SUBSURFACE PETROLEUM HYDROCARBON CONTAMINATION EVALUATION

CHEVRON BULK PLANT

Camas, Washington

Prepared For

Chevron U.S.A. Inc.

W-5388

November 1987

RITTENHOUSE-ZEMAN & ASSOCIATES

Geotechnical & Hydrogeological Consultants

RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants
1400 140th Avenue N.E.
Bellevue, Washington 98005
(206) 746-8020

8 December 1987

W-5388

Chevron U.S.A. Inc.
P.O. Box 220
Seattle, Washington 98111

Attention: Mr. Don Foresman

Subject: Subsurface Petroleum Hydrocarbon Contamination Evaluation
Chevron Bulk Plant
Camas, Washington

Gentlemen:

We are pleased to present herein a revised copy of the above referenced report. This report presents the results of our subsurface exploration program at the above referenced Chevron service station. Verbal authorization to proceed with this evaluation was provided by Mr. Don Foresman. This study was completed in accordance with our proposal. We appreciate this opportunity to be of service to you and would be pleased to discuss the contents of this report at your convenience.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Wade H. Chapman-Riggsbee

Wade H. Chapman-Riggsbee, P.G.
Chief Hydrogeologist

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CAMAS, WASHINGTON

1.0 SUMMARY

Rittenhouse-Zeman & Associates, Inc. (RZA) conducted a subsurface petroleum hydrocarbon contamination evaluation at the Chevron Bulk Plant located at S.E. 6th Avenue and S.E. Union Avenue in Camas, Washington. Our investigation, conducted between 12 and 14 October 1987, consisted of collecting soil samples from the exploratory borings for geologic data and quantitative analyses. Two borings were advanced, penetrating to a maximum depth of approximately 20 feet below the existing ground surface.

Our subsurface investigation determined:

- Subsurface conditions generally consisted of about 3 feet of silty SAND overlying damp to moist gray-brown sandy GRAVEL. Loose GRAVEL and BOULDERS were noted at a depth of 20 feet below the existing ground surface. Groundwater was not encountered in the borings. A slightly cemented zone was noted at the 20 foot depth.

- Total petroleum hydrocarbon concentrations in the composite soil samples ranged from 429 ug/g to 7,770 ug/g, which equal parts per million (ppm). The higher concentrations were indicated in samples near the surface of boring B-1 and at depth in boring B-2.

- Benzene concentrations in the analyzed soil samples ranged from 4.5 ug/kg to 151 ug/kg which equal parts per billion (ppb). The other volatile aromatic hydrocarbons such a toluene ranged from 4.5 ug/kg to 4,960 ug/kg and xylene ranged from 6.7 ug/kg to 14,510 ug/kg.

This summary is presented for introductory purposes and should be used only in conjunction with the full text of this report. The project description, site conditions, investigative techniques and evaluation results are presented in the text of this report.

2.0 PROJECT DESCRIPTION

The approximate site boundaries and the locations of the bulk plant structures, underground storage tanks, former above ground storage tanks and our explorations are presented on the Site and Exploration Plan, Figure 2.

The purpose of this evaluation was to determine if elevated petroleum hydrocarbon concentrations existed in the subsurface soils underlying the site at the time of our investigation. The scope of work consisted of modified field explorations, quantitative analyses and report preparation. This report has been prepared for the exclusive use of Chevron U.S.A. Inc,. and their agents, for specific application to this project in accordance with generally accepted hydrogeologic and geotechnical engineering practices.

3.0 SITE CONDITIONS

The site is located at the S.E. corner of S.E. 6th Avenue and S.E. Union Avenue in Camas, Washington (Figure 1). A preliminary visual site reconnaissance was conducted on 9 September 1987. Our subsurface explorations were conducted between 12 and 14 October 1987. The surface and subsurface conditions are described below; geologic logs and soil sampling procedures are presented in Appendix A. A site plan showing the locations of our explorations is shown in Figure 2. Appendix B presents quantitative analyses procedures and results.

3.1 Surface Conditions

The subject site is roughly triangular in shape, extending approximately 160 feet in a north-south direction and about 300 feet in the east-west direction. Site topography is relatively flat across the site and appeared to drain to the south. The terminal warehouse building and office is located in the southeast quarter of the site. The vehicle maintenance garage is located in the new portion of the site. The former pumps were located immediately northeast of the building and the storage tanks were located immediately north of the pumps. It is our understanding that all above-ground bulk storage tanks, the T.T.L.R. and pumps were removed in 1984 following the closing of the facility in 1983. Site plans provided to us indicate the presence of a underground fuel-oil tank southwest of the office building and a septic tank in the northeast corner or the site.

Due to the flat nature of the site and lack of topographic survey, it was difficult to determine the direction of surface water runoff. It appeared that onsite drainage ran off toward the streets to the west and south. The predominant direction of area runoff appears to be to the south, a raised railroad embankment directly north of the site precluding flow in a northerly direction.

3.2 Subsurface Conditions

The subsurface exploration program for this study consisted of two air-rotary borings which were completed to an approximate depth of 20 feet below ground surface. Due to the presence of gravels, boulders and cemented zones, the area geology presents difficult drilling conditions. The most cost effective method under these conditions was the use of air rotary. Utilizing this method the borings could be advanced where hollow-stem auger would meet refusal or mud rotary or cable tool would experience loss of fluid or injection of drilling mud or water into the formation. A compromise in sample integrity was necessary, as it was impractical to take drill samples. Therefore, samples of cuttings were collected directly adjacent to the borehole during 5 foot drilling intervals and composited to assure a representative same of the interval.

Area geology was based upon local experience and well logs of local water wells or cathodic protection borings, indicated a cemented zone approximately 19 feet below the surface and a static groundwater elevation approximately 45 feet below the ground surface. Based on this information, two test borings were advanced in areas with the greatest potential of being contaminated, namely the former T.T.L.R. and bulk storage tank areas. The intent of these preliminary explorations in addition to sampling the upper soils was to determine the existence of potential perched groundwater above the suspected cemented zone and install monitoring wells if free water was found. To drill down to the documented water table at -45 feet with high groundwater flow rates in loose gravel and boulders, would yield little information at great expense if potential contamination was limited to upper soils.

Our explorations encountered two lithologic units beneath the site. These units were from the surface downward: 1) a silty sand; and 2) a damp to moist sandy gravel. At approximately 18 - 20 feet below ground surface a cemented zone was encountered above loose gravels and boulders. All borings were terminated at the cemented zone for control on this potential infiltration barrier. The borings were subsequently backfilled with

bentonite within the barrier and at the surface. Although the moisture content increased above the suspect cemented zone, no free water or saturated soils were observed. This is not conclusive in itself as exploration tool placed following an extremely dry summer.

Appendix A contains geologic logs and soil sampling procedures.

4.0 QUANTITATIVE ANALYSES PROCEDURES AND RESULTS

All laboratory analyses were subcontracted to AmTest, Inc. Soil samples were identified by boring number and approximate depth below ground surface. Soil samples were analyzed for volatile aromatic hydrocarbons most commonly found in petroleum hydrocarbon based fuels (e.g. benzene, toluene, and xylene).

Description of the analytical techniques, results and the detection limits are provided in Appendix B. The petroleum hydrocarbon concentrations are reported in parts per million (ppm). The volatile aromatic hydrocarbon concentrations are reported in parts per billion (ppb).

4.1 Petroleum Hydrocarbon Analytical Results

Results of the quantitative analysis on soils samples collected in borings B-1 showed relatively high concentrations of petroleum hydrocarbons near the surface, concentrations ranging from 429 ppm to 7,770 ppm. The samples collected in boring B-2 showed petroleum hydrocarbon concentrations in the soils ranging from 549 ppm to 1420 ppm. Higher concentrations found within the sample interval including the cemented zone.

4.2 Volatile Aromatic Hydrocarbon Analytical Results

Volatile aromatic hydrocarbon analyses were conducted on selected soil samples. The analytical results in Table B-2 show that benzene concentrations in these samples ranged from 4.5 ppb to 151.0 ppb. The concentrations of toluene ranged from 4.5 ppb to 4,960 ppb and xylene ranged from 6.7 ppb to 14,510 ppb. These results indicate that the dissolved portions of hydrocarbon product is present at the cemented zone at a depth of approximately 20 feet. The presence of product at this level suggests that a perching of old product has occurred.

5.0 CONCLUSIONS

The quantitative analyses indicated that the site's subsurface soils have concentrations above the soil background and product is perched on a cemented zone. Elevated concentrations indicate near-surface contamination in the area of the former TTLR. At the time of our exploration there was no indication of recoverable amounts of groundwater perched atop the cemented zone that would warrant the installation of monitoring wells.

The extent to which the underlying gravel and boulder formation is effected by potential contamination was not determined for practical purposes (ie. sampling cobbles/boulders, depth to groundwater). Municipal water wells in close proximity to the site (City of Camas approximately 0.3 miles to the northwest and City of Washougal 0.2 miles to the east) show no impact to water quality. Both well fields draw from the aquifer approximately 45 feet below the site with yields of 600-800 GPM per well. No water quality problems were reported by either municipality.

The conclusions presented in this report are professional opinions and based on the explorations accomplished for this study. The number, locations, and depths of the explorations were completed within the site and proposal constraints so as to yield the information required.

We appreciate this opportunity to assist you with this evaluation. If you have any questions, please call us.

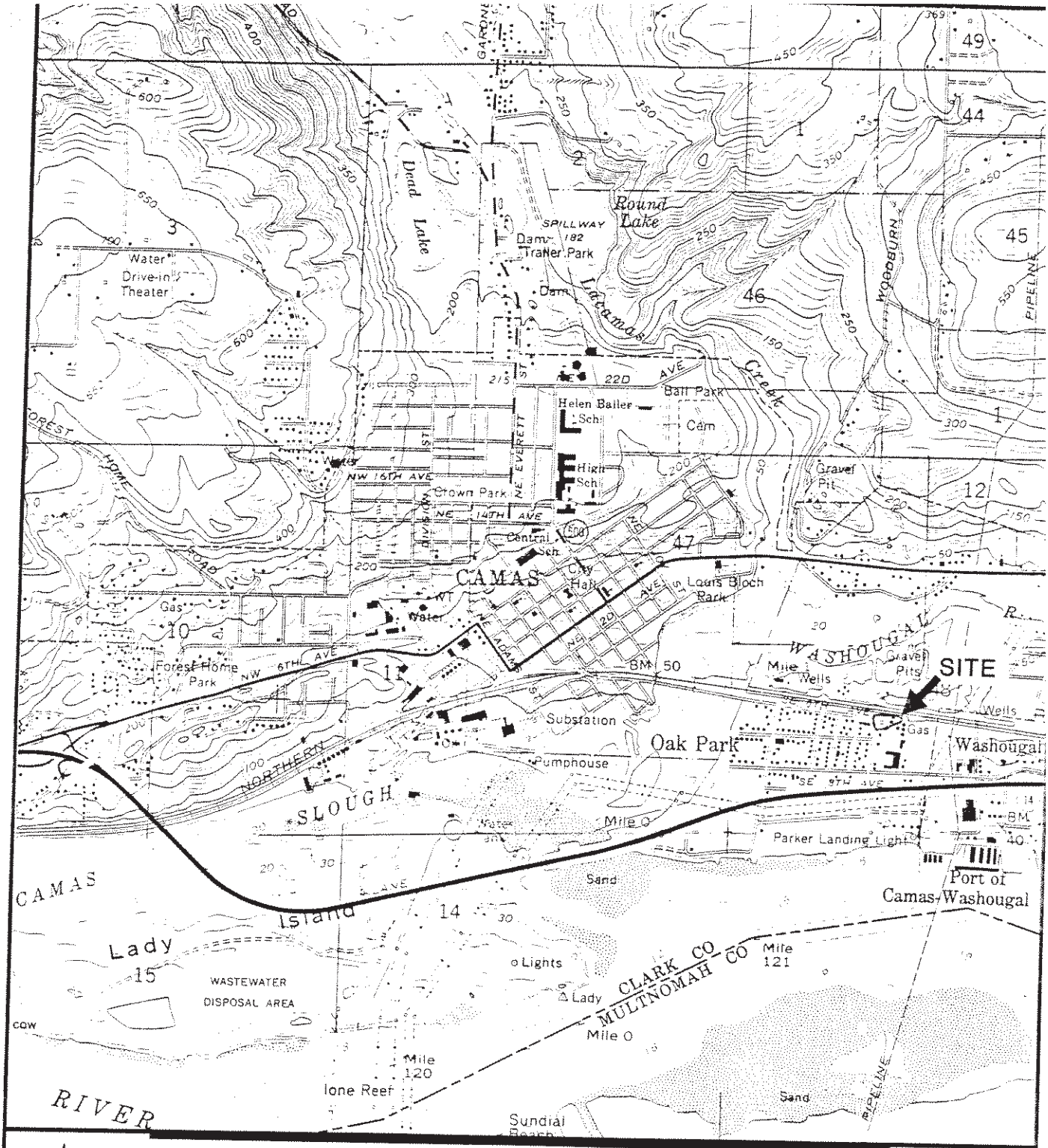
Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Wade H. Chapman-Riggsbee

Wade H. Chapman-Riggsbee, P.G.
Chief Hydrogeologist

cc: Mr. Steve Merritt, Chevron U.S.A. Inc.



CAMAS, WASHINGTON CHEVRON

SITE VICINITY MAP
FIGURE 1

W.O.	W-5388
BY	DGC
DATE	OCT 1987
SCALE	N/A

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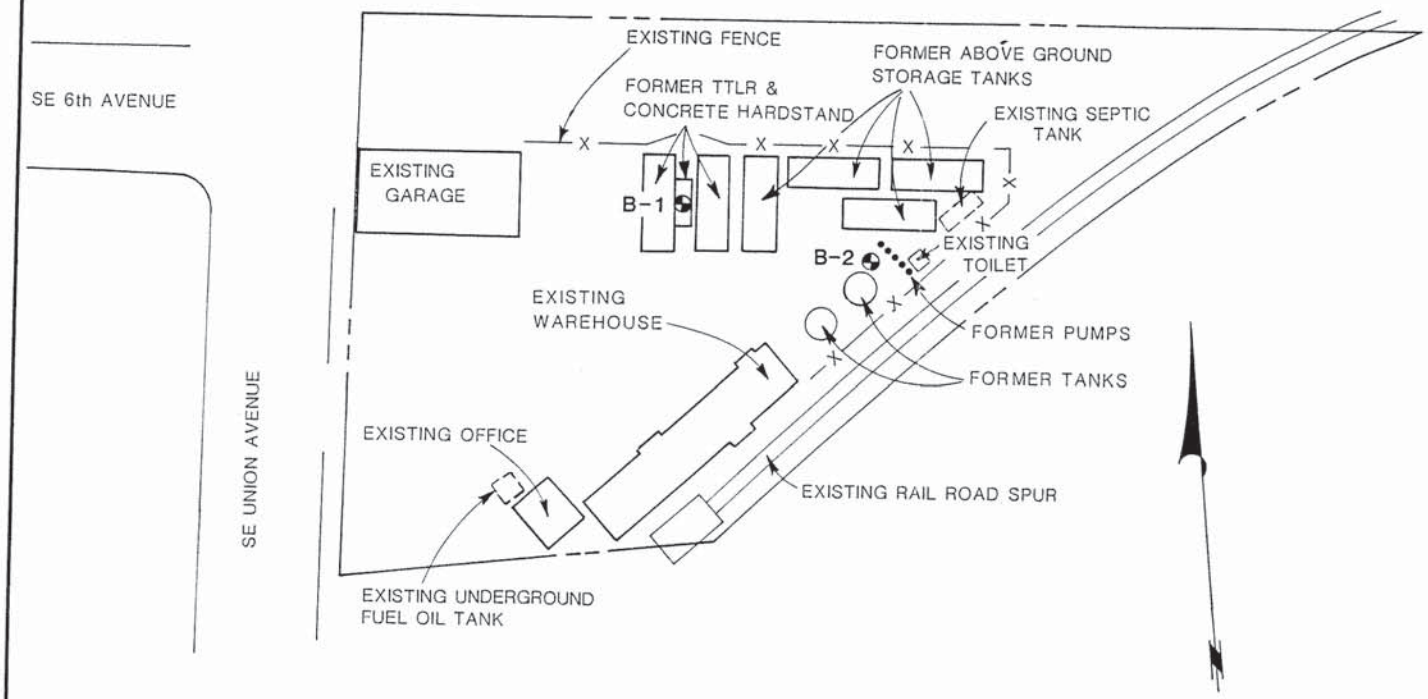
Geotechnical & Hydrogeological Consultants
1400 140th Avenue N.E.
Bellevue, WA 98005

RZA



APPROXIMATE SCALE IN FEET

0 40 80

EXPLANATION

B-2 INDICATES BORING NUMBER & APPROXIMATE LOCATION

Base map from 12-70 revised Ground Plan by Standard Oil Company of California Western Operations, Inc.

CAMAS, WASHINGTON CHEVRON

SITE & EXPLORATION PLAN
FIGURE 2

W.O. W-5388
BY DGC
DATE OCT 1987
SCALE NOTED

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1400 140th Avenue N.E.
Bellevue, Washington 98005

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APPENDIX A
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SUBSURFACE EXPLORATION

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SUBSURFACE EXPLORATION

Two soils borings were advanced at the site on 12 and 14 October 1987 to: 1) obtain soil samples, and 2) determine the presence or absence of petroleum hydrocarbons. The approximate exploration locations are shown on the Site and Exploration Plan, Figure 2. The borings were drilled by an exploration drilling company under subcontract to our firm. The borings consisted of advancing a 6-inch air-rotary boring with a truck-mounted drill rig. No foam, water or other substances were introduced during drilling.

During the drilling process, samples of cuttings composited over 5 foot intervals were obtained. Samples of the cuttings were collected directly adjacent to the borehole during 5 foot drilling intervals. The borings were continuously logged by a hydrogeologist from our firm.

The sample was then homogenized in a stainless steel bowl and representative portion of the sample was transferred to a a laboratory prepared container with a stainless steel spoon and tightly sealed. All samples were labeled to identify the project number, test pit location, sample number and depth interval. All samples were immediately placed in a cooler until transferred to cold storage at the laboratory. RZA's chain-of-custody procedures were used to insure sample integrity. the stainless steel spoon and bowl used for sampling and homogenizing were decontaminated prior to retrieving each sample. the implements were scrubbed with a stiff brush in an alconox solution, rinsed with potable water and rinsed again with distilled water. Likewise, the drill bit was decontaminated using the same procedure between borings.

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Geotechnical / Hydrogeological Consultants

BORING NUMBER B-1 W.O. W-5388

PROJECT NAME Chevron - Camas

SOIL DESCRIPTION	DEPTH (FEET)	LAB TESTS	SAMPLING	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ BLOWS PER FOOT • (140 lb. hammer, 30 inch drop) 0 10 20 30 40 50 60 70 80 90 100
Ground Surface Elevation Approximately Feet	0				
Gravel base, crushed rock					
Dry, light brown, sandy SILT, silty SAND			B		
Damp, grey-brown, sandy GRAVEL, with some silt	5				
			B		
Damp, gray-brown, sandy GRAVEL, with some silt	10				
			B		
Moist, gray-brown, sandy GRAVEL	15				
becomes silty			B		
Loose gravel, boulders	20				
Total depth 23 feet Completed 12 October 1987	25				
	30				
	35				
	40				

SAMPLING
- I 2" OD SPLIT SPOON SAMPLE
- II 3" OD SHELBY SAMPLE
- ⊠ 2.5" ID RING SAMPLE
- B BULK SAMPLE
- ★ SAMPLE NOT RECOVERED

GROUND WATER
- SEAL
- DATE
- WATER LEVEL AT TIME OF DRILLING ATD
- OBSERVATION WELL TIP

LABORATORY TESTS
- ● % WATER CONTENT
- NP NON PLASTIC
- LIQUID LIMIT
- NATURAL WATER CONTENT
- PLASTIC LIMIT

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Geotechnical / Hydrogeological Consultants

BORING NUMBER B-2 W.O. W-5388

PROJECT NAME Chevron - Camas

SOIL DESCRIPTION	DEPTH (FEET)	LAB TESTS	SAMPLING	GROUND WATER
Ground Surface Elevation Approximately Feet				
Gravel base - crushed rock	0			
Dry, light brown, sandy SILT				
Damp, gray-brown, sandy GRAVEL, with trace silt			B	
	5			
			B	
Damp, gray-brown, GRAVEL with some sand	10			
			B	
Damp to moist, bray-brown, sandy GRAVEL	15			
becomes silty, cemented			B	
Loose gravel, boulders	20			
Total depth 23 feet Completed 12 October 1987	25			
	30			
	35			
	40			

STANDARD PENETRATION RESISTANCE
▲ BLOWS PER FOOT
* (140 lb. hammer, 30 inch drop)
0 10 20 30 40 50 60 70 80 90 100

SAMPLING
I 2" OD SPLIT SPOON SAMPLE
II 3" OD SHELBY SAMPLE
☒ 2.5" ID RING SAMPLE
B BULK SAMPLE
★ SAMPLE NOT RECOVERED

GROUND WATER
WATER LEVEL AT TIME OF DRILLING ATD
SEAL
DATE
OBSERVATION WELL TIP

LABORATORY TESTS
● % WATER CONTENT
NP NON PLASTIC
LIQUID LIMIT
NATURAL WATER CONTENT
PLASTIC LIMIT

APPENDIX B
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QUANTITATIVE ANALYSES PROCEDURES