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Geotechnical Report
MacLeod Reckord
Branson Park
Burien, Washington

March 2003

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

At Shannon & Wilson, our mission is to be a progressive, well-managed professional consulting firm in the fields of engineering and applied earth sciences. Our goal is to perform our services with the highest degree of professionalism with due consideration to the best interests of the public, our clients, and our employees.

Submitted To:
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21-1-09855-001

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GEOTECHNICAL REPORT
MACLEOD RECKORD
BRANSON PARK
BURIEN, WASHINGTON

1.0 INTRODUCTION

This report presents the results of our geotechnical studies for the proposed construction of a stairway in Branson Park, located in Burien, Washington. The purpose of our work was to evaluate surface topography and subsurface soil conditions at the site by performing site reconnaissance, reviewing site history conditions, and performing subsurface explorations to develop geotechnical engineering recommendations for the proposed structure. Mr. Edward of MacLeod Reckord authorized our work on January 16, 2003.

2.0 SITE AND PROJECT DESCRIPTION

The project site is located along the west-facing slope of the shoreline in an area known as Branson Park, in the Seahurst area of Burien, Washington, as shown on the Vicinity Map, Figure 1. Construction of a new narrow footpath is proposed through the park, with the trailhead originating approximately 150 west of the intersection of SW 149th Street and 25th Avenue SW, and meandering westward through the property towards the beach. The project site is the western portion of this trail, and is located along steeply sloping terrain. The natural slope of the site is approximately 2 horizontal to 1 vertical (2H:1V), with local occurrences of 1H:1V slopes. Naturally occurring vegetation covers the slope along the project alignment. Many of the larger trees along the slope display curved trunks, which are indications of continual slope movement. Near the foot of the slope, designated wetlands are present on both sides of the proposed trail alignment.

A stairway is proposed to provide access up and down the steep slope. Figure 2 shows the Site Plan of the stairway alignment, which is located approximately 350 feet north of the intersection of 28th Avenue SW and SW 149th Place.

3.0 SITE EXPLORATIONS AND LABORATORY TESTING

Field work at the site included performing visual reconnaissance of the property, and drilling eight exploratory borings using portable equipment.

Relatively disturbed, but representative samples, were obtained from the borings at selected depths using portable Porter soil sampling equipment. The hand-operated equipment consists of a 1.4-inch outside-diameter (1.0-inch inside-diameter) split-spoon sampler connected to a string of drive rods. The sampler was driven into the ground by a 40-pound weight falling 18 inches. A 3-inch-diameter auger was used to ream out the hole down to sampling locations prior to obtaining drive samples. At each sampling location, the sampler was generally driven 18 inches (less if substantial refusal was met), the number of blows for each 6-inch increment being recorded (substantial refusal occurs when 50 or more blows are required to advance the sampler 6 inches). The resulting Porter Penetration Resistance provides an approximate means of evaluating the relative density of granular soils and the consistency of cohesive soils.

The drilling of the exploratory borings was coordinated, performed, and logged by a Shannon & Wilson representative, with the assistance of a City of Burien Parks Department employee. Explorations were performed between March 5 and 7, 2003. Samples obtained in the field were sealed in jars and returned to our laboratory for testing and future reference. The results of the Standard Penetration Tests and soil classifications are presented on the boring logs, in Appendix A.

The approximate locations of the explorations are shown on the Site Plan, Figure 2. The approximate locations of the explorations were initially flagged in the field by a Shannon & Wilson representative, and then subsequently located on a topographic survey completed by Penhallegon Associates Consulting Engineers, Inc. on March 5, 2003. The boring logs for these explorations are presented in Appendix A, Figures A-2 through A-8. A key to symbols and descriptions used on the boring logs is presented as Figure A-1.

All samples were returned to our laboratory in Seattle, where field classification and geologic category of each sample was checked. Grain-size distribution tests and moisture contents were performed on selected samples to assist with the classification. The moisture contents and visual classifications were incorporated into the soil descriptions on the boring logs. Figure A-9 presents the results of the four grain-size distribution tests.

4.0 GEOLOGIC CONDITIONS

4.1 Site Geology

The Branson Park property is topographically divided into two sections: (1) a rolling upland above elevation 150 feet and (2) a steep to very steep slope from elevation 150 feet down to the Puget Sound shoreline to the west. Based on existing geologic maps, site characteristics and soil exposures, the property is underlain by two geologic units, both of which were deposited during the last glaciation of the Puget Lowland about 14,000 years ago.

From the shoreline up to about elevation 50 feet, the underlying, undisturbed deposit is glacial lake clay and silt (commonly named Lawton Clay), which is relatively impermeable. Overlying this unit, and probably extending up to the eastern end of the property, is glacial outwash sand and gravel, which is permeable. Both of these glacial deposits have been overridden by about 3,000 feet of ice and are hard and very dense, respectively.

Springs emerge from the hillside along a line at about elevation 50 feet. We understand that one of the springs on the park property was tapped by a tunnel that was hand-mined in 1914. It was reportedly improved in 1938. More recently, a culvert was installed and the open hole of the tunnel was filled with sand. Some of the springs flow in a defined channel to the shoreline, whereas others are diffuse and seep into wetlands.

The site has a long history of slope instability, as supported by oral history and by the topographic features of the site. Continued instability has caused the evacuation of soil from the areas where springs emerge, leaving a mound of soil in the middle of the site (in between the springs).

Although most of the landslides are small slumps or earth flows in the spring areas and along the shoreline (from wave erosion), there is also evidence that large deep-seated landslides have occurred. This probably involved the movement of the sand that overlies the clay. In addition, the soil on the steep slopes creeps imperceptibly on the order of 0.05 to 0.1 inches per year. This creep is the reason for the bowing and bending of the trees on the hillside. This movement due to the force of gravity is inexorable, and will continue in the future. All of these types of soil movement provide periodic delivery of sediment to the beach.

4.2 Subsurface Conditions

In general, the project site is underlain by three geologic units based on subsurface explorations: (1) a surficial layer of colluvium (loose, heterogeneous soil layer emplaced due to gravity), (2) very dense fine to medium sand outwash, and (3) silty fine sand glacial lake deposits.

As shown on Figure 3, the colluvial layer is continuous on the slope and ranges from 5 to 14 feet thick. It is comprised chiefly of very loose to medium dense, dark brown, brown and brown-gray, locally gravelly, clean to silty sand, with organics and roots. Locally, the colluvium is dense, typically where it transitions to the undisturbed soil below. The underlying undisturbed advance outwash is dense to very dense, brown, clean to slightly silty, fine and fine to medium sand. At lower elevations, the underlying glacial lake deposit/transitional beds are composed of dense to very dense, silty, fine sand laminated with fine sandy silt.

The soils above elevation 44 feet are mostly moist, but those below this elevation are moist to wet or wet. The boring logs in Appendix A indicate if and where groundwater was encountered during drilling, and the soil descriptions on the logs report the soil moisture of the soil interval.

5.0 ENGINEERING RECOMMENDATIONS

The proposed stairway will be constructed from approximate elevation 160 feet, downslope to elevation 15 feet. It is assumed that the majority of the stairway will be elevated slightly above the slope surface to minimize disturbance to the property. Use of spread footings for support of the elevated stairway would likely result in substantial movement (lateral and vertical) of the stairway and significant disturbance to the slope during construction. We therefore recommend use of small-diameter pin piles to provide support for the stairway.

The pin piles would extend down through the generally very loose to medium dense soils, transmitting the load of the stairway to the underlying competent soils. As noted previously, the explorations along the stairway alignment indicate the competent bearing soils to be approximately 5 to 14 feet deep.

We recommend the use of 2-inch-diameter extra strong pipes for the vertical support. The pin piles should be designed for an allowable load of 4 kips (2 tons) each. We recommend that the piles be driven to approximately 1 inch of penetration in one minute with a 90-pound pneumatic jackhammer penetrating a minimum of 3 feet into the dense bearing soils. Figure 4 presents a sketch of a typical pin pile detail and some general acceptance criteria for installation.

It is our understanding that several platforms will be constructed along the stairway alignment, to serve as stairway landings. We recommend that the landings also be supported with the small-diameter pin piles. In addition, we recommend that the landings not be rigidly connected to the stairway above. Should slope movement occur along a portion of the alignment, damage to the stairway structure would be reduced to the localized area that the slope movement occurred.

The lower end of the stairway should terminate approximately 5 feet up from the beach, at approximate elevation 15 feet. Wave erosion and potential for undercutting the slope at the edge of the beach could likely damage the structure and its supports. This will also reduce the risk of construction disturbance at the shoreline.

An alternative to 2-inch-diameter pin piles could be helical piers (Chance Anchors). Chance Anchor is a proprietary system employing helical piers. Helical piers could be used for vertical support using an allowable load of 20 kips (10 tons) each. Helical piers consist of a 1 3/8- to 2 ¼-inch square steel shaft with an 8- to 10-inch-diameter steel helix located at the leading edge. The helix is pitched similar to a drill auger so the pier penetrates and drills into the soil. One or more additional helices are located along the shaft at about 3-foot intervals with diameter sizes increasing to 10 to 14 inches. The helical piers are installed using a rotary type, torque motor either electrically or hydraulically powered. Acceptance criteria for penetration of these piers into the bearing soils should be a minimum torque of 4,000 foot-pounds at the final depth to achieve an allowable load of 20 kips.

Based on the history of this slope and the potential for continued slope movement, the pin piles are not designed for to resist lateral pressures. To provide some lateral resistance against potential localized shallow slope movement (including soil creep), battered pin piles could be installed into the slope, then welded to the vertical piles.

6.0 RISK STATEMENT

The subject slope is marginally stable, and has many indicators that it has been unstable in the distant and recent past. This instability is both deep and shallow. The presence of sand over clay and groundwater seepage at the contact between the two formations; reported indicators of historic movement at the top of the bluff; and the arcuate nature of the slope indicate the presence of past and the likelihood of future deep-seated landsliding. Shallow movement is evident in the presence of chutes that indicate the periodic occurrence of debris flows. Creep, the imperceptible movement of soil in the upper few to several feet, is very active on this slope. All of these types of mass movement will continue in the future, with or without the implementation of the proposed park project.

Due to the non-invasive nature of the proposal; that is, a narrow foot trail on the upland and a pipe pile supported stairway on the steep hillside, there will be no project-induced change in the stability conditions on this hillside. The trail/stairway corridor was selected in order to minimize effects on the hillside. Surface water on the trails will be directed in a manner that will not change the subsurface hydrology and the stairway on the steep slope will allow water to fall in the same places that it has always fallen. Construction of the stairway will be accomplished by hand methods (no heavy equipment on the slope), and the pin pile foundations for the stairway will penetrate through the loose surface soils. Some surficial disturbance will occur due to repeated walking on the ground surface during construction, but it can be restored with plantings and surface protection methods. At the shoreline, the support for the stairway along the edge of the marine waters will be located several feet upland from the high water mark to prevent disturbance there.

Due to (1) the pin pile foundations, (2) the pervious sand soils on the hillside, and (3) the low-impact construction, the construction season need not be restricted to the dry months. No construction work shall be performed in wet or boggy areas.

7.0 LIMITATIONS

This report was prepared for the exclusive use of the Owner, Contractor, and Engineer in the design and installation of the proposed work. This report should be provided for information of factual data only, and not as a warranty of subsurface conditions, such as those interpreted from the exploration logs and discussions of subsurface conditions included in this report.

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist. We assume that the exploratory borings made for this project are representative of the subsurface conditions throughout the site (i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the explorations). If conditions different from those described in this report are observed or appear to be present during construction, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between submission of this report and the start of work at the site, or if conditions have changed due to natural causes, or construction operations at or near the site, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendation considering the change conditions and time lapse.

Unanticipated soil conditions are commonly encountered and cannot be fully determined by merely taking soil samples or completing test borings. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

Within the limitations of the scope, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practices in this area at the time this report was prepared. We make no other warranty, either express or implied. These conclusions and recommendations were based on our understanding of the project as described in this report and the site conditions as interpreted from the current and previous explorations.

The scope of our services did not include any environmental assessment or evaluation regarding the presence of absence of wetlands, hazardous or toxic materials in the soil surface water, groundwater, or air at the subject site. Shannon & Wilson, Inc., has qualified personnel to assist you with these services should they be necessary. Shannon & Wilson, Inc., has prepared Appendix B, "Important Information About Your Geotechnical Report," to assist you and others in understanding the use and limitations of our reports.

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RC:WTL/rc

0 1/4 1/2 1

Scale in Miles

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Burien, Washington

VICINITY MAP

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FIG. 1

NOTE

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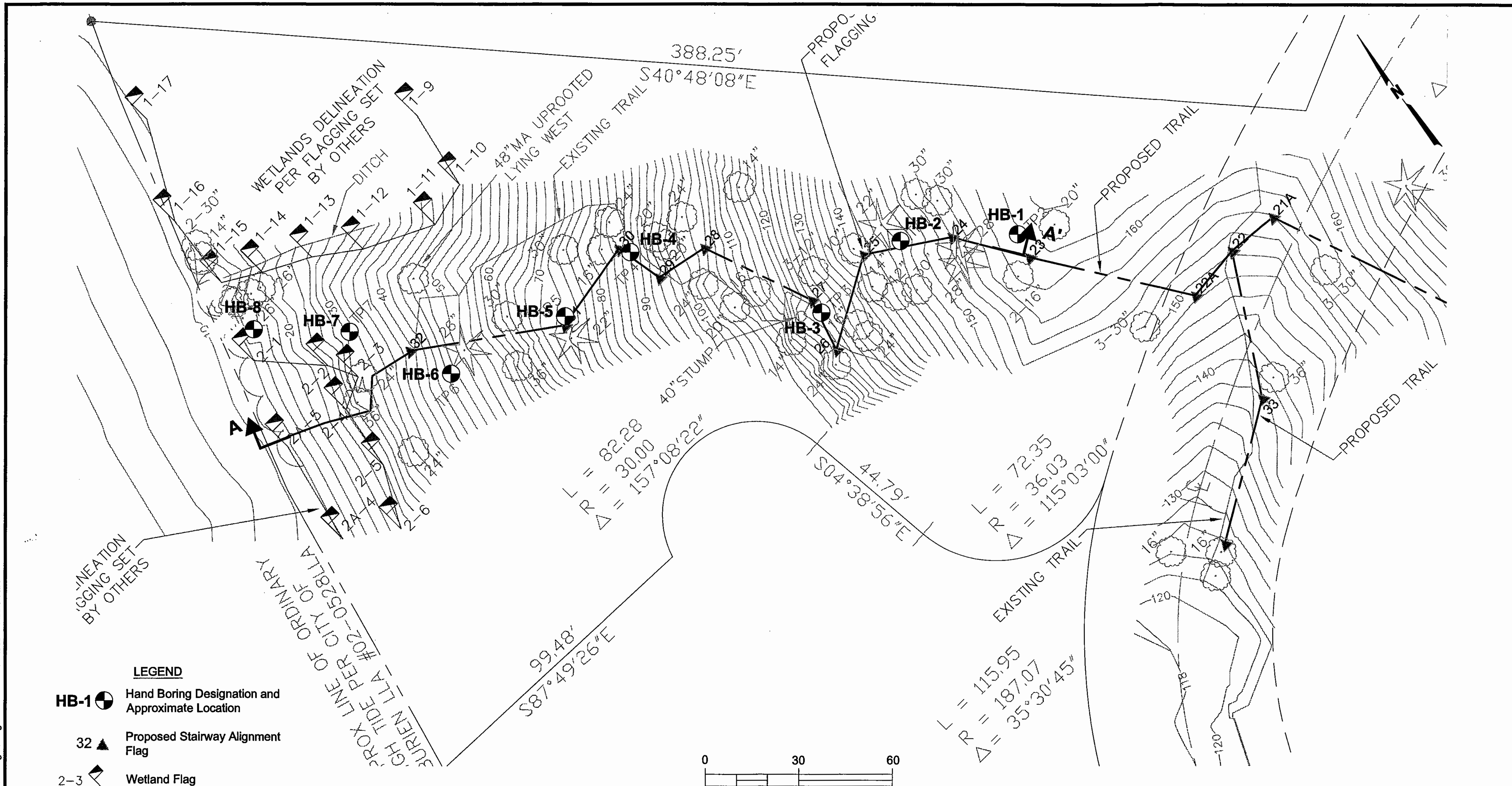

LEGEND

- HB-1 — Hand Boring Designation and Approximate Location
- 32 — Proposed Stairway Alignment Flag
- 2-3 — Wetland Flag
- Conifer or Deciduous Tree
- Property Line
- R.O.W. Line
- Ordinary High Tide Line
- A — Generalized Subsurface Profile (See Figure 3)

NOTES

1. Site plan provided by PACE, Inc., dated 3-5-03.
2. Vertical datum: NAVD 88 - City of Seattle.

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GENERALIZED SUBSURFACE PROFILE A-A'

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FIG. 2

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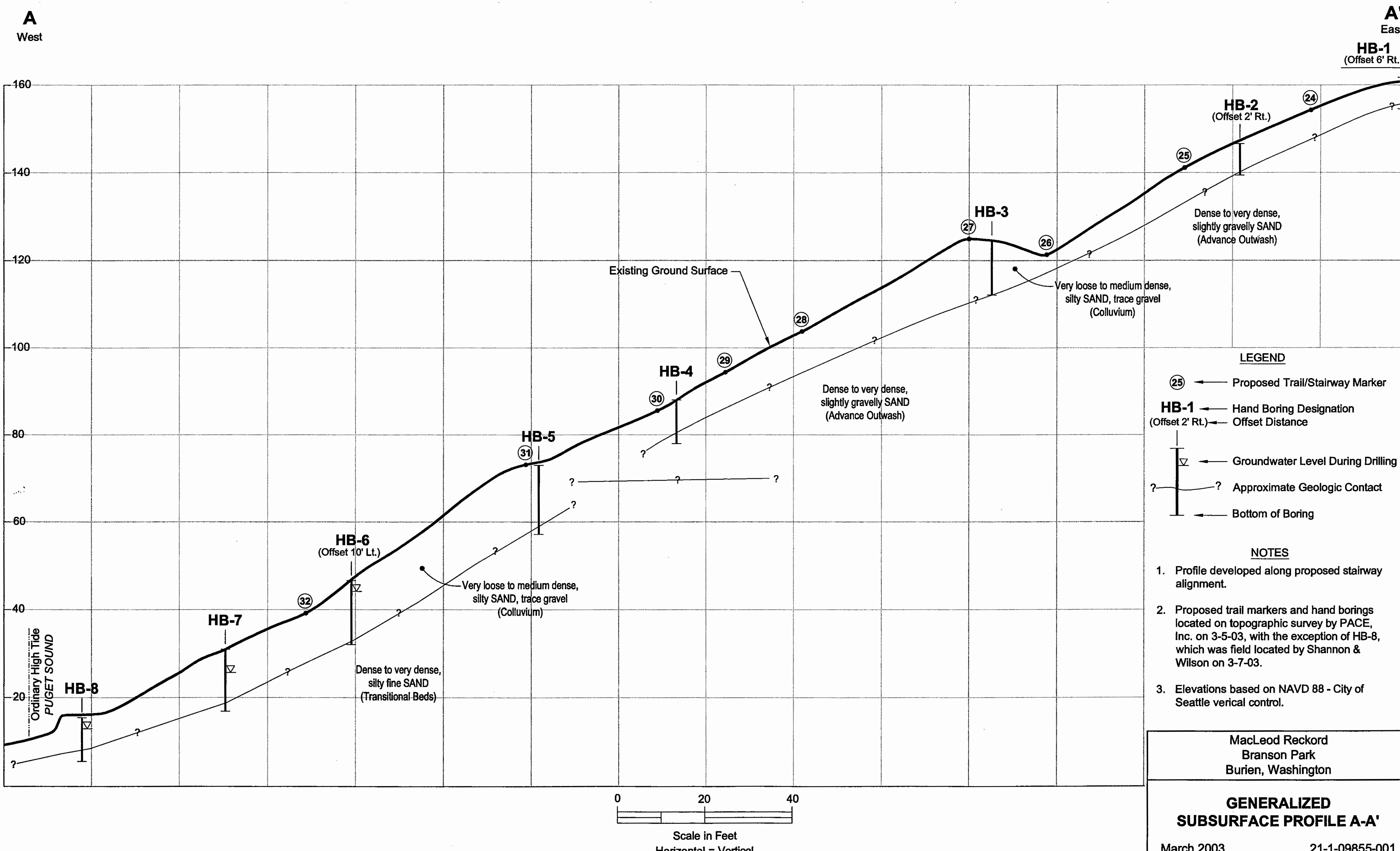

NOTES

1. Profile developed along proposed stairway alignment.
2. Proposed trail markers and hand borings located on topographic survey by PACE, Inc. on 3-5-03, with the exception of HB-8, which was field located by Shannon & Wilson on 3-7-03.
3. Elevations based on NAVD 88 - City of Seattle verical control.

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GENERALIZED SUBSURFACE PROFILE A-A'

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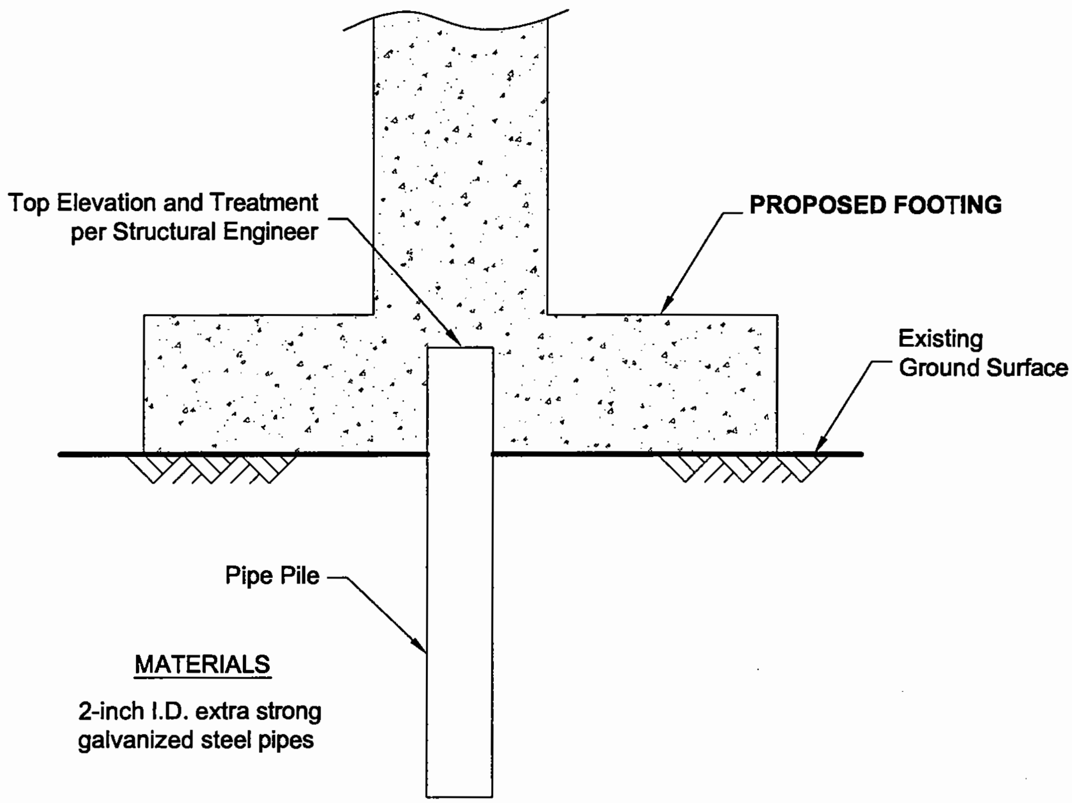
FIG. 3

File: I:\Drafting\211\09855-001\21-1-09855-001 Fig. 3.dwg Date: 03-19-2003 Author: SAC



Use - For Underpinning Lightly Loaded Concrete Foundations

Not to Scale

NOTES

1. Drive an open-ended steel pipe pile using a 90-pound jackhammer.

2. Drive pipe 3 feet or more into bearing layer, attaining "refusal" to driving.

3. "Refusal" is defined as one inch or less of pile penetration during one minute of steady driving with a 90-pound jackhammer.

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SMALL DIAMETER PIPE PILE DETAIL	
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File: I:\Drafting\21\09855-001\21-1-09855-001 Fig. 4.dwg Date: 03-19-2003 Author: SAC

APPENDIX A

FIELD EXPLORATION AND LABORATORY TEST RESULTS

Shannon & Wilson, Inc. (S&W), uses a soil classification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following page. Soil descriptions are based on visual-manual procedures (ASTM D 2488-93) unless otherwise noted.

S&W CLASSIFICATION OF SOIL CONSTITUENTS

- MAJOR constituents compose more than 40 percent, by weight, of the soil. Major consituents are capitalized (i.e., SAND).
- Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).
- Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace of gravel).

MOISTURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

ABBREVIATIONS

ATD	At Time of Drilling
Elev.	Elevation
ft	feet
FeO	Iron Oxide
MgO	Magnesium Oxide
HSA	Hollow Stem Auger
ID	Inside Diameter
in	inches
lbs	pounds
Mon.	Monument cover
N	Blows for last two 6-inch increments
NA	Not applicable or not available
NP	Non plastic
OD	Outside diameter
OVA	Organic vapor analyzer
PID	Photo-ionization detector
ppm	parts per million
PVC	Polyvinyl Chloride
SS	Split spoon sampler
SPT	Standard penetration test
USC	Unified soil classification
WLI	Water level indicator

GRAIN SIZE DEFINITION

DESCRIPTION	SIEVE NUMBER AND/OR SIZE
FINES	< #200 (0.8 mm)
SAND*	
- Fine	#200 to #40 (0.8 to 0.4 mm)
- Medium	#40 to #10 (0.4 to 2 mm)
- Coarse	#10 to #4 (2 to 5 mm)
GRAVEL*	
- Fine	#4 to 3/4 inch (5 to 19 mm)
- Coarse	3/4 to 3 inches (19 to 76 mm)
COBBLES	3 to 12 inches (76 to 305 mm)
BOULDERS	> 12 inches (305 mm)

* Unless otherwise noted, sand and gravel, when present, range from fine to coarse in grain size.

RELATIVE DENSITY / CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
0 - 4	Very loose	Under 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	15 - 30	Very stiff
		Over 30	Hard

WELL AND OTHER SYMBOLS

Bent. Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Bedrock
PVC Screen	
Vibrating Wire	

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SOIL CLASSIFICATION AND LOG KEY

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FIG. A-1
Sheet 1 of 2

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(From ASTM D 2487-98 & 2488-93)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL DESCRIPTION
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Clean Gravels *(less than 5% fines)*	GW	Well-graded gravels, gravels, gravel/sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines *(more than 12% fines)*	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Clean Sands *(less than 5% fines)*	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines *(more than 12% fines)*	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML	Inorganic silts of low to medium plasticity, rock flour, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays or medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (see ASTM D 4427)

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, slightly silty fine SAND)*are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, silty CLAY/clayey SILT; GW/SW, sandy GRAVEL/gravelly SAND)* indicate that the soil may fall into one of two possible basic groups.

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SOIL CLASSIFICATION AND LOG KEY

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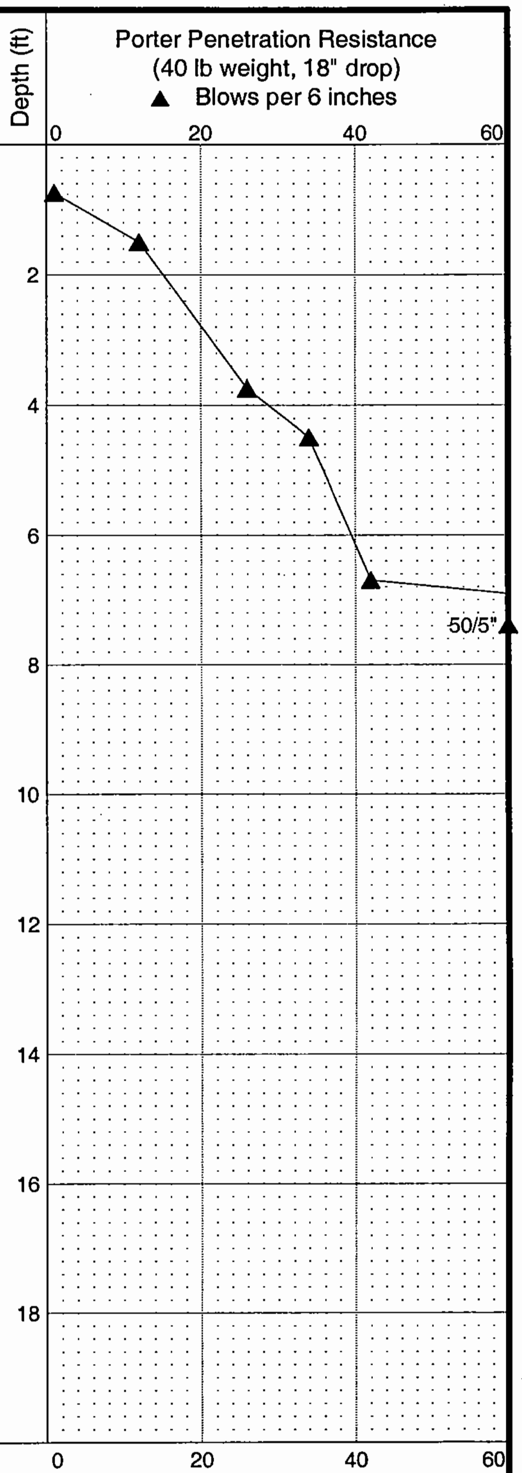
FIG. A-1
Sheet 2 of 2

SOIL DESCRIPTION Surface Elevation: Approx. 161.5 Ft.	Depth (ft)	Symbol	Samples	Ground Water
Very loose to loose, dark brown, silty SAND, trace of gravel; moist; numerous organics, tree roots; (Colluvium) SM.			1	
Medium dense to dense, brown-gray, clean to slightly silty, fine to medium SAND, trace of gravel; moist; (Colluvium) SP.	2.0		2	
Very dense, brown-gray, slightly fine gravelly SAND; moist; (Advance Outwash) SP.	6.5		3	
BOTTOM OF HAND BORING COMPLETED 3/5/2003	7.4			



● % Water Content

Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

⌶ Porter Penetration Test Sample

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF HAND BORING HB-1

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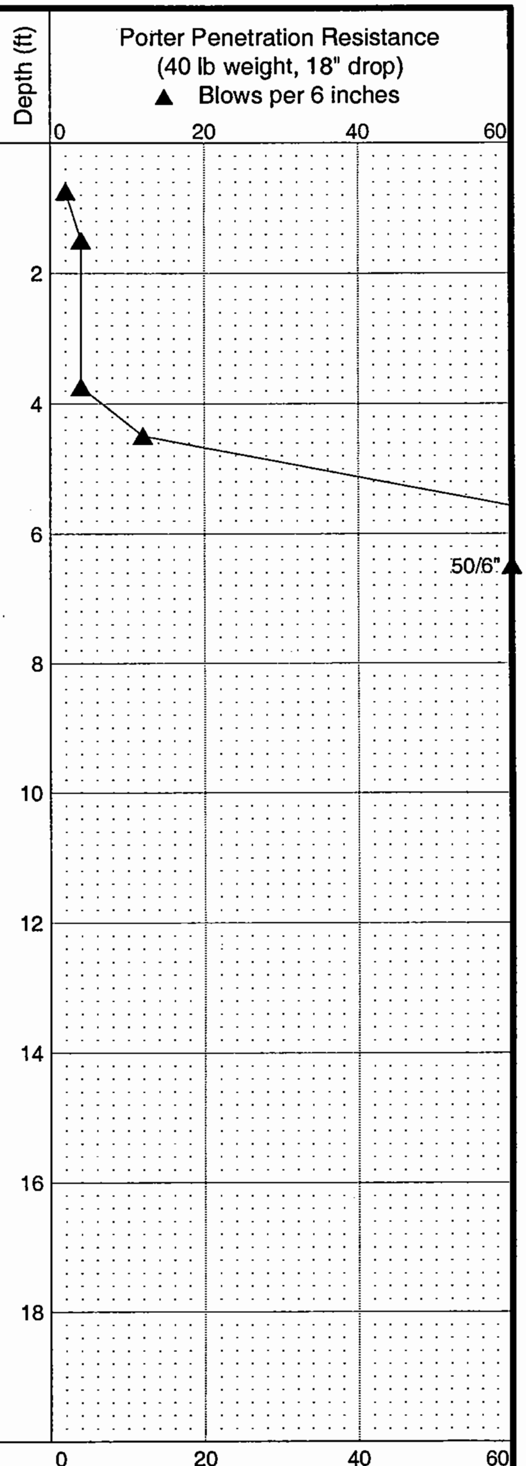
FIG. A-2

HAND BORING LOG 21-09855.GPJ SHAN WIL.GDT 3/18/03 *Log: BMP Rev: WTL Typ: EET*

SOIL DESCRIPTION Surface Elevation: Approx. 146 Ft.	Depth (ft)	Symbol	Samples	Ground Water
Very loose to loose, dark brown and brown, silty SAND, trace of gravel; moist; root and organics; (Topsoil) SM.			1	
Loose to medium dense, brown-gray, gravelly to slightly gravelly, fine to medium SAND; moist; (Colluvium) SW/SP.	2.7		2	
Dense, brown-gray, slightly gravelly SAND; moist; (Advance Outwash) SW/SP.	5.0			
Very dense, brown-gray, slightly gravelly SAND, moist; (Advance Outwash) SP.	6.5		3	
BOTTOM OF HAND BORING COMPLETED 3/5/2003	7.0			



● % Water Content

Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

⌶ Porter Penetration Test Sample

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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Burien, Washington

LOG OF HAND BORING HB-2

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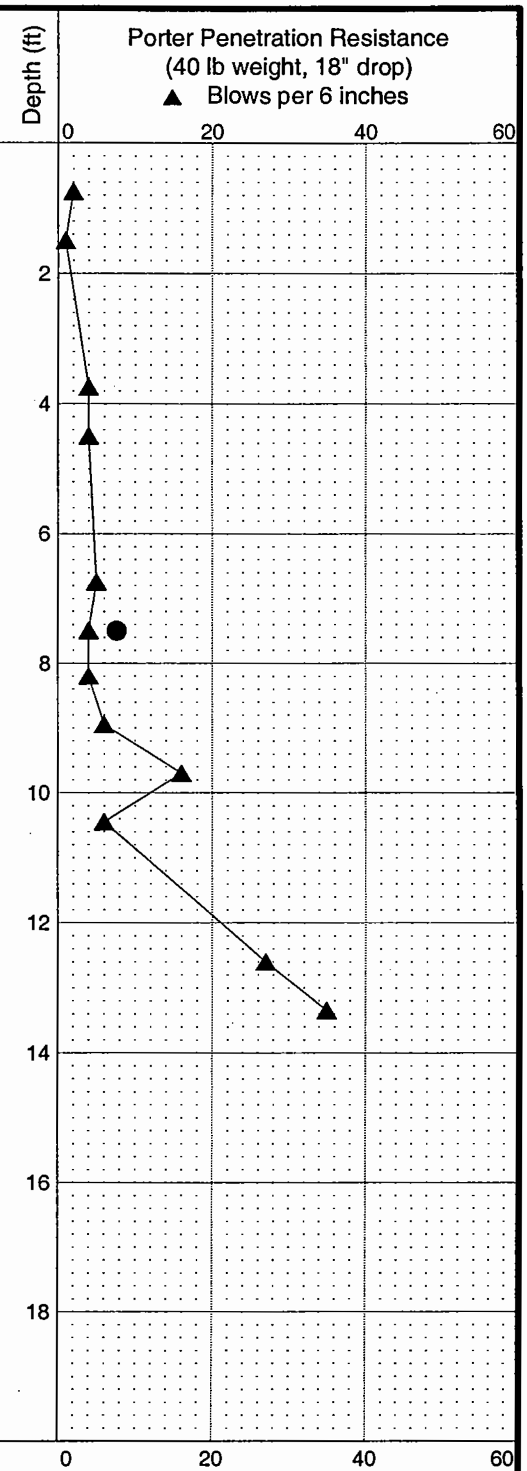
FIG. A-3

HAND BORING LOG 21-09855.GPJ SHAN WIL.GDT 3/18/03 Log: BMP Rev: WTL Typ: EET

SOIL DESCRIPTION Surface Elevation: Approx. 125.0 Ft.	Depth (ft)	Samples
Very loose, dark brown, silty SAND; moist; numerous roots and organics; (Topsoil) SM.		1
Loose, brown-gray, clean to slightly silty SAND, trace of gravel; moist; roots and organics; (Colluvium) SP-SM.	1.8	2, 3, 4
Medium dense, brown-gray, slightly gravelly SAND; moist; scattered roots and wood; (Colluvium) SP.	9.5	5, 6
Dense (no sample recovered).	13.0	
BOTTOM OF HAND BORING COMPLETED 3/5/2003	13.5	



LEGEND

Ⅰ Porter Penetration Test Sample

● % Water Content

Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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Branson Park
Burien, Washington

LOG OF HAND BORING HB-3

March 2003 | 21-1-09855-001

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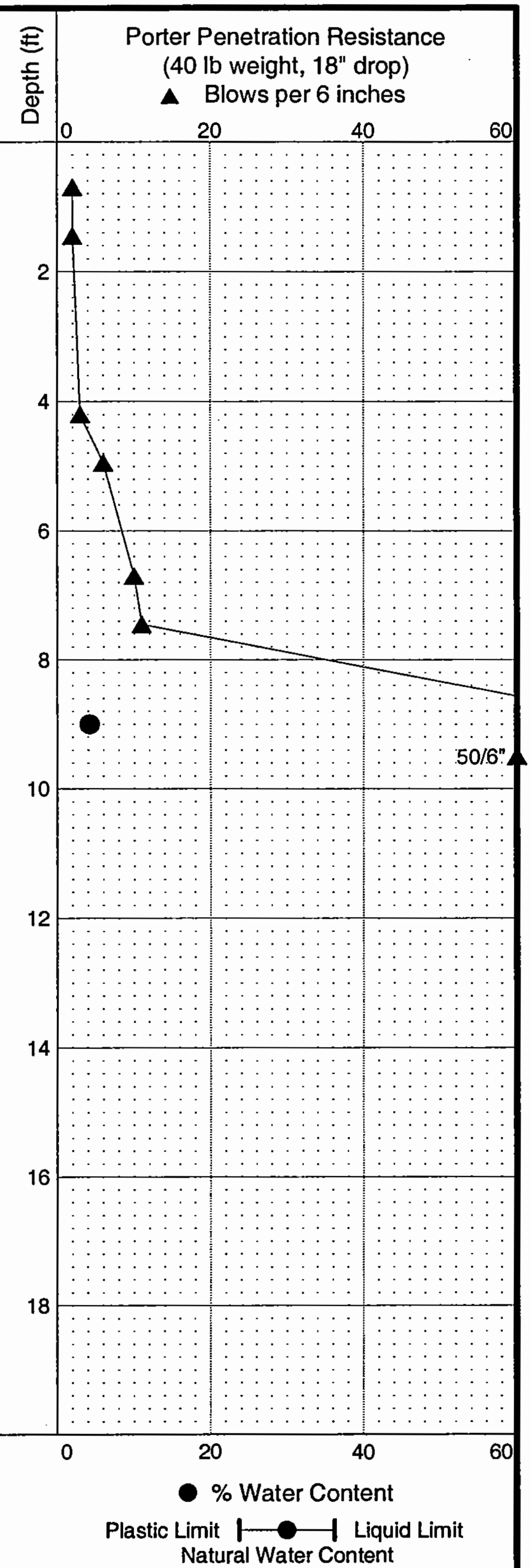
FIG. A-4

SOIL DESCRIPTION Surface Elevation: Approx. 88.0 Ft.	Depth (ft)	Symbol	Samples	Ground Water
Loose, dark brown, silty SAND to fine, sandy SILT; moist; numerous organics; (Topsoil) SM/ML.			1	
Loose to medium dense, brown-gray, slightly gravelly, trace to slightly silty SAND; moist; (Colluvium) SP-SM.	3.0		2 3	
Very dense, light brown-gray, slightly silty, fine SAND, trace fine gravel; moist; scattered fine sandy silt clasts; (Advance Outwash) SP-SM	7.5		4	
BOTTOM OF HAND BORING COMPLETED 3/6/2003	10.0			



LEGEND

⌶ Porter Penetration Test Sample

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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Burien, Washington

LOG OF HAND BORING HB-4

March 2003 21-1-09855-001

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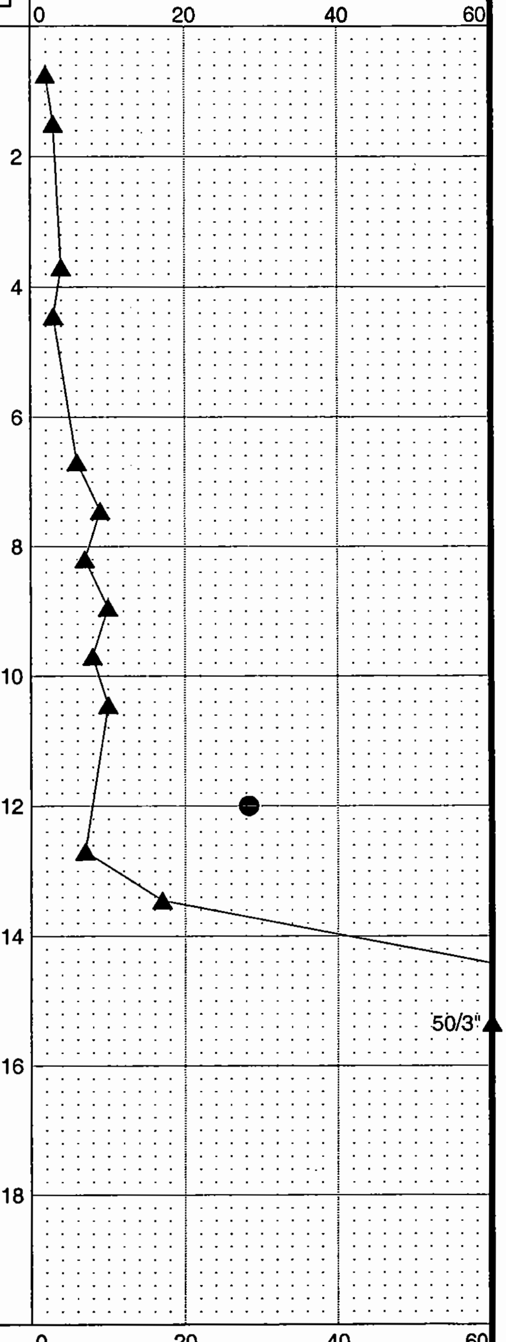
FIG. A-5

HAND BORING LOG 21-09855.GPJ SHAN WIL.GDT 3/17/03 *Log: BMP Rev: WTL Typ: EET*

SOIL DESCRIPTION Surface Elevation: Approx. 73.0 Ft.	Depth (ft)	Samples	Ground Water
Very loose, dark brown, silty SAND, trace of fine gravel; moist; numerous organics; (Topsoil) SM.		1	
Very loose to medium dense, light brown-gray, trace to slightly gravelly, trace to silty, fine to medium SAND; moist to wet (wet at 10.3 feet); occasional roots from 2 to 7 feet; (Colluvium) SP-SM.	2.0	2, 3, 4, 5, 6	During Drilling ⊻
Very dense, light brown, silty fine SAND; wet; laminated with fine sandy silt; (Transitional Beds) SP-SM/SM.	14.0	7	
BOTTOM OF HAND BORING COMPLETED 3/6/2003	15.7		

Porter Penetration Resistance
(40 lb weight, 18" drop)
▲ Blows per 6 inches



● % Water Content

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

⌶ Porter Penetration Test Sample

⊻ Ground Water Level ATD

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF HAND BORING HB-5

March 2003 21-1-09855-001

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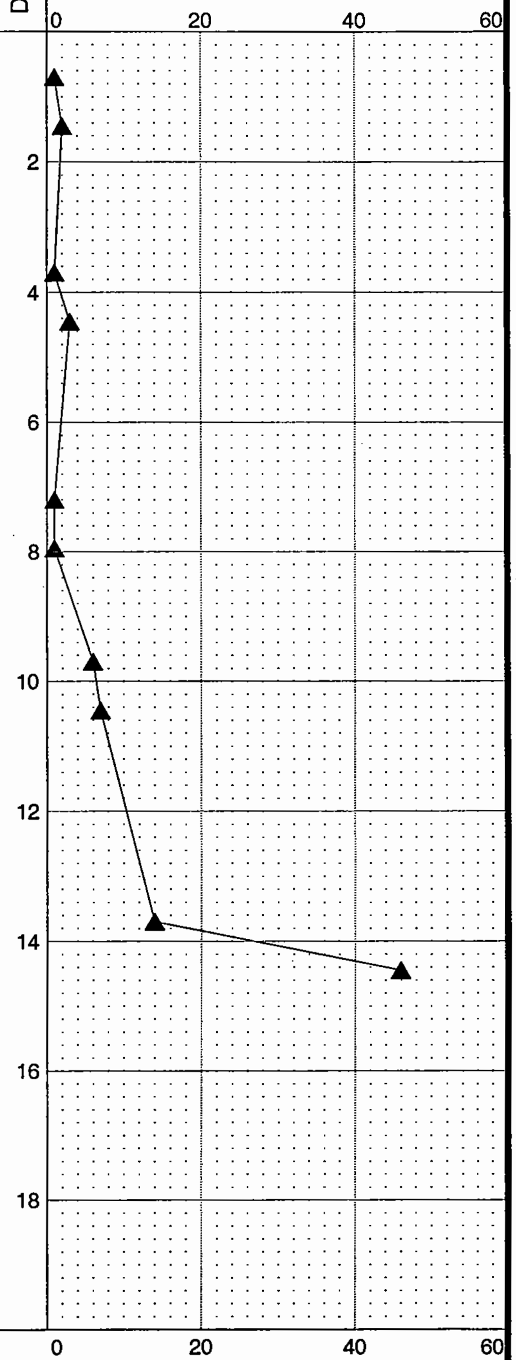
FIG. A-6

HAND BORING LOG 21-09855.GPJ SHAN WIL.GDT 3/17/03 Log: BMP Rev: WTL Typ: EET

SOIL DESCRIPTION Surface Elevation: Approx. 47.0 Ft.	Depth (ft)	Symbol	Samples	Ground Water
Very loose, dark brown and brown, silty to slightly silty SAND; moist; numerous organics; (Topsoil) SP-SM.			1	
Very loose to medium dense, light brown-gray, trace to silty SAND, trace of fine gravel; wet; (Colluvium) SP-SM.	2.0		2, 3, 4, 5	During Drilling ⊻
Dense (no sample recorded).	14.0			
BOTTOM OF HAND BORING COMPLETED 3/6/2003	14.5			

Porter Penetration Resistance
(40 lb weight, 18" drop)
▲ Blows per 6 inches



● % Water Content

Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

⌶ Porter Penetration Test Sample

⊻ Ground Water Level ATD

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF HAND BORING HB-6

March 2003 21-1-09855-001

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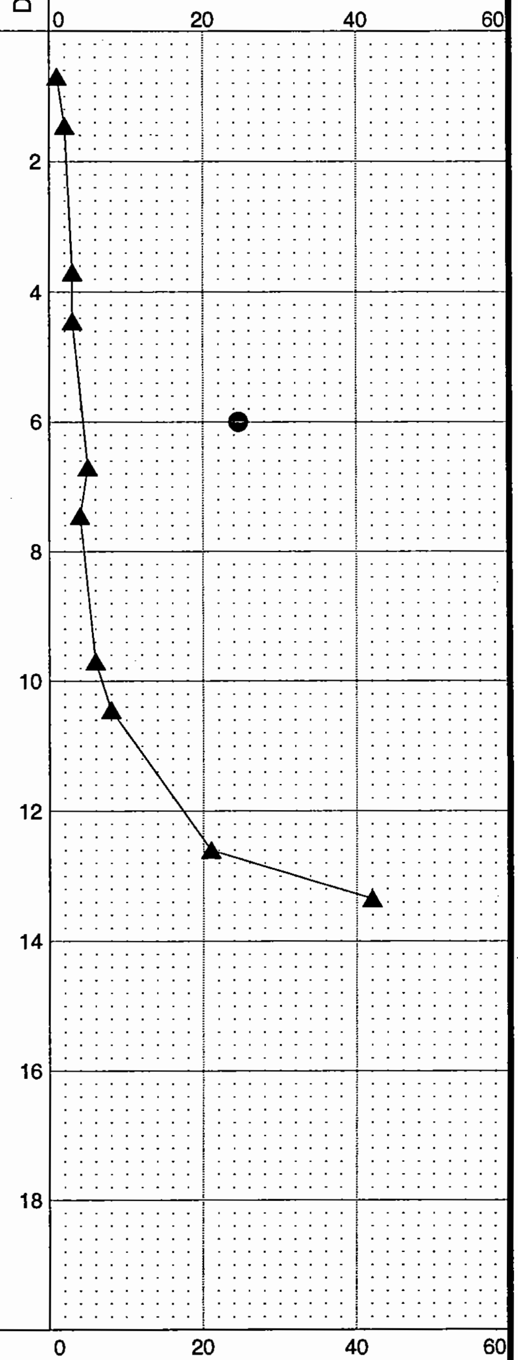
FIG. A-7

SOIL DESCRIPTION Surface Elevation: Approx. 31.0 Ft.	Depth (ft)	Symbol	Samples	Ground Water
Very loose, dark brown, silty SAND; moist; numerous organics; (Topsoil) SM.	0.5		1	
Very loose to loose, light brown-gray, silty, fine to medium SAND, trace of fine gravel; moist to wet; numerous to trace organics (decreasing with depth); (Colluvium) SM.	11.0		2, 3, 4	During Drilling ∇
Medium dense to dense (no sample recovered).	13.4		5	
BOTTOM OF HAND BORING COMPLETED 3/7/2003				

Porter Penetration Resistance
(40 lb weight, 18" drop)
▲ Blows per 6 inches



LEGEND

⌶ Porter Penetration Test Sample

∇ Ground Water Level ATD

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF HAND BORING HB-7

March 2003 21-1-09855-001

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FIG. A-8

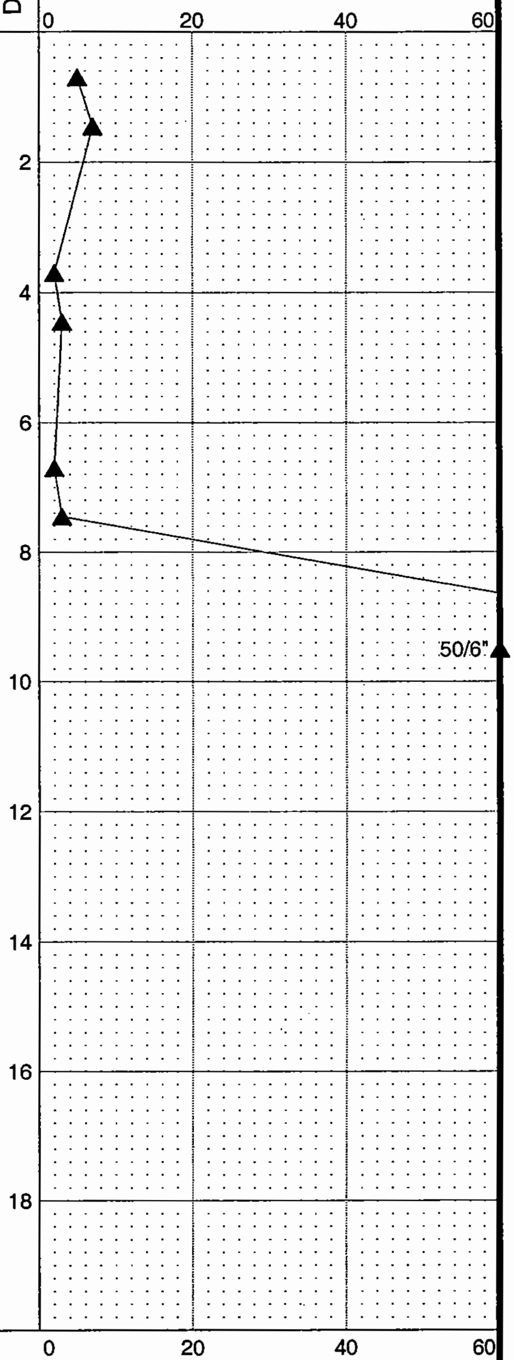
HAND BORING LOG 21-09855.GPJ SHAN WIL.GDT 3/17/03 Log: BMP Rev: WTL Typ: EET

SOIL DESCRIPTION

Surface Elevation: Approx. 15.0 Ft.

Soil Description	Depth (ft)	Samples	Ground Water
Topsoil; SM.	0.3		
Very loose to loose, light brown-gray, interbedded with green-gray, silty, fine to medium SAND; moist to wet; scattered to numerous organics; (Colluvium) SM.		1, 2, 3	During Drilling ⊻
Soft to medium stiff, light brown, silty CLAY to clayey SILT; wet; ML.	8.0		
Very dense, brown-gray, silty, fine to medium SAND; wet; scattered to numerous organics; SM.	8.7	4	
BOTTOM OF HAND BORING COMPLETED 3/7/2003	10.0		

Porter Penetration Resistance
(40 lb weight, 18" drop)
▲ Blows per 6 inches



LEGEND

⌶ Porter Penetration Test Sample

⊻ Ground Water Level ATD

● % Water Content

Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Hand Boring drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF HAND BORING HB-8

March 2003 21-1-09855-001

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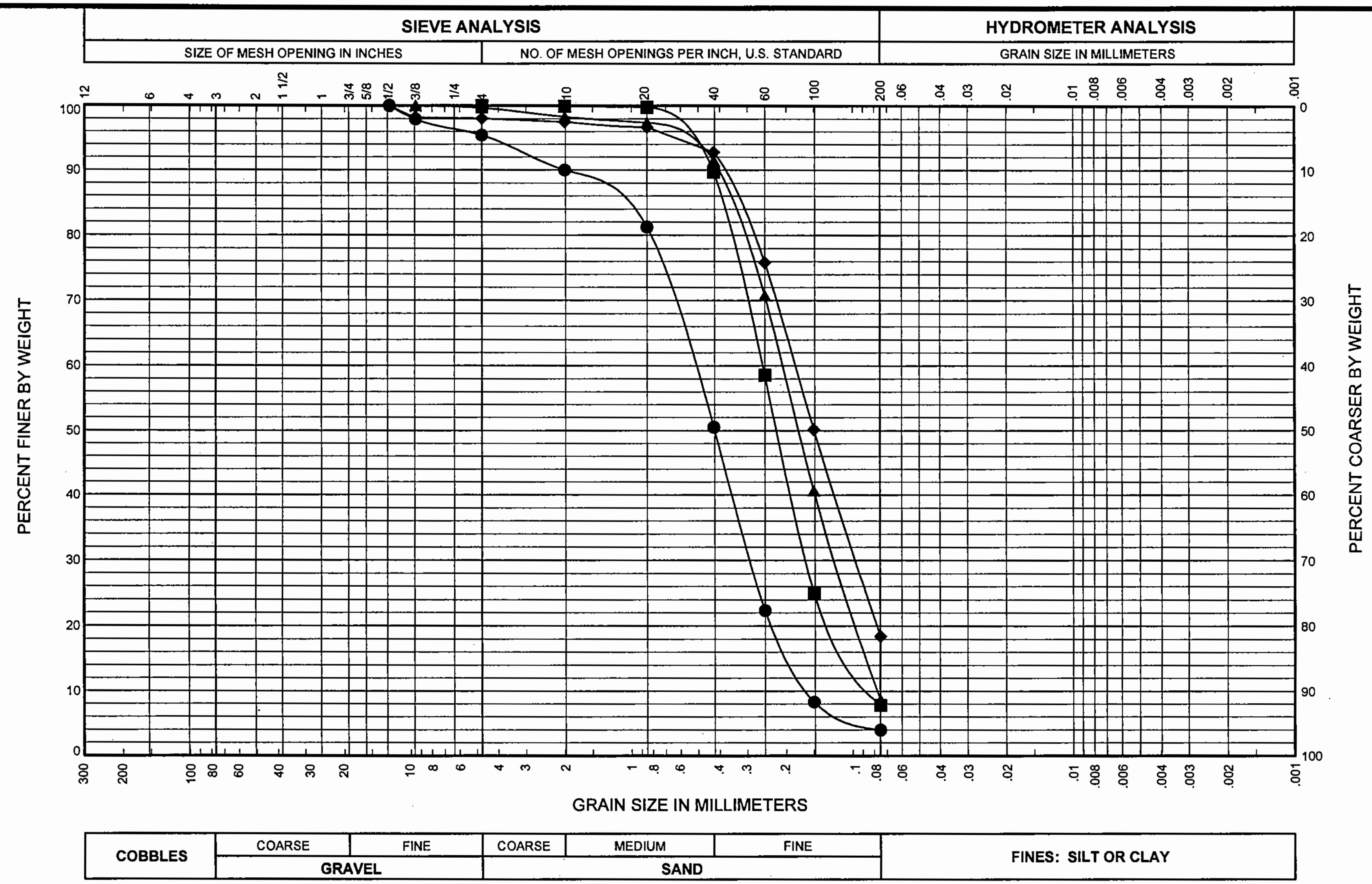
FIG. A-9



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● HB-3, S-4	7.5	SP	Brown, fine to medium SAND, trace of silt and gravel	4.0	7.6			
■ HB-4, S-4	9.0	SP-SM	Light brown-gray, slightly silty, fine SAND	7.8	4.2			
▲ HB-5, S-6	12.0	SP-SM	Brown, slightly silty, fine SAND	8.7	28.4			
◆ HB-7, S-3	6.0	SM	Brown, silty, fine SAND, trace of gravel; scattered organics; iron-oxide stains	18.4	24.6			

MacLeod Reckord
Branson Park
Burien, Washington

GRAIN SIZE DISTRIBUTION

March 2003 21-1-09855-001

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FIG. A-10

FIG. A-10

APPENDIX B

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to and part of Report 21-1-09855-001

Date: March 19, 2003
To: Mr. Ed MacLeod
MacLeod Reckord

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland