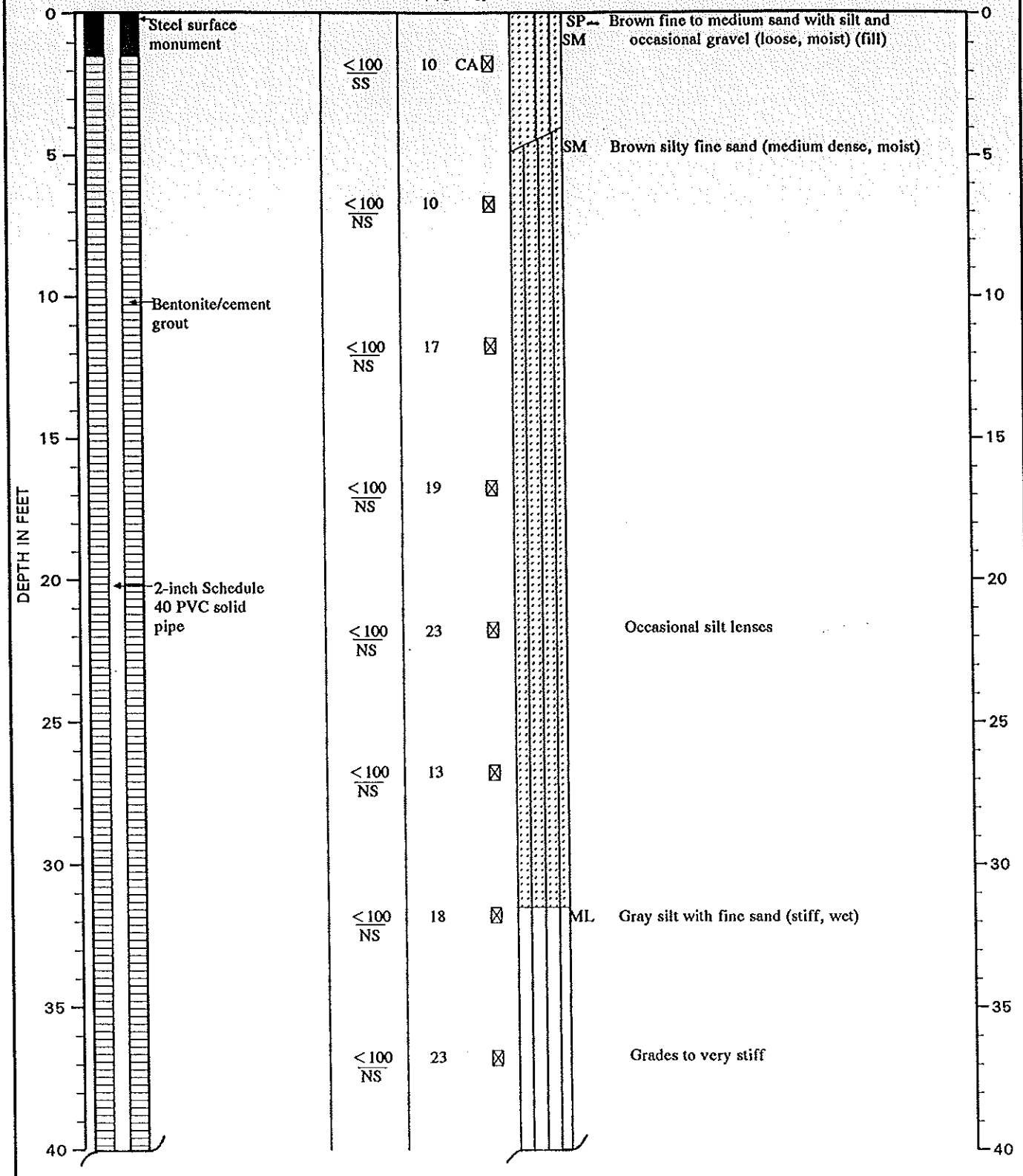
FIGURE A-20

MONITORING WELL NO. MW-11(U)

WELL SCHEMATIC

Casing Elevation (ft.): 106.53
Casing Stickup (ft.): 0.16

Surface Elevation (ft.): 106.69



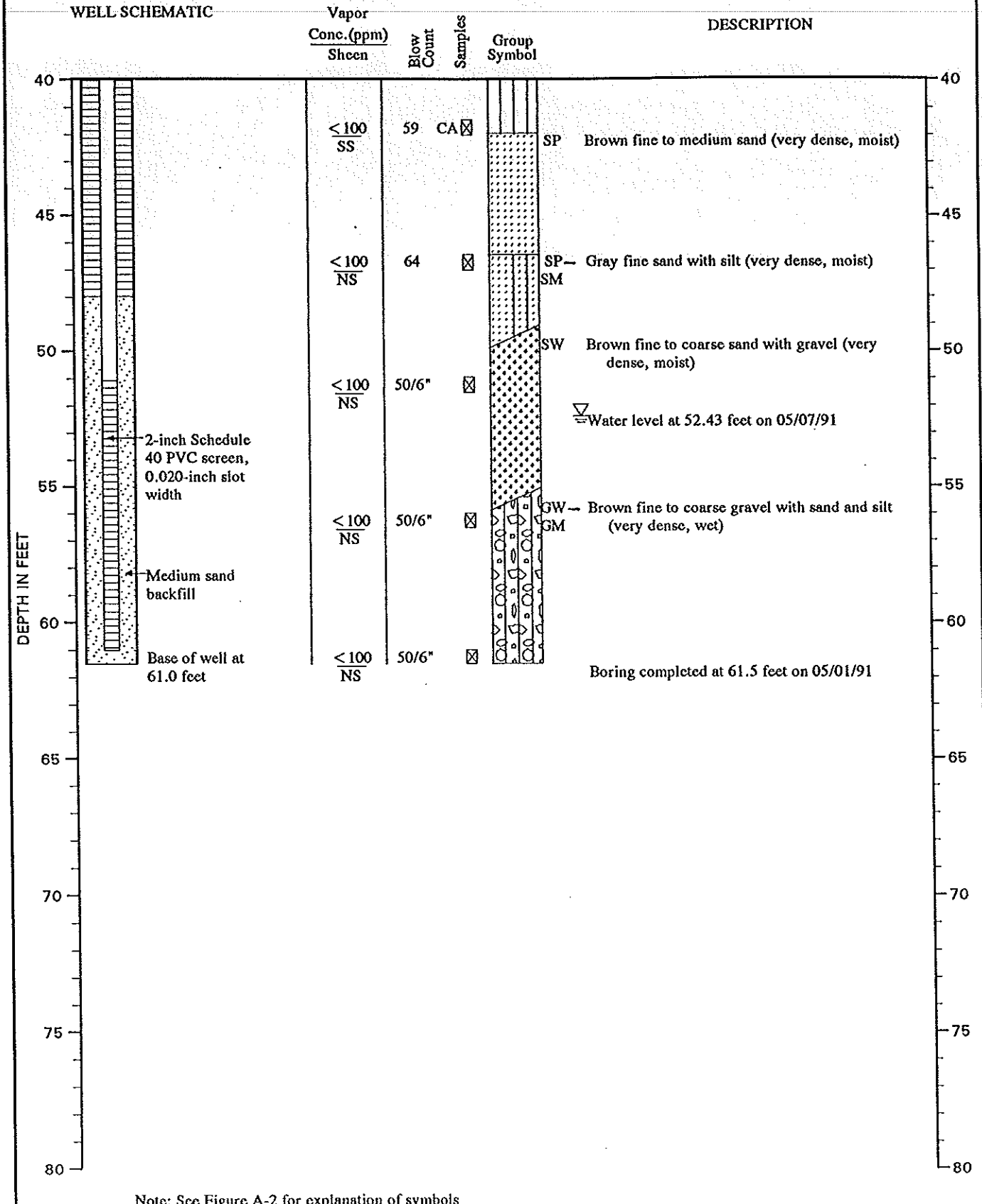
Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-21

MONITORING WELL NO. MW-11(U)
(Continued)



Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF MONITORING WELL

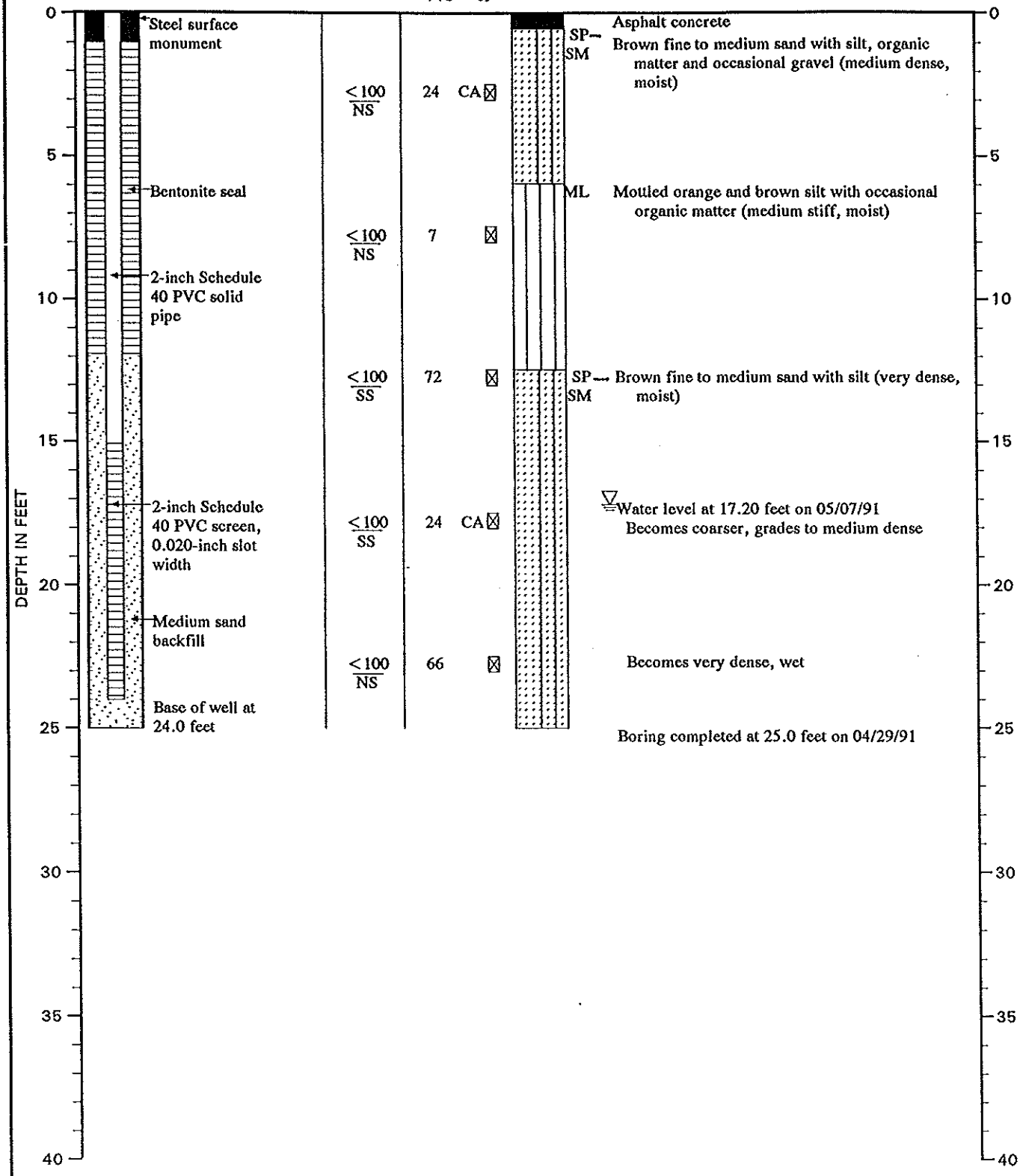
FIGURE A-21

MONITORING WELL NO. MW-13(U)

WELL SCHEMATIC

Casing Elevation (ft.): 52.19
Casing Stickup (ft.): -0.37

Surface Elevation (ft.): 52.56



Note: See Figure A-2 for explanation of symbols

Geo Engineers

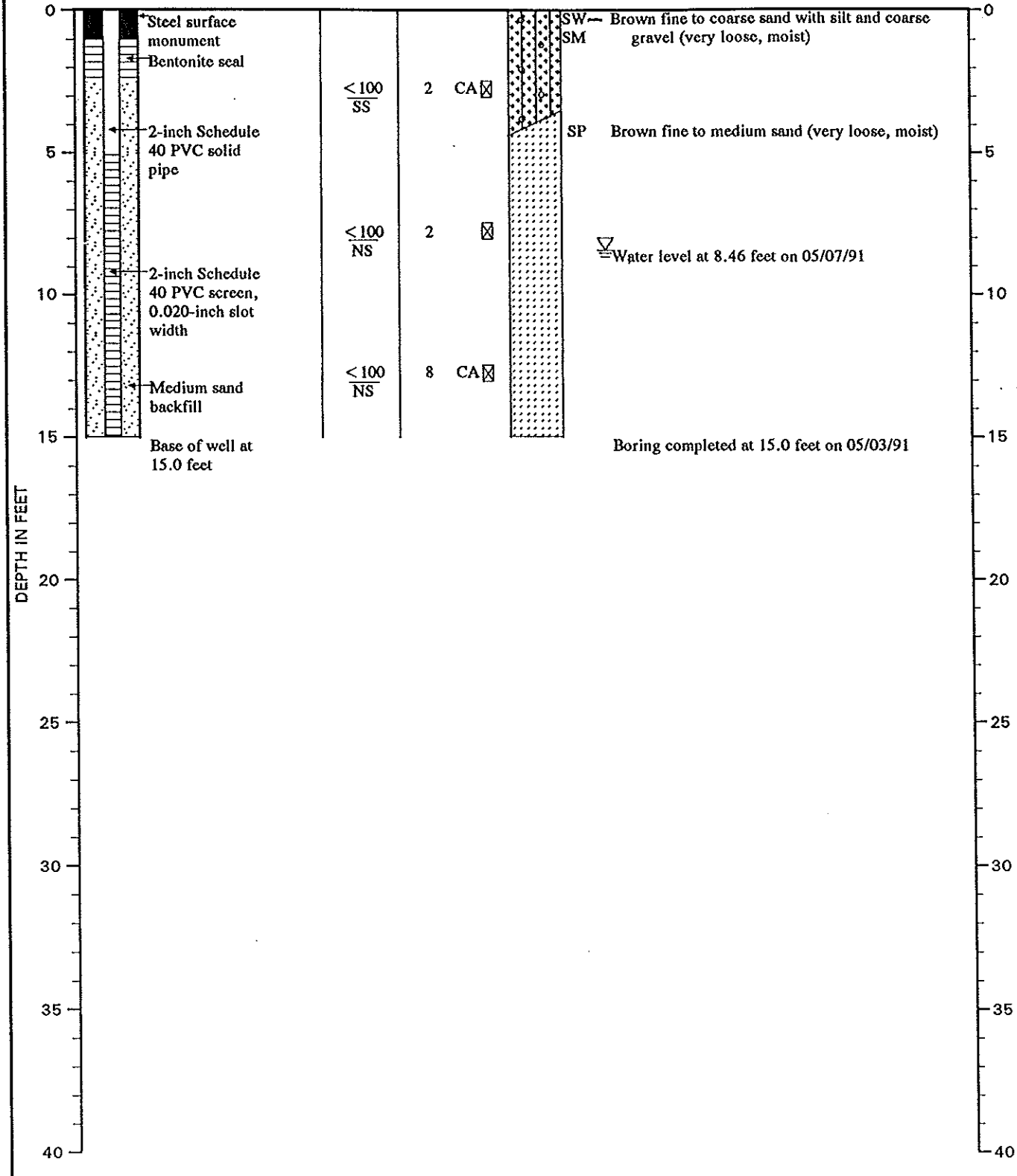
LOG OF MONITORING WELL

FIGURE A-22

MONITORING WELL NO. MW-27

WELL SCHEMATIC

Casing Elevation (ft.): 40.29
Casing Stickup (ft.): -0.17



Note: See Figure A-2 for explanation of symbols

GeoEngineers

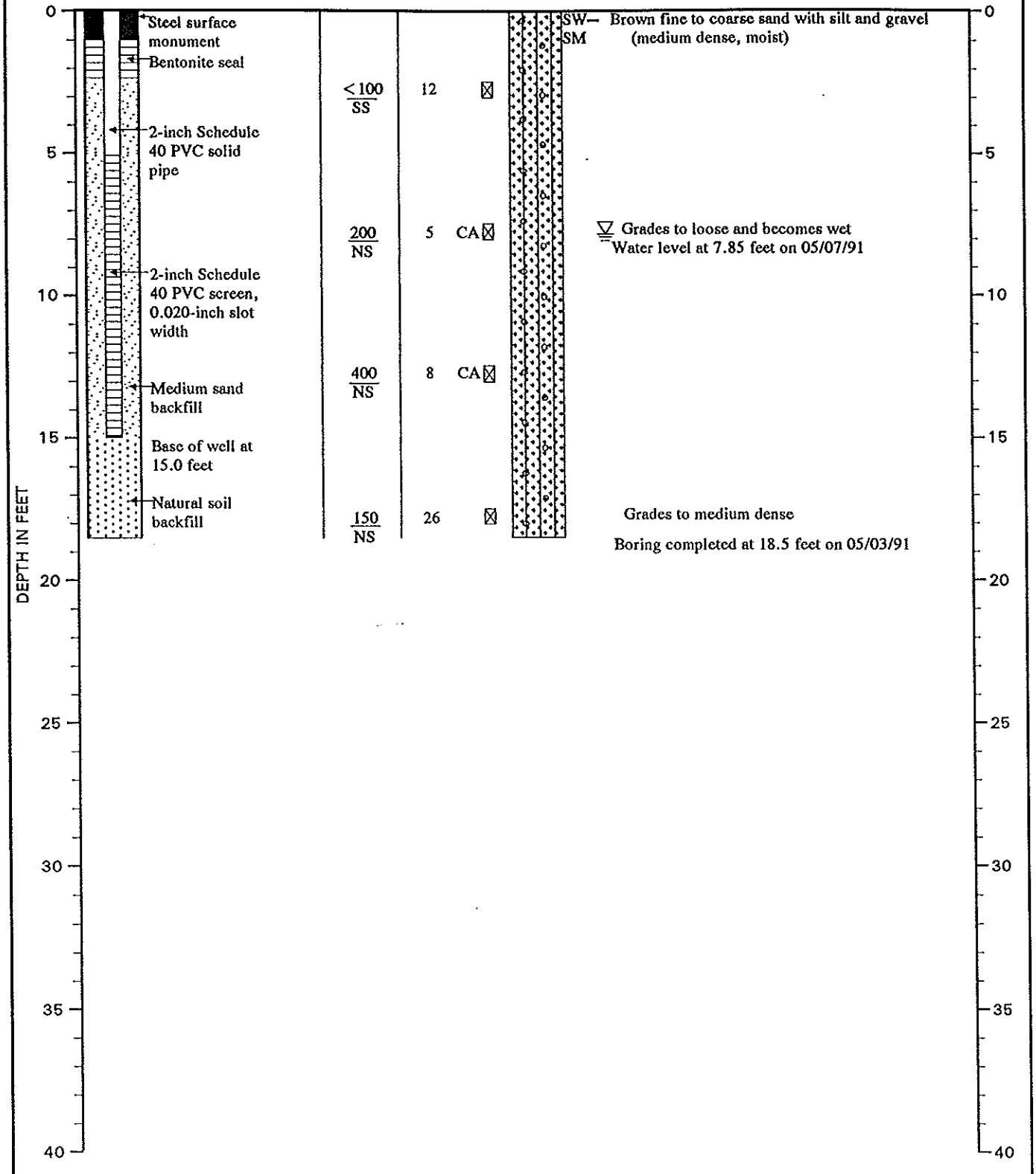
LOG OF MONITORING WELL

FIGURE A-23

MONITORING WELL NO. MW-28

WELL SCHEMATIC

Casing Elevation (ft.): 39.71
Casing Stickup (ft.): -0.19



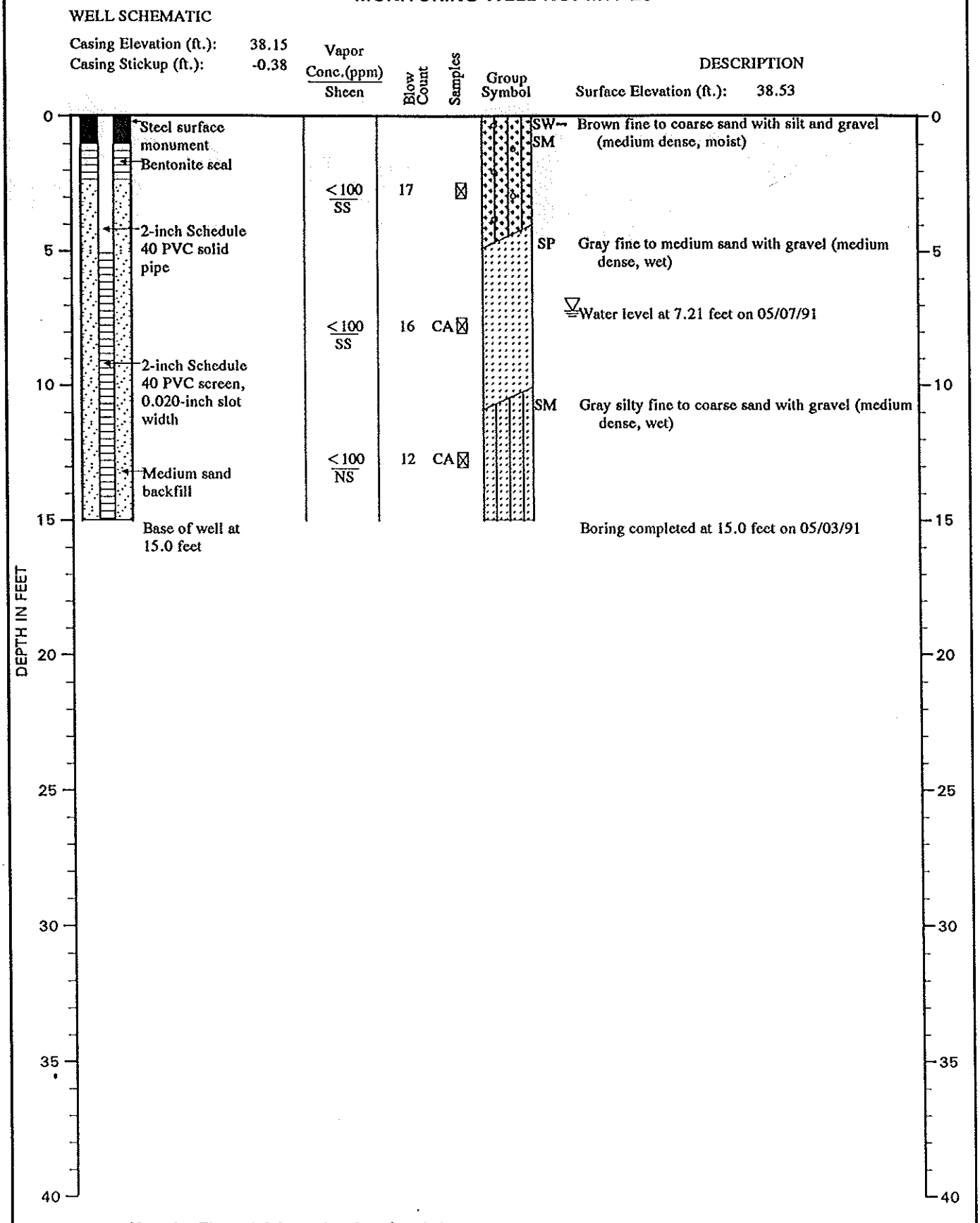
Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF MONITORING WELL

FIGURE A-24

MONITORING WELL NO. MW-29



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-25

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT 26
0.0 - 1.0	GP	Gray sandy gravel with a trace of silt (medium dense, moist)
1.0 - 4.5	ML	Tan silt with sand (stiff, moist)
4.5 - 6.4	ML	Gray silt with lenses of silty sand (stiff, moist)
		Test pit completed at 6.4 feet on 04/29/91
		No ground water seepage observed
		Disturbed soil sample obtained at 6.4 feet for chemical analysis; soil samples obtained at 1-foot intervals for field screening
		TEST PIT 27
0.0 - 2.0	OL	Blackish brown organic soil with sand (soft, wet)
2.0 - 3.0	ML	Gray silt with a trace of sand (medium stiff, moist)
3.0 - 6.0	SP-SM	Dark gray fine to medium sand with silt (medium dense, moist)
6.0 - 10.0	ML	Dark gray silt with a trace of sand (medium stiff, moist)
		Test pit completed at 10.0 feet on 04/29/91
		Ground water seepage observed at 1.5 feet
		Disturbed soil samples obtained at 7.0 and 10.0 feet for chemical analysis; soil samples obtained at 2-foot intervals for field screening.

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT 28
0.0 - 1.5	GP	Brown fine gravel with sand (medium dense, wet)
1.5 - 7.0	SP-SM	Gray fine sand with lenses of gray silt (medium dense, moist)
7.0 - 8.5	SP-SM	Gray fine sand with lenses of gray silt (medium dense, moist)
		Test pit completed at 8.5 feet on 04/29/91
		Ground water seepage observed at 1.5 feet
		Disturbed soil sample obtained at 1.0 foot for chemical analysis; soil samples obtained at variable intervals for field screening
		TEST PIT 29
0.0 - 0.5	SP	Brown sand with gravel and a trace of silt (medium dense, moist)
0.5 - 3.0	SP-SM	Brown fine sand with silt and occasional gravel (medium dense, moist)
3.0 - 9.0	ML	Gray silt with a trace of sand (stiff, moist)
		Test pit completed at 9.0 feet on 04/29/91
		No ground water seepage observed
		Disturbed soil sample obtained at 1.0 foot for chemical analysis; soil samples obtained at variable intervals for field screening

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

APPENDIX B

APPENDIX B

CHEMICAL ANALYTICAL PROGRAM

TEST METHODS

Forty-nine soil samples and 10 ground water samples were analyzed by ATI (Analytical Technologies, Inc) of Renton, Washington. Gas chromatography was used to quantify specific aromatic hydrocarbons (BETX) in the soil and ground water samples using EPA Method 8020. Gas chromatography methods were also used to quantify fuel hydrocarbons (gasoline and diesel) in the soil samples by modified EPA Method 8015. Soil from HA-25 was analyzed for purgeable halocarbons by EPA Method 8010 and for polychlorinated biphenyls by EPA Method 8080. Ground water and soil samples selected for TPH analysis were analyzed using infrared spectroscopy by EPA Method 418.1.

The analytical data are presented in Tables 1 and 2. Chain-of-custody reports and laboratory data reports are presented in Appendix B.

ANALYTICAL DATA REVIEW

ATI maintains an internal quality assurance program as documented in their laboratory quality assurance manual. ATI uses a combination of blanks, surrogate percent recovery, matrix spike recovery and duplicate recovery to evaluate the validity of analytical results. Listed below are the project data quality goals for analytes found during this study.

Analyte	% Recovery Valid Range		Relative % Difference Acceptable Upper Limit	
	Water	Soil	Water	Soil
Fuel Hydrocarbons	75-106	51-114	20	11
Total Petroleum Hydrocarbons	41-110	82-130	20	39
BETX	67-128	52-128	20	20

Analytical results were reviewed for conformance with the data quality goals and for other quality deficiencies. Following is a list of the exceptions.

Analyte	Data Quality Problem	Evaluation
Polychlorinated Biphenyls	Analyzed after the 14-day holding time	Sample was in cold storage and extracted within 18 days. Detection limits should be considered as estimated.
BETX MW-9(U)-1 HA-23, 1.0'	Surrogate out of limits	Problem due to high concentrations of petroleum hydrocarbons in the samples. Results are valid.
Total Petroleum Hydrocarbons MW-9(U)-1 TP-26, 6.4' TP-27, 7.0' TP-28, 1.0' TP-29, 1.0' HA-16, 2.0' HA-16, 5.5' HA-24, 1.0' HA-25, 2.0' HA-22, 3.0' MW-10(U)-1B	Matrix spike recovery out of limits	Matrix spike not calculated because of high concentrations of petroleum hydrocarbons. Blank spike results were acceptable. Results are valid for their intended purpose.
Fuel Hydrocarbons MW-10(U)* MW-11(U) MW-27 MW-28 MW-29	Relative % difference was 32% instead of 20%	All results were reported as < 1ppm. Small increase in reported value would not affect data interpretation.

*Reported as MW-10W(U)

SUMMARY

Some data quality problems were encountered in analyzing the samples for this project. The sample results were used in a semiquantitative manner to evaluate the horizontal and vertical extent of contamination, not to determine if cleanup levels were achieved. Based on our review of the data and their intended use, it is our opinion that the analytical data are of acceptable quality for use in this report.

Analytical Technologies, Inc. 560 Noches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9105-009

May 30, 1991

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Attention : Dan Crevensten

Project Number : 161-288-B04 289

Project Name : Unocal Edmonds Terminal

On May 1, 1991, Analytical Technologies, Inc., received 16 soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Senior Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/tc

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9105-009-1	MW-7(U)-3	04/29/91	SOIL
9105-009-2	MW-7(U)-16	04/29/91	SOIL
9105-009-3	MW-9(U)-1	04/30/91	SOIL
9105-009-4	MW-9(U)-2	04/30/91	SOIL
9105-009-5	MW-13(U)-1	04/29/91	SOIL
9105-009-6	MW-13(U)-4	04/29/91	SOIL
9105-009-7	HA-15-3	04/29/91	SOIL
9105-009-8	TP-26, 6.4	04/29/91	SOIL
9105-009-9	TP-27, 7.0	04/29/91	SOIL
9105-009-10	TP-27, 10.0	04/29/91	SOIL
9105-009-11	TP-28, 1.0	04/29/91	SOIL
9105-009-12	TP-29, 1.0	04/29/91	SOIL
9105-009-13	HA-16, 2.0	04/30/91	SOIL
9105-009-14	HA-16, 5.5	04/30/91	SOIL
9105-009-15	HA-24, 1.0	04/30/91	SOIL
9105-009-16	HA-25, 2.0	04/30/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	16

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL

ANALYSIS	TECHNIQUE	REFERENCE	LAB
PURGEABLE HALOCARBONS	GC/ELCD	EPA 8010	R
BETX	GC/PID	EPA 8020	R
POLYCHLORINATED BIPHENYLS (PCBs)	GC/ECD	EPA 8080	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
LEAD	AA/F	EPA 7420	R
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-288-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/15/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8010	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BROMODICHLOROMETHANE	<0.010
BROMOFORM	<0.010
BROMOMETHANE	<0.050
CARBON TETRACHLORIDE	<0.010
CHLOROBENZENE	<0.025
CHLOROETHANE	<0.050
CHLOROFORM	<0.010
CHLOROMETHANE	<0.10
DIBROMOCHLOROMETHANE	<0.010
1,1-DICHLOROETHANE	<0.010
1,2-DICHLOROETHANE	<0.010
1,1-DICHLOROETHENE	<0.010
CIS-1,2-DICHLOROETHENE	<0.010
TRANS-1,2-DICHLOROETHENE	<0.010
1,2-DICHLOROPROPANE	<0.010
CIS-1,3-DICHLOROPROPENE	<0.010
TRANS-1,3-DICHLOROPROPENE	<0.010
METHYLENE CHLORIDE	<0.10
1,1,2,2-TETRACHLOROETHANE	<0.010
TETRACHLOROETHENE	<0.010
1,1,1-TRICHLOROETHANE	<0.010
1,1,2-TRICHLOROETHANE	<0.010
TRICHLOROETHENE (TCE)	<0.010
TRICHLOROFLUOROMETHANE	<0.025
VINYL CHLORIDE	<0.050
SURROGATE PERCENT RECOVERY	
BROMOCHLOROMETHANE	103

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: HA-25, 2.0	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8010	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BROMODICHLOROMETHANE	<0.010
BROMOFORM	<0.010
BROMOMETHANE	<0.050
CARBON TETRACHLORIDE	<0.010
CHLOROBENZENE	<0.025
CHLOROETHANE	<0.050
CHLOROFORM	<0.010
CHLOROMETHANE	<0.10
DIBROMOCHLOROMETHANE	<0.010
1,1-DICHLOROETHANE	<0.010
1,2-DICHLOROETHANE	<0.010
1,1-DICHLOROETHENE	<0.010
CIS-1,2-DICHLOROETHENE	<0.010
TRANS-1,2-DICHLOROETHENE	<0.010
1,2-DICHLOROPROPANE	<0.010
CIS-1,3-DICHLOROPROPENE	<0.010
TRANS-1,3-DICHLOROPROPENE	<0.010
METHYLENE CHLORIDE	0.22
1,1,2,2-TETRACHLOROETHANE	<0.010
TETRACHLOROETHENE	<0.010
1,1,1-TRICHLOROETHANE	<0.010
1,1,2-TRICHLOROETHANE	<0.010
TRICHLOROETHENE (TCE)	<0.010
TRICHLOROFLUOROMETHANE	<0.025
VINYL CHLORIDE	<0.050
SURROGATE PERCENT RECOVERY	
BROMOCHLOROMETHANE	82

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: 9105-090-25
PROJECT #	: 161-288-B04	DATE EXTRACTED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE ANALYZED	: 05/10/91
EPA METHOD	: 8010	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
CHLOROBENZENE	<0.025	0.40	0.414	104	0.410	102	1
1,1-DICHLOROETHENE	<0.010	0.40	0.304	76	0.314	78	3
TETRACHLOROETHENE	<0.010	0.40	0.396	99	0.390	98	2
TRICHLOROETHENE	<0.010	0.40	0.341	85	0.338	84	1

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-288-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/18/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/20/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
PCB 1016	<0.033
PCB 1221	<0.033
PCB 1232	<0.033
PCB 1242	<0.033
PCB 1248	<0.033
PCB 1254	<0.033
PCB 1260	<0.033

SURROGATE PERCENT RECOVERY

DECACHLOROBIPHENYL	115
DIBUTYLCHLORENDATE	54

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/18/91*
CLIENT I.D.	: HA-25, 2.0	DATE ANALYZED	: 05/20/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
PCB 1016	<0.033
PCB 1221	<0.033
PCB 1232	<0.033
PCB 1242	<0.033
PCB 1248	<0.033
PCB 1254	<0.033
PCB 1260	<0.033

SURROGATE PERCENT RECOVERY

DECACHLOROBIPHENYL	112
DIBUTYLCHLORENDATE	23 **

* Please note that the sample was extracted past the recommended 14 day hold time.

** Out of limits due to acid cleanup.

POLYCHLORINATED BIPHENYLS (PCB)
QUALITY CONTROL

CLIENT	: GEOENGINEERS, INC.	SAMPLE ID	: BLANK SPIKE
PROJECT #	: 161-288-B04	DATE EXTRACTED	: 05/18/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE ANALYZED	: 05/20/91
EPA METHOD	: 8080 (PCB)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
PCB 1260	<0.033	0.33	0.347	105	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-288-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	83

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-7(U)-3	DATE ANALYZED	: 05/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	80

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-7(U)-16	DATE ANALYZED	: 05/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	81

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-9(U)-1	DATE ANALYZED	: 05/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	0.44
TOLUENE	0.085
TOTAL XYLENES	3.3

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	*

* Out of limits due to matrix interference.

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-9(U)-2	DATE ANALYZED	: 05/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	99

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-13(U)-1	DATE ANALYZED	: 05/02/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	86

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: 9105-009-7
PROJECT #	: 161-288-B04	DATE EXTRACTED	: 05/02/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE ANALYZED	: 05/02/91
EPA METHOD	: 8020 (BETX)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
BENZENE	<0.025	1.00	0.818	82	0.853	85	4
TOLUENE	<0.025	1.00	0.847	85	0.893	89	5
TOTAL XYLENES	<0.025	2.00	1.72	86	1.81	90	5

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-288-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/03/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-7(U)-3	DATE ANALYZED	: 05/03/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-7(U)-16	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-9(U)-1	DATE ANALYZED	: 05/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 100

COMPOUND	RESULT
FUEL HYDROCARBONS	2,700 *
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	19,000
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

* Sample chromatogram indicates a diesel-like contamination.

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-9(U)-2	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-13(U)-1	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: MW-13(U)-4	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: HA-15-3	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: TP-26, 6.4	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: TP-27, 7.0	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: TP-27, 10.0	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: TP-28, 1.0	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/29/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: TP-29, 1.0	DATE ANALYZED	: 05/04/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: HA-16, 2.0	DATE ANALYZED	: 05/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 20

COMPOUND	RESULT
FUEL HYDROCARBONS	1,500 *
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	9,300
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

* Sample chromatogram indicates a diesel-like contamination.

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: HA-16, 5.5	DATE ANALYZED	: 05/05/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 10

COMPOUND	RESULT
FUEL HYDROCARBONS	390 *
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	1,800
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

* Sample chromatogram indicates a diesel-like contamination.

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: HA-24, 1.0	DATE ANALYZED	: 05/03/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	14
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	160 *
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

* Sample chromatogram indicates a petroleum hydrocarbon-like contamination heavier than diesel.

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-288-B04	DATE RECEIVED	: 05/01/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE EXTRACTED	: 05/02/91
CLIENT I.D.	: HA-25, 2.0	DATE ANALYZED	: 05/07/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 2

COMPOUND	RESULT
FUEL HYDROCARBONS	<10
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	1,200 *
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

* Sample chromatogram indicates a petroleum hydrocarbon-like contamination heavier than diesel.

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: 9105-009-15
PROJECT #	: 161-288-B04	DATE EXTRACTED	: 05/02/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE ANALYZED	: 05/03/91
EPA METHOD	: 8015 MODIFIED	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
FUEL HYDROCARBONS (GASOLINE)	8.0	500	441	87	457	90	4

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: BLANK SPIKE
PROJECT #	: 161-288-B04	DATE EXTRACTED	: 05/02/91
PROJECT NAME	: UNOCAL EDMONDS TERMINAL	DATE ANALYZED	: 05/03/91
EPA METHOD	: 8015 MODIFIED	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
FUEL HYDROCARBONS (GASOLINE)	<5	500	465	93	461	92	1

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL
SAMPLE MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
LEAD (SAMPLE #16)	05/10/91	05/14/91
LEAD (SAMPLE #12)	05/13/91	05/14/91

METALS RESULTS

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9105-009-12	TP-29, 1.0	<10
9105-009-16	HA-25, 2.0	<10
REAGENT BLANK	(05/10/91)	<10
REAGENT BLANK	(05/13/91)	<10

METALS QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
LEAD	9105-123-1	1,250	1,480	17	**	**	**
LEAD	BLANK SPIKE	N/A	N/A	N/A	210	250	84
LEAD	9105-103-1	<10	<10	NC	280	270	104

NC = Not calculable.

** Due to the necessary dilution of the sample, result was not attainable.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

GENERAL CHEMISTRY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL
SAMPLE MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
PETROLEUM HYDROCARBONS	05/07/91	05/07/91
MOISTURE (SAMPLE #1-7)	-	05/06/91
MOISTURE (SAMPLE #12)	-	05/07/91
MOISTURE (SAMPLE #16)	-	05/13/91

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9105-009-3	MW-9(U)-1	30,000
9105-009-8	TP-26, 6.4	11
9105-009-9	TP-27, 7.0	46
9105-009-10	TP-27, 10.0	53
9105-009-11	TP-28, 1.0	420
9105-009-12	TP-29, 1.0	11
9105-009-13	HA-16, 2.0	460
9105-009-14	HA-16, 5.5	21,000
9105-009-15	HA-24, 1.0	3,100
9105-009-16	HA-25, 2.0	11,000
REAGENT BLANK	-	<5

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9105-009-1	MW-7(U)-3	3.4
9105-009-2	MW-7(U)-16	14
9105-009-3	MW-9(U)-1	17
9105-009-4	MW-9(U)-2	6.1
9105-009-5	MW-13(U)-1	15
9105-009-6	MW-13(U)-4	14
9105-009-7	HA-15-3	26
9105-009-12	TP-29, 1.0	11
9105-009-16	HA-25, 2.0	13

GENERAL CHEMISTRY QUALITY CONTROL

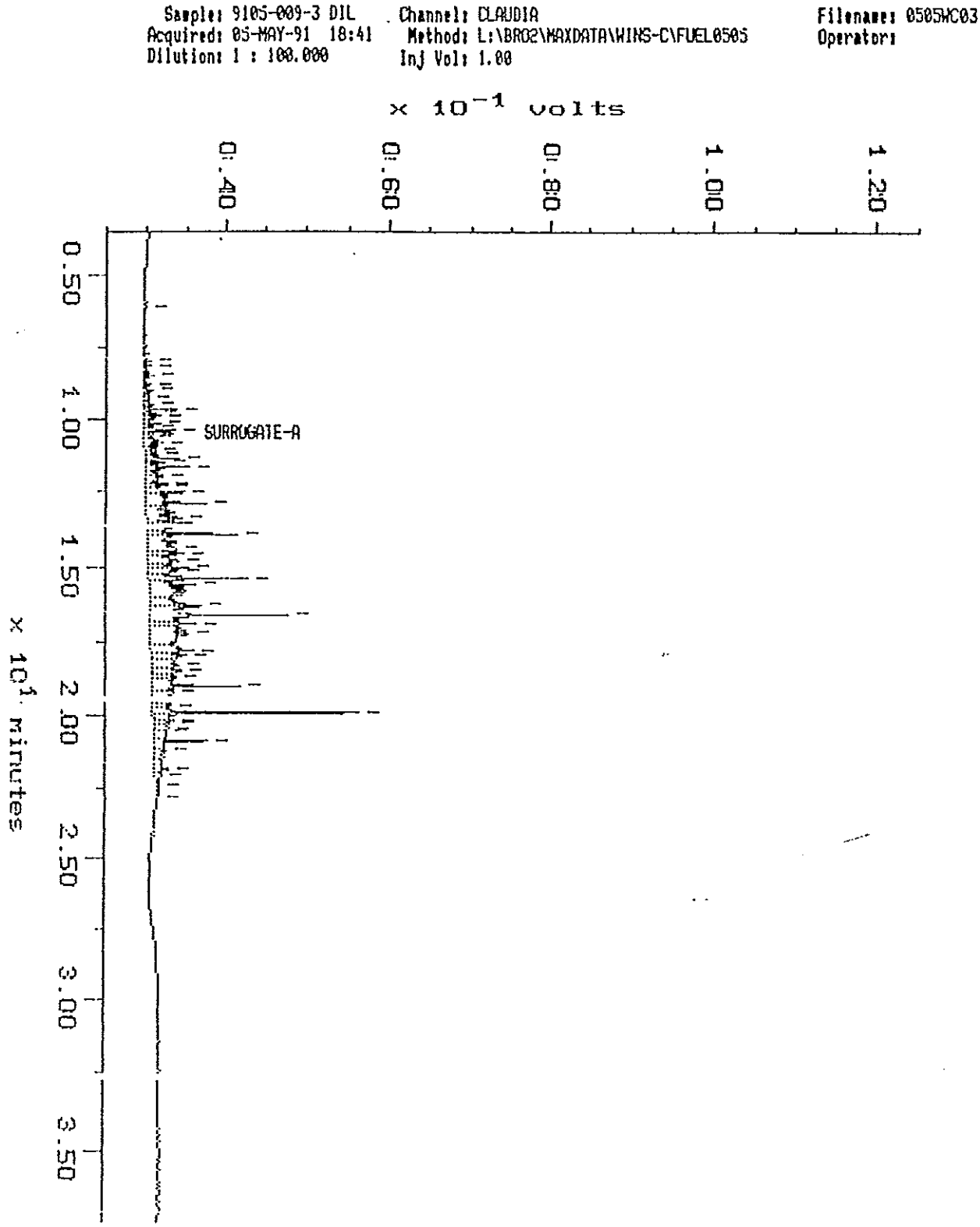
CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-288-B04
PROJECT NAME : UNOCAL EDMONDS TERMINAL

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/Kg	9105-009-16	11,000	11,000	0	**	**	**
PETROLEUM HYDROCARBONS	mg/Kg	BLANK SPIKE	N/A	N/A	N/A	246	248	99
MOISTURE	%	9105-009-1	3.4	3.5	3	N/A	N/A	N/A
MOISTURE	%	9105-009-12	11	11	0	N/A	N/A	N/A
MOISTURE	%	9105-106-3	11	9.8	12	N/A	N/A	N/A

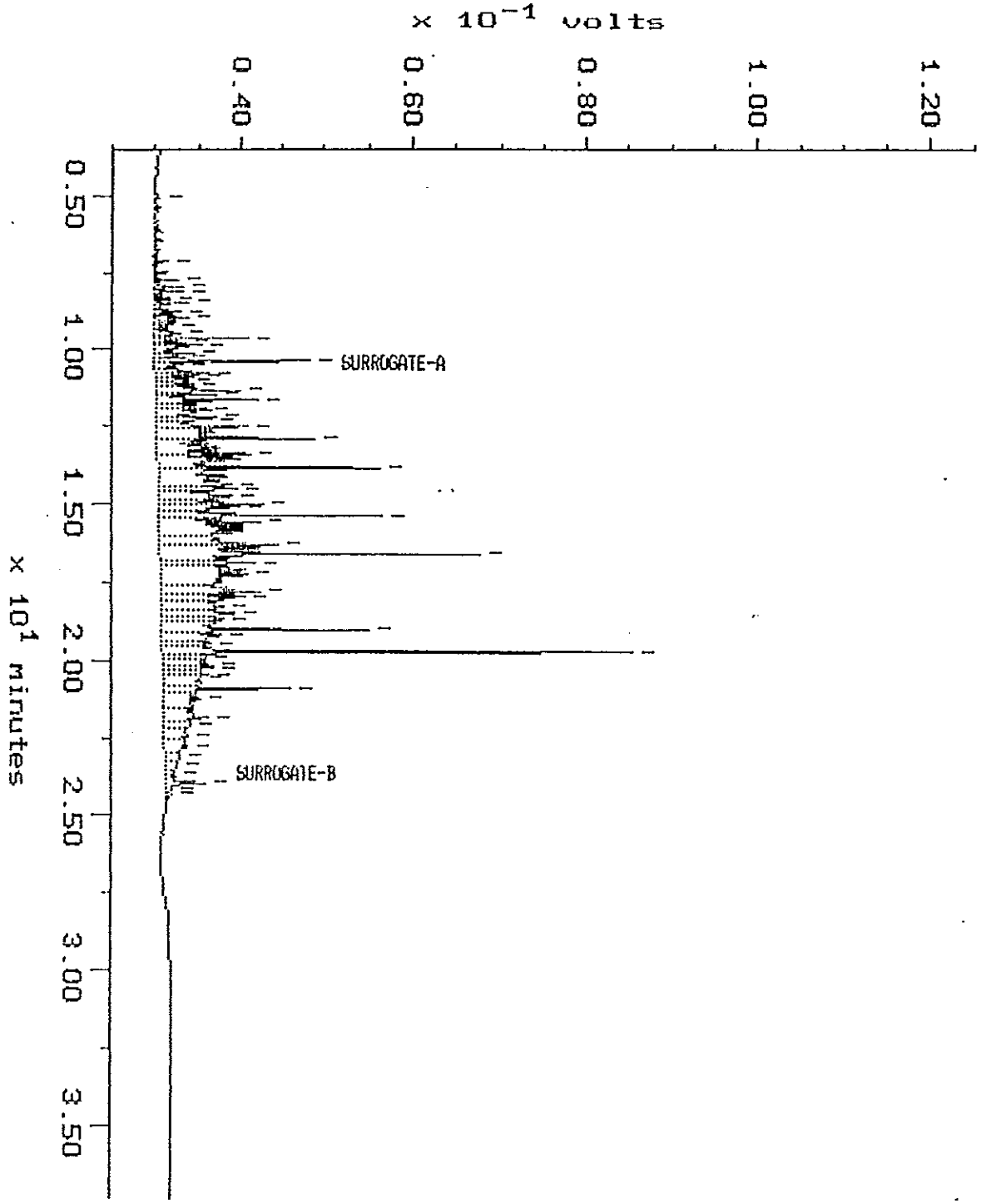
** Due to the necessary dilution of the sample, result was not attainable.

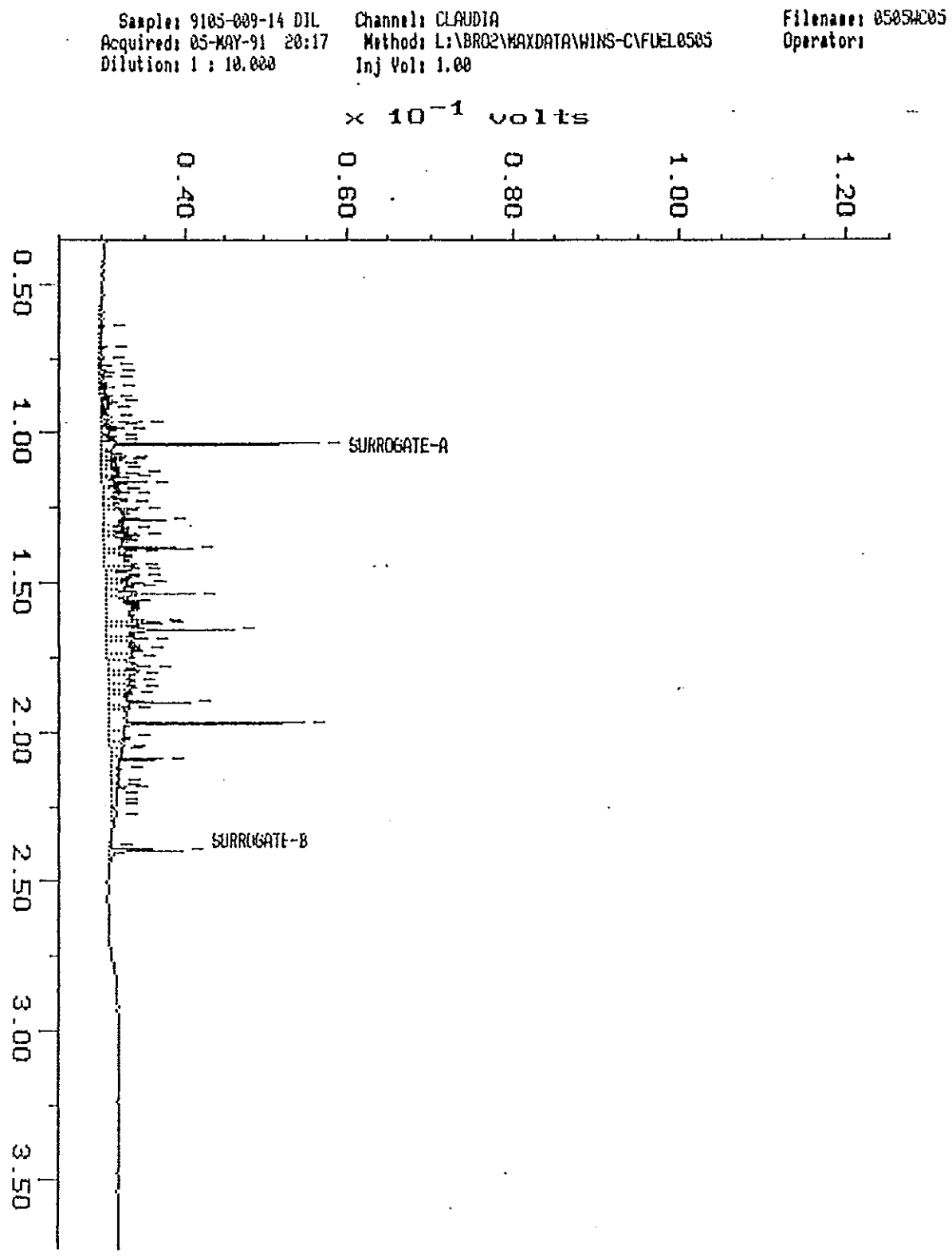
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

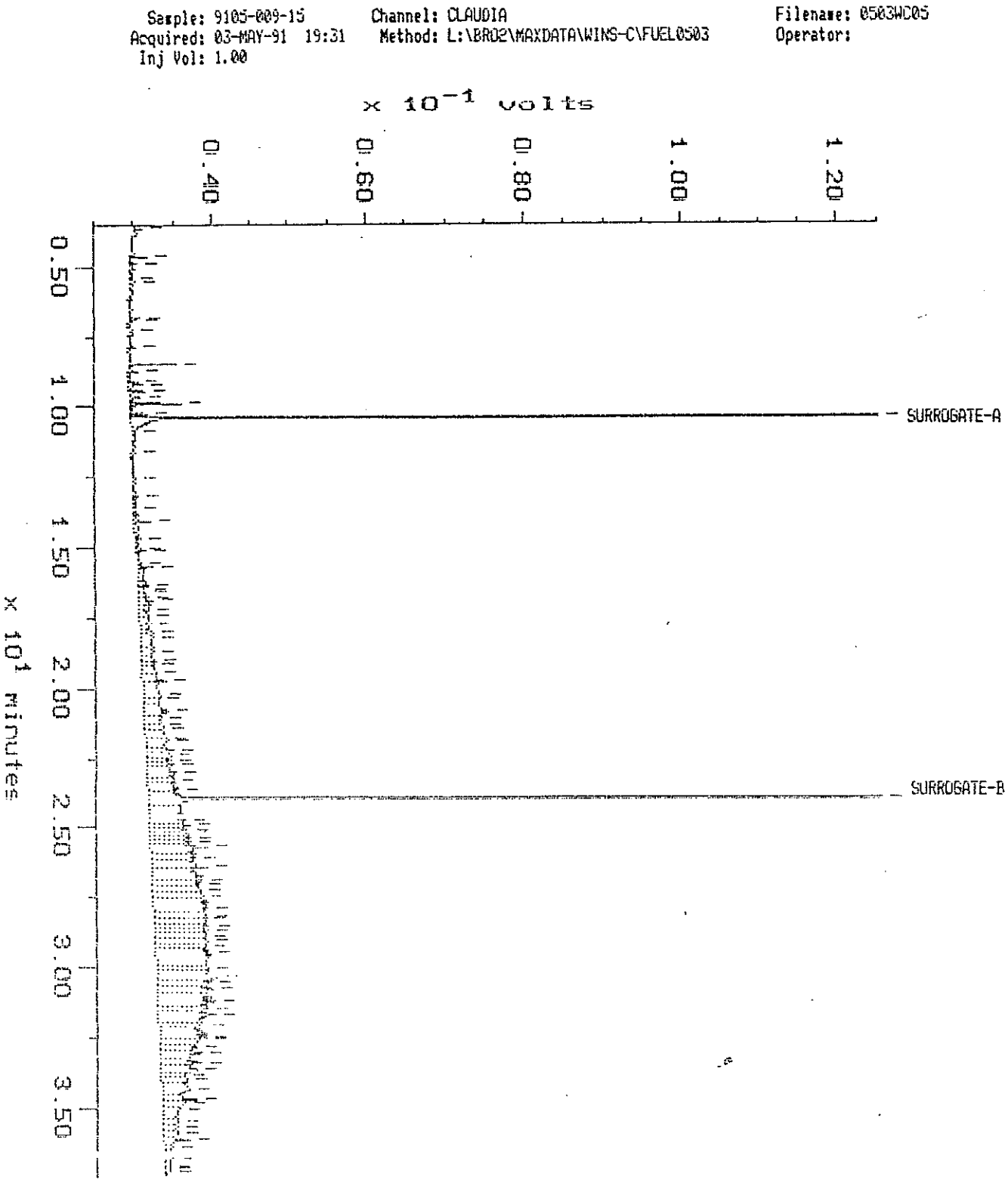
$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

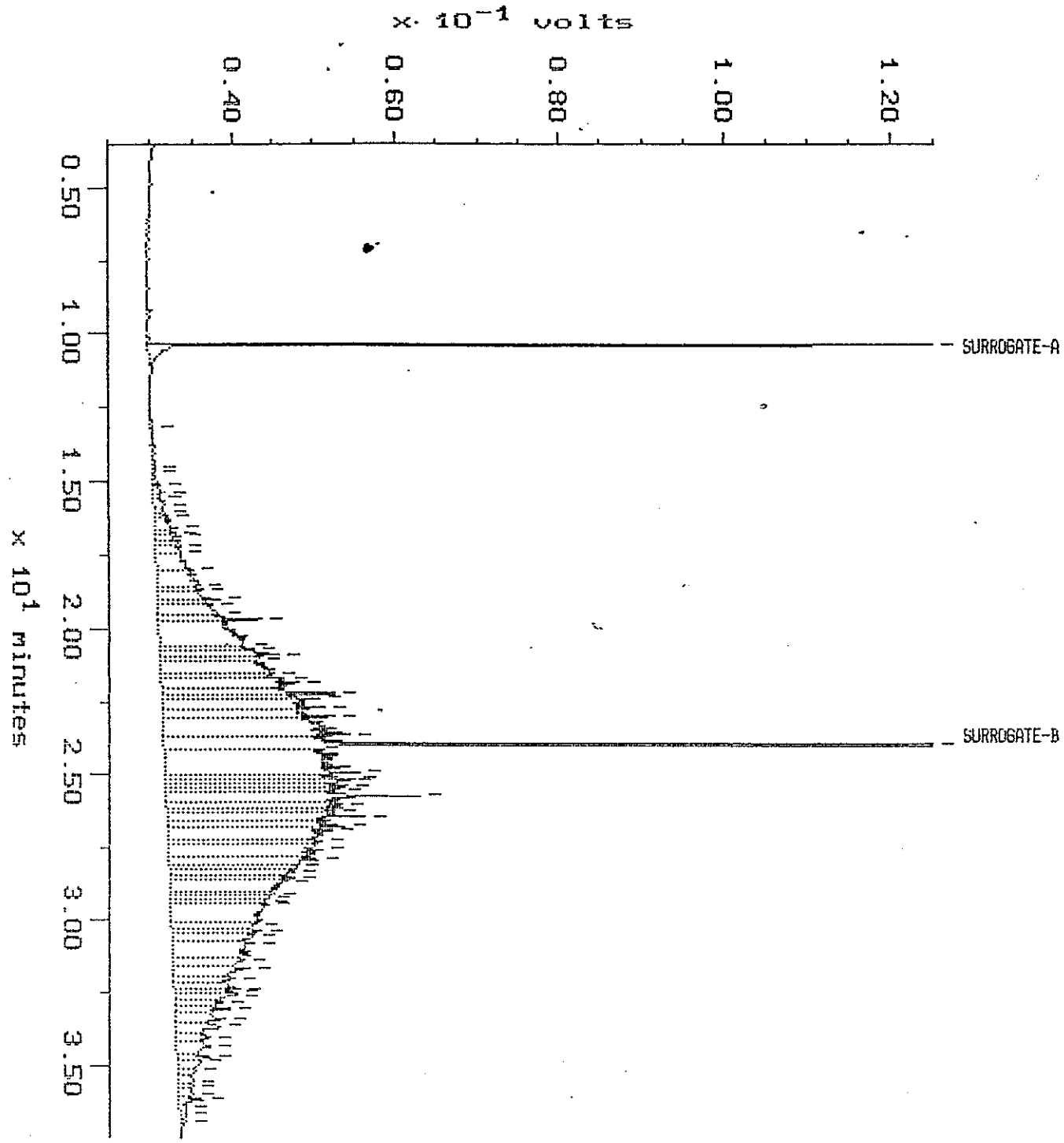

Sample: 9105-009-3 DIL
Acquired: 05-MAY-91 18:41
Dilution: 1 : 100.000
Channel: CLAUDIA
Method: L:\BRO2\MAXDATA\WINS-C\FUEL0505
Inj Vol: 1.00
Filename: 0505WC03
Operator:
x 10⁻¹ volts
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
SURROGATE-A
x 10¹ minutes

Sample: 9105-009-13 DIL Channel: CLAUDIA Filename: 0505HC06
Acquired: 05-MAY-91 21:05 Method: L:\BRO2\MAXDATA\WINS-C\FUEL0505 Operator:
Dilution: 1 : 20.000 Inj Vol: 1.00




Sample: 9105-009-14 DIL
Acquired: 05-MAY-91 20:17
Dilution: 1 : 10.000
Channel: CLAUDIA
Method: L:\BRO2\MAXDATA\WINS-C\FUEL0505
Inj Vol: 1.00
Filename: 0505WC05
Operator:
x 10⁻¹ volts
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10¹ minutes
SURROGATE-A
SURROGATE-B


Sample: 9105-009-15
Acquired: 03-MAY-91 19:31
Inj Vol: 1.00
Channel: CLAUDIA
Method: L:\BR02\MAXDATA\WINS-C\FUEL0503
Filename: 0503WC05
Operator:
x 10⁻¹ volts
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10¹ minutes
SURROGATE-A
SURROGATE-B


Sample: 9105-009-16 DIL
Acquired: 07-MAY-91 18:42
Dilution: 1 : 2.000
Channel: CLAUDIA
Method: L:\BRO2\MAXDATA\WINS-C\FUEL0507
Inj Vol: 1.00
Filename: 0507WC03
Operator:
x 10⁻¹ volts
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10¹ minutes
SURROGATE-A
SURROGATE-B

Analytical**Technologies**, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody

DATE 5-1-91 PAGE 1 OF 2

LABORATORY NUMBER: 9105-009

PROJECT MANAGER: Don Reversten
COMPANY: Geo Engineers
ADDRESS: 8410 154th Ave. NE
Redmond, WA 98052
PHONE: 861-6000 SAMPLED BY: DEH/MDW

SAMPLE DISPOSAL INSTRUCTIONS

☐ ATI Disposal @ $5.00 each ☐ Return

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
MW-7(u)-3	4-29-91	1500	SOIL	-1			X											X													1
MW-7(u)-16	4-29-91	1100		-2			X											X													1
MW-9(u)-1	4-30-91	1315		-3			X									X		X													1
MW-9(u)-2	4-30-91	1345		-4			X											X													1
MW-13(u)-1	4-29-91	1030		-5			X											X													1
MW-13(u)-4	4-29-91	1030		-6			X											X													1
~~BETX-4~~ HA-15-3	4-29-91	1320		-7			X											X													1
~~TP-26, 1~~	~~4-29-91~~	—		~~8~~												X		X													1
TP-26, 6.4	4-29-91	—		~~9~~	X											X		X													1
TP-27, 7.0	4-29-91	—		~~10~~	4											X	1	X													1
TP-27, 10.0	4-29-91	—		~~11~~	10											X		X													1
TP-28, 1.0	4-29-91	—		~~12~~	11											X		X													1

B-

PROJECT INFORMATION

PROJECT NUMBER: 161-288-304
PROJECT NAME: Naval Edmonds Term.
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☒ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	16
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☒ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK
GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Michael D. Watkins Time: 7:15	Signature: Time:	Signature: Time:
Printed Name: Michael D. Watkins Date: 5/1/91	Printed Name: Date:	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: J. Kellie Time: 1030	Signature: Time:	Signature: Time:
Printed Name: V. PENNICK Date: 5/1/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Company: Analytical Technologies, Inc.

Analytical Technologies, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

DATE 5-7-91 PAGE 1 OF 2

Chain of Custody

LABORATORY NUMBER: 9105-009

PROJECT MANAGER: Dan Clevenster
COMPANY: 8410 154th Ave N.E.
ADDRESS: REDMOND, WA
& Geo Engineers
PHONE: 861-6000 SAMPLED BY: DEH/MDW

SAMPLE DISPOSAL INSTRUCTIONS
☒ ATI Disposal @ $5.00 each ☐ Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
TP-29, 1.0	4/29/91	–	Soil	12
HA-16, 2.0	4/30/91	–		13
HA-16, 5.5	4/30/91	–		14
HA-24, 1.0	4/30/91	–		15
HA-25, 2.0	4/30/91	–		16

ANALYSIS REQUEST

LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	8080 Pesticide (4)	8240 ZH-EXT	8270	8150 Herbicides (2)	Metals (8)	Pb - method 3005/7421		NUMBER OF CONTAINERS
12												X		X											X		1
13												X		X													1
14												X		X													1
15												X		X													1
16							✓					X		X											✓		1
✓							✓																				

PROJECT INFORMATION
PROJECT NUMBER: 161-288-B04
PROJECT NAME: Mocal Edmonds
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☑ NO ☐

SAMPLE RECEIPT
TOTAL NUMBER OF CONTAINERS: 1
COC SEALS/INTACT? Y/N/NA:
RECEIVED GOOD COND./COLD:
RECEIVED VIA:

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS
TAT: (NORMAL) ☑ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK
GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Michael D. Watkins Time: 7:15	Signature: Time:	Signature: Time:
Printed Name: Michael D. Watkins Date:	Printed Name: Date:	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time: 1020A	Signature: Time:	Signature: Time:
Printed Name: V. PENWICK Date: 5/2/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9105-087

GeoEngineers

MAY 28 1991

Routing DCC

File

May 22, 1991

GeoEngineers, Inc.
8410-154th Ave. N.E.
Redmond, WA 98052

Attention : Dan Crevensten

Project Number : 161-289-B04

Project Name : Unocal/Edmonds

On May 8, 1991, Analytical Technologies, Inc., received 4 water and one soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Bob A. Olsiewski
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/hal/cn

Analytical Technologies, Inc.

ATI I.D. # 9105-087

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL/EDMONDS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9105-087-1	MW-1	05/07/91	WATER
9105-087-2	MW-2	05/07/91	WATER
9105-087-3	MW-4	05/07/91	WATER
9105-087-4	MW-7(U)	05/07/91	WATER
9105-087-5	HA-20, 1.0	05/01/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	1
WATER	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9105-087

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL/EDMONDS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9105-087

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	92

Analytical Technologies, Inc.

ATI I.D. # 9105-087

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
SURROGATE PERCENT RECOVERIES	
BROMOFLUOROBENZENE	103

Analytical Technologies, Inc.

ATI I.D. # 9105-087-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-1	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	97

Analytical Technologies, Inc.

ATI I.D. # 9105-087-2

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-BO4	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-2	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	101

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-087-3

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-4	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	95

Analytical Technologies, Inc.

ATI I.D. # 9105-087-4

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-7(U)	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	102

Analytical Technologies, Inc.

ATI I.D. # 9105-087

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9105-064-16
PROJECT #	: 161-289-B04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL/EDMONDS	DATE ANALYZED	: 05/09/91
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	8.15	20.0	27.6	97	29.3	106	6
TOLUENE	10.1	20.0	30.0	99	31.8	109	6
TOTAL XYLENES	75.2	40.0	116	101	121	115	5

$$\%\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9105-087

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087-1

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-1	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087-2

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-2	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087-3

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-4	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087-4

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/07/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-7(U)	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9105-087-2
PROJECT #	: 161-289-B04	DATE EXTRACTED	: 05/08/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE ANALYZED	: 05/09/91
EPA METHOD	: 8015 (MODIFIED)	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
GASOLINE	<1.0	100	76.7	77	70.5	71	8

$$\%\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9105-087

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL\EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087-5

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-BO4	DATE RECEIVED	: 05/08/91
PROJECT NAME	: UNOCAL\EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: HA-20, 1.0	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-087

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: BLANK SPIKE
PROJECT #	: 161-289-B04	DATE EXTRACTED	: 05/10/91
PROJECT NAME	: UNOCAL\EDMONDS	DATE ANALYZED	: 05/10/91
EPA METHOD	: 8015 MODIFIED	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % RECOVERY	RPD
FUEL HYDROCARBONS (DIESEL)	<5	500	410	82	431	86	5

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody

LABORATORY NUMBER: 9105-087-B8

V02

PROJECT MANAGER: Dan Creverstein
COMPANY: GeoEngineers
ADDRESS:
PHONE: 461-6000 SAMPLED BY: DEH

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/H (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
mw-1	5-7-91	1350	~~Soil~~ water	-1			X											X													3
mw-2	5-7-91	1445	~~Soil~~ water	-2			X											X													3
mw-4	5-7-91	1445	~~Soil~~ water	-3			X											X													3
mw-7(w)	5-7-91	1530	~~Soil~~ water	-4			X											X													3
HA-20, 1:0	5-1-91		Soil	-5														X													1

PROJECT INFORMATION

PROJECT NUMBER: 161-7.89-B04
PROJECT NAME: Unocal Edmonds
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☒ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	13
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☒ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK
GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Donald E. Hanson Time: 0810	Signature: Time:	Signature: Time:
Printed Name: Donald E. Hanson Date: 5-8-91	Printed Name: Date:	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2**	**RECEIVED BY: (LAB) 3.**
Signature: P. Nicholls Time: 10:00 AM	Signature: Time:	Signature: Time:
Printed Name: D. Nicholls Date: 5/8/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

AnalyticalTechnologies,Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9105-053

May 15, 1991

GeoEngineers
MAY 22 1991
Routing DCC
File

GeoEngineers, Inc.
8410-154th Ave. N.E.
Redmond, WA 98052

Attention : Dan Crevensten

Project Number : 161-289-B04

Project Name : Unocal/Edmonds

On May 3, 1991, Analytical Technologies, Inc., received 14 soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Bob A. Olsiewski
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/hal/cn

Analytical Technologies, Inc.

ATI I.D. # 9105-053

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-BO4
PROJECT NAME : UNOCAL/EDMONDS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9105-053-1	MW10U-1B	05/02/91	SOIL
9105-053-2	MW10U-4	05/02/91	SOIL
9105-053-3	MW11U-9	05/01/91	SOIL
~~9105-053-4~~	~~MW30-2~~	~~05/02/91~~	~~SOIL~~
~~9105-053-5~~	~~MW30-4~~	~~05/02/91~~	~~SOIL~~
~~9105-053-6~~	~~MW31-2~~	~~05/02/91~~	~~SOIL~~
~~9105-053-7~~	~~MW31-4~~	~~05/02/91~~	~~SOIL~~
9105-053-8	HA-17, 2.5	05/01/91	SOIL
9105-053-9	HA-18, 2.0	05/01/91	SOIL
9105-053-10	HA-21, 1.0	05/02/91	SOIL
9105-053-11	HA-22, 3.0	05/02/91	SOIL
9105-053-12	HA-22, 9.0	05/02/91	SOIL
9105-053-13	HA-22, 10.0	05/02/91	SOIL
9105-053-14	HA-26, 2.0	05/02/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	14

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9105-053

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL/EDMONDS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9105-053

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
OJECT #	: 161-289-B04	DATE RECEIVED	: N/A
OJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/10/91
ENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/10/91
PLE MATRIX	: SOIL	UNITS	: mg/Kg
A METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
WEIGHT BASIS			

MPOUNDS	RESULTS
NZENE	<0.025
HYLBENZENE	<0.025
JENE	<0.025
AL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

OMOFLUOROBENZENE	87

VOLATILE ORGANICS ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: 9105-053-7
PROJECT #	: 161-289-B04	DATE EXTRACTED	: 05/10/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE ANALYZED	: 05/10/91
EPA METHOD	: 8020 (BETX)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC	RPD
BENZENE	<0.025	1.00	0.880	88	0.896	90	2
TOLUENE	<0.025	1.00	0.946	95	0.964	96	2
TOTAL XYLENES	<0.025	2.00	1.93	97	2.10	105	8

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9105-053

FUEL HYDROCARBONS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
OJECT #	: 161-289-B04	DATE RECEIVED	: N/A
JECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
ENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/08/91
PLE MATRIX	: SOIL	UNITS	: mg/Kg
THOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

MPOUNDS	RESULTS
EL HYDROCARBONS	<5
DROCARBON RANGE	C7 - C12
ROCARBON QUANTITATION USING	GASOLINE
EL HYDROCARBONS	<5
ROCARBON RANGE	C12 - C24
ROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-1

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
PROJECT #	: 161-289-BO4	DATE RECEIVED	: 05/03/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
CLIENT I.D.	: MW10U-1B	DATE ANALYZED	: 05/08/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	550 *
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	6700
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

* Sample chromatogram indicates a diesel-like contamination.

Analytical Technologies, Inc.

ATI I.D. # 9105-053-2

FUEL HYDROCARBONS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
JECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
OJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
ENT I.D.	: MW10U-4	DATE ANALYZED	: 05/07/91
PLE MATRIX	: SOIL	UNITS	: mg/Kg
THOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

MPOUNDS	RESULTS
L HYDROCARBONS	<5
DROCARBON RANGE	C7 - C12
ROCARBON QUANTITATION USING	GASOLINE
EL HYDROCARBONS	<5
ROCARBON RANGE	C12 - C24
ROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-3

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
CLIENT I.D.	: MW11U-9	DATE ANALYZED	: 05/07/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-8

FUEL HYDROCARBONS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
OJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
OJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
ENT I.D.	: HA-17, 2.5	DATE ANALYZED	: 05/07/91
PLE MATRIX	: SOIL	UNITS	: mg/Kg
THOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

MPOUNDS	RESULTS
EL HYDROCARBONS	<5
DROCARBON RANGE	C7 - C12
ROCARBON QUANTITATION USING	GASOLINE
EL HYDROCARBONS	<5
ROCARBON RANGE	C12 - C24
ROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-9

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
CLIENT I.D.	: HA-18, 2.0	DATE ANALYZED	: 05/07/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-10

FUEL HYDROCARBONS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
OJECT #	: 161-289-BO4	DATE RECEIVED	: 05/03/91
OJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
ENT I.D.	: HA-21, 1.0	DATE ANALYZED	: 05/08/91
LE MATRIX	: SOIL	UNITS	: mg/Kg
THOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 2

MPOUNDS	RESULTS
L HYDROCARBONS	310 *
DROCARBON RANGE	C7 - C12
OCARBON QUANTITATION USING	GASOLINE
EL HYDROCARBONS	2700
OCARBON RANGE	C12 - C24
OCARBON QUANTITATION USING	DIESEL

mple chromatogram indicates a diesel-like contamination.

Analytical Technologies, Inc.

ATI I.D. # 9105-053-11

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
CLIENT I.D.	: HA-22, 3.0	DATE ANALYZED	: 05/07/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	260
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-12

FUEL HYDROCARBONS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
OJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
OJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
ENT I.D.	: HA-22, 9.0	DATE ANALYZED	: 05/07/91
MPLE MATRIX	: SOIL	UNITS	: mg/Kg
THOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

MPOUNDS	RESULTS
EL HYDROCARBONS	<5
DROCARBON RANGE	C7 - C12
ROCARBON QUANTITATION USING	GASOLINE
EL HYDROCARBONS	150
ROCARBON RANGE	C12 - C24
ROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053-13

FUEL HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
CLIENT I.D.	: HA-22, 10.0	DATE ANALYZED	: 05/07/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	7 *
HYDROCARBON RANGE	C7 - C12
HYDROCARBON QUANTITATION USING	GASOLINE
FUEL HYDROCARBONS	90
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL

* Sample chromatogram indicates a diesel-like contamination.

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-053-14

FUEL HYDROCARBONS
DATA SUMMARY

ENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
OJECT #	: 161-289-B04	DATE RECEIVED	: 05/03/91
OJECT NAME	: UNOCAL/EDMONDS	DATE EXTRACTED	: 05/06/91
ENT I.D.	: HA-26, 2.0	DATE ANALYZED	: 05/07/91
PLE MATRIX	: SOIL	UNITS	: mg/Kg
THOD	: 8015 (MODIFIED)	DILUTION FACTOR	: 1

MPOUNDS	RESULTS
EL HYDROCARBONS	<5
DROCARBON RANGE	C7 - C12
ROCARBON QUANTITATION USING	GASOLINE
EL HYDROCARBONS	<5
ROCARBON RANGE	C12 - C24
ROCARBON QUANTITATION USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-053

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9105-053-7
PROJECT #	: 161-289-B04	DATE EXTRACTED	: 05/06/91
PROJECT NAME	: UNOCAL/EDMONDS	DATE ANALYZED	: 05/06/91
EPA METHOD	: 8015 (MODIFIED)	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
GASOLINE	<5.0	500	365	73	298	60	20

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-053

GENERAL CHEMISTRY RESULTS

CLIENT	: GEOENGINEERS, INC.	DATE EXTRACTED	: 05/07/91
PROJECT #	: 161-288-B04	DATE ANALYZED	: 05/07/91
PROJECT NAME	: UNOCAL/EDMONDS	MATRIX	: SOIL
		UNITS	: mg/Kg

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9105-053	REAGENT BLANK	<5
9105-053-1	MW10U-1B	10000
9105-053-4	MW30-2	22
9105-053-6	MW31-2	490
9105-053-11	HA-22, 3.0	570

Analytical Technologies, Inc.

ATI I.D. # 9105-053

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL/EDMONDS

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/Kg	9105-053-11	570	550	4	**	**	**
PETROLEUM HYDROCARBONS	mg/Kg	BLANK SPIKE	N/A	N/A	N/A	246	248	99

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9105-053

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-288-BO4
PROJECT NAME : UNOCAL/EDMONDS

DATE EXTRACTED : 05/10/91
DATE ANALYZED : 05/10/91
MATRIX : SOIL
UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9105-053	REAGENT BLANK	<5
9105-053-5	MW-30-4	59
9105-053-6	MW31-2	31000
9105-053-7	MW31-4	200

Analytical Technologies, Inc.

ATI I.D. # 9105-053

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-289-BO4
PROJECT NAME : UNOCAL/EDMONDS

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/Kg	9105-115-5	21	18	15	301	258	108

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9105-053

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL/EDMONDS

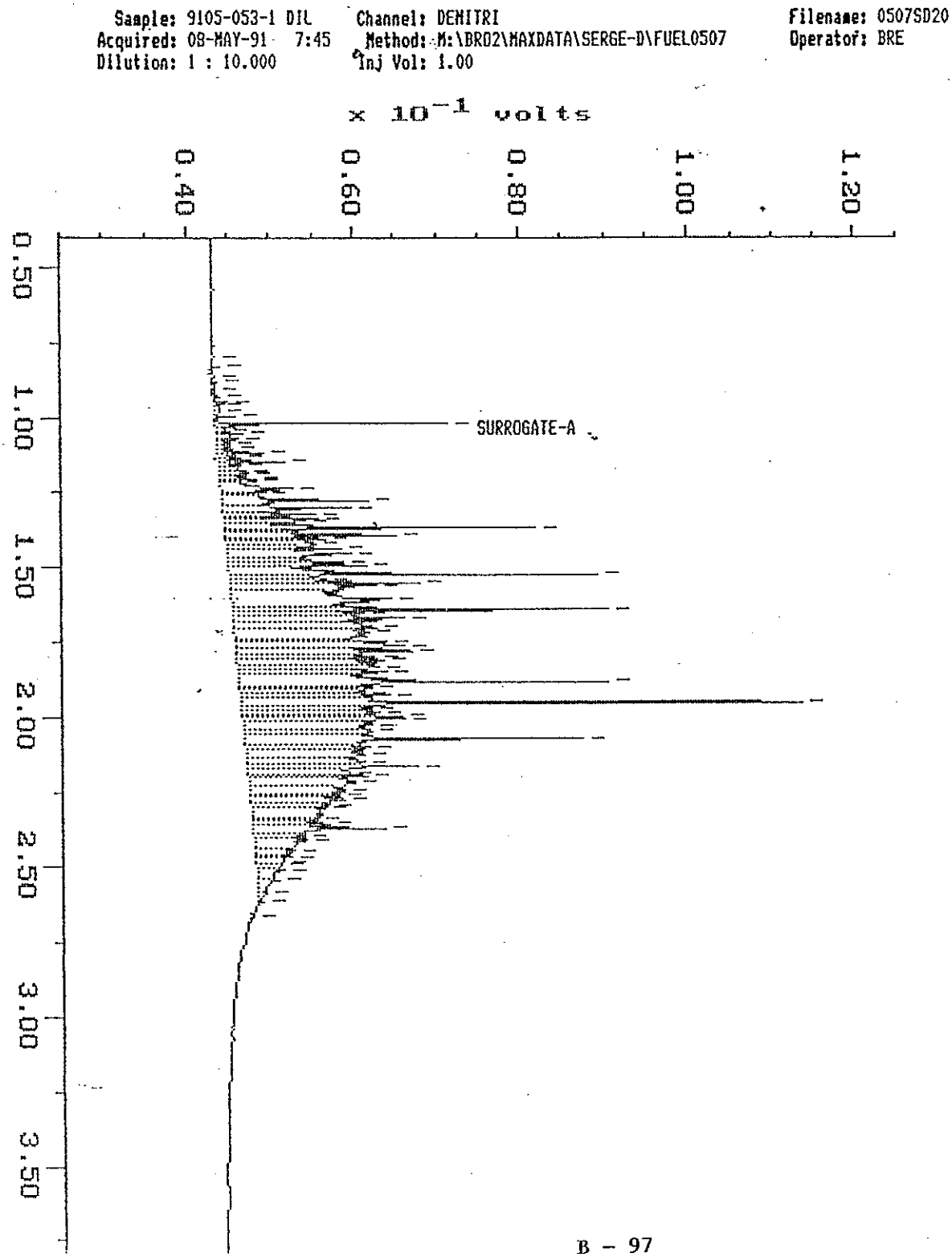
DATE ANALYZED : 05/10/91
MATRIX : SOIL
UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9105-061-3	23	23	NC	N/A	N/A	N/A

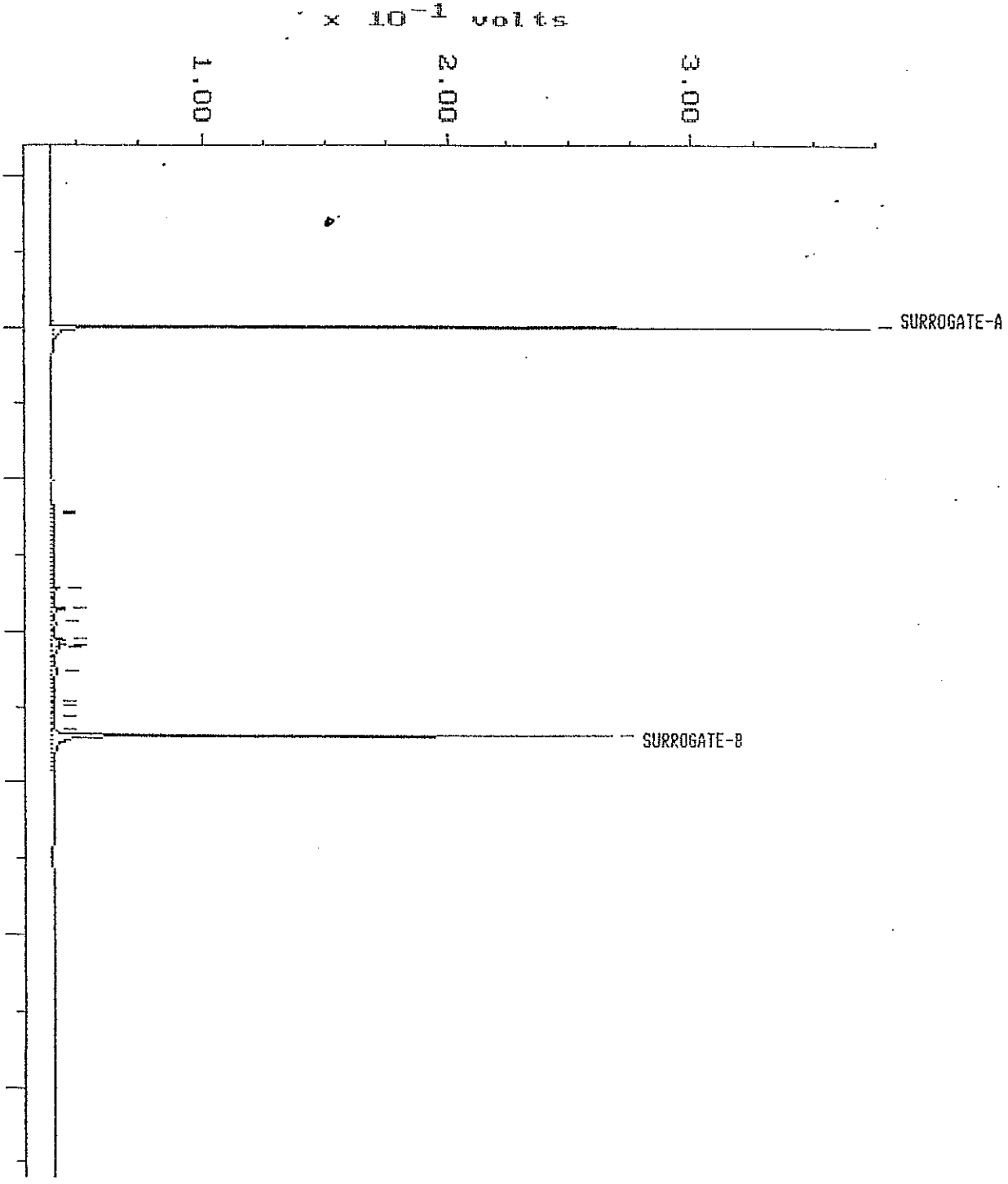
NC Not calculable

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$


Sample: 9105-053-1 DIL
Channel: DEMITRI
Filename: 0507SD20
Acquired: 08-MAY-91 7:45
Method: M:\BRO2\MAXDATA\SERGE-D\FUEL0507
Operator: BRE
Dilution: 1 : 10.000
Inj Vol: 1.00
x 10⁻¹ volts
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
SURROGATE-A

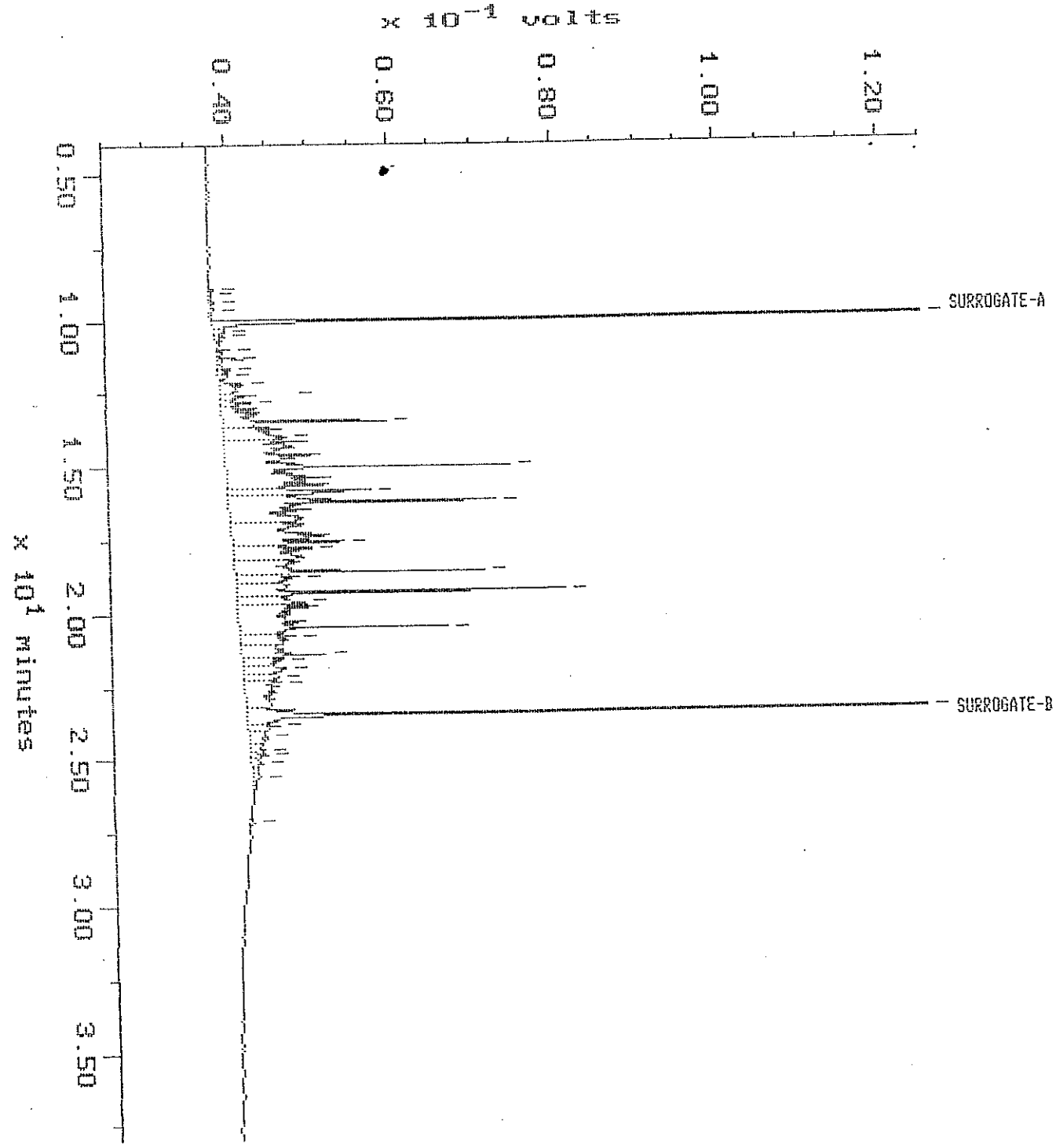
Sample: 9105-053-7 Channel: CLARENCE Filename: 0506SC04
Acquired: 06-MAY-91 18:41 Method: M:\BR02\MAXDATA\SERGE-C\FUEL0506 Operator: BRE
Inj Vol: 1.00



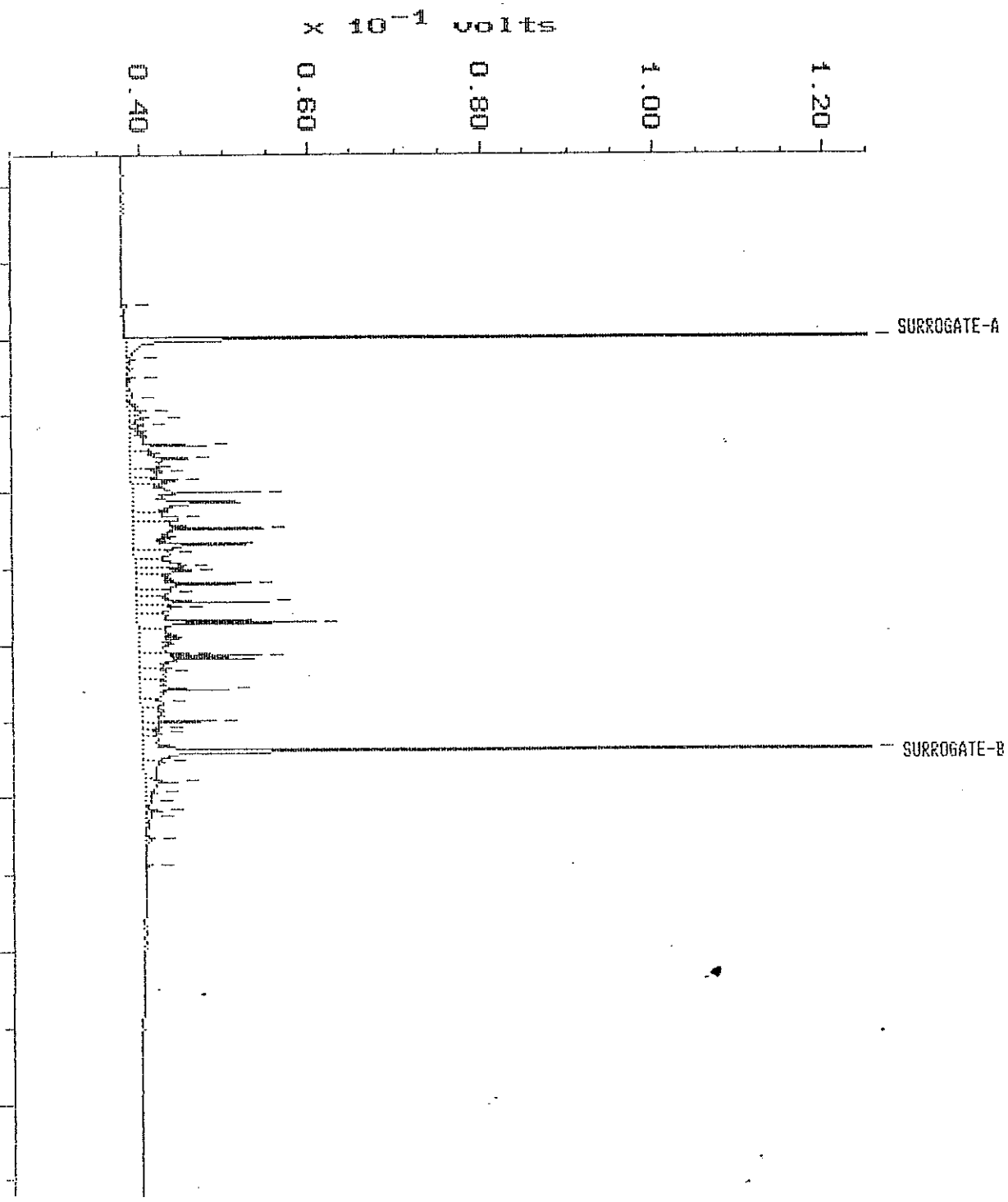
Sample: 9105-053-11
Acquired: 07-MAY-91 12:04
Inj Vol: 1.00

Channel: CLARENCE
Method: M:\BRO2\MAXDATA\SERGE-C\FUEL0506

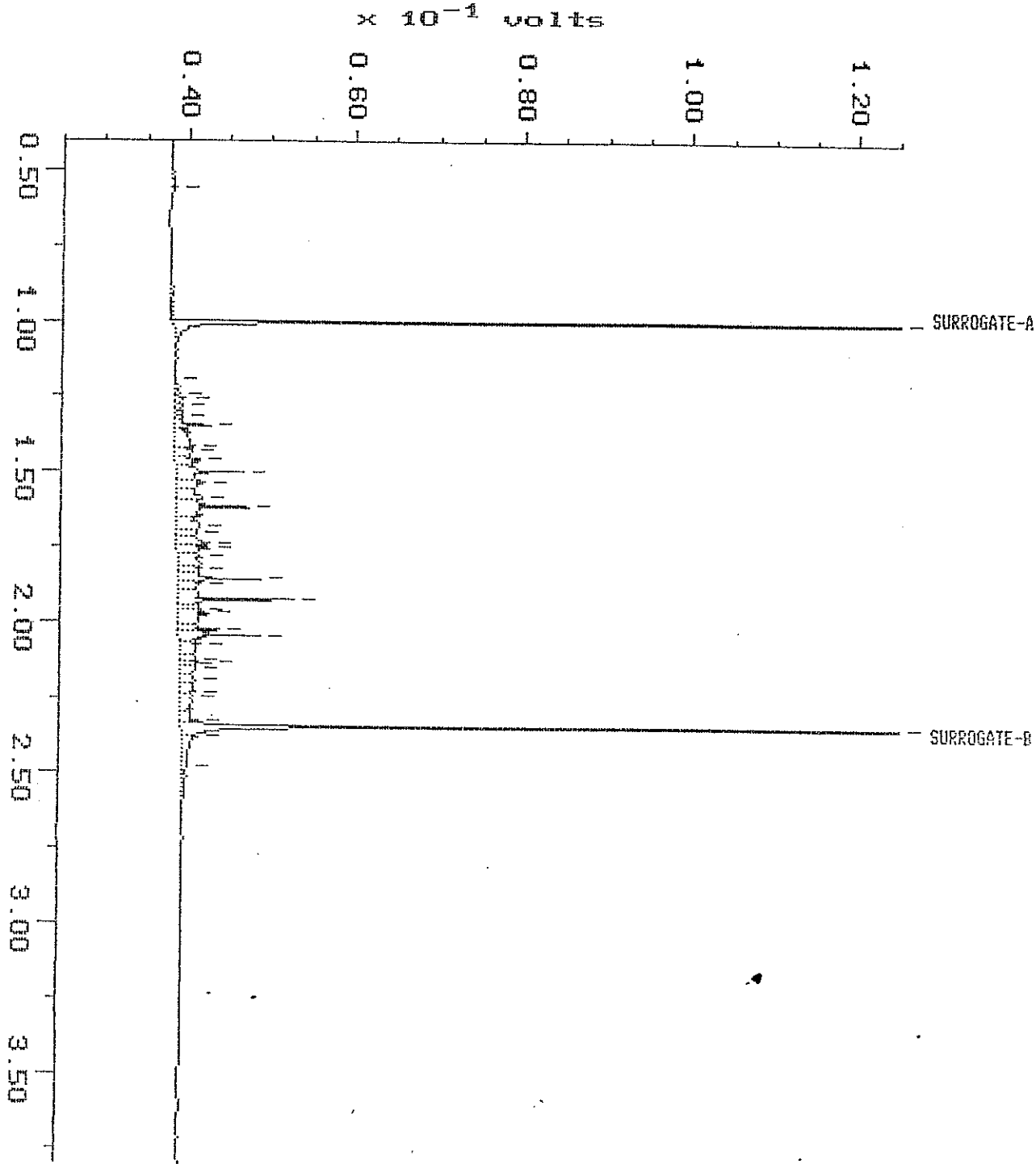
Filename: 05065C26
Operator: BRE



Sample: 9105-053-12 Channel: CLARENCE Filename: 0506SC27
Acquired: 07-MAY-91 12:52 Method: M:\BRO2\MAXDATA\SERGE-C\FUEL0506 Operator: BRE
Inj Vol: 1.00



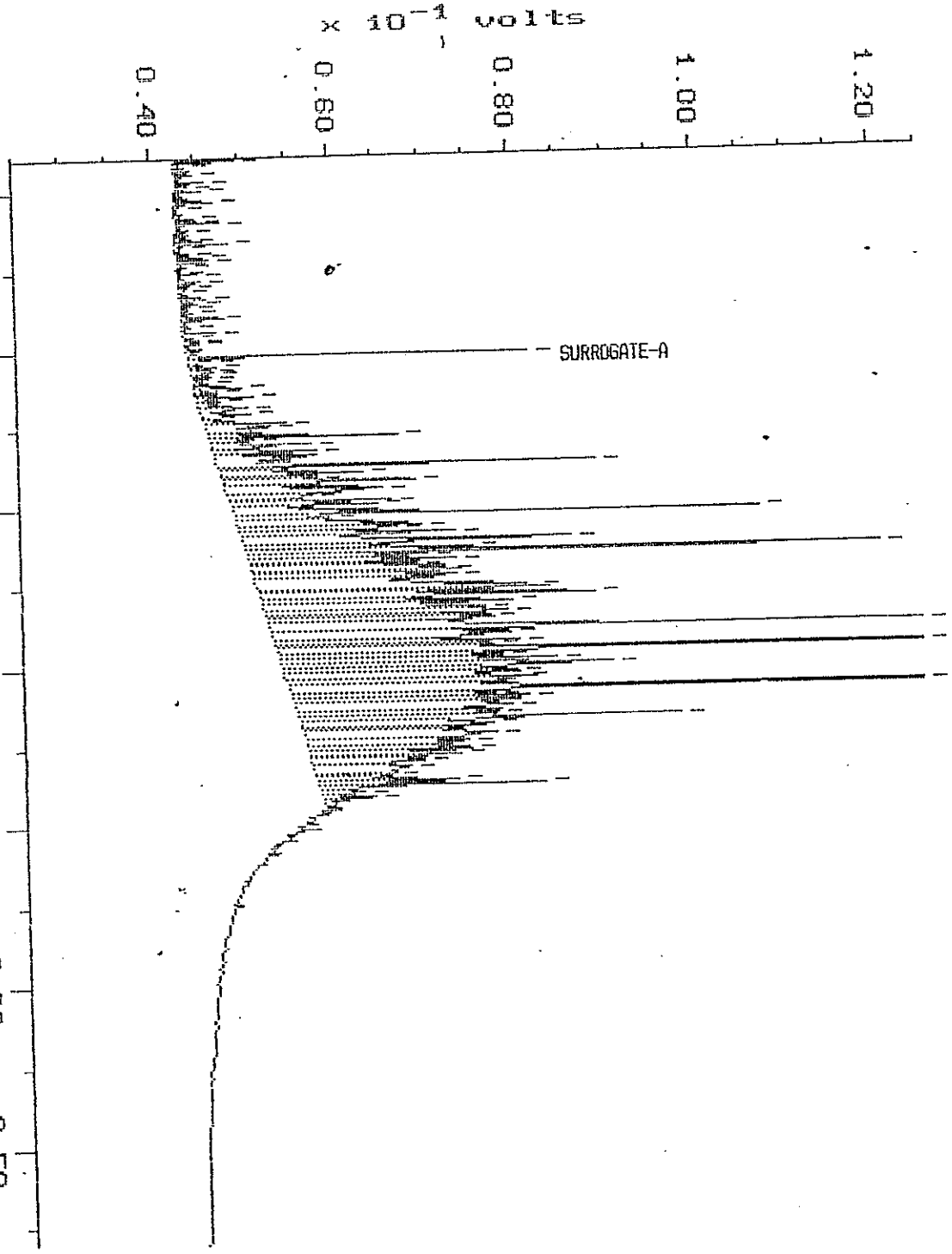
Sample: 9105-053-13 Channel: CLARENCE Filename: 0506SC28
Acquired: 07-MAY-91 13:45 Method: M:\BRO2\MAXDATA\SERGE-C\FUEL0506 Operator: BRE
Inj Vol: 1.00



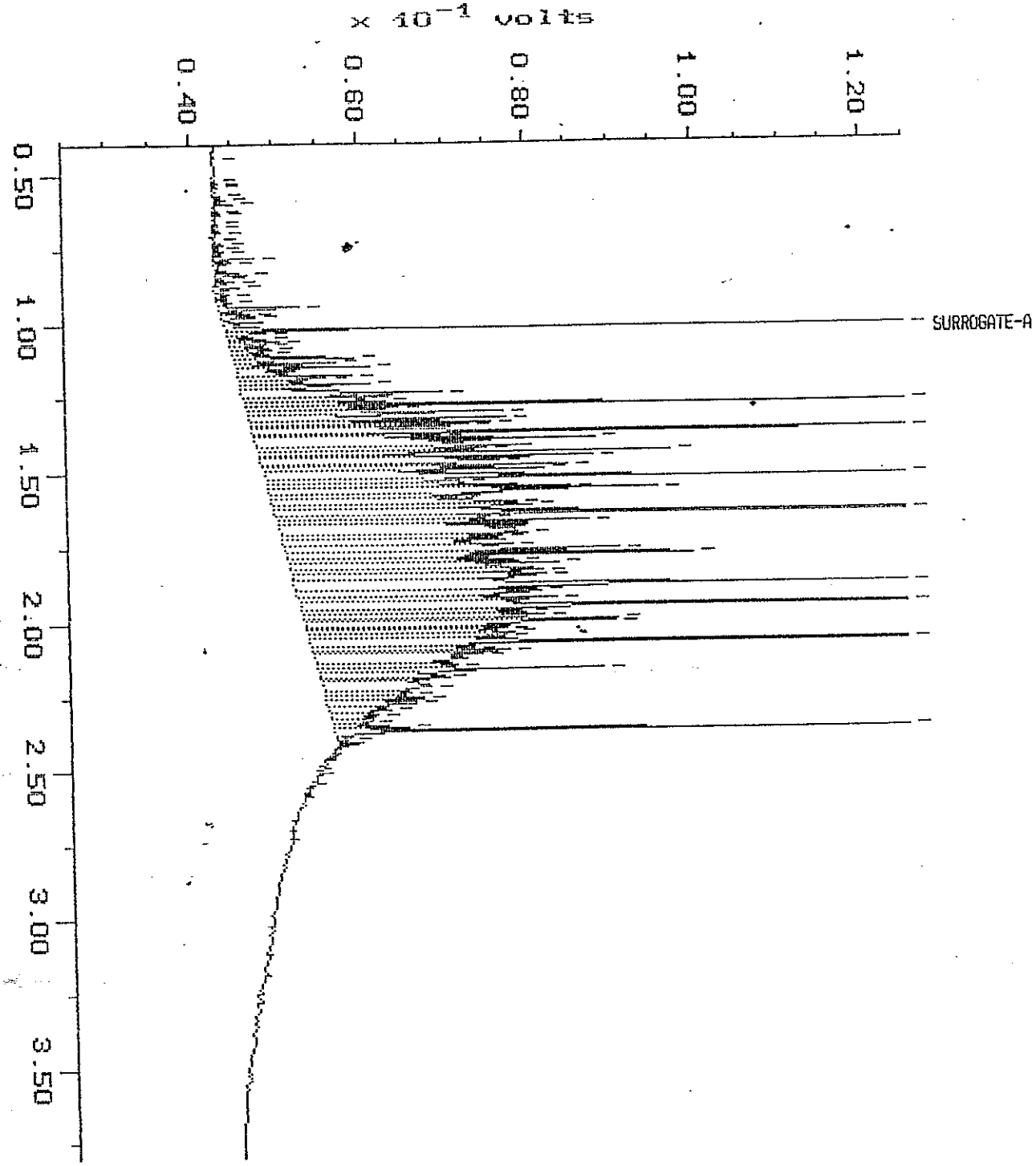
Sample: 9105-053-6 DIL
Acquired: 08-MAY-91 8:32
Dilution: 1 : 10.000

Channel: DEMITRI
Method: M:\BRO2\MAXDATA\SERGE-D\FUEL0507
Inj Vol: 1.00

Filename: 0507SD21
Operator: BRE



Sample: 9105-053-10 DIL Channel: DEMITRI Filename: 0507SD22
Acquired: 08-MAY-91 9:19 Method: M:\BRO2\MAXDATA\SERGE-D\FUEL0507 Operator: BRE
Dilution: 1 : 2.000 Inj Vol: 1.00



Chain of Custody

LABORATORY NUMBER: 9105-053

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

PROJECT MANAGER: Dan Crevanston
COMPANY: Geo Engineers, Inc.
ADDRESS: 8410 - 154th Ave NE
Redmond, WA 98052
PHONE: 861-6000 SAMPLED BY: MOW/DEH

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
MW10U-1B	5/2/91		Soil	-1												X		X													1
MW 10U-4	"		"	-2														X													1
MW 11U-9	5/1/91		"	-3														X													1
MW 30-2	5/2/91		"	-4			X									X		X													1
MW 30-4	5/2/91		"	-5												X		X													1
MW 31-2	5/2/91		"	-6			X									X		X													1
MW 31-4	5/2/91		"	-7														X													1
HA-17, 2.5	5/1/91		"	-8														X													1
HA-18, 2.0	5/1/91		"	-9														X													1
HA-21, 1.0	5/2/91		"	-10														X													1
HA-22, 3.0	5/2/91		"	-11												X		X													1
HA-22, 9.0	5/2/91		"	-12														X													1

PROJECT INFORMATION

PROJECT NUMBER: 161-288-804
PROJECT NAME: UNOCAL EDMONDS
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☒ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	14
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☒ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK

GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS: Fax info to Dan Crevanston

UNOCAL EDMONDS TERMINAL

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Michael D. Watkins Time:	Signature: Time: 10:30	Signature: Time:
Printed Name: Michael D Watkins Date:	Printed Name: Date: 5/3/91	Printed Name: Date:
Company: GET	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time: 5:45	Signature: Time:	Signature: Time:
Printed Name: Date: DW Thomas 5-3-91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 **DISTRIBUTION:** White, Canary - ATI • Pink - ORIGINATOR

№ 4555

B - 104

Analytical Technologies, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody

DATE 5/3/91 PAGE 2 OF 2

LABORATORY NUMBER: 91-05-053

PROJECT MANAGER: _____
COMPANY: _____
ADDRESS: _____
PHONE: _____ SAMPLED BY: _____

SAMPLE DISPOSAL INSTRUCTIONS

☐ ATI Disposal @ $5.00 each ☐ Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZHEXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
HA-22 ,10.0	5/2/91		Soil	-13														X													1
HA-26 ,2.0	5/2/91		S	-14														X													1

PROJECT INFORMATION

PROJECT NUMBER:
PROJECT NAME:
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☐ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	14
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☐ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK
GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:
See sht 1

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Michael D Watkins Time:	Signature: 10:30 Time:	Signature: Time:
Printed Name: Michael D. Watkins Date:	Printed Name: Date: 5/3/91	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time: 5:45	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

B - 105

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9105-081

GeoEngineers

MAY 28 1991

Routing DCC

File

May 24, 1991

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052

Attention : Dan Crevensten

Project Number : 161-289-B04

Project Name : Unocal Edmonds

On May 7, 1991, Analytical Technologies, Inc., received 19 soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Donna M. McKinney
Senior Project Manager

Donna M. McKinney for
Frederick W. Grothkopp
Technical Manager

FWG/tc

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9105-081-1	MW-27,1	05/03/91	SOIL
9105-081-2	MW-27,3	05/03/91	SOIL
9105-081-3	MW-28,2	05/03/91	SOIL
9105-081-4	MW-28,3	05/03/91	SOIL
9105-081-5	MW-29,2	05/03/91	SOIL
9105-081-6	MW-29,3	05/03/91	SOIL
9105-081-7	HA-13,1.0	05/03/91	SOIL
9105-081-8	HA-14,1.0	05/03/91	SOIL
9105-081-9	HA-23,1.0	05/03/91	SOIL
9105-081-10	HA-23,5.5	05/03/91	SOIL
9105-081-11	HA-19,6.0	05/01/91	SOIL
9105-081-12	HA-19,9.0	05/01/91	SOIL
9105-081-13	HA-20,5	05/01/91	SOIL
9105-081-14	MW-31,4	05/02/91	SOIL
9105-081-15	MW-11(U),1	05/01/91	SOIL
9105-081-16	HA-21,5.0	05/02/91	SOIL
9105-081-17	HA-26,5.0	05/02/91	SOIL
9105-081-18	MW-9(U)-4	04/30/91	SOIL
9105-081-19	MW-9(U)-12	05/01/91	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	19

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
LEAD	AA/F	EPA 7420	R
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/08/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	100

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-27,3	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	83

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-28,3	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	78

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-29,3	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	81

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-23,1.0	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	0.55
TOLUENE	0.33
TOTAL XYLENES	2.0

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	*

* Out of limits due to matrix interference.

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-19,6.0	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	82

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-11(U),1	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	83

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-9(U)-4	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	78

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-9(U)-12	DATE ANALYZED	: 05/08/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

BROMOFLUOROBENZENE	86

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D.	: 9105-081-19
PROJECT #	: 161-289-B04	DATE EXTRACTED	: 05/08/91
PROJECT NAME	: UNOCAL EDMONDS	DATE ANALYZED	: 05/08/91
EPA METHOD	: 8020 (BETX)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
BENZENE	<0.025	1.00	0.983	98	0.936	94	5
TOLUENE	<0.025	1.00	0.997	100	0.974	97	2
TOTAL XYLENES	<0.025	2.00	2.00	100	1.92	96	4

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/08/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-27,1	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-27,3	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-28,2	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-28,3	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-29,2	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-29,3	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-13,1.0	DATE ANALYZED	: 05/08/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-14,1.0	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-23,1.0	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 100

COMPOUND	RESULT
FUEL HYDROCARBONS	1,300
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	19,000
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

BEST ESTIMATE OF FUEL TYPE - 1 PART GASOLINE : 15 PARTS DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/03/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-23,5.5	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-19,6.0	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-19,9.0	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-20,5	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/01/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-11(U),1	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-21,5.0	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/02/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: HA-26,5.0	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 04/30/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/07/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/08/91
CLIENT I.D.	: MW-9(U)-4	DATE ANALYZED	: 05/09/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS
SAMPLE MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
LEAD	05/10/91	05/14/91

METALS RESULTS

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9105-081-4	MW-28,3	<10
9105-081-11	HA-19,6.0	<10
REAGENT BLANK	-	<10

METALS QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. MATRIX : SOIL
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
LEAD	9105-103-1	<10	<10	NC	280	270	104

NC = Not calculable.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

GENERAL CHEMISTRY

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS
SAMPLE MATRIX : SOIL

PARAMETER	DATE PREPARED	DATE ANALYZED
PETROLEUM HYDROCARBONS	05/09/91	05/09/91
MOISTURE	-	05/10/91

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9105-081-1	MW-27,1	<5
9105-081-3	MW-28,2	<5
9105-081-5	MW-29,2	<5
9105-081-9	HA-23,1.0	22,000
9105-081-10	HA-23,5.5	56
9105-081-14	MW-31,4	62
REAGENT BLANK	-	<5

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9105-081-2	MW-27,3	18
9105-081-4	MW-28,3	18
9105-081-6	MW-29,3	12
9105-081-9	HA-23,1.0	21
9105-081-11	HA-19,6.0	10
9105-081-14	MW-31,4	15
9105-081-15	MW-11(U),1	8.6
9105-081-18	MW-9(U)-4	17
9105-081-19	MW-9(U)-12	12

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/Kg	9105-081-14	62	50	21	300	257	93
MOISTURE	%	9105-081-11	10	10	0	N/A	N/A	N/A

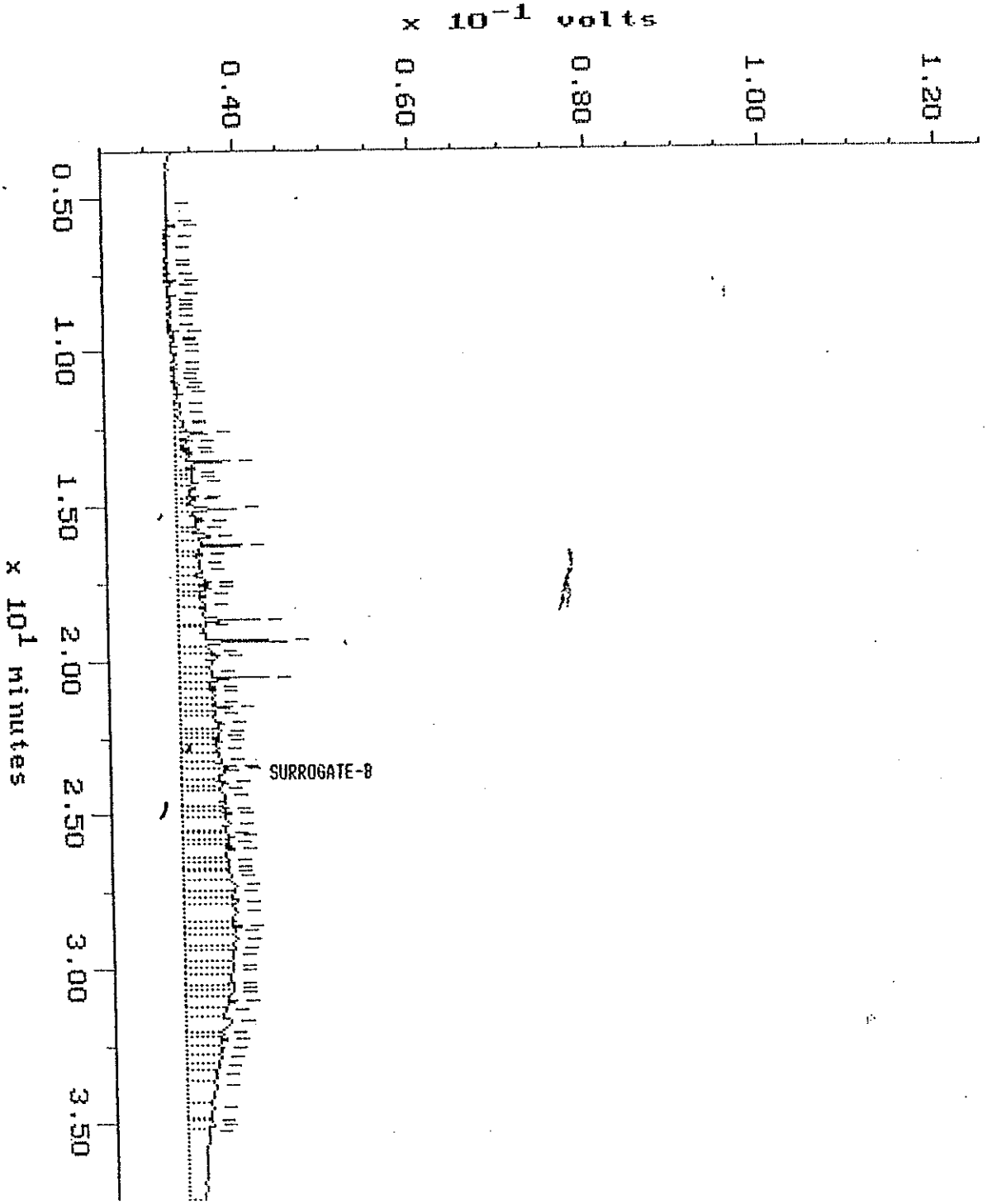
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9105-081-9 DIL
Acquired: 09-MAY-91 17:19
Dilution: 1 : 100.000

Channel: ERNIE
Method: L:\BRO2\MAXDATA\ERNIE\FUEL0508
Inj Vol: 1.00

Filename: 0508ER34
Operator:



Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

DATE 5-6-91 PAGE 1 OF 2

Chain of Custody LABORATORY NUMBER: 9105-081

PROJECT MANAGER: Dan Crevenston
COMPANY: GeoEngineers
ADDRESS: 8410 154th Ave N.E.
Redmond, WA 98052
PHONE: 861-6000 SAMPLED BY: DEH/MMOW

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-27, 1	5-3-91		SOIL	-1
MW-27, 3	5-3-91		SOIL	-2
MW-28, 2	5-3-91		SOIL	-3
MW-28, 3	5-3-91		SOIL	-4
MW-29, 2	5-3-91		SOIL	-5
MW-29, 3	5-3-91		SOIL	-6
HA-13, 1.0	5-3-91	1430	SOIL	-7
HA-14, 1.0	5-3-91	1500	SOIL	-8
HA-23, 1.0	5-3-91	1300	SOIL	-9
HA-23, 5.5	5-3-91	1300	SOIL	-10
HA-19, 6.0	5-1-91	1330	SOIL	-11
HA-19, 9.0	5-1-91	1330	SOIL	-12

ANALYSIS REQUEST

SAMPLE ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)	Pb method 3050/7421		NUMBER OF CONTAINERS
MW-27, 1												X		X													1
MW-27, 3			X											X													1
MW-28, 2												X		X													1
MW-28, 3			X											X											X		1
MW-29, 2												X		X													1
MW-29, 3			X											X													1
HA-13, 1.0														X													1
HA-14, 1.0														X													1
HA-23, 1.0			X									X		X													1
HA-23, 5.5												X		X													1
HA-19, 6.0			X									-		X											X		1
HA-19, 9.0			-											X													1

PROJECT INFORMATION

PROJECT NUMBER: 16I-289-804
PROJECT NAME: Unocal Edmonds
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☒ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	19
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMALLY) ☒ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK

GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Donald E Hanson Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Donald E. Hanson Date: 5-6-91	Printed Name: Date:	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: P. Nichols Time: 10:15	Signature: Time:	Signature: Time:
Printed Name: P. Nichols Date: 5/7/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

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DATE 5/14 PAGE 1 OF 3

Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody

LABORATORY NUMBER: 9105-081

PROJECT MANAGER: Dan Creverster
COMPANY: GeoEngineers
ADDRESS: 8410 154th Ave N.E.
Redmond, WA 98052
PHONE: 861-6000 SAMPLED BY: DEH/MDW

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
~~HA-20, 1~~	~~5-1-91~~	~~1600~~	~~SOIL~~	
HA-20, 5	5-1-91	1600	SOIL	-13
~~MW-30, 2~~	~~5-2-91~~	~~1400~~	~~SOIL~~	
~~MW-30, 4~~	~~5-2-91~~	~~1400~~	~~SOIL~~	
~~MW-30, 2~~	~~5-2-91~~	~~1400~~	~~SOIL~~	
~~MW-30, 4~~	~~5-2-91~~	~~1400~~	~~SOIL~~	
~~MW-31, 2~~	~~5-2-91~~	~~1545~~	~~SOIL~~	
~~MW-31, 4~~	~~5-2-91~~	~~1545~~	~~SOIL~~	-14
MW-11(W), 1	5-1-91	1345	SOIL	-15
~~HA~~-21, 5.0	5-2-91	1420	SOIL	-16
HA-26, 5.0	5-2-91	1020	SOIL	-17

ANALYSIS REQUEST

8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
													X													1
													X													1
		X											X													1
																										1
		X																								1
											X															1
		X																								1
		X									X															1
		X									X		X													1
													X													1
													X													1

PROJECT INFORMATION

PROJECT NUMBER: 161-289-B04
PROJECT NAME: Unreal Edmonds
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☒ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	19
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☒ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK
GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:
You already have MW-30, MW-31, MW-11(W)
~~HA-21, HA-26~~

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Donald E. Harson Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Donald E. Harson Date: 5-6-91	Printed Name: Date:	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: P. Nicholls Time: 10:15	Signature: Time:	Signature: Time:
Printed Name: P. Nicholls Date: 5/7/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

№ 2290

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DATE 5-6-91 PAGE 3 OF 3

AnalyticalTechnologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody

LABORATORY NUMBER: 9105-081

PROJECT MANAGER: Dan Cravenstein
COMPANY: Geo Engineers
ADDRESS:
PHONE: 861-6000 SAMPLED BY: DEFILLIPIS

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH's (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
MW-9(w)-4	4-30-91		Soil	-18			X											X													1
MW-4(w)-12	5-1-91		Soil	-19			X											X													1

PROJECT INFORMATION

PROJECT NUMBER: 161-289-B04
PROJECT NAME: Naval Edmonds
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☑ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS: 19
COC SEALS/INTACT? Y/N/NA: Y
RECEIVED GOOD COND./COLD: Y
RECEIVED VIA: Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☑ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK

GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS: Previous Samples (161-288-B04) are the same job + should be re-numbered 161-289-B04 thanks

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Donald E Hanson Time: 1600	Signature: Time:	Signature: Time:
Printed Name: Donald E. Hanson Date: 5-7-91	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: P. Nichols Time: 10:15	Signature: Time:	Signature: Time:
Printed Name: P. Nichols Date: 5/7/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 **DISTRIBUTION:** White, Canary - ATI • Pink - ORIGINATOR

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Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9105-102

GeoEngineers

MAY 28 1991

Routing DCC

File

May 22, 1991

GeoEngineers, Inc.
8410-154th Ave. N.E.
Redmond, WA 98052

Attention : Dan Crevensten

Project Number : 161-289-B04

Project Name : Unocal Edmonds

On May 9, 1991, Analytical Technologies, Inc., received 8 water and 4 soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Bob A. Olsiewski
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/hal/cn

Analytical Technologies, Inc.

ATI I.D. # 9105-102

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9105-102-1	MW-10W(U)	05/08/91	WATER
9105-102-2	MW-11(U)	05/08/91	WATER
9105-102-3	MW-13(U)	05/08/91	WATER
9105-102-4	MW-27	05/08/91	WATER
9105-102-5	MW-28	05/08/91	WATER
9105-102-6	MW-29	05/08/91	WATER
~~9105-102-7~~	~~MW-30~~	~~05/08/91~~	~~WATER~~
~~9105-102-8~~	~~MW-31~~	~~05/08/91~~	~~WATER~~
9105-102-9	HA-27,4.0	05/08/91	SOIL
9105-102-10	HA-27,6.0	05/08/91	SOIL
9105-102-11	GARAGE DITCH,0.5	05/08/91	SOIL
9105-102-12	GARAGE DITCH,1.5	05/08/91	SOIL

not included

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	4
WATER	8

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9105-102

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	102

Analytical Technologies, Inc.

ATI I.D. # 9105-102-1

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-10W(U)	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	0.8

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	108

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102-2

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-11(U)	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	110

Analytical Technologies, Inc.

ATI I.D. # 9105-102-3

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-13(U)	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
SURROGATE PERCENT RECOVERIES	
BROMOFLUOROBENZENE	105

Analytical Technologies, Inc.

ATI I.D. # 9105-102-6

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-29	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	107

Analytical Technologies, Inc.

ATI I.D. # 9105-102-7

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-30	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	0.8
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	3.6

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	106

AnalyticalTechnologies, Inc.

ATI I.D. # 9105-102-8

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-31	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	8.5
TOLUENE	13
ETHYLBENZENE	6.7
TOTAL XYLENES	49

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	118

Analytical Technologies, Inc.

ATI I.D. # 9105-102

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9105-102-1
PROJECT #	: 161-289-B04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL EDMONDS	DATE ANALYZED	: 05/13/91
EPA METHOD	: 8020 (BETX)	UNITS	: ug/L
SAMPLE MATRIX	: WATER		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	20.0	20.9	105	21.4	107	2
TOLUENE	<0.5	20.0	20.8	104	21.5	108	3
TOTAL XYLENES	0.8	40.0	42.2	106	44.0	110	4

$$\%\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 161-289-B04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUNDS	RESULTS
BENZENE	<0.025
TOLUENE	<0.025
ETHYLBENZENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	87

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102-9

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: HA-27,4.0	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT		% MOISTURE	: 22

COMPOUNDS	RESULTS
BENZENE	<0.025
TOLUENE	<0.025
ETHYLBENZENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	71

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102-10

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: HA-27,6.0	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT		% MOISTURE	: 27

COMPOUNDS	RESULTS
BENZENE	<0.025
TOLUENE	<0.025
ETHYLBENZENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	70

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102-11

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/15/91
CLIENT I.D.	: GARAGE DITCH,0.5	DATE ANALYZED	: 05/15/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT		% MOISTURE	: 38

COMPOUNDS	RESULTS
BENZENE	<0.040
TOLUENE	<0.040
ETHYLBENZENE	<0.040
TOTAL XYLENES	0.049

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	58

Analytical Technologies, Inc.

ATI I.D. # 9105-102-12

VOLATILE ORGANIC COMPOUNDS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT #	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: GARAGE DITCH,1.5	DATE ANALYZED	: 05/13/91
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1
RESULTS BASED ON DRY WEIGHT		% MOISTURE	: 25

COMPOUNDS	RESULTS
BENZENE	<0.025
TOLUENE	<0.025
ETHYLBENZENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE	74

Analytical Technologies, Inc.

ATI I.D. # 9105-102

VOLATILE ORGANIC COMPOUNDS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9105-053-7
PROJECT #	: 161-289-B04	DATE EXTRACTED	: 05/10/91
PROJECT NAME	: UNOCAL EDMONDS	DATE ANALYZED	: 05/10/91
EPA METHOD	: 8020 (BETX)	UNITS	: mg/Kg
SAMPLE MATRIX	: SOIL		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.880	88	0.896	90	2
TOLUENE	<0.025	1.00	0.946	95	0.964	96	2
TOTAL XYLENES	<0.025	2.00	1.93	97	2.10	105	8

$$\%\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

AnalyticalTechnologies,Inc.

ATI I.D. # 9105-102

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT	: 161-289-BO4	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 05/10/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102-1

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: MW-10(U)	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102-2

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: MW-11(U)	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102-3

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: MW-13(U)	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102-4

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT	: 161-289-B04	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: MW-27	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102-5

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT	: 161-289-BO4	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: MW-28	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102-6

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 05/08/91
PROJECT	: 161-289-BO4	DATE RECEIVED	: 05/09/91
PROJECT NAME	: UNOCAL EDMONDS	DATE EXTRACTED	: 05/10/91
CLIENT I.D.	: MW-29	DATE ANALYZED	: 05/11/91
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C7 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	C12 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

Analytical Technologies, Inc.

ATI I.D. # 9105-102

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : WATER
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/L	9105-102-7	2.0	2.1	5	7.5	10	55

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9105-102

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC.
PROJECT # : 161-289-B04
PROJECT NAME : UNOCAL EDMONDS

DATE ANALYZED : 05/10/91
MATRIX : SOIL
UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9105-095-2	16	14	13	N/A	N/A	N/A

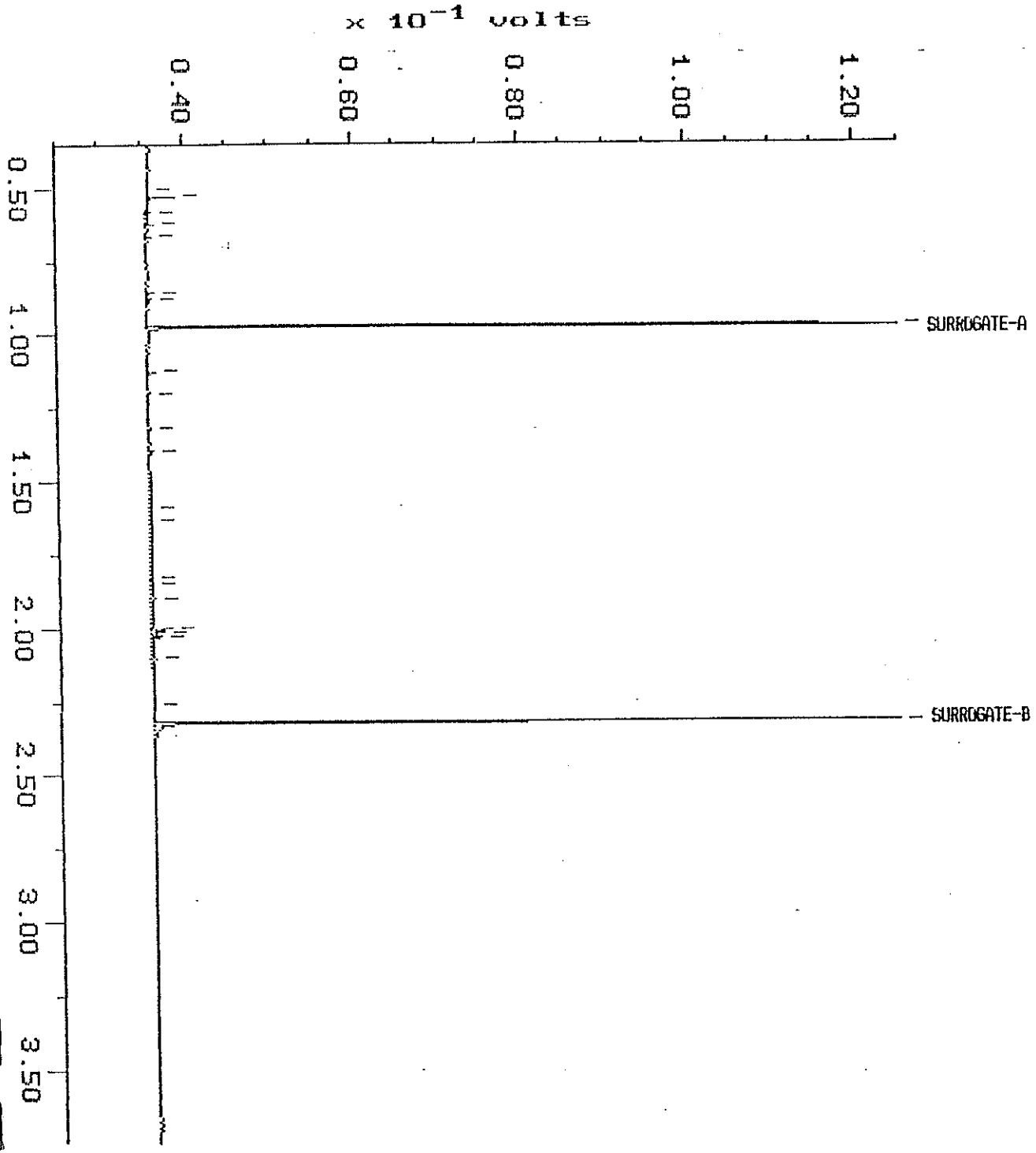
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Sample: 9105-102-B
Acquired: 11-MAY-91 5:33
Inj Vol: 1.00

Channel: LISA
Method: C:\MAXDATA\WINS-L\FUEL0510

Filename: 0510AL27
Operator:



DATE 5-7-11 PAGE 1 OF 1

Analytical Technologies, Inc.

560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335

Chain of Custody LABORATORY NUMBER: 9105-102

PROJECT MANAGER: Dan Crevelsten
COMPANY: Geo Engineers
ADDRESS:
PHONE: 861-6000 SAMPLED BY: DEH

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	8020 BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	8080 PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
MW-10(W)	5-8-91	1037	Water	-1			X											X													3
MW-11(W)	5-8-91	1000	Water	-2			X									X		X													4
MW-13(W)	5-8-91	1120	Water	-3			X									X		X													4
MW-27	5-8-91		Water	-4			X											X													3
MW-28	5-8-91		Water	-5			X											X													3
MW-29	5-8-91	1500	Water	-6			X											X													3
MW-30	5-8-91	1150	Water	-7			X									X		X													3
MW-31	5-8-91	1300	Water	-8			X											X													3
HA-27, 4.0	5-8-91		Soil	-9			X																								1
HA-27, 6.0	5-8-91		Soil	-10			X																								1
Garage ditch, 0.5	5-8-91		Soil*	-11			X																								1
Garage ditch, 1.5	5-8-91		Soil	-12			X																								1

PROJECT INFORMATION

PROJECT NUMBER: 161-289-B04
PROJECT NAME: Unocal Edmonds
PURCHASE ORDER NUMBER:
ONGOING PROJECT? YES ☒ NO ☐

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	32
COC SEALS/INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
RECEIVED VIA:	Courier

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) ☒ 2WKS (RUSH) ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK

GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:
Edmonds Marketing Terminal

* Garage ditch, 0.5 sample high % organics

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Donald Harbor Time: 0800	Signature: Time:	Signature: Time:
Printed Name: Donald E. Harbor Date: 5-9-91	Printed Name: Date:	Printed Name: Date:
Company: GFI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: P. Nichols Time: 9:40	Signature: Time:	Signature: Time:
Printed Name: P. Nichols Date: 5/9/91	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

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