

**GEOTECHNICAL ENGINEERING AND
ENVIRONMENTAL EVALUATION
HOQUIAM RIVER WOODLAWN WATER PIPELINE CROSSING
HOQUIAM, WASHINGTON**

Submitted To:

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7-91M-11957-0



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GEOTECHNICAL ENGINEERING AND ENVIRONMENTAL EVALUATION 7-91M-11957-0
HOQUIAM RIVER WOODLAWN WATER PIPELINE CROSSING
HOQUIAM, WASHINGTON

1.0 PROJECT DESCRIPTION

The project site is located along Broadway Avenue near the intersection with Rayonier Avenue on the east side of the Hoquiam River and along Washington Avenue near the intersection with Tyler Street in the Woodlawn area on the west side of the Hoquiam River in Hoquiam, Washington. The east side site area has several single-family residences with lots which slope mildly to the west toward the Hoquiam River. The west side site area was formerly a lumber and shingle mill, and meat slaughter house, and is currently vacant and generally overgrown with small trees and surface brush.

Development plans call for directional drill installation of a 16-inch outside diameter (O.D.) high density polyethylene (HDPE) water pipeline below the Hoquiam River. We advanced test borings along two alternate routes classified as upstream and downstream crossings. We understand the upstream crossing is currently the more desirable route and as such we focused our geotechnical analysis along this area. The upstream crossing is on the order of 988 feet in length from the east side entry point and west side exit location. The entry and exit angle for the water pipeline is planned at 10 degrees below the horizontal. The current design shows the upstream pipe centerline low point approximately 70 feet below grade near the west bank of the Hoquiam River and a minimum of 14 to 15 feet below the river bottom on the east side of the channel.

Environmental sampling and testing was performed due to the concern with the previous site history of the west side site area and possible contaminated drill cuttings being encountered during the directional drilling. A subsurface soil assessment along the proposed alignment was performed to characterize the potential drill cuttings with respect to analytes consistent with the historical site activities.

It should be realized that the conclusions and recommendations contained in this report are based on our understanding of the currently proposed utilization of the project site, as derived from layout drawings, written information, and verbal information supplied to us. Consequently, if any changes are made in the currently proposed project, we may need to modify our conclusions and recommendations contained herein to reflect those changes.

2.0 EXPLORATORY METHODS

We explored surface and subsurface conditions at the project site from 12 through 15 November 1997. Our field exploration and testing program consisted of the following elements:

- A visual surface reconnaissance was made of the project site;
- A track-mounted excavator cleared the west side site area for drilling access.

- Six hollow stem auger and rotary borings, three borings each for the two alternate routes were advanced at strategic locations along the upstream and downstream crossings;
- Two grain size analyses, two Atterberg limits and fifteen moisture content tests were performed on selected soil samples obtained from strategic locations from the test borings;
- A review was made of published geologic maps and seismologic literature;
- Four hollow stem auger borings and additional sampling for environmental testing was accomplished along the west side site area. Soil samples were field screened for the presence of volatile hydrocarbons using an Organic Vapor Meter (OVM). Seven samples were collected and tested for petroleum hydrocarbons, halogenated volatile organics (HVOs), pentachlorophenol (PCP), polycyclic aromatic hydrocarbons (PAHs) and RCRA metals.

Table 1, below, summarizes the approximate functional locations, surface elevations, and termination depths of all subsurface explorations, and our *Site & Exploration Plan* (Figure 2) depicts their approximate relative locations. Appendix A of this report describes our field exploration procedures and borings logs. Appendix B describes our geotechnical laboratory testing procedures and results and Appendix C describes our analytical test results.

TABLE 1 APPROXIMATE LOCATIONS, ELEVATIONS, AND DEPTHS OF EXPLORATIONS			
Exploration	Functional Location	Surface Elevation (feet)	Termination Depth (feet)
B-1	Downstream crossing east side	20	50.5
B-2	Upstream crossing east side	10	51.5
B-3	Upstream crossing west side	13	76.5
B-4	Downstream crossing west side	12	91.5
B-5	Upstream crossing west side	12	31.5
B-6	Downstream crossing west side	12	31.5
B-7	Upstream crossing west side	12	26.5
B-8	Upstream crossing west side	12.5	21.5
B-9	Upstream crossing west side	13	16.5
B-10	Upstream crossing west side	12	11.5

Elevation datum: NAVD88 U.S. Feet

The specific number, locations, and depths of our explorations were selected in relation to the existing and proposed site features, under the constraints of surface access, and budget considerations. Roger Lenius Engineering was contracted to perform the site survey and located our staked boring locations on the site plan. Elevations of our explorations were estimated by interpolating between spot elevations shown on this same plan. Consequently, the data listed in Table 1, and the locations depicted on Figure 2, should be considered accurate only to the degree permitted by our data sources and implied by our measuring methods.

It should be realized that the explorations performed for this evaluation reveal subsurface conditions only at discrete locations across the project site and that actual conditions in other areas could vary. Furthermore, the nature and extent of any such variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed at that time, we may need to modify our conclusions and recommendations contained in this report to reflect the actual site conditions.

3.0 SITE CONDITIONS

The following sections of text present our observations, measurements, findings, and interpretations regarding development, utility, surface, soil, groundwater, and seismic conditions at the project site. Descriptive logs of our subsurface explorations and graphic results of our laboratory tests are included in Appendix A, Appendix B, and Appendix C of this report.

3.1 Development Conditions

The east side of the upstream Hoquiam River site area has several single-family residences and driveways which front on Broadway Avenue to the east. One residence apparently operates a wholesale operation which includes storage of salal and cedar for decorations. The downstream location on the east side of the site area consists of an access drive to a stockpile of crushed rock used by the City of Hoquiam's Department of Public Works.

The west side of the Hoquiam River site area was formerly a lumber and shingle mill and meat slaughter house over the past century. The buildings were removed from the site; the site is currently vacant and generally overgrown with small trees and surface brush. Washington Avenue formerly accessed the west side of the site area development but is blocked off at Tyler Street. The Washington Avenue right-of-way on the site is currently overgrown and serves as a trail. In review of historical documents regarding the west side site area development, the majority of the buildings were located south of the Washington Street right-of-way and are not within the proposed directional drilling alignments.

3.2 Utility Conditions

Our site reconnaissance and understanding of the site area indicates that utilities on the east side site area include overhead power and cable, underground phone, water and sanitary

APPENDIX A
FIELD EXPLORATION PROCEDURES AND RESULTS
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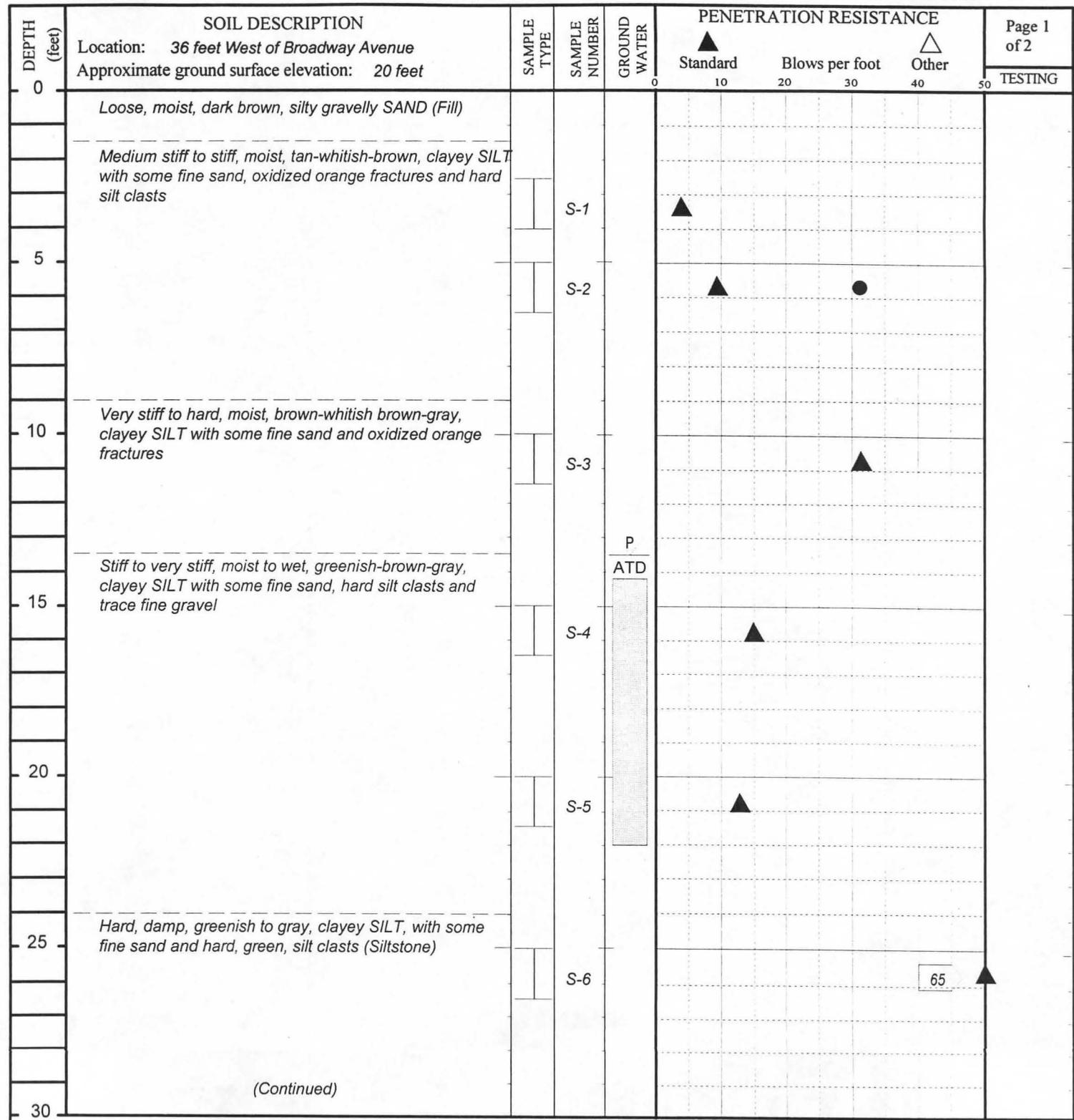
Our field exploration program for this evaluation included ten borings, using hollow stem auger and rotary drilling methods. The following paragraphs describe our procedures associated with these explorations. Descriptive logs of our explorations are enclosed in this appendix.

Soil Boring Procedures

Our exploratory borings were advanced from 12 through 15 November 1997 with a hollow-stem auger, using a track-mounted drill rig operated by an independent drilling firm working under subcontract to AEE. Using the same drill rig we switched to mud rotary drilling methods to complete the deeper borings, B-3 and B-4. A geologist from our firm continuously observed the borings, logged the subsurface conditions, and collected representative soil samples. All samples were stored in watertight containers and later transported to our laboratory for further visual examination and testing. Soil samples were field screened for the presence of volatile hydrocarbons using an Organic Vapor Meter (OVM). Any readings greater than 0 and any unusual odors or discolorations of the samples are noted on the boring logs. After each boring was completed, the borehole was backfilled with a mixture of bentonite chips and soil cuttings, and the surface was patched with asphalt or concrete (where appropriate).

Throughout the drilling operation, soil samples were obtained at 2½- or 5-foot depth intervals by means of the Standard Penetration Test (SPT) per ASTM:D-1586. This testing and sampling procedure consists of driving a standard 2-inch-diameter steel split-spoon sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval is counted, and the total number of blows struck during the final 12 inches is recorded as the Standard Penetration Resistance, or "SPT blow count." If a total of 50 blows is struck within any 6-inch interval, the driving is stopped and the blow count is recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils. In addition, a 3-inch-diameter steel split spoon sampler was used to retrieve a larger sample for analytical testing. The blow counts for the 3-inch sampler were converted to the Standard Penetration Resistance.

The enclosed *Boring Logs* describe the vertical sequence of soils and materials encountered in each boring, based primarily on our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.



LEGEND

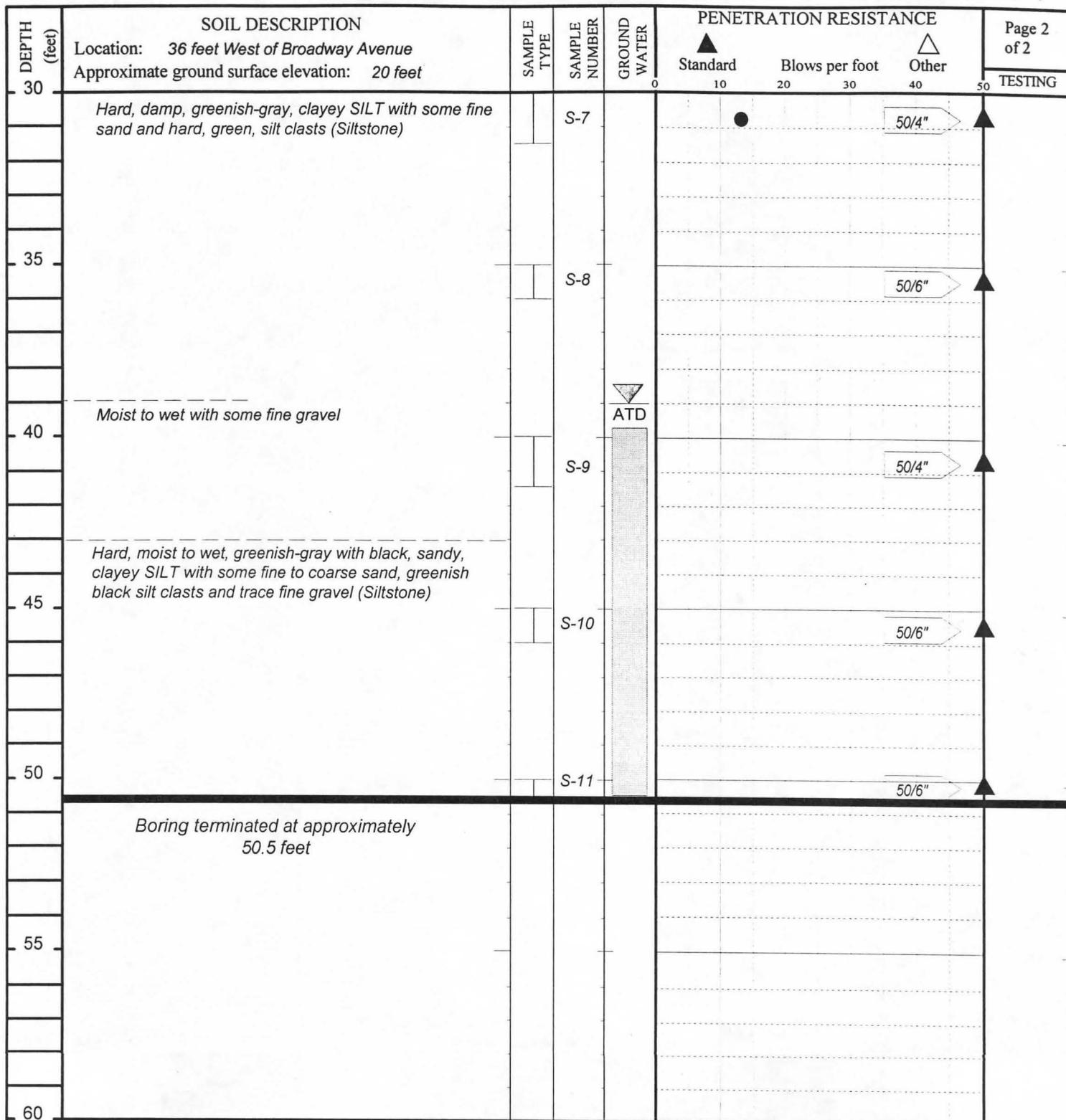
- 2.00-inch O.D. split spoon sample
- 3.00-inch OD split-spoon sample
- Groundwater level at time of drilling
- Perched groundwater level at time of drilling

MOISTURE CONTENT

Plastic limit Natural Liquid limit

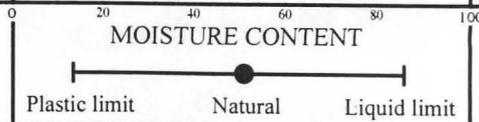
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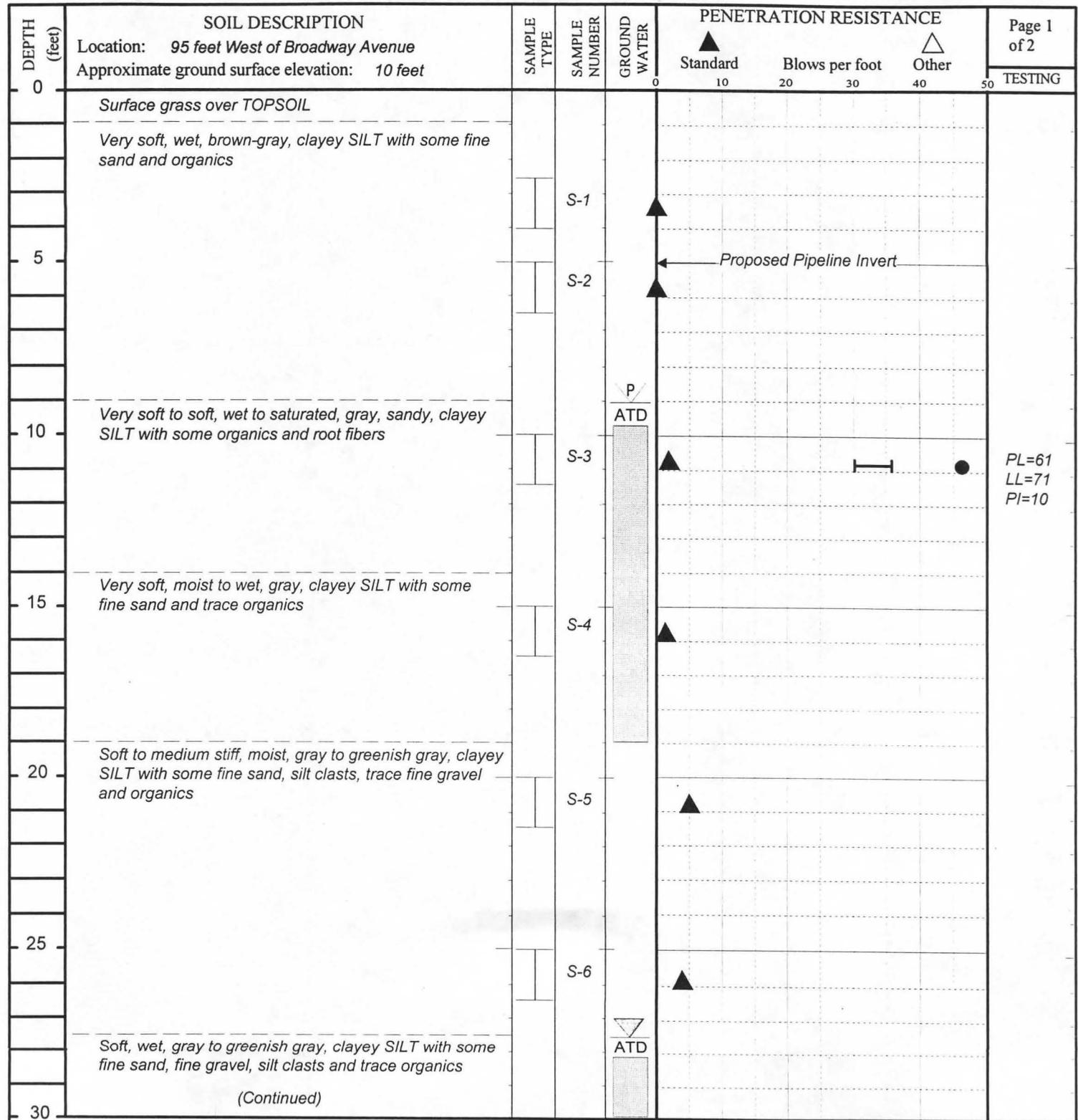
LEGEND

- | 2.00-inch O.D. split spoon sample
- || 3.00-inch OD split-spoon sample
- ▽ ATD Groundwater level at time of drilling



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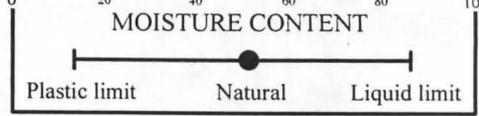
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LL=71
PI=10

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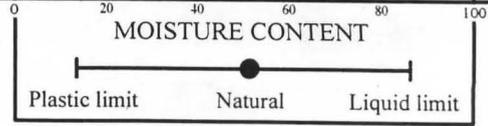
-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling
-  Perched groundwater level at time of drilling



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DEPTH (feet)	SOIL DESCRIPTION Location: <i>95 feet West of Broadway Avenue</i> Approximate ground surface elevation: <i>10 feet</i>	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE			Page 2 of 2		
					Standard ▲	Blows per foot	Other △			
30	<i>Clayey SILT as above</i>		S-7		10	20	30	40	50	TESTING
35	<i>Medium stiff, moist to wet, gray to greenish gray, clayey SILT with some fine sand, fine gravel, silt clasts, trace organics and white volcanic ash</i>		S-8		10					
40			S-9		10		30			
45	<i>Medium stiff, wet, gray to greenish gray, clayey SILT with some fine to coarse sand, fine gravel, silt clasts and trace organics</i>		S-10		10					
50			S-11		10					
<i>Boring terminated at approximately 51.5 feet</i>										
55										
60										

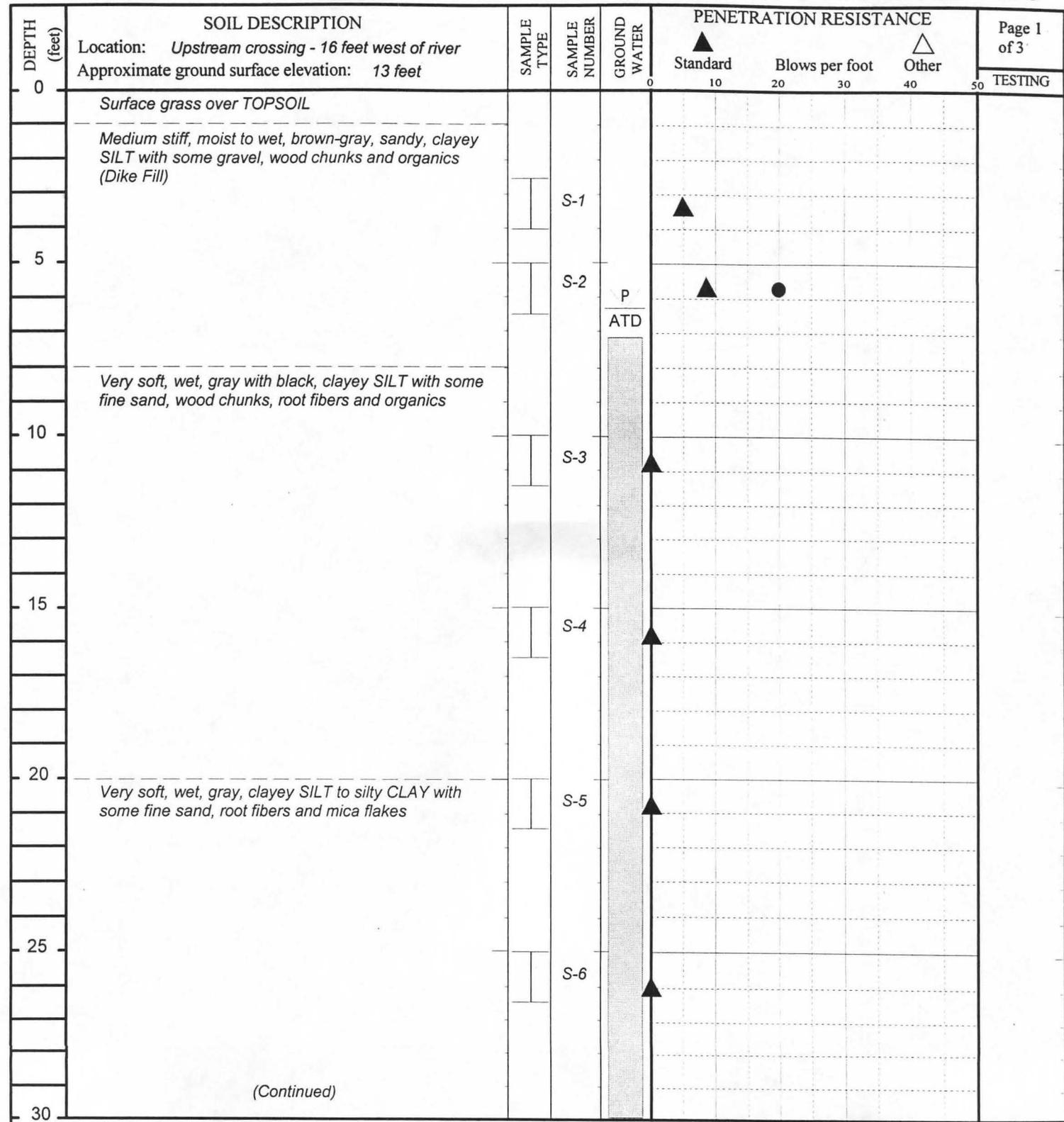


LEGEND

-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling

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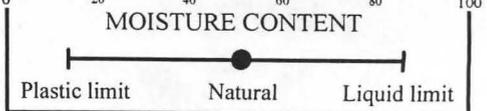
LEGEND

2.00-inch O.D. split spoon sample

3.00-inch OD split-spoon sample

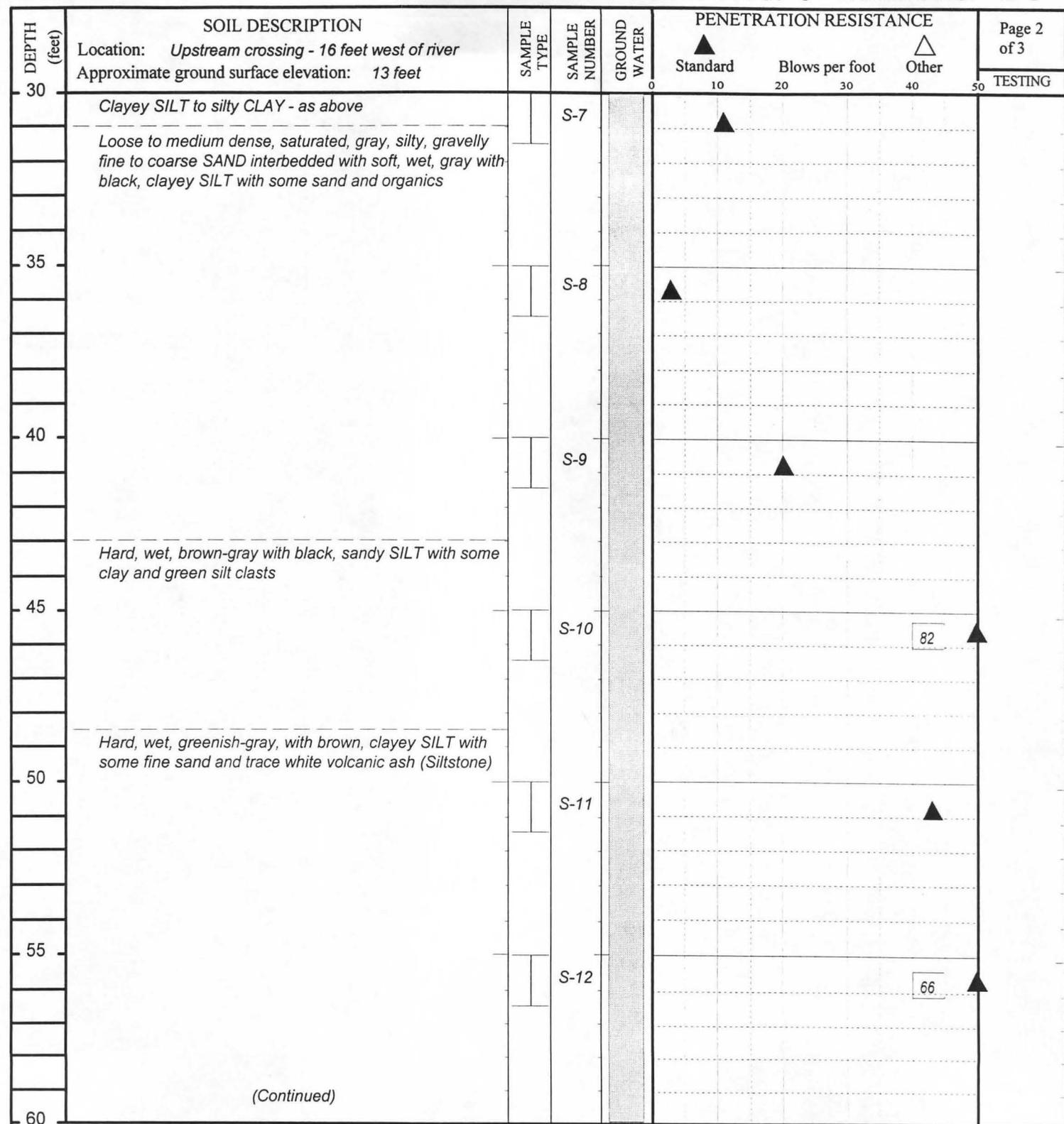
Groundwater level at time of drilling

$\frac{P}{ATD}$ Perched groundwater level at time of drilling



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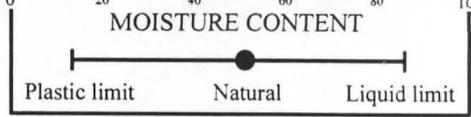
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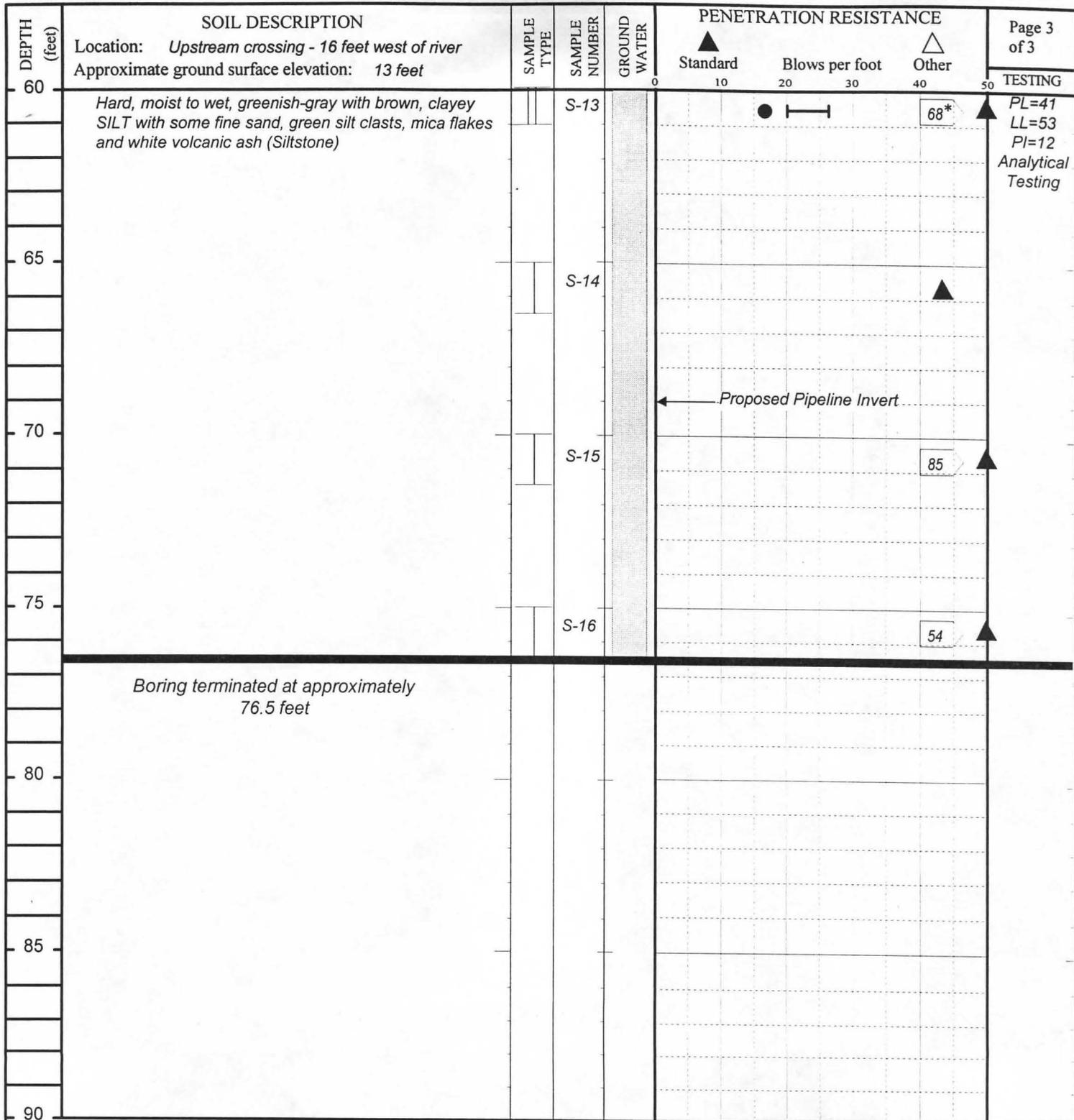
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-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling



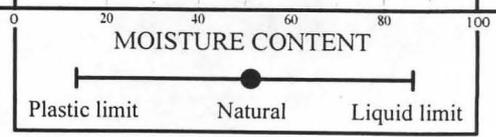
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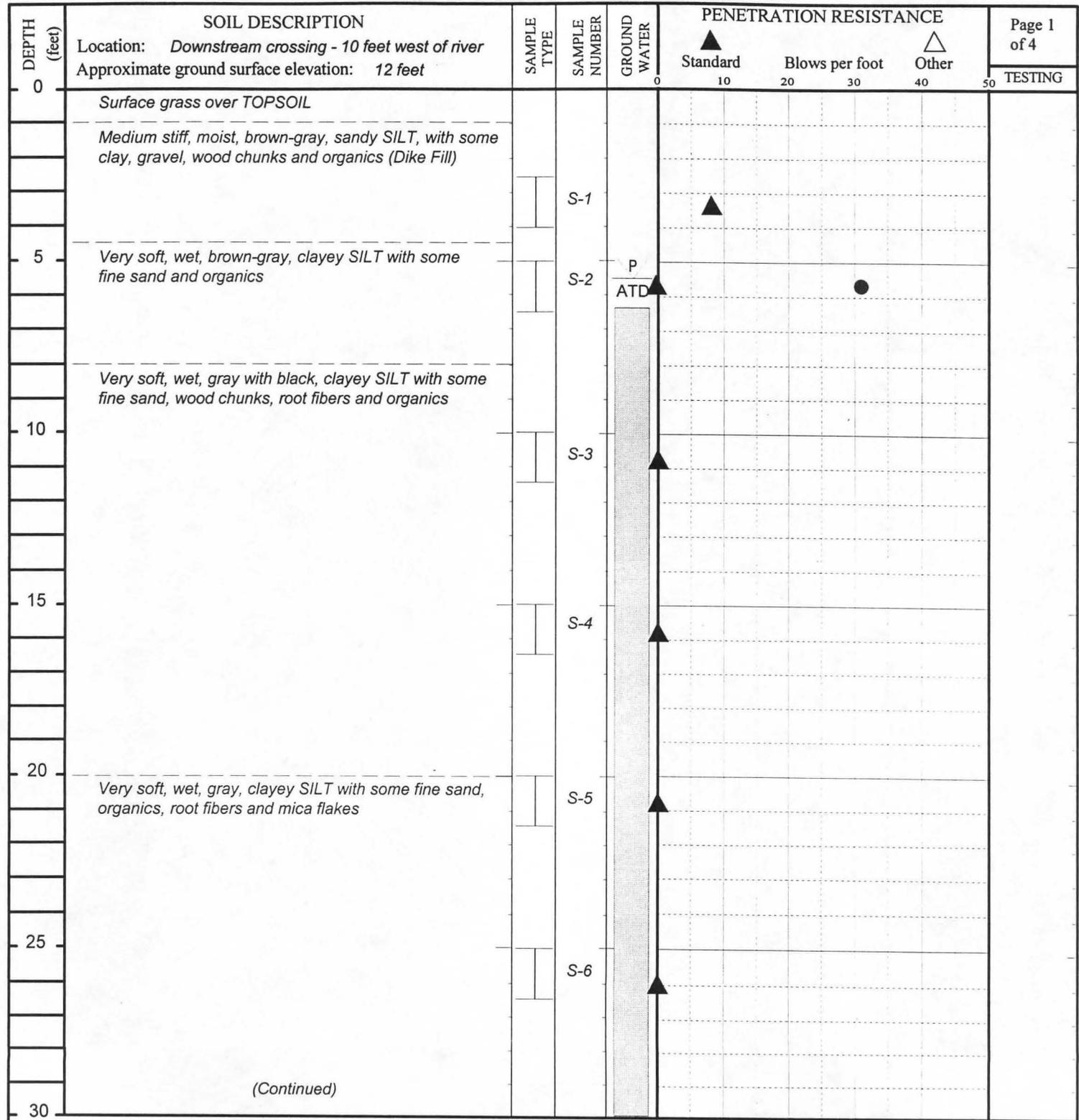


LEGEND

- 2.00-inch O.D. split spoon sample
- 3.00-inch OD split-spoon sample
- Groundwater level at time of drilling
- ATD
- * Blow count conversion to S.P.T.

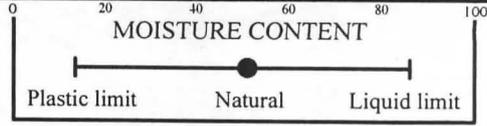


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LEGEND

-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling
-  Perched groundwater level at time of drilling



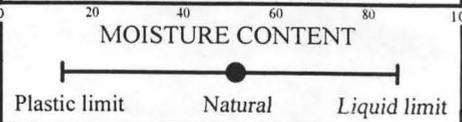
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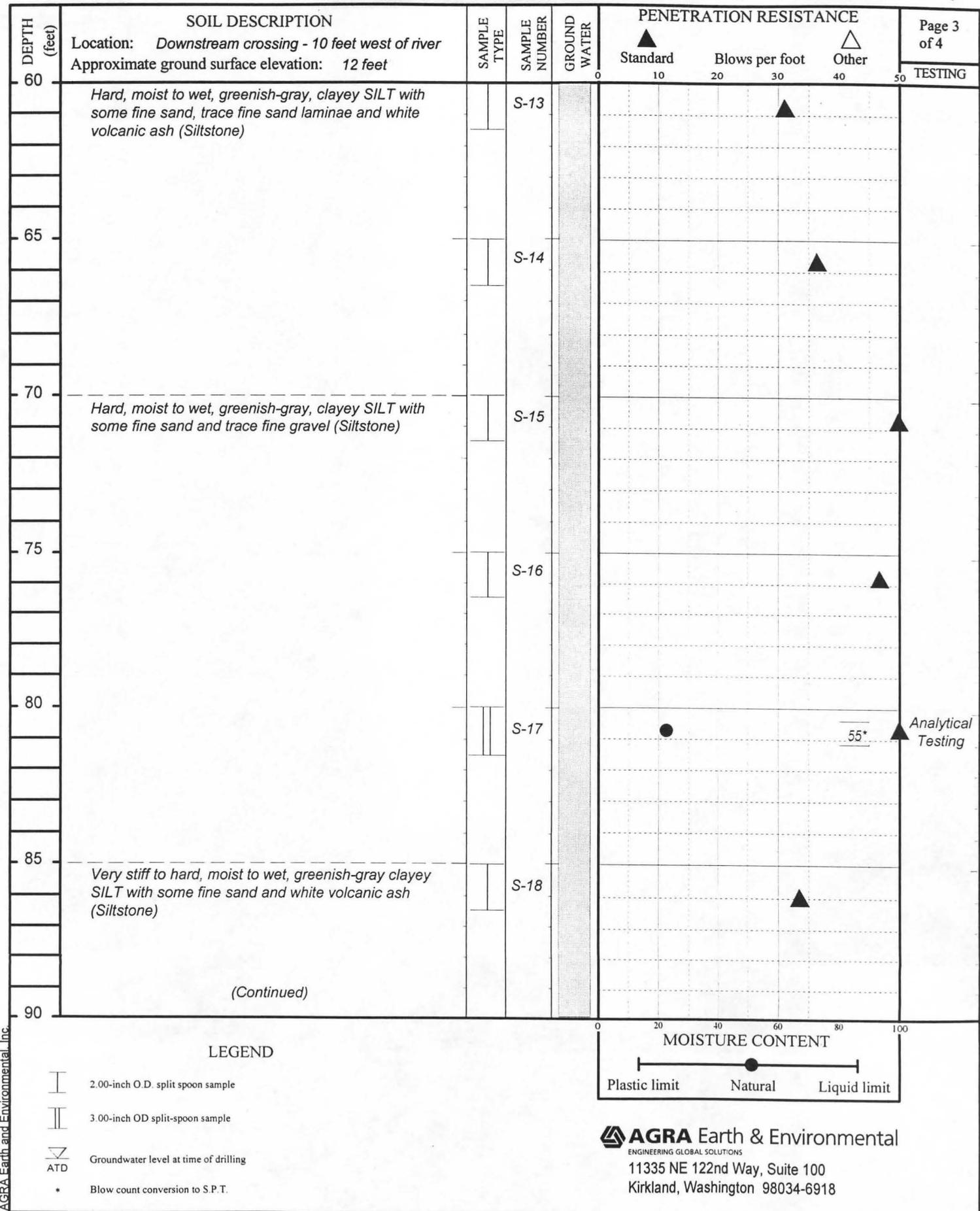
DEPTH (feet)	SOIL DESCRIPTION Location: <i>Downstream crossing - 10 feet west of river</i> Approximate ground surface elevation: <i>12 feet</i>	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE			Page 2 of 4
					Standard ▲	Blows per foot	Other △	
30	<i>Very soft, wet, gray, clayey SILT with some fine sand, trace organics and root fibers</i>		S-7					TESTING
35	<i>Medium stiff, wet, gray, clayey SILT with some sand, trace gravel and organics interbedded with loose, wet, gray, silty, gravelly SAND</i>		S-8					
40	<i>Very stiff, wet, greenish-gray, clayey SILT with some fine sand and fine sand laminae and trace white volcanic ash</i>		S-9					
45			S-10					
50			S-11					
55	<i>Hard, moist to wet, greenish-gray, clayey SILT with some fine sand and trace fine sand laminae and white volcanic ash (Siltstone)</i>		S-12					
60	<i>(Continued)</i>							

LEGEND

- 2.00-inch O.D. split spoon sample
- 3.00-inch OD split-spoon sample
- Groundwater level at time of drilling



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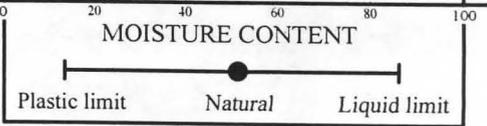
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DEPTH (feet)	SOIL DESCRIPTION Location: <i>Downstream crossing - 10 feet west of river</i> Approximate ground surface elevation: <i>12 feet</i>	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE			Page 4 of 4		
					Standard ▲	Blows per foot	Other △			
90	<i>Clayey SILT - as above</i>		<i>S-19</i>		10	20	30	40	50	TESTING
<i>Boring terminated at approximately 91.5 feet</i>										
95										
100										
105										
110										
115										
120										

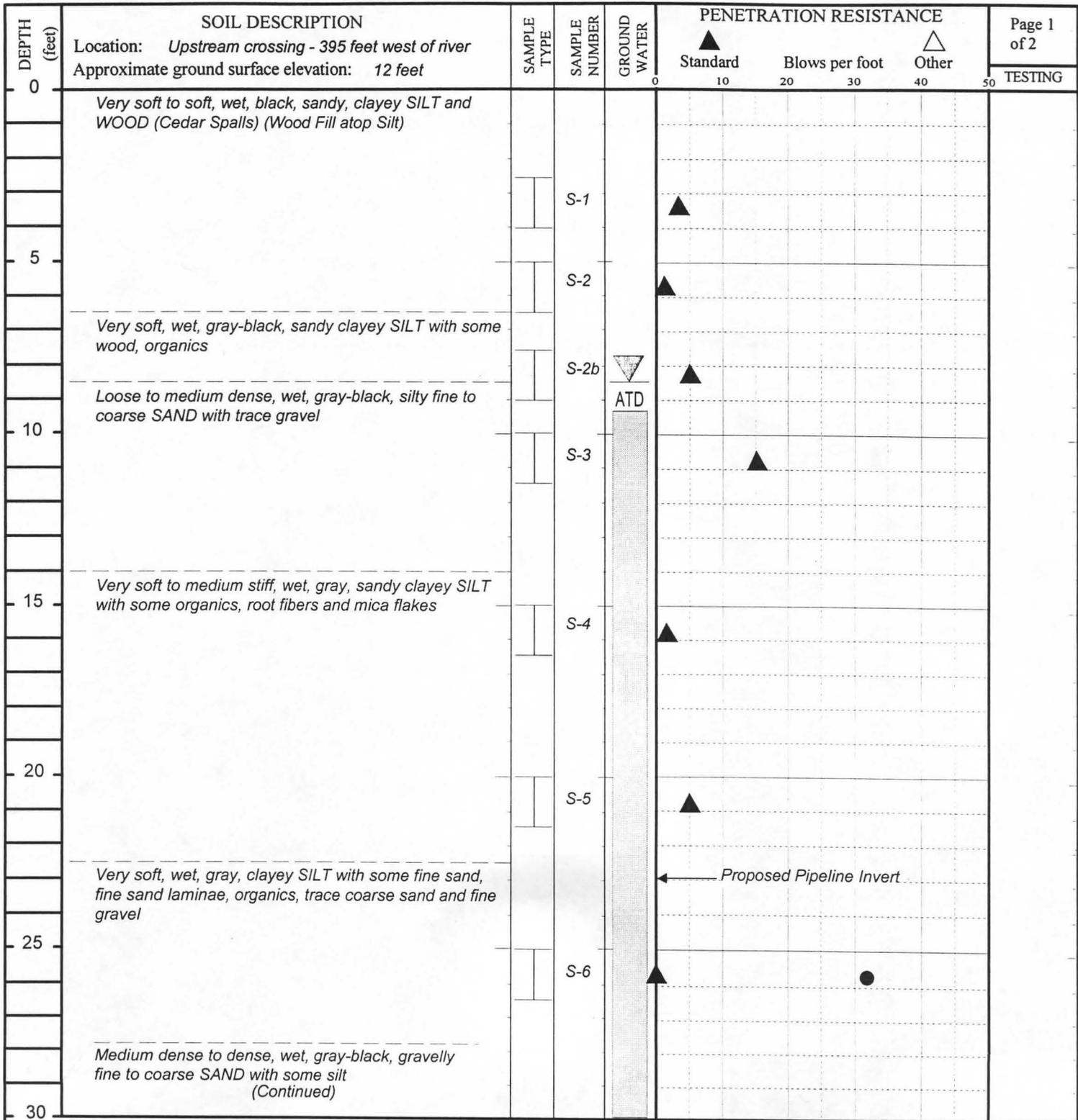
LEGEND

-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling



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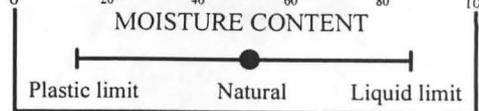
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LEGEND

- 2.00-inch O.D. split spoon sample
- 3.00-inch OD split-spoon sample
- Groundwater level at time of drilling
- ATD
- Grain size analysis

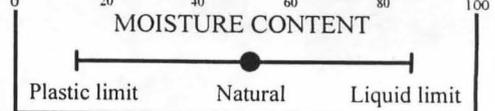


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DEPTH (feet)	SOIL DESCRIPTION Location: <i>Upstream crossing - 395 feet west of river</i> Approximate ground surface elevation: <i>12 feet</i>	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE			Page 2 of 2
					Standard	Blows per foot	Other	
30	<i>Gravelly SAND with some silt- as above</i>		S-7		●	▲*		
<p><i>Boring terminated at approximately 31.5 feet</i></p>								<i>Analytical Testing</i>
35								
40								
45								
50								
55								
60								

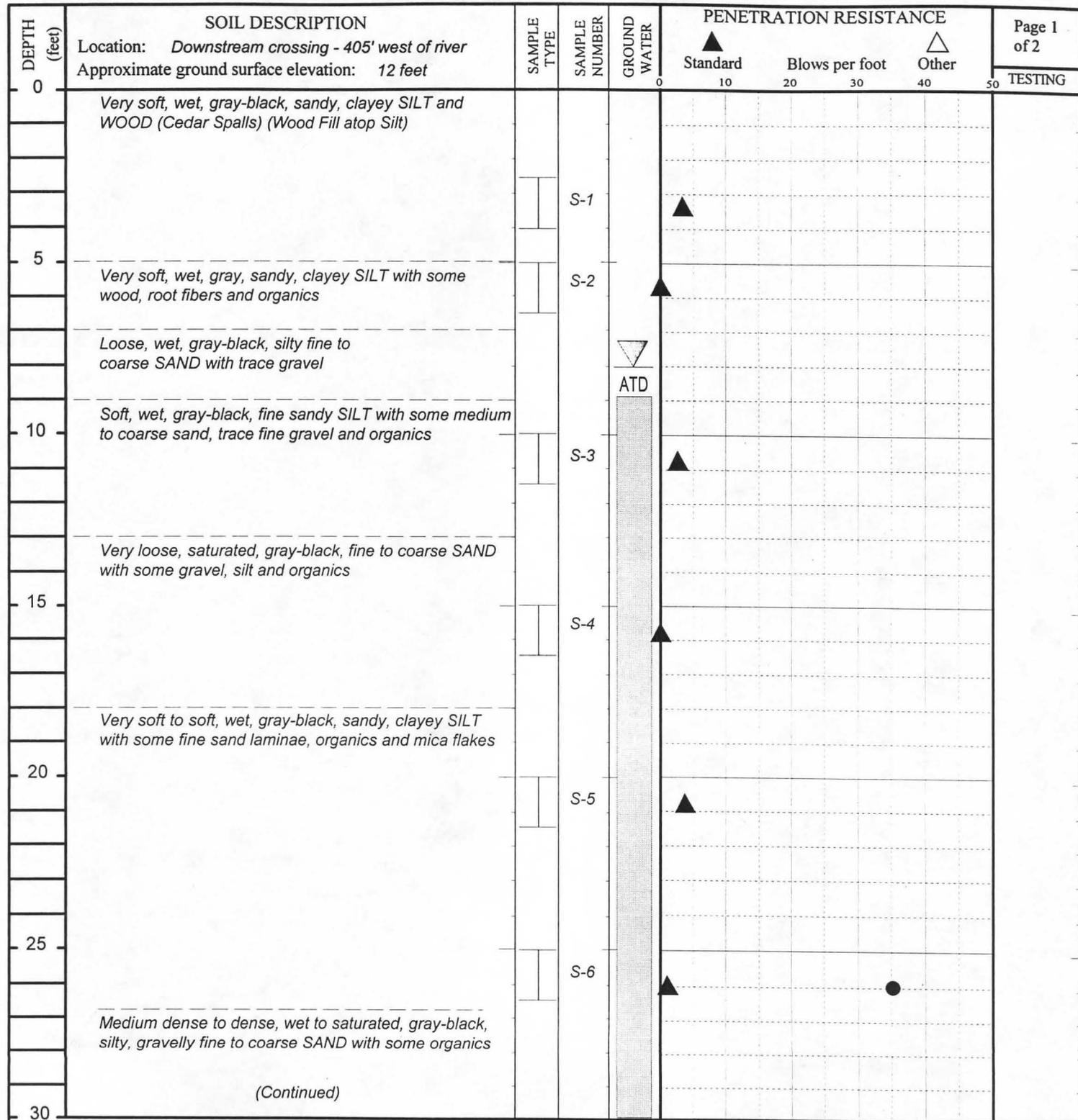
LEGEND

- 2.00-inch O.D. split spoon sample
- 3.00-inch OD split-spoon sample
- Groundwater level at time of drilling
- ATD
- Blow count conversion to S.P.T.
- Grain size analysis



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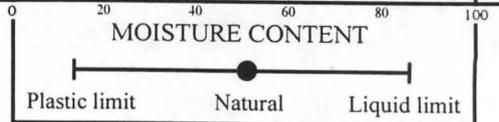
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LEGEND

-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling
-  ATD
-  • Blow count conversion to S.P.T.

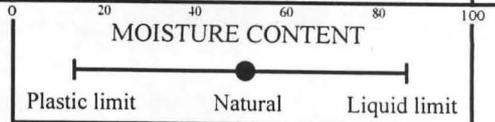


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DEPTH (feet)	SOIL DESCRIPTION Location: <i>Downstream crossing - 405 feet west of river</i> Approximate ground surface elevation: <i>12 feet</i>	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE			Page 2 of 2
					Standard ▲ 10	Blows per foot ● 20 30	Other △ 40	
30	<i>Silty, gravelly SAND - as above</i>		<i>S-7</i>		●	*▲		Analytical Testing
<i>Boring terminated at approximately 31.5 feet</i>								
35								
40								
45								
50								
55								
60								

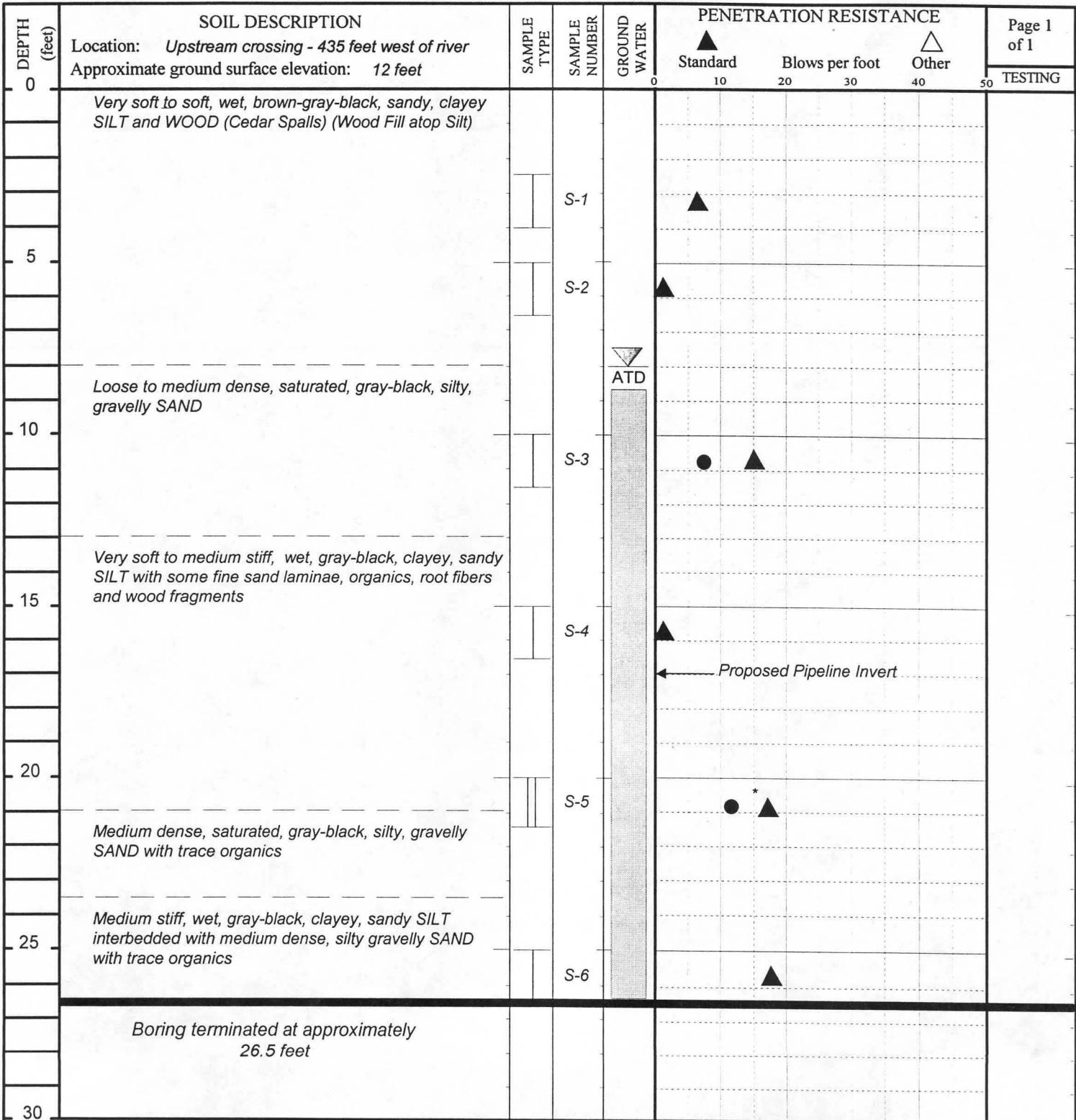
LEGEND

-  2.00-inch O.D. split spoon sample
-  3.00-inch OD split-spoon sample
-  Groundwater level at time of drilling
-  ATD
- * Blow count conversion to S.P.T.



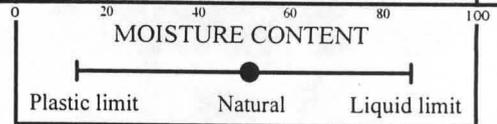
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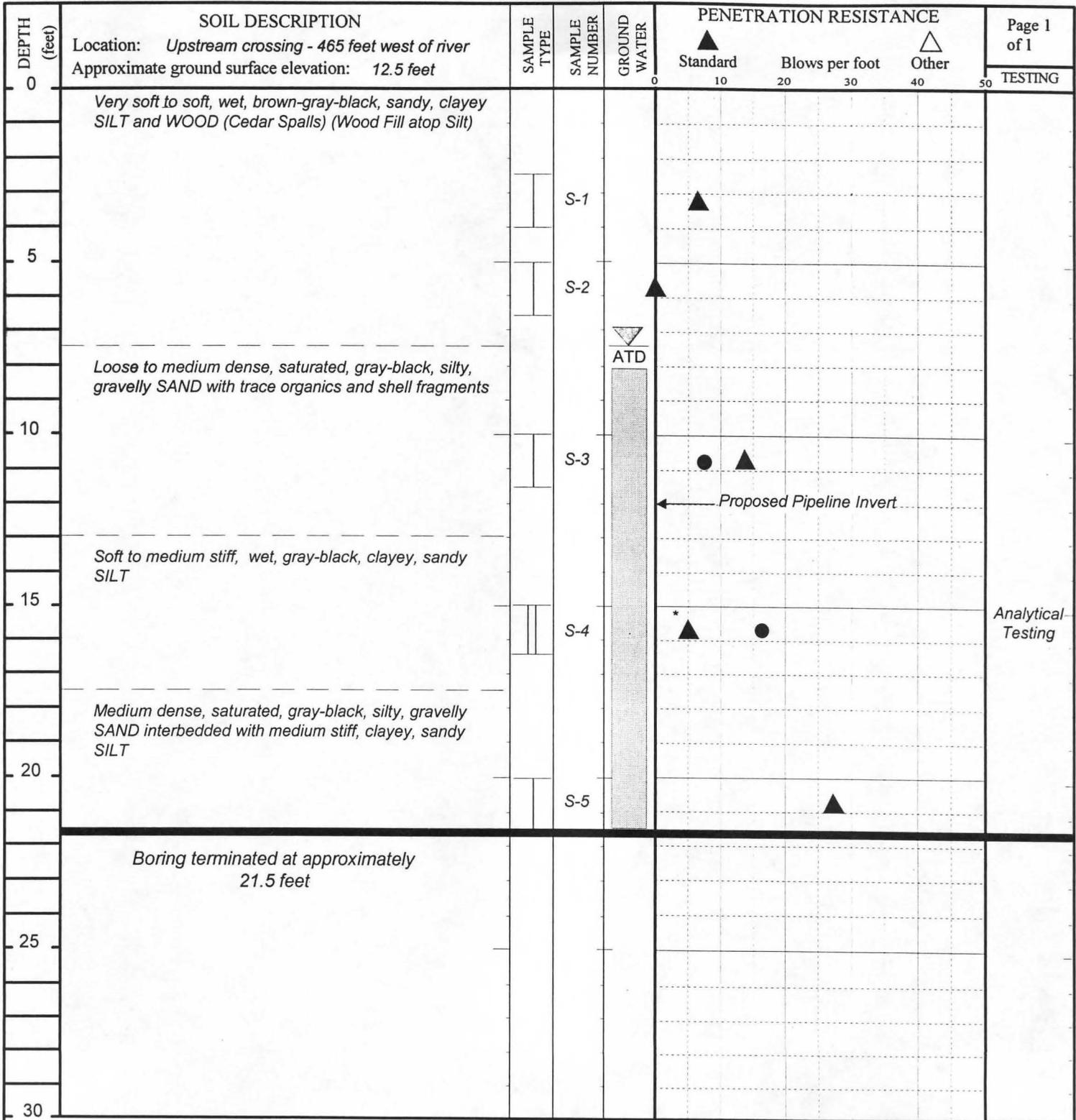
LEGEND

- | | 2.00-inch O.D. split spoon sample
- | | 3.00-inch OD split-spoon sample
- ▽ Groundwater level at time of drilling
- ATD
- * Blow count conversion to S.P.T.



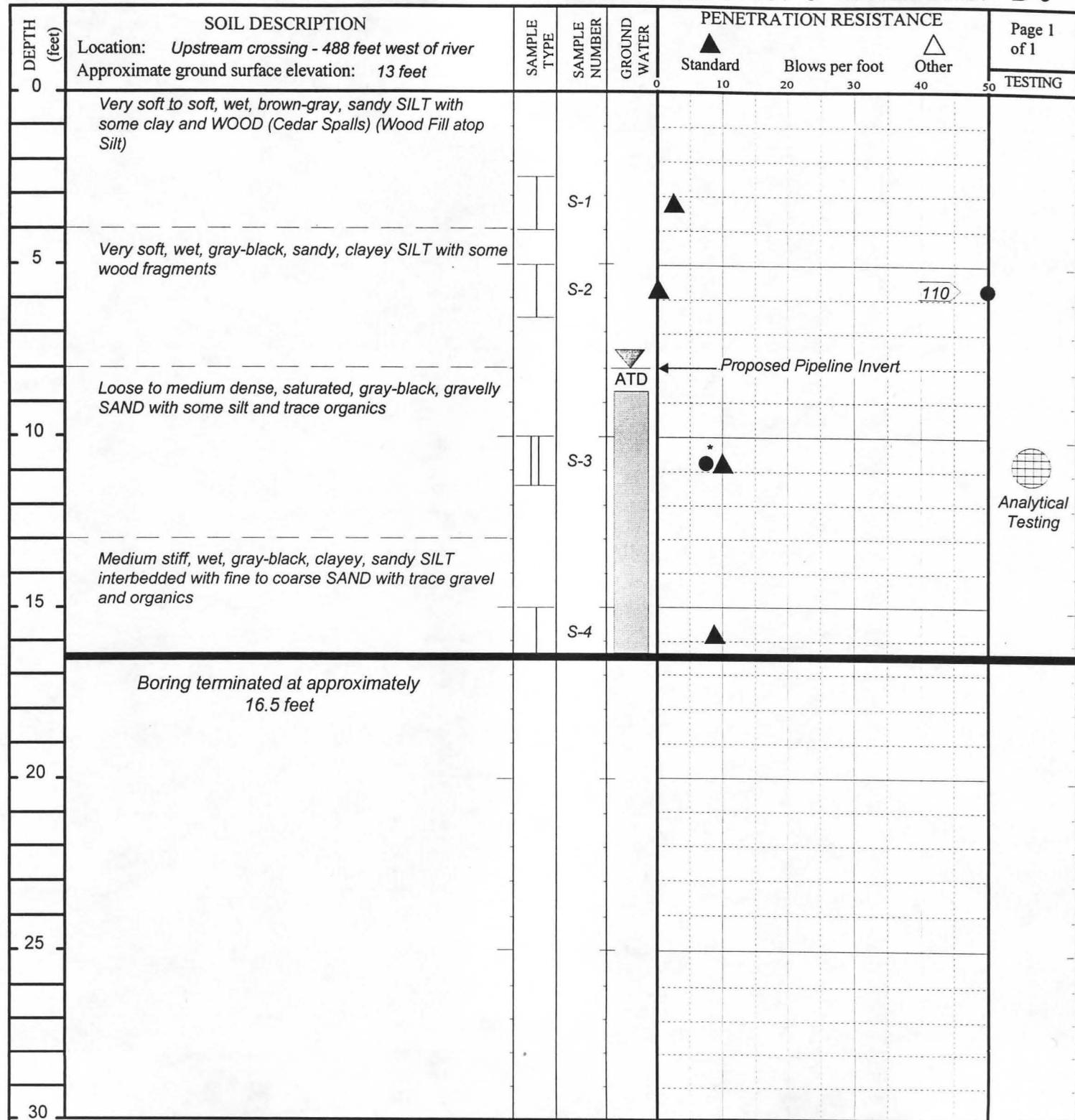
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LEGEND

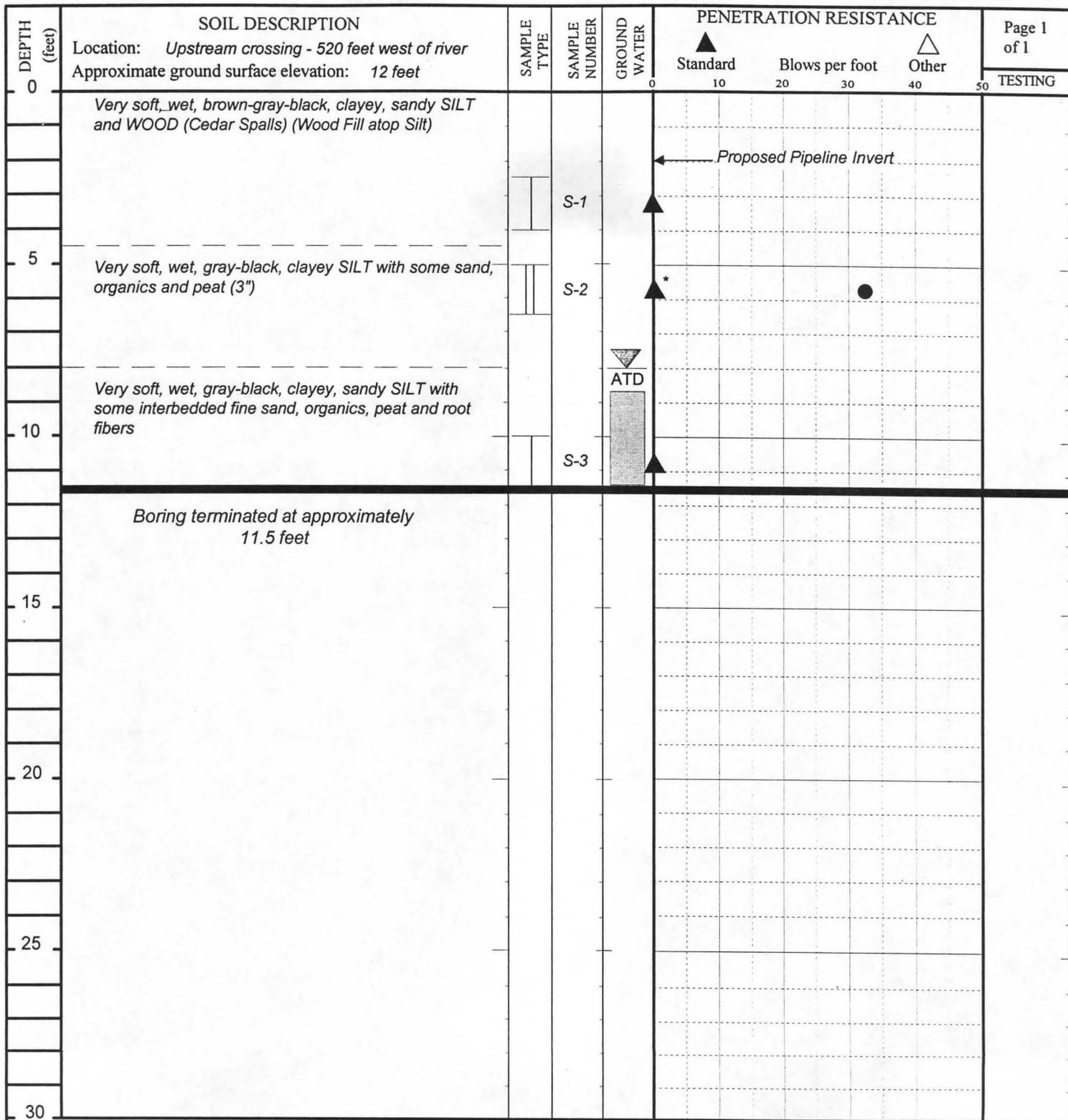
- 2.00-inch O.D. split spoon sample
- 3.00-inch OD split-spoon sample
- Groundwater level at time of drilling
- ATD
- Grain size analysis
- * Blow count conversion to S.P.T.

MOISTURE CONTENT (Scale from 0 to 100)

Plastic limit Natural Liquid limit

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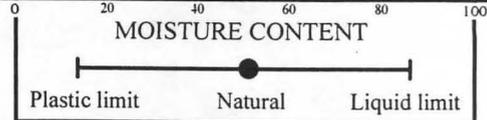
AGRA Earth and Environmental, Inc.



AGRA Earth and Environmental, Inc.

LEGEND

- [Symbol] 2.00-inch O.D. split spoon sample
- [Symbol] 3.00-inch OD split-spoon sample
- [Symbol] Groundwater level at time of drilling
- ATD
- * Blow count conversion to S.P.T.



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**APPENDIX C
ANALYTICAL TEST RESULTS
7-91M-11957-0**



AGRA Earth & Environmental

ENGINEERING GLOBAL SOLUTIONS

**AGRA Earth &
Environmental, Inc.**

7477 SW Tech Center Drive
Portland, Oregon
USA 97223-8025
Tel (503) 639-3400
Fax (503) 620-7892

November 25, 1997

AGRA Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, WA 98034

Attention: Mr. Curt Thompson

Dear Mr. Thompson:

RE: Analytical Results For Project 7-91M-11957-0

Attached are the results for the samples submitted on November 18, 1997 from the above referenced project. For your reference, our project number associated with these samples is WA970763.

The samples were analyzed for diesel and heavy oil range total petroleum hydrocarbons, volatile organic halocarbons, and polynuclear aromatic hydrocarbons and pentachlorophenol by GC/MSD/SIM at the AGRA Earth & Environmental Portland Chemistry Laboratory. The samples were also subcontracted to North Creek Analytical (NCA) for metals analysis. The NCA data will be reported under separate cover at a later date.

All analyses were conducted in accordance with applicable QA/QC guidelines. The results apply only to the samples submitted.

Please feel free to contact me if you have any questions regarding this report, or if I can be of any assistance in any other matter.

Respectfully submitted,

AGRA Earth & Environmental

Sean Gormley
Laboratory Manager



Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/24/97
 Report No.: 97076306a
 C.O.C. No.: 03130

**Polynuclear Aromatic Hydrocarbons and Pentachlorophenol by GC/MSD/SIM
 EPA Methods 3545/8270C**

**µg/kg(ppb)
 Dry Weight Basis**

Sample Name: Lab Code:	B-3/S-13/ 60'-61' 0763-1	B-4/S-17/ 80'-81.5' 0763-2	B-5/S-7/ 30'-31.5' 0763-3	B-6/S-7/ 30'-31.5' 0763-4	B-9/S-3 10'-11.5' 0763-6	B-10/S-2 5'-6.5' 0763-7	Reporting Limit
Naphthalene	ND	ND	ND	ND	ND	ND	10
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	10
1-Methylnaphthalene	ND	ND	ND	ND	ND	ND	10
Acenaphthylene	ND	ND	ND	ND	ND	ND	10
Acenaphthene	13	14	ND	ND	ND	ND	10
Fluorene	ND	ND	ND	ND	ND	ND	10
Pentachlorophenol	ND	ND	ND	ND	ND	ND	20
Phenanthrene	ND	ND	ND	ND	ND	ND	10
Anthracene	ND	ND	ND	ND	ND	ND	10
Fluoranthene	ND	ND	ND	ND	ND	ND	10
Pyrene	13	14	ND	ND	ND	ND	10
Benzo[a]anthracene	ND	ND	ND	ND	ND	ND	10
Chrysene	ND	ND	ND	ND	ND	ND	10
Benzo[b]fluoranthene	ND	ND	ND	ND	ND	ND	10
Benzo[k]fluoranthene	ND	ND	ND	ND	ND	ND	10
Benzo[a]pyrene	ND	ND	ND	ND	ND	ND	10
Indeno[1,2,3-cd]pyrene	ND	ND	ND	ND	ND	ND	10
Dibenzo[a,h]anthracene	ND	ND	ND	ND	ND	ND	10
Benzo[g,h,i]perylene	ND	ND	ND	ND	ND	ND	10
Sample Date:	11/13/97	11/14/97	11/14/97	11/15/97	11/15/97	11/15/97	
Extraction Date:	11/20/97	11/20/97	11/20/97	11/20/97	11/20/97	11/20/97	
Analysis Date:	11/21/97	11/21/97	11/21/97	11/21/97	11/21/97	11/21/97	

Surrogate Recoveries:							%Recovery Acceptance
2-Fluorophenol:	76%	59%	84%	84%	84%	66%	25%-121%
Phenol-d5:	63%	47%	65%	66%	62%	56%	24%-113%
Nitrobenzene-d5:	78%	58%	80%	85%	68%	45%	23%-120%
2-Fluorobiphenyl:	74%	62%	81%	77%	75%	61%	30%-115%
2,4,6-Tribromophenol:	33%	25%	44%	45%	45%	41%	19%-122%
p-Terphenyl-d14:	68%	60%	70%	75%	71%	63%	18%-137%

ND Not Detected

Pat Marshall
 Signature of Chemist

QA/QC Review *[Signature]*

Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/24/97
 Report No.: 97076306b
 C.O.C. No.: 03130

Polynuclear Aromatic Hydrocarbons and Pentachlorophenol by GC/MSD/SIM
EPA Methods 3545/8270C
µg/kg(ppb)
Dry Weight Basis

Sample Name:	B-8/S-4/ 15'-16.5'	Lab Blank	Reporting Limit
Lab Code:	0763-8	0763-MB	
Naphthalene	ND	ND	10
2-Methylnaphthalene	ND	ND	10
1-Methylnaphthalene	ND	ND	10
Acenaphthylene	ND	ND	10
Acenaphthene	ND	ND	10
Fluorene	ND	ND	10
Pentachlorophenol	ND	ND	20
Phenanthrene	ND	ND	10
Anthracene	ND	ND	10
Fluoranthene	ND	ND	10
Pyrene	ND	ND	10
Benzo[a]anthracene	ND	ND	10
Chrysene	ND	ND	10
Benzo[b]fluoranthene	ND	ND	10
Benzo[k]fluoranthene	ND	ND	10
Benzo[a]pyrene	ND	ND	10
Indeno[1,2,3-cd]pyrene	ND	ND	10
Dibenzo[a,h]anthracene	ND	ND	10
Benzo[g,h,i]perylene	ND	ND	10

Sample Date: 11/15/97 11/20/97
 Extraction Date: 11/20/97 11/20/97
 Analysis Date: 11/21/97 11/21/97

Surrogate Recoveries:	%Recovery Acceptance		
2-Fluorophenol:	85%	108%	25%-121%
Phenol-d5:	69%	89%	24%-113%
Nitrobenzene-d5:	71%	117%	23%-120%
2-Fluorobiphenyl:	76%	93%	30%-115%
2,4,6-Tribromophenol:	45%	58%	19%-122%
p-Terphenyl-d14:	73%	90%	18%-137%

ND Not Detected

Pat Maslly

 Signature of Chemist

QA/QC Review

Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/24/97
 Report No.: 97076308
 C.O.C.: 03130

QC Data Report
MS/MSD Spike Summary
Polynuclear Aromatic Hydrocarbons and Pentachlorophenol by GC/MSD/SIM
EPA Methods 3545/8270C
µg/kg(ppb)
Dry Weight Basis

	B-6/S-7/ 30'-31.5'	Spike Level (µg/kg)	Matrix Spike	Percent Recovery (MS)	Matrix Spike Duplicate	Percent Recovery (MSD)	8270C % Recovery Acceptance Criteria	Relative Percent Difference (RPD)
Sample Name:								
Lab Code:	0763-4							
Naphthalene	<10	210	150	71	160	76	21%-133%	6
Acenaphthene	<10	210	150	71	160	76	47%-145%	6
Pentachlorophenol	<20	210	100	48	110	52	14%-176%	10
Pyrene	<10	210	160	76	170	81	52%-115%	6
Benzo(a)pyrene	<10	210	170	81	180	86	17%-163%	6
Benzo(g,h,i) perylene	<10	210	170	81	180	86	1%-219%	6
Sample Date:	11/15/97	~	11/15/97	~	11/15/97	~	~	
Extraction Date:	11/20/97	~	11/20/97	~	11/20/97	~	~	
Analysis Date:	11/21/97	~	11/22/97	~	11/22/97	~	~	
Surrogate Recovery:							Control Limits	
2-Fluorophenol:	84%	~	81%	~	85%	~	25%-121%	
Phenol-d5:	66%	~	73%	~	79%	~	24%-113%	
Nitrobenzene-d5:	85%	~	93%	~	100%	~	23%-120%	
2-Fluorobiphenyl:	77%	~	78%	~	83%	~	30%-115%	
2,4,6-Tribromophenol:	45%	~	47%	~	51%	~	19%-122%	
p-Terphenyl-d14:	75%	~	72%	~	77%	~	18%-137%	

Pat Marshall

Signature of Chemist

QA/QC Review



AGRA Earth & Environmental
 ENGINEERING GLOBAL SOLUTIONS

Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/24/97
 Report No.: 97076307
 C.O.C.: 03130

QC Data Report
Blank Spike Summary
 Polynuclear Aromatic Hydrocarbons and Pentachlorophenol by GC/MSD/SIM
 EPA Methods 3545/8270C
 µg/kg(ppb)
 Dry Weight Basis

Sample Name:	Lab Blank	Spike Level	Blank Spike	Percent Recovery	Blank Spike Duplicate	Percent Recovery	8270C % Recovery Acceptance Criteria	Relative Percent Difference
Lab Code:	0763-MB	(µg/kg)	Spike	(BS)	Duplicate	(BSD)		(RPD)
Naphthalene	<10	250	210	84	220	88	21%-133%	5
Acenaphthene	<10	250	210	84	220	88	47%-145%	5
Pentachlorophenol	<20	250	140	56	150	60	14%-176%	7
Pyrene	<10	250	230	92	240	96	52%-115%	4
Benzo(a)pyrene	<10	250	240	96	250	100	17%-163%	4
Benzo(g,h,i) perylene	<10	250	240	96	250	100	1%-219%	4
Sample Date:	11/20/97	~	11/20/97	~	11/20/97	~	~	
Extraction Date:	11/20/97	~	11/20/97	~	11/20/97	~	~	
Analysis Date:	11/21/97	~	11/21/97	~	11/21/97	~	~	
Surrogate Recovery:							Control Limits	
2-Fluorophenol:	108%	~	98%	~	105%	~	25%-121%	
Phenol-d5:	89%	~	77%	~	78%	~	24%-113%	
Nitrobenzene-d5:	117%	~	116%	~	119%	~	23%-120%	
2-Fluorobiphenyl:	93%	~	92%	~	102%	~	30%-115%	
2,4,6-Tribromophenol:	58%	~	60%	~	60%	~	19%-122%	
p-Terphenyl-d14:	90%	~	89%	~	89%	~	18%-137%	

Pat Marshall
 Signature of Chemist

[Signature]
 QA/QC Review

Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/19/97
 Report No.: 97076301a
 C.O.C. No.: 03130

Volatile Organic Halocarbons
EPA Methods 5030B/8260B
 mg/kg(ppm)

Sample Name:	B-3/ S-13/60'-61'	B-4/ S-17/80'-81.5'	B-5/ S-7/30'-31.5'	B-6/ S-7/30'-31.5'	B-9/ S-3/10'-11.5'	Method Reporting Limit
Lab Code:	0763-1	0763-2	0763-3	0763-4	0763-6	
Chloromethane	ND	ND	ND	ND	ND	0.1
Vinyl Chloride	ND	ND	ND	ND	ND	0.1
Bromomethane	ND	ND	ND	ND	ND	0.1
Chloroethane	ND	ND	ND	ND	ND	0.1
Trichlorofluoromethane	ND	ND	ND	ND	ND	0.1
1,1-Dichloroethene	ND	ND	ND	ND	ND	0.1
Methylene Chloride	ND	ND	ND	ND	ND	0.1
T-1,2-Dichloroethene	ND	ND	ND	ND	ND	0.1
1,1-Dichloroethane	ND	ND	ND	ND	ND	0.1
C-1,2-Dichloroethene	ND	ND	ND	ND	ND	0.1
Chloroform	ND	ND	ND	ND	ND	0.1
1,1,1-Trichloroethane (TCA)	ND	ND	ND	ND	ND	0.1
Carbon Tetrachloride	ND	ND	ND	ND	ND	0.1
1,2-Dichloroethane (EDC)	ND	ND	ND	ND	ND	0.1
Trichloroethene (TCE)	ND	ND	ND	ND	ND	0.1
1,2-Dichloropropane	ND	ND	ND	ND	ND	0.1
Bromodichloromethane	ND	ND	ND	ND	ND	0.1
2-Chloroethylvinyl ether	ND	ND	ND	ND	ND	0.1
T-1,3-Dichloropropene	ND	ND	ND	ND	ND	0.1
C-1,3-Dichloropropene	ND	ND	ND	ND	ND	0.1
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	0.1
Tetrachloroethene (PCE)	ND	ND	ND	ND	ND	0.1
Dibromochloromethane	ND	ND	ND	ND	ND	0.1
1,2-Dibromoethane (EDB)	ND	ND	ND	ND	ND	0.1
Chlorobenzene	ND	ND	ND	ND	ND	0.1
Bromoform	ND	ND	ND	ND	ND	0.1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	0.1
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	0.1
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	0.1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	0.1
Sample Date:	11/13/97	11/14/97	11/14/97	11/15/97	11/15/97	
Extraction Date:	11/18/97	11/18/97	11/18/97	11/18/97	11/18/97	
Analysis Date:	11/18/97	11/18/97	11/18/97	11/18/97	11/18/97	

ND Not Detected



Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/19/97
 Report No.: 97076301b
 C.O.C. No.: 03130

Volatile Organic Halocarbons
EPA Methods 5030B/8260B
 mg/kg(ppm)

Sample Name: Lab Code:	B-10/ S-2/5'-6.5' 0763-7	B-8/ S-4/15'-16.5' 0763-8	Lab Blank 0763-MB	Method Reporting Limit
Chloromethane	ND	ND	ND	0.1
Vinyl Chloride	ND	ND	ND	0.1
Bromomethane	ND	ND	ND	0.1
Chloroethane	ND	ND	ND	0.1
Trichlorofluoromethane	ND	ND	ND	0.1
1,1-Dichloroethene	ND	ND	ND	0.1
Methylene Chloride	ND	ND	ND	0.1
T-1,2-Dichloroethene	ND	ND	ND	0.1
1,1-Dichloroethane	ND	ND	ND	0.1
C-1,2-Dichloroethene	ND	ND	ND	0.1
Chloroform	ND	ND	ND	0.1
1,1,1-Trichloroethane (TCA)	ND	ND	ND	0.1
Carbon Tetrachloride	ND	ND	ND	0.1
1,2-Dichloroethane (EDC)	ND	ND	ND	0.1
Trichloroethene (TCE)	ND	ND	ND	0.1
1,2-Dichloropropane	ND	ND	ND	0.1
Bromodichloromethane	ND	ND	ND	0.1
2-Chloroethylvinyl ether	ND	ND	ND	0.1
T-1,3-Dichloropropene	ND	ND	ND	0.1
C-1,3-Dichloropropene	ND	ND	ND	0.1
1,1,2-Trichloroethane	ND	ND	ND	0.1
Tetrachloroethene (PCE)	ND	ND	ND	0.1
Dibromochloromethane	ND	ND	ND	0.1
1,2-Dibromoethane (EDB)	ND	ND	ND	0.1
Chlorobenzene	ND	ND	ND	0.1
Bromoform	ND	ND	ND	0.1
1,1,2,2-Tetrachloroethane	ND	ND	ND	0.1
1,3-Dichlorobenzene	ND	ND	ND	0.1
1,4-Dichlorobenzene	ND	ND	ND	0.1
1,2-Dichlorobenzene	ND	ND	ND	0.1
Sample Date:	11/15/97	11/15/97	11/18/97	
Extraction Date:	11/18/97	11/18/97	11/18/97	
Analysis Date:	11/18/97	11/18/97	11/18/97	

ND Not Detected



ANALYSIS
EPA Methods 5030B/8260B

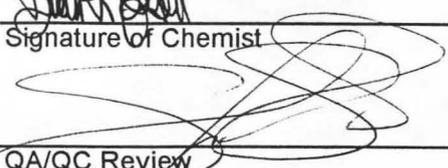
Surrogate Recoveries:

	B-3/ S-13/60'-61'	B-4/ S-17/80'-81.5'	B-5/ S-7/30'-31.5'	B-6/ S-7/30'-31.5'	B-9/ S-3/10'-11.5'	Control Limits
Sample Name:						
Lab Code:	0763-1	0763-2	0763-3	0763-4	0763-6	
Date Analyzed:	11/18/97	11/18/97	11/18/97	11/18/97	11/18/97	
Dibromofluoromethane:	95%	94%	97%	98%	96%	75%-111%
Toluene-d ₈ :	93%	95%	95%	96%	94%	75%-112%
4-Bromofluorobenzene:	98%	98%	109%	107%	106%	77%-122%

	B-10/ S-2/5'-6.5'	B-8/ S-4/15'-16.5'	Lab Blank	Control Limits
Sample Name:				
Lab Code:	0763-7	0763-8	0763-MB	
Date Analyzed:	11/18/97	11/18/97	11/18/97	
Dibromofluoromethane:	97%	95%	103%	75%-111%
Toluene-d ₈ :	96%	92%	101%	75%-112%
4-Bromofluorobenzene:	114%	110%	120%	77%-122%



Signature of Chemist


QA/QC Review



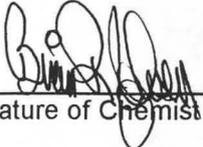
Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/19/97
 Report No.: 97076302
 C.O.C.: 03130

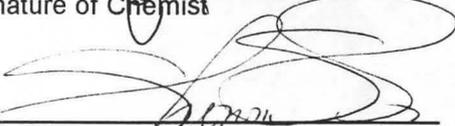
**QC Data Report
 MS/MSD Summary
 Volatile Organic Compounds by GC/MSD
 EPA Methods 5030B/8260B
 mg/kg(ppm)**

Sample Name:	Batch QC	Spike Level (mg/kg)	Matrix Spike	Percent Recovery (MS)	Matrix Spike Duplicate	Percent Recovery (MSD)	AEE % Recovery Acceptance Criteria	Relative Percent Difference (RPD)
1,1 - Dichloroethene	<0.1	2.5	1.8	72	1.8	72	34% - 121%	<1
Benzene	<0.1	2.5	2.1	84	2.1	84	60% - 115%	<1
Trichloroethene	<0.1	2.5	2.1	84	2.0	80	53% - 116%	5
Toluene	<0.1	2.5	2.1	84	2.1	84	63% - 114%	<1
Chlorobenzene	<0.1	2.5	2.2	88	2.2	88	66% - 114%	<1
Sample Date:	11/12/97	~	11/12/97	~	11/12/97	~	~	
Extraction Date:	11/18/97	~	11/18/97	~	11/18/97	~	~	
Analysis Date:	11/18/97	~	11/18/97	~	11/18/97	~		
Surrogate Recovery:							AEE Acceptance Limits	
Dibromofluoromethane:	96%	~	95%	~	96%	~	75%-111%	
Toluene-d ₈ :	94%	~	92%	~	93%	~	75%-112%	
4-Bromofluorobenzene:	107%	~	103%	~	104%	~	77%-122%	

ND Not Detected



 Signature of Chemist



 QA/QC Review



Project: Hoquiam River Crossing
Project No.: 7-91M-11957-0
Project Manager: Curt Thompson
Sample Matrix: Soil

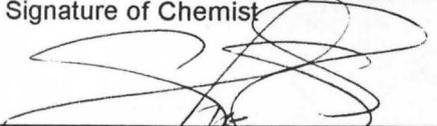
Service Request No.: WA970763
Report Date: 11/20/97
Report No.: 97076303
C.O.C. No.: 03130

Total Petroleum Hydrocarbons - Diesel and Heavy Oil Range
WDOE Method WTPH-D Extended
mg/kg (ppm)
Dry Weight Basis

Sample Name	Lab Code	Sample Date	Extraction Date	Analysis Date	Diesel Result	Heavy Oil Result	Surrogate Recovery O-Terphenyl
B-3/S-13/60'-61'	0763-1	11/13/97	11/18/97	11/19/97	<25	<100	92
B-4/S-17/80'-81.5'	0763-2	11/14/97	11/18/97	11/19/97	<25	<100	84
B-5/S-7/30'-31.5'	0763-3	11/14/97	11/18/97	11/19/97	<25	<100	88
B-6/S-7/30'-31.5'	0763-4	11/15/97	11/18/97	11/19/97	<25	<100	88
B-9/S-3/10'-11.5'	0763-6	11/15/97	11/18/97	11/19/97	<25	<100	84
B-10/S-2/5'-6.5'	0763-7	11/15/97	11/18/97	11/19/97	<25	<100	88
B-8/S-4/15-16.5'	0763-8	11/15/97	11/18/97	11/19/97	<25	<100	84
Lab Blank	0763-MB	11/18/97	11/18/97	11/19/97	<25	<100	87

Acceptance Criteria: 50%-150%


Signature of Chemist


QA/QC Review



Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

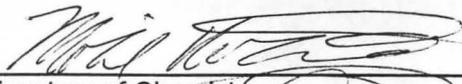
Service Request No.: WA970763
 Report Date: 11/20/97
 Report No.: 97076304
 C.O.C. No.: 03130

QC Data Report - Blank Spike Recoveries
Diesel and Heavy Oil Range Petroleum Hydrocarbons
WDOE Method WTPH-D Extended
mg/kg(ppm)
As Received Basis

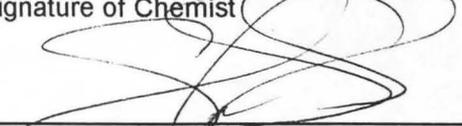
Sample Name:	Lab Blank	Spike Level (mg/kg)	Blank Spike	Percent Recovery (BS)	Blank Spike Duplicate	Percent Recovery (BSD)	Relative Percent Difference
Lab Code:	0764-MB						
Diesel:	<25	250	210	84	190	76	10
Acceptance Limits:	~	~	~	75%-125%	~	75%-125%	<25
Extraction Date:	11/18/97	~	11/18/97	~	11/18/97	~	~
Analysis Date:	11/19/97	~	11/19/97	~	11/19/97	~	~
Surrogate Recovery:							Control Limits
O-Terphenyl:	87%	~	104%	~	94%	~	50%-150%

ND Not Detected

Spike Source: #2 Diesel Fuel (AEE Lot # 96-1-82-1).



 Signature of Chemist



 Laboratory Manager



Project: Hoquiam River Crossing
 Project No.: 7-91M-11957-0
 Project Manager: Curt Thompson
 Sample Matrix: Soil

Service Request No.: WA970763
 Report Date: 11/20/97
 Report No.: 97076305
 C.O.C. No.: 03130

QC Data Report - Duplicate Summary
Diesel and Heavy Oil Range Petroleum Hydrocarbons
WDOE Method WTPH-D Extended
mg/kg(ppm)
Dry Weight Basis

Sample Name:	B-9/S-3/ 10'-11.5'	Sample	Relative
Lab Code:	0763-6	Duplicate	Percent
			Difference
Diesel:	<25	<25	(a)
Heavy Oil:	<100	<100	(a)
Acceptance Limits:	~	~	<25
Sample Date:	11/15/97	11/15/97	~
Extraction Date:	11/18/97	11/18/97	~
Analysis Date:	11/19/97	11/19/97	~
Surrogate Recovery:			Control
O-Terphenyl:	84%	90%	Limits
			50%-150%

ND Not Detected

(a) Not applicable when sample concentration is less than the method reporting limit.



 Signature of Chemist

 QA/QC Review



**AGRA Earth & Environmental Portland Chemistry Laboratory
Sample Receipt Documentation Form**

Project: <u>Hogwam River Crossing</u>	Cooler Temperatures	3.2	3.8
SR No.: <u>WA970763</u>			
Date: <u>11/18/97</u>			
Time: <u>940am</u>			
Temperature of Cooler Upon Receipt (Record to the Right):			
Received By: <u>cdw</u>	3.7		

Section One: Shipping/Delivery Issues

1. Method of Sample Delivery: <u>UPS red</u>			
2. Airbill or Courier Receipt Number: <u>na</u>			
3. Is a copy of the airbill or courier receipt available to be placed in the job file?	Yes	No	<u>NA</u>

Section Two: Sample Custody Issues

4. Are custody seals on the shipping container intact?	Yes	No	<u>NA</u>
5. Is a COC or other sample transmittal document present?	<u>Yes</u>	No	NA
6. Is the COC complete?	Yes	<u>No</u>	NA
7. Are the sample seals intact?	Yes	No	<u>NA</u>
8. Does the COC match the samples received?	Yes	<u>No</u>	NA

Section Three: Sample Integrity Issues

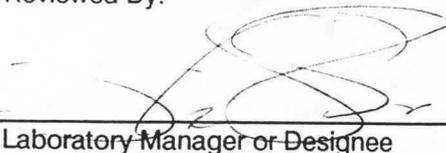
9. Are all sample containers intact and not leaking?	<u>Yes</u>	No	NA
10. Are all samples preserved properly?	Yes	No	<u>NA</u>
11. Are all samples within holding time for the required tests?	<u>Yes</u>	No	NA
12. Were all samples received at the proper temperature?	<u>Yes</u>	No	NA
13. Are samples for volatiles and other headspace sensitive parameters free of headspace or bubbles?	Yes	No	<u>NA</u>

Section Four: Sample Containers Received:

14. 4 oz. glass jars:	19. 2oz. amber (MeOH):
15. 8 oz. glass jars: <u>4</u>	20. Encore samplers:
16. 40ml VOA vials:	21. 500ml plastic:
17. 1 liter glass:	22. 1liter plastic:
18. Other (describe):	

#6 - Samples were not relinquished on COC. Matrix not indicated on COC.
 #8 - Sample B8/S5/20-21.5 was not included with the samples.
 B8/S4/15-16.5 was included, but not listed on COC. It was assigned the lab # 0763-8. - ~~SS~~ Sample B8/S5-20-21.5 should be B8/S4/15-16.5
 Samples were not labeled, but identified by the description on top of the jars, which included sample name, and project number.

Reviewed By:



Laboratory Manager or Designee



December 8, 1997

AGRA Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, WA 98034

Attention: Mr. Curt Thompson

Dear Mr. Thompson:

RE: Analytical Results For Project 7-91M-11957-0

Attached are the metals results for the samples submitted on November 18, 1997 from the above referenced project. For your reference, our project number associated with these samples is WA970763.

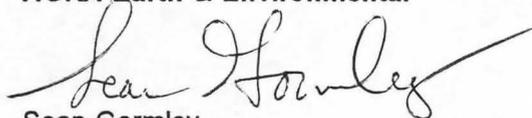
Diesel and heavy oil range total petroleum hydrocarbons, volatile organic halocarbons, and polynuclear aromatic hydrocarbons and pentachlorophenol by GC/MSD/SIM results were reported under separate cover in a package dated November 25, 1997.

All analyses were conducted in accordance with applicable QA/QC guidelines. The results apply only to the samples submitted.

Please feel free to contact me if you have any questions regarding this report, or if I can be of any assistance in any other matter.

Respectfully submitted,

AGRA Earth & Environmental



Sean Gormley
Laboratory Manager



NORTH CREEK ANALYTICAL

Environmental Laboratory Services

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Agra Earth and Environmental, Inc
 7477 S.W. Tech Center Drive
 Portland, OR 97223-8024

Project: Hoquiam River Crossing
 Project Number: 7-91M-11957-0
 Project Manager: Sean Gormley

Sampled: 11/13/97 to 11/15/97
 Received: 11/18/97
 Reported: 12/7/97 22:59

ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
B-3/S-13/60'-61'	P711296-01	Soil	11/13/97
B-4/S-17/80'-81.5'	P711296-02	Soil	11/14/97
B-5/S-7/30'-31.5'	P711296-03	Soil	11/14/97
B-6/S-7/30'-31.5'	P711296-04	Soil	11/15/97
B-8/S-4/15'-16.5'	P711296-05	Soil	11/15/97
B-9/S-3/10'-11.5'	P711296-06	Soil	11/15/97
B-10/S-2/5'-6.5'	P711296-07	Soil	11/15/97

North Creek Analytical, Inc.

*The results in this report apply to the samples analyzed in accordance with the chain of custody document.
 This analytical report must be reproduced in its entirety.*

Philip Nerenberg, Laboratory Manager

18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508
 East 11115 Montgomery, Suite B, Spokane, WA 99206-4776
 9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132

Agra Earth and Environmental, Inc 7477 S.W. Tech Center Drive Portland, OR 97223-8024	Project: Hoquiam River Crossing Project Number: 7-91M-11957-0 Project Manager: Sean Gormley	Sampled: 11/13/97 to 11/15/97 Received: 11/18/97 Reported: 12/7/97 22:59
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**Total Metals per EPA 6000/7000 Series Methods
North Creek Analytical - Portland**

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
<u>B-3/S-13/60'-61'</u>								
				<u>P711296-01</u>			<u>Soil</u>	
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	204	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	1.09	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	26.2	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	13.2	"	
Selenium	"	"	"	EPA 6020	0.500	2.11	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	0.0693	"	
<u>B-4/S-17/80'-81.5'</u>								
				<u>P711296-02</u>			<u>Soil</u>	
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	226	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	0.828	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	20.2	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	15.7	"	
Selenium	"	"	"	EPA 6020	0.500	1.43	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	ND	"	
<u>B-5/S-7/30'-31.5'</u>								
				<u>P711296-03</u>			<u>Soil</u>	
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	13.1	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	1.24	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	32.1	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	1.18	"	
Selenium	"	"	"	EPA 6020	0.500	ND	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	ND	"	
<u>B-6/S-7/30'-31.5'</u>								
				<u>P711296-04</u>			<u>Soil</u>	
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	14.0	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	1.02	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	30.5	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	2.34	"	
Selenium	"	"	"	EPA 6020	0.500	ND	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	ND	"	

North Creek Analytical, Inc.

*Refer to end of report for text of notes and definitions.



Philip Nerenberg, Laboratory Manager

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NORTH CREEK ANALYTICAL

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Agra Earth and Environmental, Inc 7477 S.W. Tech Center Drive Portland, OR 97223-8024	Project: Hoquiam River Crossing Project Number: 7-91M-11957-0 Project Manager: Sean Gormley	Sampled: 11/13/97 to 11/15/97 Received: 11/18/97 Reported: 12/7/97 22:59
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Total Metals per EPA 6000/7000 Series Methods North Creek Analytical - Portland

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
<u>B-8/S-4/15'-16.5'</u>		<u>P711296-05</u>			<u>Soil</u>			
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	21.8	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	1.10	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	34.7	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	5.99	"	
Selenium	"	"	"	EPA 6020	0.500	ND	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	ND	"	
<u>B-9/S-3/10'-11.5'</u>		<u>P711296-06</u>			<u>Soil</u>			
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	8.42	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	1.34	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	38.1	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	2.73	"	
Selenium	"	"	"	EPA 6020	0.500	ND	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	ND	"	
<u>B-10/S-2/5'-6.5'</u>		<u>P711296-07</u>			<u>Soil</u>			
Barium	1270016	11/26/97	12/1/97	EPA 6010A	0.500	25.8	mg/kg dry	
Cadmium	"	"	12/3/97	EPA 6010A	0.500	ND	"	
Chromium	"	"	12/4/97	EPA 6010A	0.500	47.9	"	
Lead	"	"	12/3/97	EPA 6010A	10.0	ND	"	
Silver	"	"	12/1/97	EPA 6010A	1.00	ND	"	
Arsenic	1170494	11/21/97	12/2/97	EPA 6020	0.500	4.27	"	
Selenium	"	"	"	EPA 6020	0.500	ND	"	
Mercury	1170563	11/26/97	12/1/97	EPA 7471A	0.0500	ND	"	

North Creek Analytical, Inc.

*Refer to end of report for text of notes and definitions.

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Philip Nerenberg, Laboratory Manager

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**Dry Weight Determination
North Creek Analytical - Portland**

Sample Name	Lab ID	Matrix	Result	Units
B-3/S-13/60'-61'	P711296-01	Soil	73.6	%
B-4/S-17/80'-81.5'	P711296-02	Soil	66.4	%
B-5/S-7/30'-31.5'	P711296-03	Soil	84.8	%
B-6/S-7/30'-31.5'	P711296-04	Soil	83.5	%
B-8/S-4/15'-16.5'	P711296-05	Soil	68.4	%
B-9/S-3/10'-11.5'	P711296-06	Soil	86.1	%
B-10/S-2/5'-6.5'	P711296-07	Soil	50.4	%

North Creek Analytical, Inc.



Philip Nerenberg, Laboratory Manager

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Total Metals per EPA 6000/7000 Series Methods/Quality Control North Creek Analytical - Portland

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Reporting Limit Units	Recov. %	RPD Limit	RPD %	Notes*
Batch: 1170494									
Blank									
<u>Date Prepared: 11/21/97</u>									
<u>1170494-BLK1</u>									
Arsenic	12/2/97			ND	mg/kg dry	0.500			
Selenium	"			ND	"	0.500			
LCS									
<u>1170494-BS1</u>									
Arsenic	12/2/97	10.0		9.95	mg/kg dry	80.0-120	99.5		
Selenium	"	10.0		10.3	"	80.0-120	103		
Duplicate									
<u>1170494-DUP1</u> <u>P711233-01</u>									
Arsenic	12/2/97		22.6	22.4	mg/kg dry			40.0	0.889
Selenium	"		ND	ND	"			40.0	
Matrix Spike									
<u>1170494-MS1</u> <u>P711233-01</u>									
Arsenic	12/2/97	12.7	22.6	38.4	mg/kg dry	75.0-125	124		
Selenium	"	12.7	ND	12.9	"	75.0-125	102		
Batch: 1170563									
Blank									
<u>Date Prepared: 11/26/97</u>									
<u>1170563-BLK1</u>									
Mercury	12/1/97			ND	mg/kg dry	0.0500			
LCS									
<u>1170563-BS1</u>									
Mercury	12/1/97	0.500		0.480	mg/kg dry	80.0-120	96.0		
Duplicate									
<u>1170563-DUP1</u> <u>P711295-01</u>									
Mercury	12/1/97		ND	ND	mg/kg dry			20.0	
Matrix Spike									
<u>1170563-MS1</u> <u>P711295-01</u>									
Mercury	12/1/97	0.558	ND	0.569	mg/kg dry	75.0-125	102		
Batch: 1270016									
Blank									
<u>Date Prepared: 11/26/97</u>									
<u>1270016-BLK1</u>									
Barium	12/1/97			ND	mg/kg dry	0.500			
Cadmium	"			ND	"	0.500			
Chromium	12/4/97			ND	"	0.500			
Lead	12/1/97			ND	"	10.0			
Silver	"			ND	"	1.00			

North Creek Analytical, Inc.

*Refer to end of report for text of notes and definitions.

Philip Nerenberg, Laboratory Manager

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Agra Earth and Environmental, Inc 7477 S.W. Tech Center Drive Portland, OR 97223-8024	Project: Hoquiam River Crossing Project Number: 7-91M-11957-0 Project Manager: Sean Gormley	Sampled: 11/13/97 to 11/15/97 Received: 11/18/97 Reported: 12/7/97 22:59
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**Total Metals per EPA 6000/7000 Series Methods/Quality Control
North Creek Analytical - Portland**

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
<u>LCS</u>		<u>1270016-BS1</u>								
Barium	12/1/97	50.0		46.5	mg/kg dry	80.0-120	93.0			
Cadmium	"	20.0		20.0	"	80.0-120	100			
Chromium	12/4/97	50.0		47.2	"	80.0-120	94.4			
Lead	12/1/97	100		102	"	80.0-120	102			
Silver	"	50.0		47.2	"	80.0-120	94.4			
<u>Duplicate</u>		<u>1270016-DUP1</u>	<u>P711330-02</u>							
Barium	12/1/97		31.5	36.1	mg/kg dry			40.0	13.6	
Cadmium	"		1.40	1.48	"			40.0	5.56	
Chromium	12/4/97		12.1	17.0	"			40.0	33.7	
Lead	12/1/97		27.5	26.0	"			40.0	5.61	
Silver	"		ND	ND	"			40.0		
<u>Matrix Spike</u>		<u>1270016-MS1</u>	<u>P711330-02</u>							
Barium	12/1/97	82.3	31.5	113	mg/kg dry	75.0-125	99.0			
Cadmium	"	32.9	1.40	32.9	"	75.0-125	95.7			
Chromium	12/4/97	82.3	12.1	92.2	"	75.0-125	97.3			
Lead	12/1/97	165	27.5	184	"	75.0-125	94.8			
Silver	"	82.3	ND	75.4	"	75.0-125	91.6			

SN



Agra Earth and Environmental, Inc
7477 S.W. Tech Center Drive
Portland, OR 97223-8024

Project: Hoquiam River Crossing
Project Number: 7-91M-11957-0
Project Manager: Sean Gormley

Sampled: 11/13/97 to 11/15/97
Received: 11/18/97
Reported: 12/7/97 22:59

Notes and Definitions

#	Note
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DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis

Recov. Recovery

RPD Relative Percent Difference

North Creek Analytical, Inc.

Philip Nerenberg, Laboratory Manager

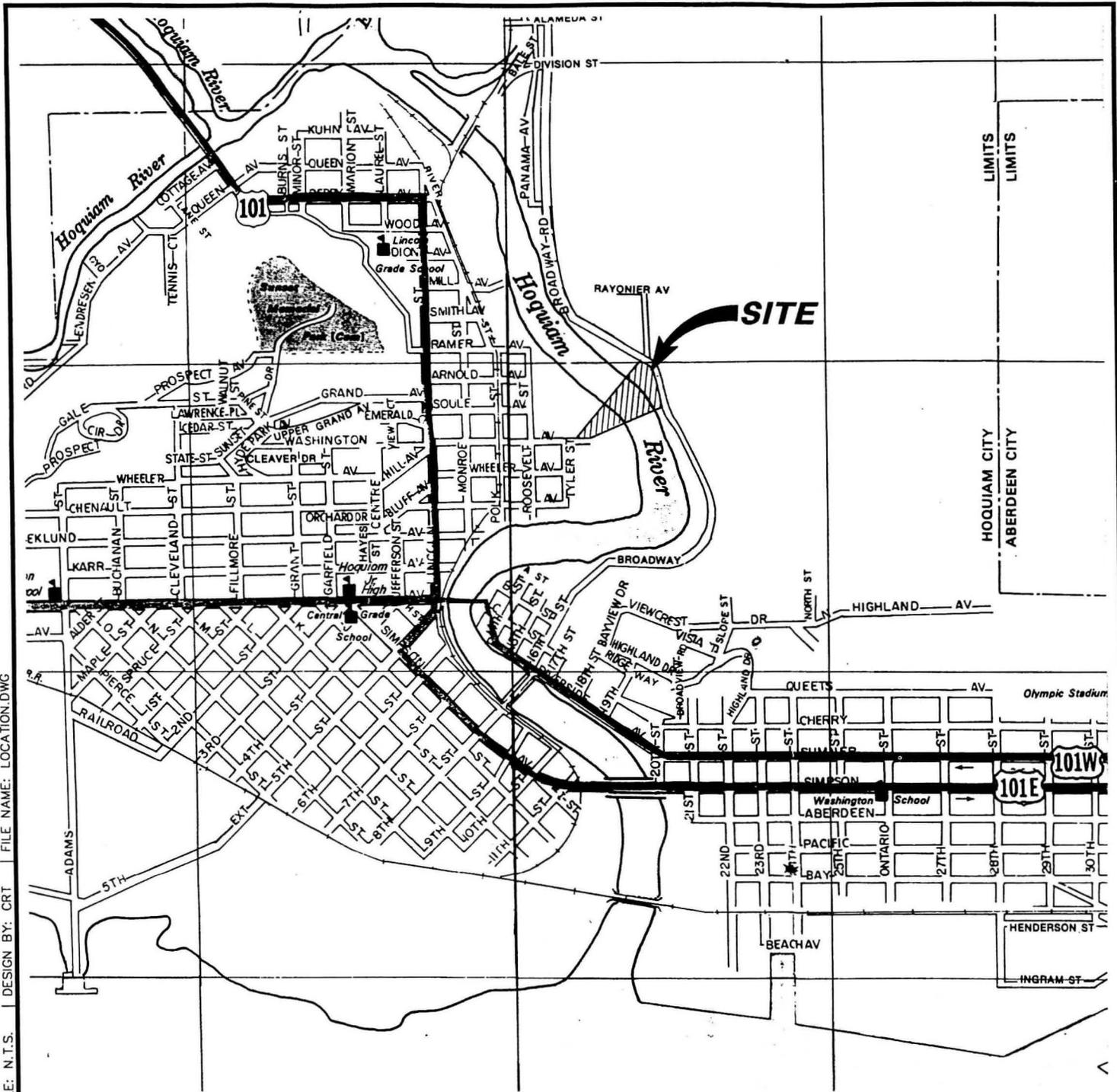
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CHAIN OF CUSTODY REPORT

Work Order # **P711296**

REPORT TO: ATTENTION: <u>Sean Gormley</u> ADDRESS: <u>7477 SwTech Center Dr.</u>			INVOICE TO: ATTENTION: ADDRESS:			TURNAROUND REQUEST in Business Days * Organic & Inorganic Analyses <input checked="" type="checkbox"/> 10 <input type="checkbox"/> 7 <input type="checkbox"/> 5 <input type="checkbox"/> 4 <input type="checkbox"/> 3 <input type="checkbox"/> 2 <input type="checkbox"/> 1 <input type="checkbox"/> Same Day Fuels & Hydrocarbon Analyses <input type="checkbox"/> 5 <input type="checkbox"/> 3-4 <input type="checkbox"/> 2 <input type="checkbox"/> 1 <input type="checkbox"/> Same Day Standard <input type="checkbox"/> OTHER Specify: _____ * Turnaround Requests less than standard may incur Rush Charges.					
PHONE: <u>639-3400</u> FAX:			P.O. NUMBER:						NCA QUOTE #:		
PROJECT NAME: <u>Hogwam River Crossing</u>			Analysis Request: EPA 6010 RCRA Metals								
PROJECT NUMBER: <u>7-91m-11957-0</u>											
SAMPLED BY: <u>Curt Thompson</u>											
CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)				MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS			
1. B-3 S-13 60'-61'	11/13/97 / 1300		↓			S	1902				
2. B-4 S-17 80'-81.5'	11/14/97 / 1215										
3. B-5 S-7 30'-31.5'	↓ / 1015										
4. B-6 S-7 30'-31.5'	11/15/97 / 0930										
5. B-8 S-4 15'-16.5'	↓ / 11:00										
6. B-9 S-3 10'-11.5'	↓ / 1300										
7. B-10 S-2 5'-6.5'	↓ / 1345										
8.											
9.											
10.											
RELINQUISHED BY (Signature): <u>Cynthia Nuxoll</u>			DATE: <u>11/18/97</u>			RECEIVED BY (Signature): <u>Larry Spangler</u>					
PRINT NAME: _____ FIRM: <u>ACE</u>			TIME: <u>3900</u>			PRINT NAME: <u>Larry Spangler</u> FIRM: <u>NCA</u>					
RELINQUISHED BY (Signature): <u>Larry Spangler</u>			DATE: <u>11-18-97</u>			RECEIVED BY (Signature): <u>Kari Cline</u>					
PRINT NAME: <u>Larry Spangler</u> FIRM: <u>NCA</u>			TIME: <u>1615</u>			PRINT NAME: <u>KARI CLINE</u> FIRM: <u>NCA</u>					
ADDITIONAL REMARKS: <u>WA970763</u>						PAGE 1 OF 1					

JOB NO.: 7-91M-11957-0 | DWG DATE: 12-05-97 | SCALE: N.T.S. | DESIGN BY: CRT | FILE NAME: LOCATION.DWG

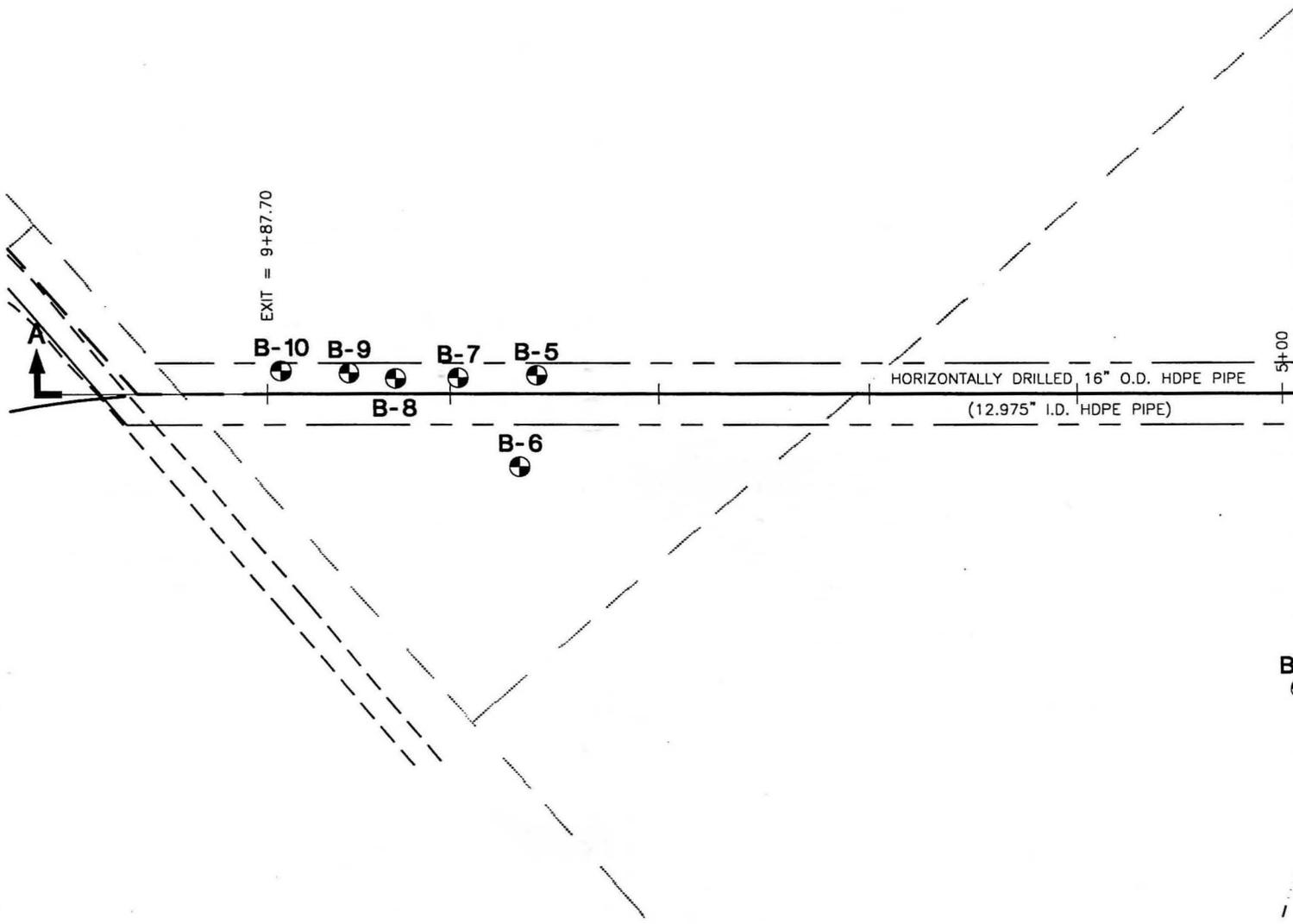


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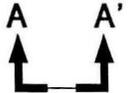
LOCATION MAP
 HOQUIAM RIVER WATERLINE CROSSING
 HOQUIAM, WASHINGTON

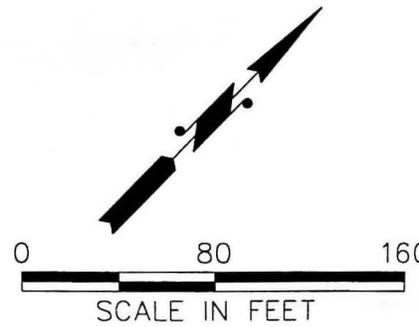
FIGURE
1

JOB NO.: 7-91M-11957-0 | DWG DATE: 12-11-97 | SCALE: 1"=80' | DESIGN BY: CRT | FILE NAME: SITE.DWG

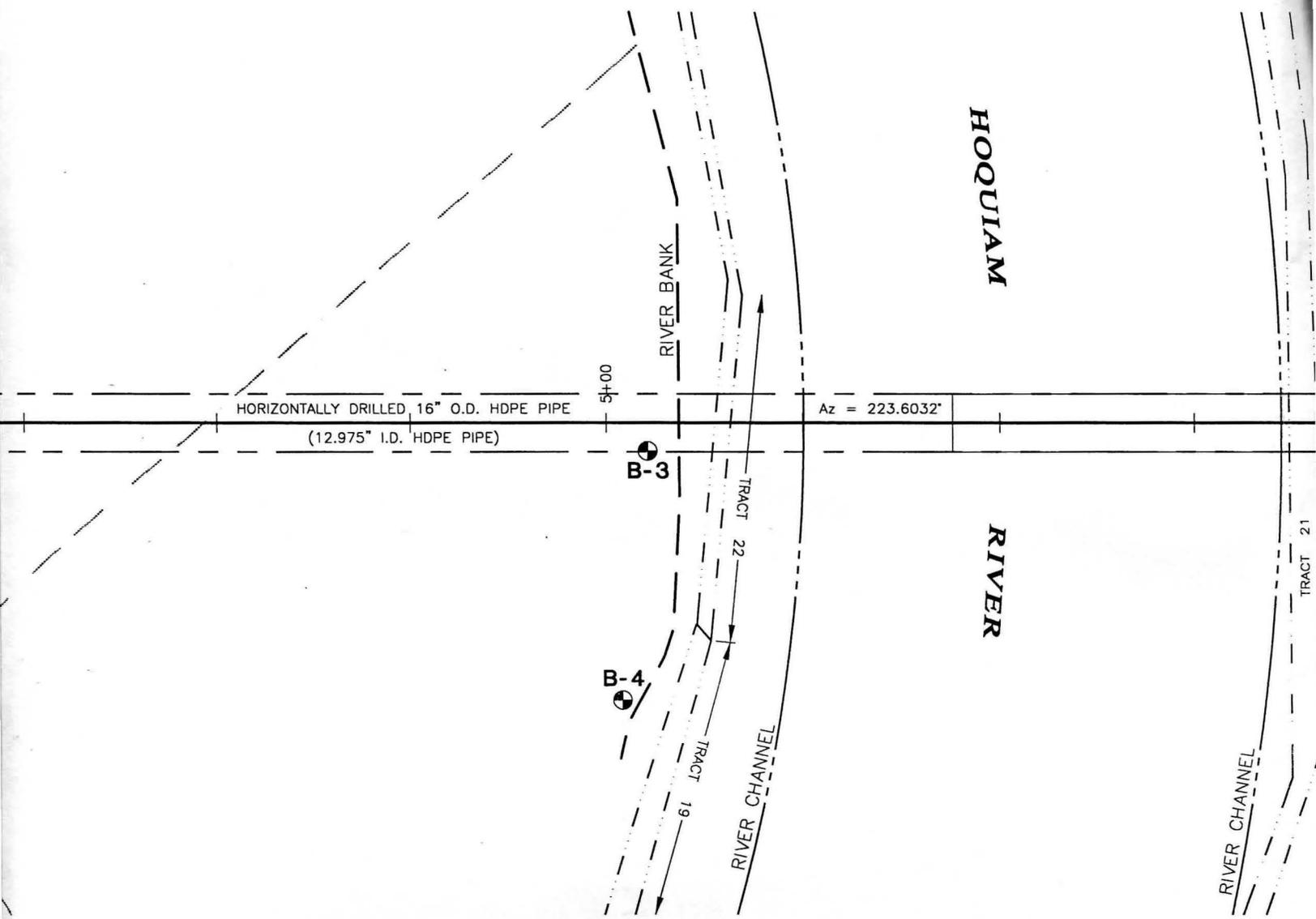


LEGEND

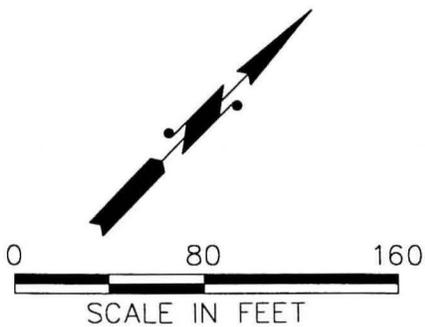
-  B-10 BORING NUMBER AND APPROXIMATE LOCATION
-  GEOLOGIC CROSS-SECTION DESIGNATION AND APPROXIMATE LOCATION



SOURCE: DRAWING BASED ON SURVEY PROVIDED BY ROGER LENIUS ENGINEERING.



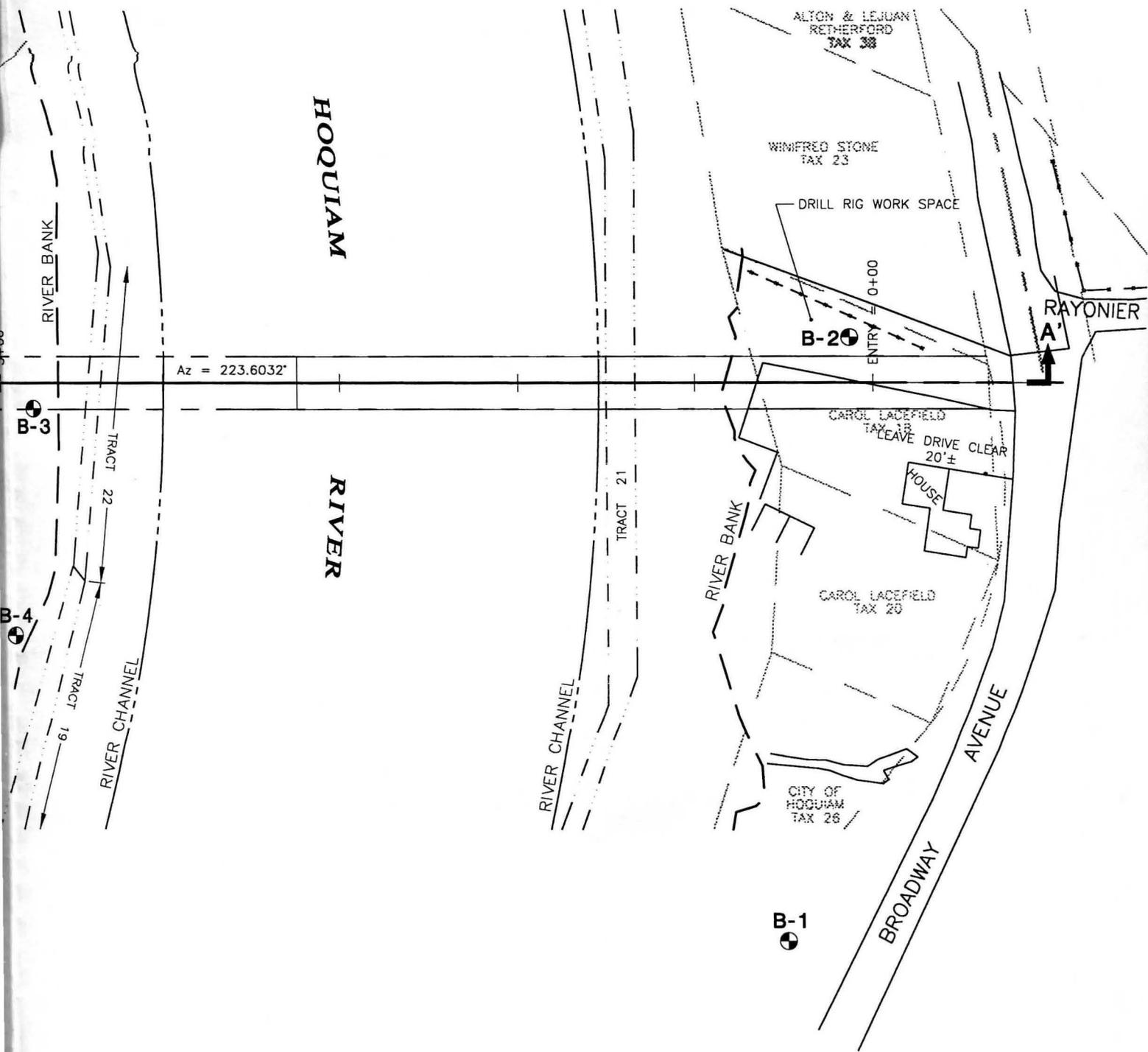
LOCATION
ION AND



LENIUS ENGINEERING.

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SIT
HOQUIA



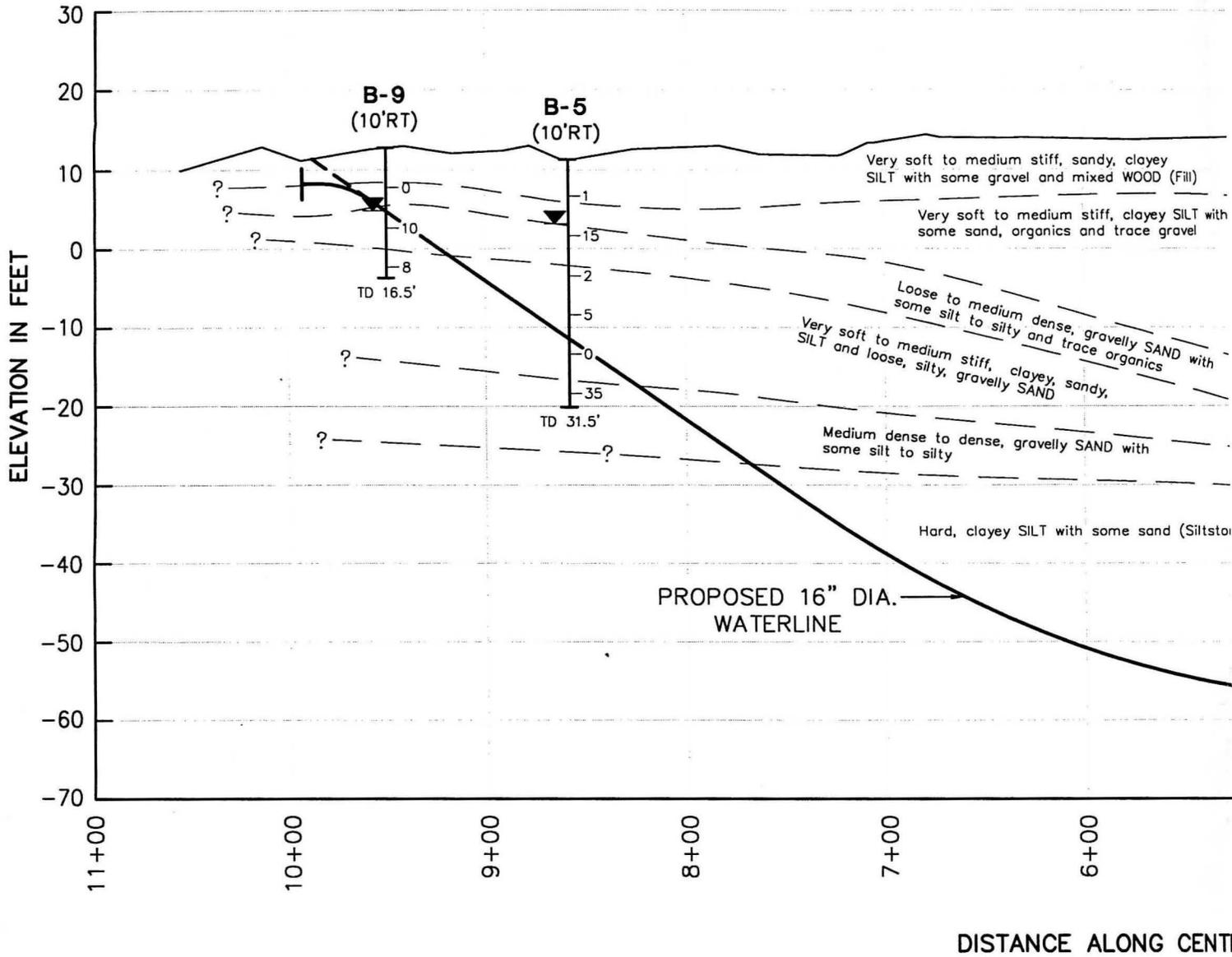
Az = 223.6032'

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SITE & EXPLORATION PLAN
 HOQUIAM RIVER WATERLINE CROSSING
 HOQUIAM, WASHINGTON

FIGURE
2

A
SOUTHWEST



LEGEND

B-2
(26'RT)

BORING NUMBER AND APPROXIMATE LOCATION
OFFSET FROM SECTION LINE



STANDARD PENETRATION RESISTANCE IN
BLOWS PER FOOT



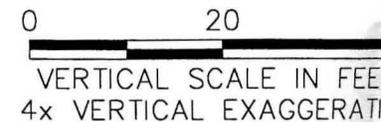
PERCHED GROUNDWATER LEVEL AT TIME OF DRILLING



GROUNDWATER LEVEL AT TIME OF DRILLING

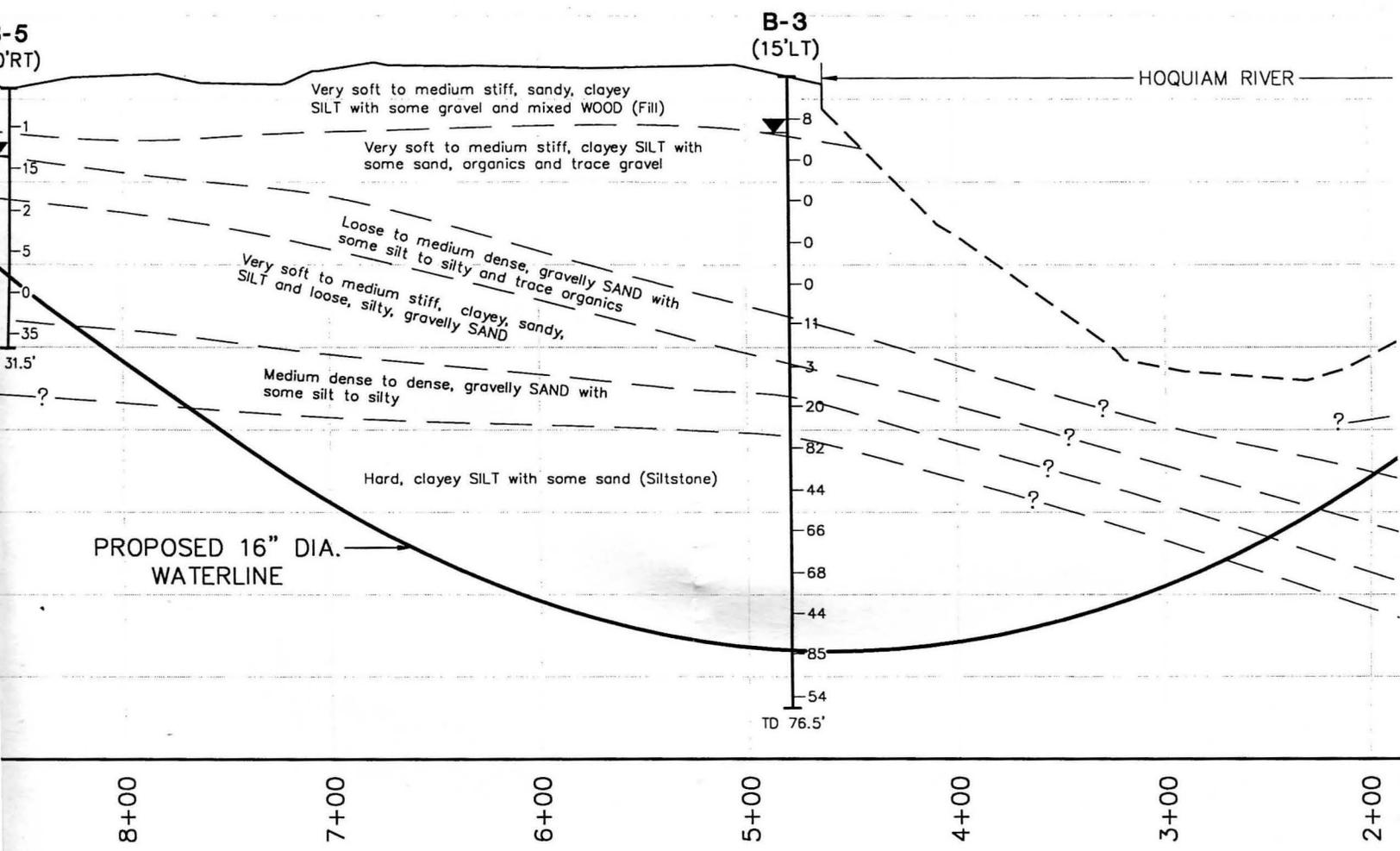


TOTAL DEPTH OF BORING



JOB NO.: 7-91M-11957-0 | DWG DATE: 12-12-97 | SCALE: NOTED | DESIGN BY: CRT | FILE NAME: SECTION A.DWG

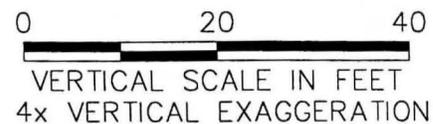
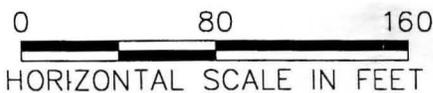
SOURCE: DRAWING BASED ON SURVEY PROVIDED BY ROGER LENIUS ENGINEERING.



DISTANCE ALONG CENTERLINE IN FEET

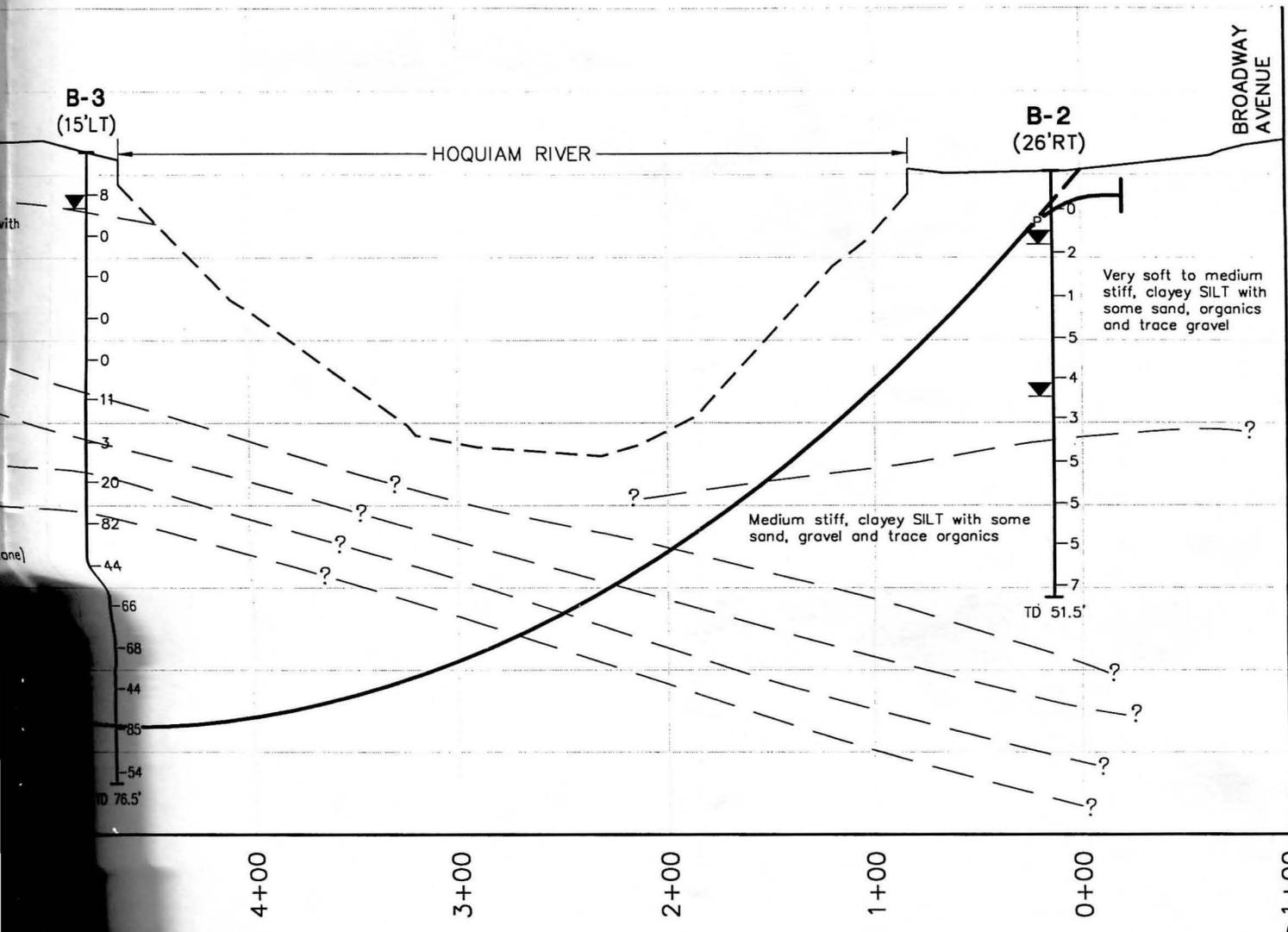
LOCATION
 DATE IN
 TIME OF DRILLING
 DRILLING

NOTES:
 THE STRATA /
 BETWEEN EXP
 REPRESENT A
 SIMPLIFIED NA
 DEPOSITS, BA
 DESCRIPTIONS
 REPORT TEXT



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GE
 HOQ



IN FEET

NOTES:

THE STRATA ARE BASED UPON INTERPOLATION BETWEEN EXPLORATIONS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.

SIMPLIFIED NAMES ARE SHOWN FOR SOIL DEPOSITS, BASED ON GENERALIZATIONS OF SOIL DESCRIPTIONS. SEE EXPLORATION LOGS AND REPORT TEXT FOR COMPLETE SOIL DESCRIPTIONS.

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GEOLOGIC CROSS-SECTION A-A'
 HOQUIAM RIVER WATERLINE CROSSING
 HOQUIAM, WASHINGTON

FIGURE
3