Geotechnical Report

For Construction of:

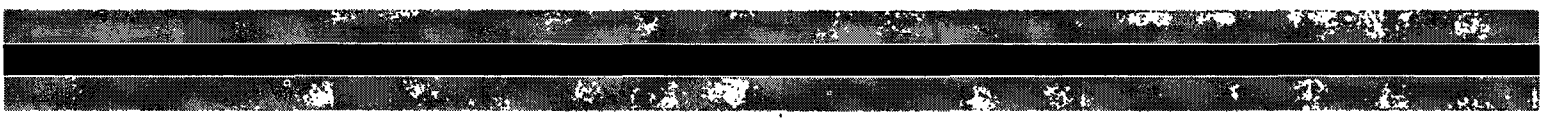
SR 500 MP 4.58 TO MP 5.96

N.E. 112TH AVE./GHER RD. INTERCHANGE

Overcrossing & E-NS ramp over NE Ramp Bridges

CLARK COUNTY

STATE PROJECT



Washington State Department of Transportation

GEOTECHNICAL REPORT

SR-500

MP 4.86 to 5.82

NE 112th /NE Gher Road Interchange

Geotechnical Recommendations for NE 112 Avenue/NE Gher Road Overcrossing and E-NS Ramp over NE Ramp Bridges.
0L-2529

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11/1/00

EXPIRES JULY 1, 2001

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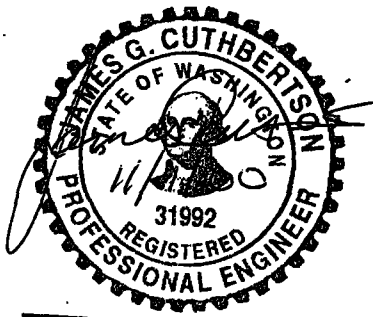

EXPIRES 03-13-02

October 31, 2000

Washington State Department of Transportation
Sid Morrison
Secretary of Transportation

Field Operations Support Service Center
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CONTENTS

1. INTRODUCTION

1.1. GENERAL

This report presents the results of our geotechnical investigation for the SR-500, E-NS Ramp Over NE Ramp and NE 112th Avenue/NE Gher Road Overcrossing. This project will include a new alignment for the E-NS Ramp Over NE Ramp and modifications to the existing SR500 alignment including walls, new collector distributor lanes, and a new grade separation for the NE 112th Avenue/NE Gher Road Overcrossing. A vicinity map illustrating the location of the project is presented in Figure 1. This report provides information and recommendations for bridge foundations. Recommendations for retaining walls based on available wall site data will be addressed in a separate report. When the PS&E is completed for this project, our office will provide the *Summary of Geotechnical Conditions* for inclusion in the Special Provisions, Appendix B.

The analyses, conclusions, and recommendations provided in this report are based on the project description, and site conditions existing at the time of the field explorations. The exploratory borings are assumed to be representative of the subsurface conditions throughout the project area. If during construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

1.2. PROJECT DESCRIPTION

The portion of this project discussed in this report includes two bridges. The details of the two bridges are presented below.

1.2.1 E-NS Ramp Bridge

The E-NS ramp bridge crosses over the NE ramp and consists of three spans with the abutment walls at the end. The heights of the NE and SW approach embankments are approximately 10.1 m (33 ft) and 5.8 m (19 ft). The embankment fill slope is proposed to be 2H: 1V. Plan and profile of this bridge are presented in Figures 2 and 3.

1.2.2 Gher Road Over Crossing Bridge

The Gher Road Over Crossing Bridge consists of three spans and supported by columns at the end. The heights of the NE and SW approach embankments are approximately 7.3 m (24 ft) and 6.8 m (22.5 ft). The embankment fill slope is proposed to be 3H: 1V. Plan and profile of this bridge are presented in Figures 4 and 5.

2. FIELD INVESTIGATION AND TESTING

2.1. FIELD EXPLORATION

The field exploration program for the project consisted of Standard Penetration Test (SPT) borings. The information obtained during the field exploration was used in conjunction with existing information obtained from the previous studies to characterize the subsurface conditions throughout the project area. The logs of the test borings in Appendix D of this report should be included in the contract documents.

Standard Penetration Tests (SPT), in general, were performed at 1.5 m (5 ft) intervals in the test borings. Disturbed soil samples from the SPT were visually classified in the field then submitted to the OSC Materials Laboratory for more detailed classification and testing. Fine grained material with less than 30 blows/0.3 m, as determined from the SPT, was sampled using a Washington Undisturbed Sampler. Undisturbed samples were also submitted to the OSC Materials Laboratory for testing.

The borings completed for this study utilized wet rotary methods with safety hammers for the SPT tests. Older log SPT values were likely obtained using cat-head operated hammers, however, the drilling method is not known. SPT values reported on the logs and profiles are the actual field measured SPT values. They have not been corrected for energy, silt content, rod weight and flexure, or overburden pressures.

The locations of the borings are shown in both plan and profile views of each structure on the plan and profile sheets. The sheets are presented in Figures 2 through 5.

2.2. LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program. The samples are grouped into two categories, disturbed and undisturbed. Disturbed samples are those that were obtained during the Standard Penetration Test while undisturbed samples are those samples that were obtained using the WSDOT sampler.

All disturbed soil samples were visually examined and then grouped together based on particle size distribution, consistency, and color. Once groups of samples were established that had similar characteristics, a minimum of one sample per group was tested. The testing consisted of performing particle size analyses, determining the liquid limit if applicable, and determining the plastic limit and plasticity index if applicable. The tests were done in accordance with AASHTO T-88, T-89, and T-90 guide specifications respectively. After the testing was complete, the samples were classified using the Unified Soil Classification System (USCS). The laboratory test results are presented in Appendix E.

3. GEOLOGIC SETTING AND SUBSURFACE CONDITIONS

Subsurface conditions in the project area were explored by a field exploration program consisting of rotary drilled test borings and classified through a laboratory testing program. Appendix D, provides all test hole data obtained in the field exploration program. Appendix E, provides all data obtained in the laboratory testing program.

3.1. GEOLOGY

The project site is located west of the Cascade Range on a flat lying terrace composed of sand and gravel. These deposits are the result of the glacial outburst floods of Glacial Lake Missoula that occurred during the Pleistocene period 10,000 to 2 million years ago. This glacial lake breached an ice dam in the Idaho-Montana area, ultimately undermining the dam completely and thus allowing the 2000 cubic kilometer lake to drain rapidly. The water flowed through the present sites of Pend Oreille and Couer D'Alene Lakes and the Rathdrum Prairie-Spokane Valley area. The floodwaters cut across the Columbia Plateau through the Pasco and Umatilla Basins, down the Columbia River Gorge and eventually into the Pacific Ocean. These floodwaters began to slow down once they exited the Columbia River Gorge near the area of the project site, depositing the sand and gravel sized particles observed at the site.

Since the post-glacial flooding, low lying depressions in the vicinity of the site have ponded water and become filled with shallow deposits of silt and organic silt. Some of these deposits have been modified by human activity, including a substantial amount of over excavation and replacement beneath portions of SR 500 west of the project site.

3.2. TECTONIC SETTING AND SEISMICITY

The tectonic structure and stresses in Western Washington are mostly associated with the subduction of the Juan de Fuca Plate under the North American Plate. Under the framework of the subduction zone, the region can be divided into three tectonic provinces: (1) the Juan de Fuca Plate, (2) the continental forearc on the western edge of the North American Plate, and (3) the landward continental volcanic arc. Regional faulting and structural trends are greatly complicated by the glacial and non-glacial soil deposits masking the bedrock.

Within this tectonic environment three potential seismic sources can be identified. Interplate and intraplate seismic activity associated directly with the subduction of the Juan de Fuca under the North American Plate, and seismic activity associated with the volcanic arc and shallow crustal earthquakes.

Interface, or subduction zone, earthquakes take place at the boundary of the Juan de Fuca and the North American Plates. Although a subduction zone earthquake has not been recorded off the coast of Washington or Oregon during historic time, geologic evidence suggest that they may occur. The last great earthquake to occur on the interface zone appears to have occurred around 1700. Studies of recurrence suggest that the average recurrence interval is about 450 years with about 90 percent confidence interval of about 200 years. A magnitude M8 to M9 earthquake is believed possible along subduction zone.

Intraslab earthquakes take place within the subducting Juan de Fuca Plate at depths between 40 to 60 km. These earthquakes occur inland from the interface earthquakes. Intraslab earthquakes have occurred north of the site in the Puget Sound region, with five historical earthquakes having magnitudes greater than 6. The largest earthquakes include the 1949 magnitude 7.1 Olympia earthquake and the 1965 magnitude 6.5 Seattle-Tacoma earthquake. The recurrence interval for intraslab earthquakes is highly uncertain.

The third major type of earthquake is the crustal earthquake, which occurs in the North American Plate, typically at depths between 10 and 20 km. Several earthquakes, between M4.0 and M5+,

have occurred in the Cascade Range over the past 150 years. The maximum expected magnitude for crustal earthquake varies throughout the state and depends on the thickness of the crust, the length and rate at which seismic strain accumulates on faults.

3.3. SEISMIC HAZARDS

3.3.1 Design Earthquake Parameters

The seismic design of the bridges can be accomplished using AASHTO Standard Specifications for Highways and Bridges (1996). The seismic design provisions are based upon a design earthquake having a 10-percent probability of exceedance in a 50-year interval. The project site is located in a seismically active area associated with the interaction of the Juan de Fuca and North American crustal plates and corresponds to an acceleration coefficient of 0.15g based on the seismic acceleration map in the WSDOT Bridge Design Manual. Recent seismological discoveries of additional seismic hazards in Washington State have initiated some changes to WSDOT design for earthquake loads. According to WSDOT policy, all bridges west of the Cascade Range will be designed for a minimum peak ground acceleration coefficient of 0.20g. This acceleration coefficient supersedes the recommended coefficient by the WSDOT Bridge Design Manual and was used in design. The design response spectra presented in AASHTO guide specifications for seismic design of highway bridges are considered appropriate. The effects of site conditions on the bridge response can be approximated by using a site coefficient "S" equal to 1.2 corresponding to a Type II soil profile as presented in AASHTO's Standard Specifications for Highway Bridges.

3.3.2. Liquefaction Potential

Liquefaction of saturated sands occurs when the sands are subject to cyclic loading. The cyclic loading causes the water pressure to increase in the sand reducing the intergranular stresses. As the intergranular stresses are reduced, the shearing resistance of the sand decreases. If pore pressures develop to the point where the effective stresses acting between the grains become zero, the soil will behave like a viscous fluid. Under this condition soil flow is possible. The effect of liquefaction can range from reduced shear strength to viscous fluid behavior.

The liquefaction potential of saturated sands, non plastic silts and gravels is evaluated mainly on soil gradation, relative density, and the depth of the deposit. The potential for liquefaction is highest for loose, fine to medium grained sands and silty sands under saturated conditions. Based on all the available information, it is our opinion that the upper 10 m (30 ft) of the on-site soils at the NE 112th Avenue/NE Gher Road Overcrossing are susceptible to isolated zones of liquefaction. Liquefaction is not anticipated at the E-NS Ramp Over NE Ramp location. The attached P-y curve input parameters have been adjusted to account for soil shear strength reduction as a result of liquefaction. In addition, we anticipate settlement of on-site soils to occur after a seismic event as a result of the liquefaction. The settlement from liquefaction would effect the stability and settlement of shallow foundations and cause downdrag loads on deep foundations such as piles or drilled shafts. The anticipated down drag loads due to liquefaction, on the drilled shaft foundations at the NE 112th Avenue/NE Gher Road Overcrossing bridge, are provided in Table 7 of Section 4.3.2.1.

3.4. SITE SOIL CONDITIONS

The soil deposits encountered in the test borings, have been grouped into soil units for geotechnical distinction. The soil units are grouped primarily on the basis of engineering properties and classification, and in general, reflect depositional environments as well. Subsurface profiles illustrating a summary of the subsurface data and the interpreted conditions are provided for both the E-NS Ramp Over NE Ramp and the NE 112th Avenue/NE Gher Road Overcrossing in Figures 3 and 5. Descriptions of the general project soil units are provided on the figures and are as follows:

3.4.1 E-NS Ramp

Unit 1 is a loose to dense gravel with silt and sand. Cobbles and boulders are present in this unit.

Unit 2 is a medium dense to dense silty sand with gravel.

Unit 3 is a dense to very dense gravel with silt and sand.

Unit 4 is a medium dense silty sand with gravel.

Unit 5 is a very dense silty gravel with sand.

3.4.2 Gher Road Over Crossing Bridge

Unit 1 is a loose to medium dense gravel with silt and sand. Occasional cobbles and boulders and layers of loose non plastic silt may be encountered in the upper 1 to 2 m of the profile.

Unit 2 is a loose to very dense silty sand and sandy silt with occasional layers of low plasticity clay. Portions of this unit with blow counts in excess of 50 blows per 0.3 m may consist of moderately cemented silty sand.

Unit 3 is a medium dense to very dense silty gravel and poorly graded gravel with sand. This unit consisted of occasional cobbles and boulders.

3.5. GROUND WATER

It is expected that ground water elevation fluctuations will occur at the site dependent upon variation in seasonal precipitation and tidal fluctuations.

3.5.1 E-NS Ramp Bridge

Ground water was found at elevation 51.8 m in May 1999 and at 55.8 m in March of 2000 at this bridge location.

3.5.2 Gher Road Over Crossing Bridge

Ground water varied between elevations 48.4 m and 60.7 m during the period of August 1998 and March 1999 at this bridge location.

4. GEOTECHNICAL RECOMMENDATIONS

4.1. EMBANKMENT DESIGN RECOMMENDATIONS

The approach embankments at both bridge locations will require the addition of new fill. Select or Gravel Borrow material with Method C compaction should be used for approach embankments. Select borrow or common borrow with Method B compaction should be used for embankment construction outside of the Bridge Approach Embankments limits.

Select and Common Borrow are more sensitive to moisture than Gravel Borrow and may be difficult to work with during wet seasons.

4.1.1 E-NS Ramp Approach Embankment

The proposed approach embankment heights at Pier 1 and Pier 4 are 6.8 m (22.5 ft) and 10.1 m (33.4 ft) respectively. The proposed side slope at 2H: 1V will be stable under static and seismic conditions. We anticipate approximately 50 mm and 70 mm of settlements at Pier 1 and Pier 4 respectively. We believe that these settlements will occur as the load is applied. Post construction settlement is expected to be negligible.

4.1.2 Gher Road Over Crossing Bridge Approach Embankment

The proposed approach embankment heights at Pier 1 and Pier 4 are 6.3 m (20.8 ft) and 7.3 m (24.1 ft) respectively. The proposed side slope at 3H: 1V will be stable under static and seismic conditions. We anticipate approximately 150 mm of settlement due to embankment loading at both piers. We believe that these settlements will occur as the load is applied. Post construction settlement is expected to be negligible.

4.2. APPROACH SLABS

Considering the fill heights, we recommend using approach slabs at both bridges.

4.3. FOUNDATION DESIGN RECOMMENDATIONS

Soil conditions at both bridge sites are geotechnically viable for either shallow or deep foundations. Liquefaction and constructability concerns exist at the NE 112th Avenue/NE Gher Road Overcrossing site and were considered when choosing foundation types.

4.3.1. E-NS Ramp Bridge Foundation

Based on discussions with WSDOT Bridge and Structures, it is our understanding that spread footings are the preferred foundation type at the E-NS Ramp Over NE Ramp site. Pile foundations were not considered due to the difficult driving conditions. Shaft foundations were eliminated due to cost considerations.

We recommend removing the compressible soils at the locations of piers 3 and 4 to elevations of 58.4 m (193 ft) and 57.0 m (188.3 ft) receptively, and replacing it with gravel borrow with Method C compaction. We expect a medium dense silty sand at the proposed elevations of the

over excavation at Piers 3 and 4. Over excavation details are presented in Figures 6 and 7. We recommend that the shallow footing be founded at or below minimum elevations presented in Table 1 below. We expect that the bearing soils at the proposed foundation elevations at Piers 1 and 2 will be medium dense Gravel with sand and silt. Appendix A provides the bearing capacity graphs for shallow footing at all applicable design limit states.

Pier #	Elevations	
	m	ft
1	BDM*	BDM*
2	61.8	204.1
3	BDM*	BDM*
4	BDM*	BDM*

Table 1 Minimum foundation elevations

* According to Bridge Design Manual minimum embedment requirements

At all piers, we believe that the settlement will occur as the loads are applied. At the service limit state, the differential settlement between the abutment piers on spread footings could be as much as 25 mm (1.0 inch). Post construction settlement is expected to be negligible.

Since the finished grade will be paved or protected stable slope at all pier locations, we recommend that the passive resistance of the front fill be considered for all piers when the stability of the foundation is being evaluated against sliding. The following soil properties should be used to estimate the active and passive pressures of the foundations.

Soil Parameter	Abutment walls & Interior Piers
Unit weight (kN/m3)	19.6
Friction Angle	36
Active Pressure Coefficient	0.26
Passive Pressure Coefficient	3.9
Coefficient of sliding	0.73

Table 2: Soil parameters for lateral earth pressure and resistance

4.3.1.1 Resistance Factors for spread footing design_

The recommended resistance factors for applicable limit states for spread footing design are presented in Table 3 below.

Limit state	Bearing	Sliding resistance	
		Shear	Passive
Strength	0.35	0.8	0.5
Service	1	N/A	N/A
Extreme Event	1	1	1

Table 3: Resistance factors for spread footing design

4.3.1.2 Vertical soil spring constants for spread footing design

We recommend that equivalent spring constants for the spread footing foundation be determined by the method outlined in section 7.2.4 of FHWA Report No. FHWA-IP-87-6 entitled: Seismic Design and Retrofit Manual for Highway Bridges.

Based on the results of our analysis, we have developed a range of shear modulus values for the bearing soil unit under seismic load. The most critical spring constant for the pier support depends on the rigidity of the superstructure. This is determined by the structural engineer. Table 4 presents a range of shear modulus values in the applicable strain range so that you may decide which is more critical, a weak or stiff spring.

Pier #	Dynamic Shear Modulus (MPa)		Possion's ratio
	0.02%	0.20%	
1	88	30	0.3
2	88	30	0.3
3	80	27	0.3
4	80	27	0.3

Table 4: Soil parameters for vertical spring constants

4.3.2 Gher Road Over Crossing Bridge

Based on discussions with WSDOT Bridge and Structures, drilled shafts are the preferred foundation type at the NE 112th Avenue/NE Gher Road Overcrossing site. This option was chosen primarily due to liquefaction concerns associated with the use of spread footings and constructability issues with using driven piles. Two different diameter shafts are recommended for use. A 1.5 m (5 ft) diameter shaft should be used for abutment pier foundations and a 2.43 m (8 ft) diameter shaft should be used for interior pier foundations. Test borings indicate that the soils condition at this bridge location is variable and consists of isolated zones of liquefiable soils. Test borings near the intermediate pier locations did not indicate the presence of a liquefiable soil layer. However, the test borings near the abutment pier locations indicated the presence of liquefiable layers. Due to the presence of a liquefiable and loose soil layers at the abutment pier locations, we recommend that shafts be founded at or below the minimum tip elevations presented in Table 5.

Pier #	Min. Tip elevation (m)
1	51
2	53
3	53
4	50

Table 5 Minimum Tip Elevations

4.3.2.1 Axial Loading

The ultimate compressive shaft capacity at each design limit state is a combination of both skin friction and end bearing which are presented on graphs for each pier in Appendix B. The uplift capacity under strength and extreme event loading should be estimated from the skin friction curve multiplied by the appropriate resistance factor. We do not expect the shafts to carry any uplift loads under the service limit state. The resistance factor values for axial loading at each limit state are presented in Table 6.

Limit State	Skin Friction, Qs	End Bearing, Qb	Uplift, Qup
Strength	0.65	0.5	0.55
Service	1	1	N/A
Extreme Event	1	1	0.75

Table 6 Resistance Factors for axial capacities

We recommend that the approach embankments be built before installing the shafts to eliminate the down drag forces due to settlement of the fill and subsurface. Therefore, we do not anticipate a down drag or skin friction loss under strength or service limit states. Due to the presence of a liquefiable layer at the end pier locations, down drag forces and skin friction losses due to the liquefiable layers should be accounted for when designing this structure for *Extreme Event I* loading conditions. Since the intermediate piers will be outside of the approach fills, we expect that the settlement and downdrag caused by localized liquefaction will be negligible. Table 7 presents the values of skin friction loss and down drag forces for corresponding piers. Table 8 presents the reduction factor for the group effects on the axial capacities of shafts at all applicable limit states.

Pier #	Due to Liquefaction	
	Down Drag (MN)	Skin Friction loss (MN)
1	5.5	5.5
2	-	-
3	-	-
4	4.0	5.0

Table 7 Down Drag and Skin Friction Loss Values

Center-Center Spacing	Reduction Factor
3b	0.67
8b	1

Table 8 Group reduction factors for axial loading

Due to a presence of potential caving at varying depths at each pier location, we recommend using temporary casing for the full depth of shaft installation. Shafts that are specified with temporary casing must have the casing removed or pulled out prior to initial setup of the concrete in order to obtain the capacity shown in the charts. If the casing has to be left permanently for

other reasons, please contact the Geotechnical Branch to revise the capacity charts for drilled shafts.

4.3.2.2 Lateral Loading

For shaft design under lateral load, we recommend using P-y iterative methods. P-y curve input parameters for computer programs LPILE or COM624 are included in Appendix C. We recommend using the reduced soil strength parameters to account for the group effects as described in the Bridge Design Manual, section 9.9.7.F. The following group reduction factors presented in Table 9 should be used.

C-C. Spacing	Efficiency Red. factor for multiple row groups or single row groups loaded transverse to the bridge	Efficiency Red. factor for single row groups for loading longitudinal to the bridge
2b	0.40	0.60
3b	0.50	0.80
4b	0.65	0.90
5b	0.80	1.00
6b	0.90	1.00
8b	1.00	1.00

Table 9 Group reduction factors for lateral loading

5. CONSTRUCTION CONSIDERATIONS

5.1 E-NS RAMP BRIDGE

Shoring or temporary slopes will be necessary during the construction of all spread footings. Sheet pile shoring systems may not be feasible due to the presence of cobbles and boulders.

We expect to find medium dense to dense silty sand at the recommended elevation of the over excavation. The water table elevation changes with seasonal variation. The maximum elevation of the water table during the test boring drilling indicates that dewatering may not be necessary during over excavation. However, dewatering may be necessary if the construction is done in wet seasons.

5.2 GHER ROAD OVER CROSSING BRIDGE

Temporary casing will be required for shaft construction. Due to the presence of cobbles and boulders and cemented soils, casing installation will be difficult. The relative density of the soil changes with depth at all pier locations and may influence the drilling process and casing installation. This report should be provided to the contractors for their information.

All shaft construction should be expected to be constructed by wet methods. The positive head requirement above the bottom of the casing for drilling slurries should be strictly enforced.

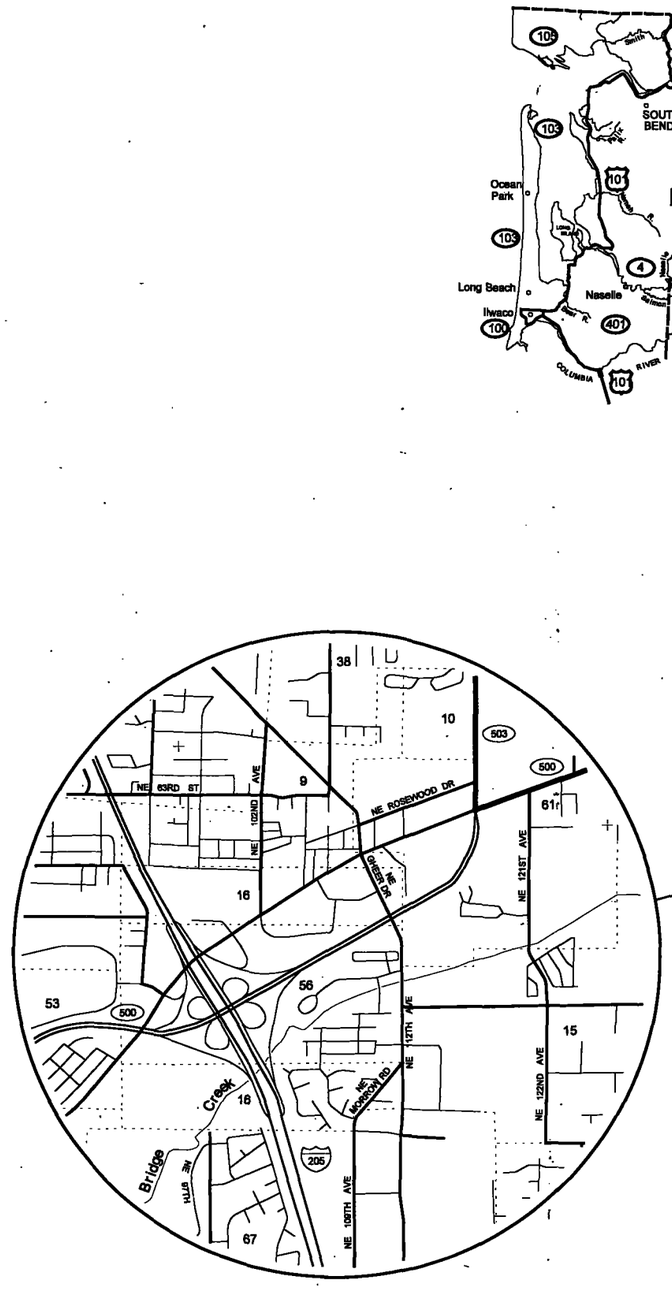
Nondestructive testing of the shafts using Cross Sonic Logging (CSL) should be performed to full depth on every shaft. Installation of the CSL hardware (logging tubes) should occur during shaft construction. After shaft construction and acceptable cure time, CSL testing of each shaft should be performed in a timely matter and the results interpreted by a geotechnical engineer from the WSDOT Geotechnical Branch. Detection of significant structural flaws within the shaft could result in the need for shaft repair, replacement or the addition of more shafts at the foundation contractor's expense.

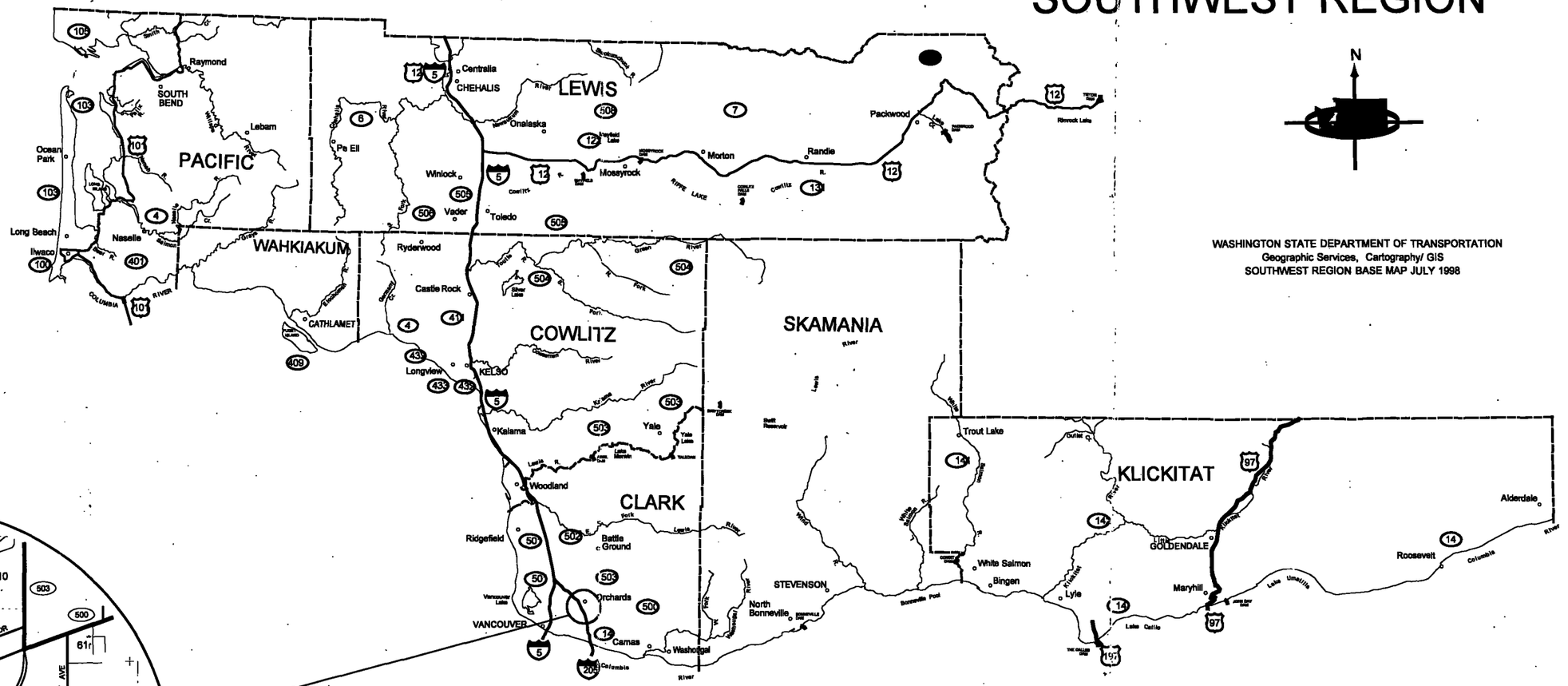
6. CLOSURE

The analyses, conclusions and recommendations presented in this report were prepared in accordance with generally accepted professional engineering principles and practice in this area at the time this report was prepared. These analyses, conclusions and recommendations are based upon the site conditions as they existed during our site exploration, and further assume that the exploratory borings are representative of the site conditions along the bridge alignment. If during construction, subsurface conditions differ from those described in this report and presented in the boring logs, we should be advised so that we can re-evaluate our recommendations.

If you have any questions or require additional information, please feel free to call M. Bahiradhan at (360) 709-5459 or Bryan Dias at (360) 709-5458.

WSDOT
SOUTHWEST REGION





WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
Geographic Services, Cartography/ GIS
SOUTHWEST REGION BASE MAP JULY 1998

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112th / GHER ROAD INTERCHANGE

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 4/2000
SCALE N.T.S. VERT. HORIZ.
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FIGURE 1: GENERAL SITE VICINITY

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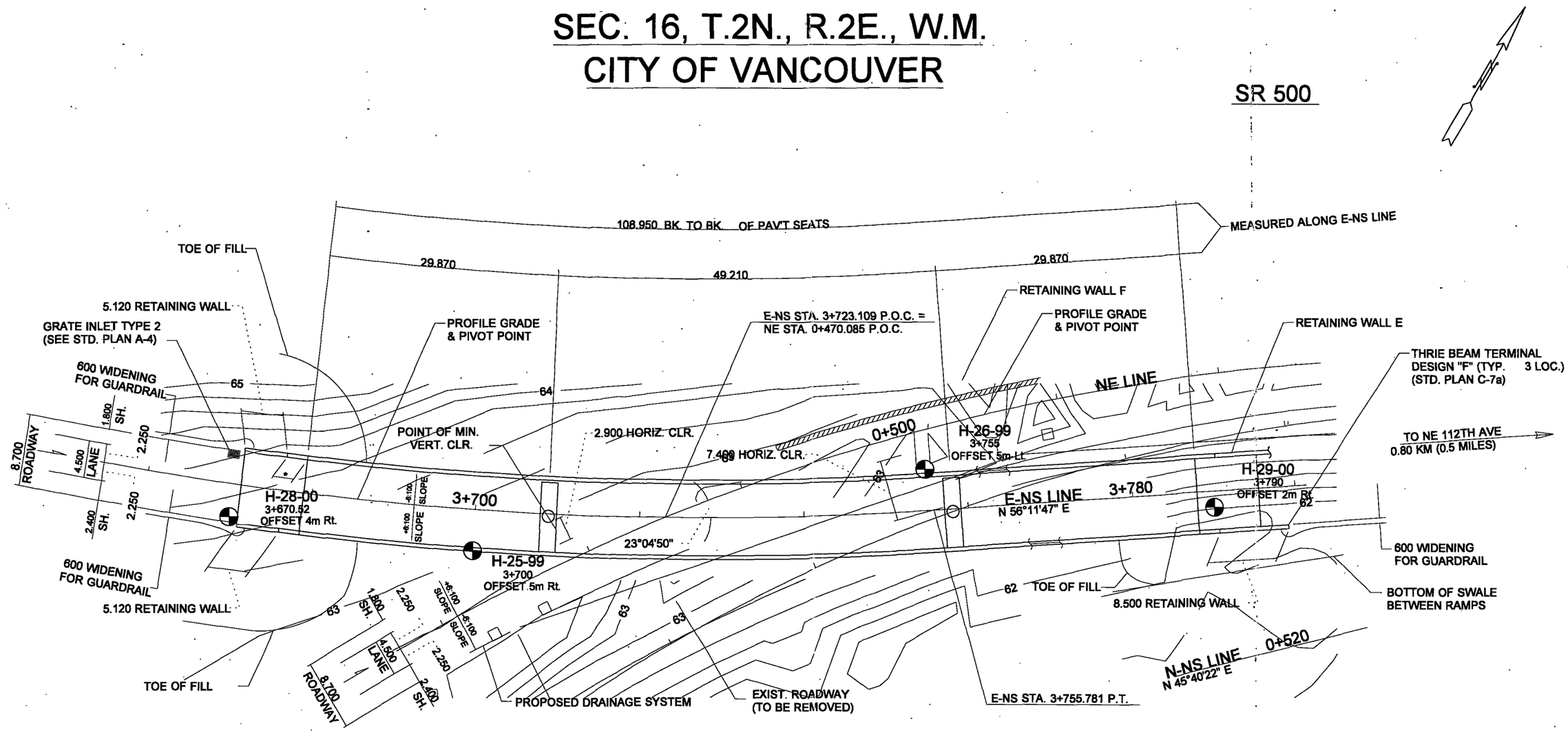

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112th / GHER ROAD INTERCHANGE

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T. E. BAKER MATERIALS ENGINEER

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FIGURE 2: E-NS RAMP OVER NE RAMP PLAN

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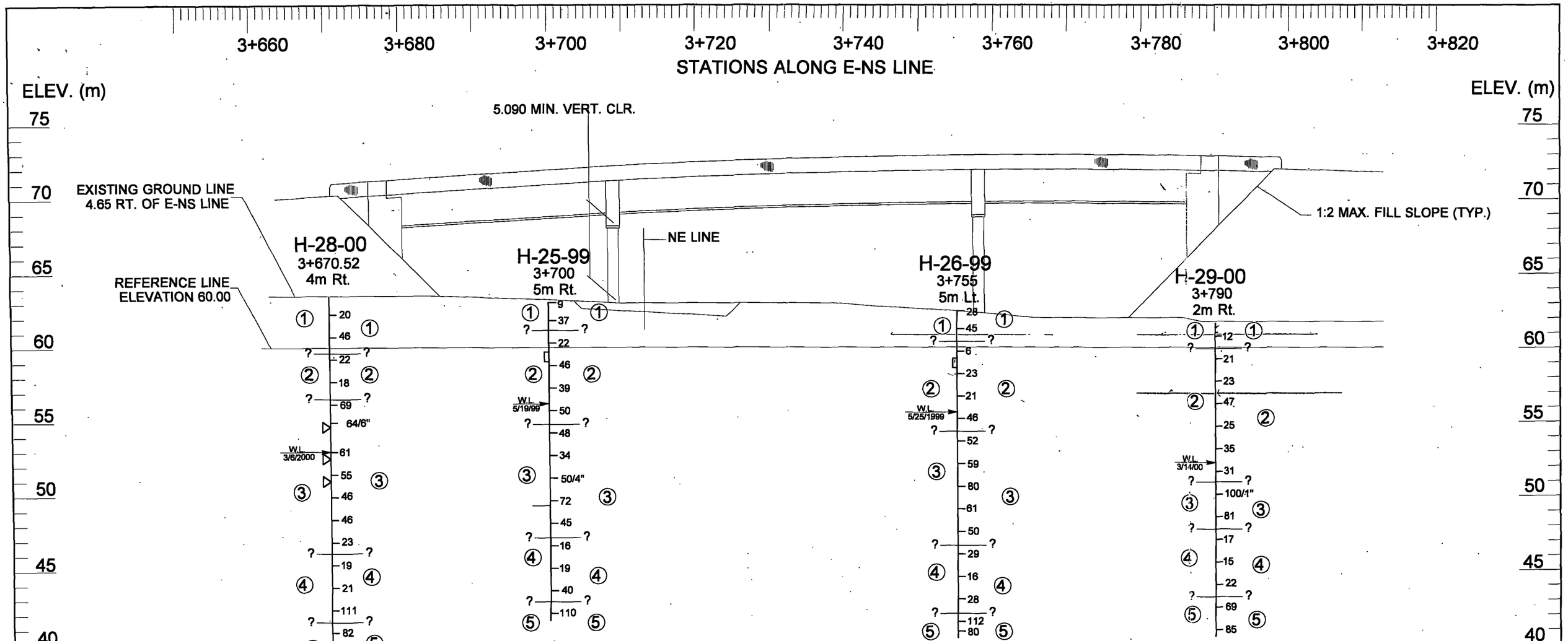

TEST HOLE LEGEND

H-1-98	TEST HOLE NUMBER
0+265	TEST HOLE STATION
3.5 m Rt.	TEST HOLE OFFSET FROM E-NS LINE C L
23	STANDARD PENETROMETER TEST (BLOWS PER FOOT)
	UNDISTURBED SAMPLE
W.L. 8-6-86	WATER LEVEL & DATE
?	INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
	INDICATES INTACT ROCK
86%	INDICATES CORE SAMPLE TAKEN
	ROCK QUALITY DESIGNATION

DATUM
NAVD 1988

GENERAL PROJECT SOIL DESCRIPTIONS

UNIT 1: Loose to dense gravel with silt and sand.
UNIT 2: Medium dense to dense silty sand with gravel.
UNIT 3: Dense to very dense gravel with silt and sand.
UNIT 4: Medium dense silty sand with gravel.
UNIT 5: Very dense silty gravel with sand.

FIGURE 3: E-NS RAMP OVER NE RAMP PROFILE

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112th / GHER ROAD INTERCHANGE

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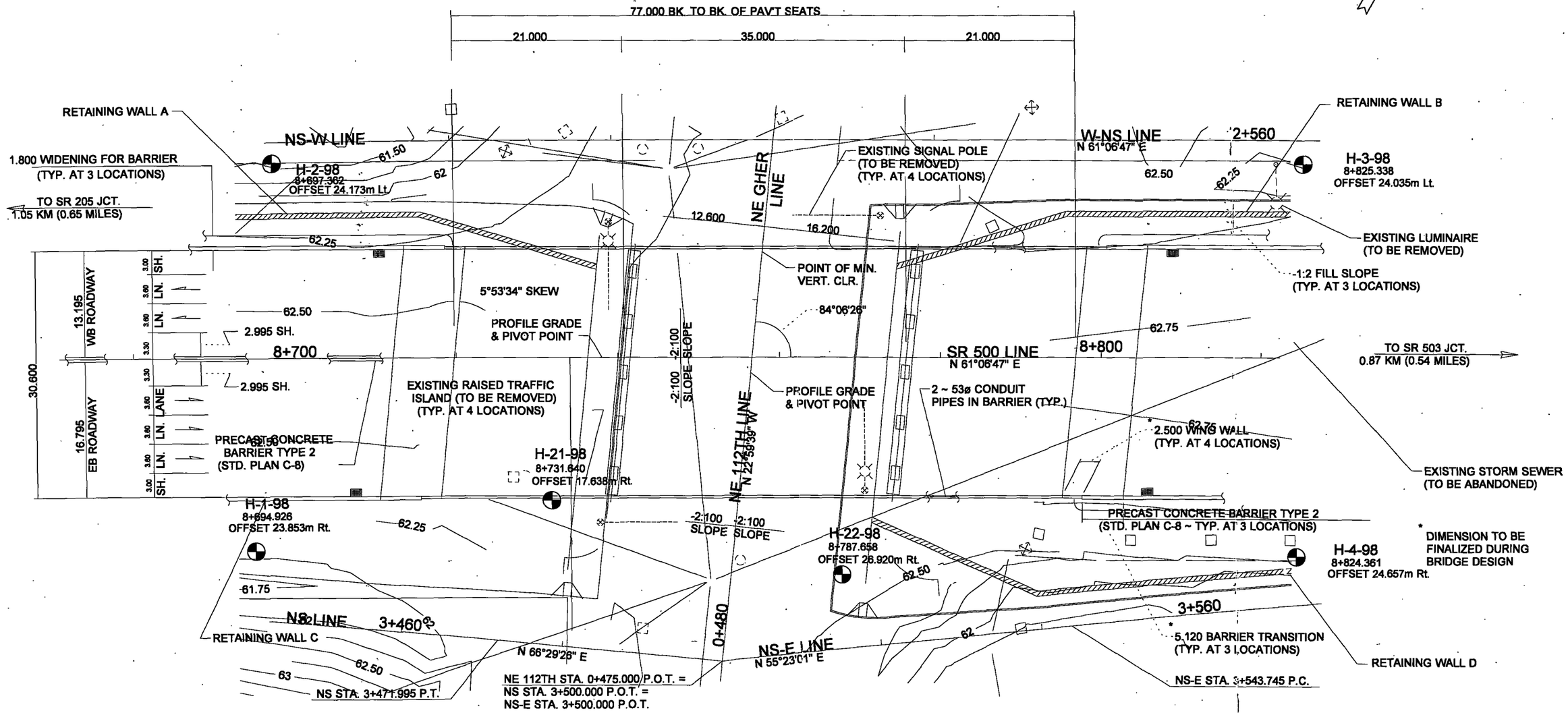
CITY OF VANCOUVER



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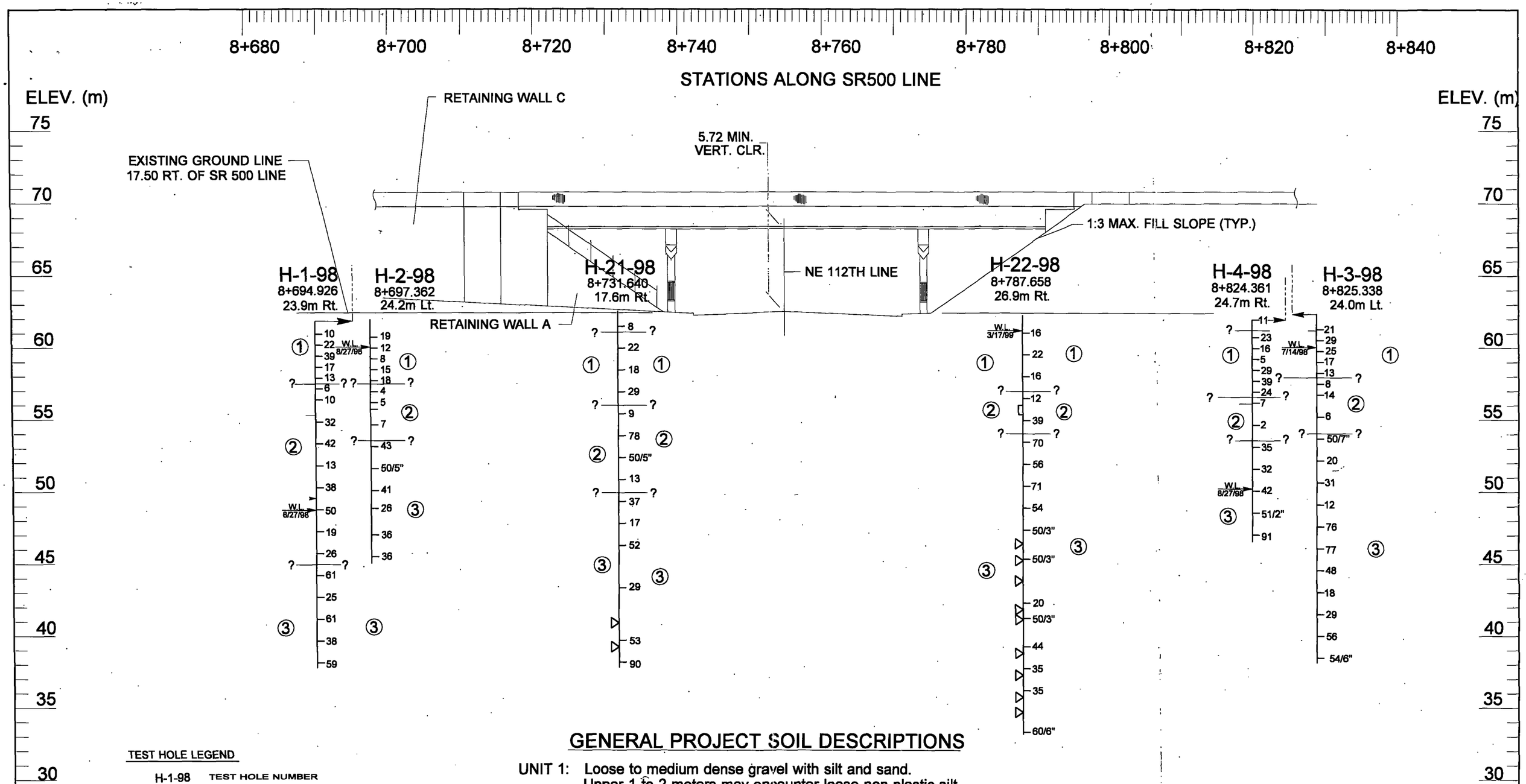
DATE 4/2000
SCALE 1:500 VERT.
1:500 HORIZ.
SHEET 1 OF 1
DRAWN BY W.M.

FIGURE 4: NE 112th AVE/NE GHER ROAD OXING PLAN

C:\DGN\SR500 ALT\500alt.dgn 10/23/2000 02:01:57 PM



TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET FROM SR500 C L

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)

UNDISTURBED SAMPLE

W.L. 8-6-86 WATER LEVEL & DATE

? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS

INDICATES INTACT ROCK

86% INDICATES CORE SAMPLE TAKEN

ROCK QUALITY DESIGNATION

DATUM
NAVD 1988

GENERAL PROJECT SOIL DESCRIPTIONS

UNIT 1: Loose to medium dense gravel with silt and sand. Upper 1 to 2 meters may encounter loose non plastic silt.

UNIT 2: Loose to very dense silty sand and sandy silt with occasional layers of low plasticity clay. Portion of unit with blow counts in excess of 50 per 0.3m may consist of moderate sand cementation.

UNIT 3: Medium dense to very dense silty gravel and poorly graded gravel with sand.

FIGURE 5: NE 112 AVE/NE GHER ROAD OXING PROFILE

JOB OL-2529 S.R. 500 C.S. 0640

112th / GHER ROAD INTERCHANGE

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 4/2000
SCALE 1:250 VERT.
1:500 HORIZ.
SHEET 1 OF 1
DRAWN BY W.M.

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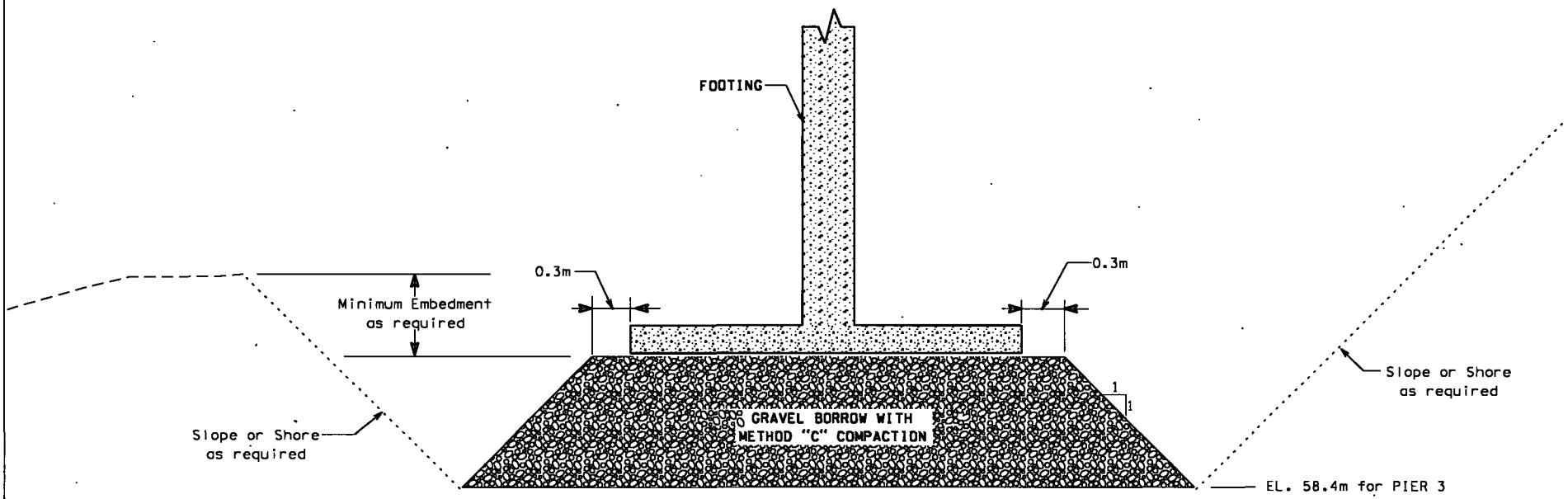


NOTE: Foundation Material Class A or B shall be placed below water table, if water table is present.

FIGURE 6: OVER EXCAVATION DETAIL - PIER 3

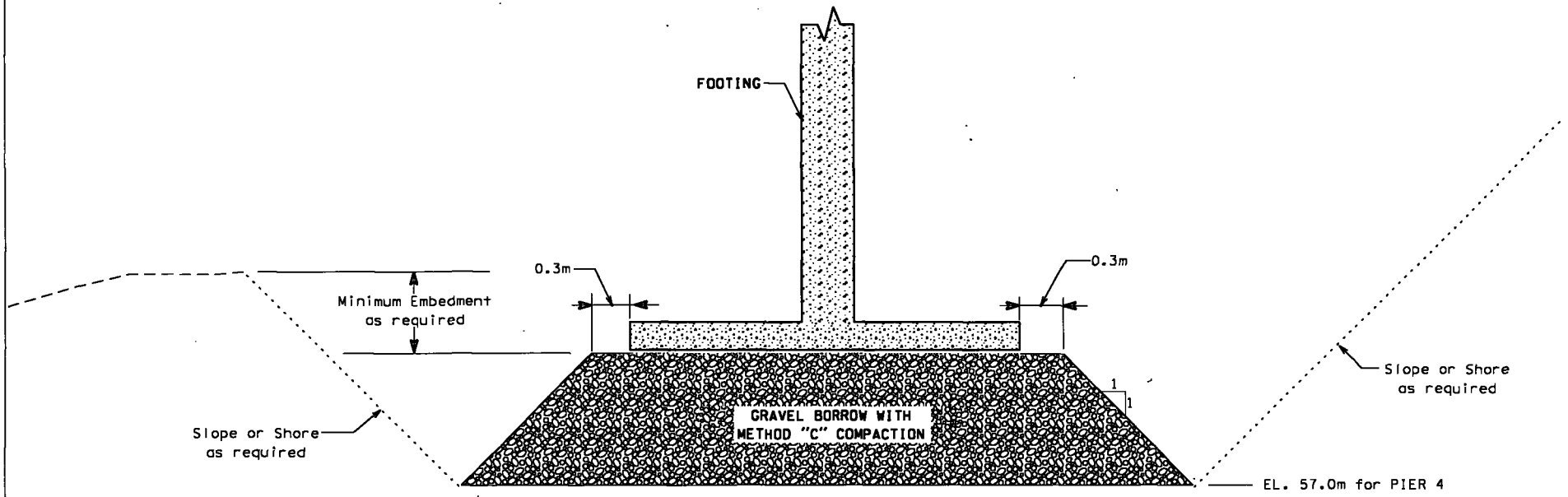
JOB DL-2529 S.R. 500 C.S. 0640 LAYOUT

112th/GHER ROAD INTERCHANGE

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T.E. BAKER MATERIALS ENGINEER

DATE 10/2000
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\Genernic drawings\overex.dgn 10/31/2000 09:35:22 AM



NOTE: Foundation Material Class A or B shall be placed below water table, if water table is present.

FIGURE 7: OVER EXCAVATION DETAIL - PIER 4

JOB 0L-2529 S.R. 500 C.S. 0640 LAYOUT

112th/GHER ROAD INTERCHANGE

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 10/2000
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

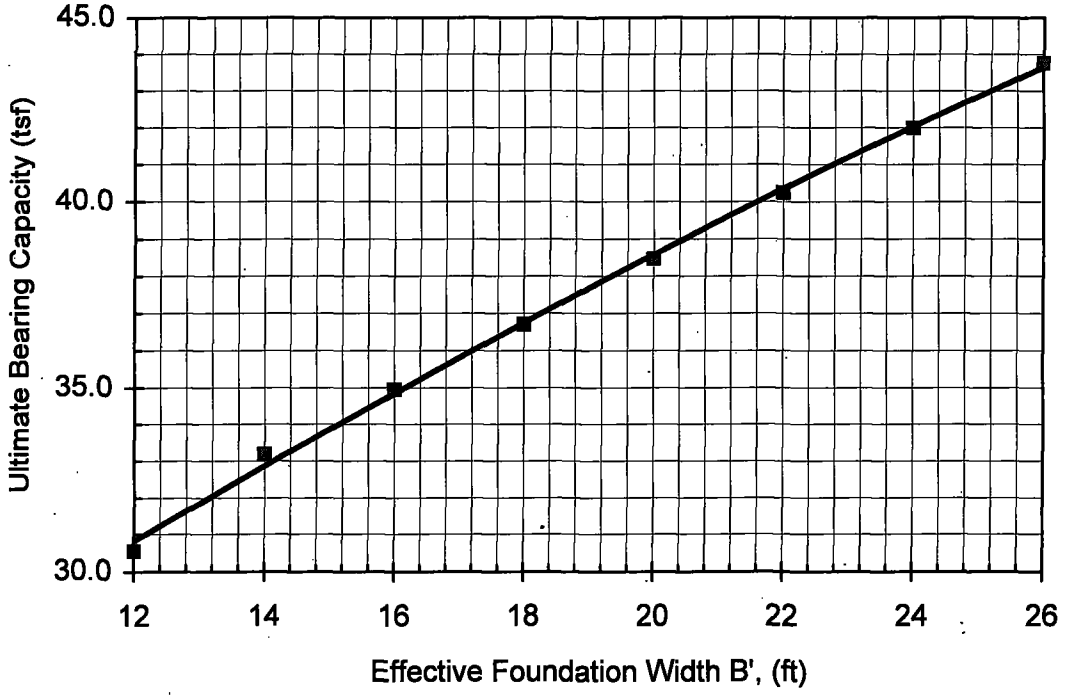
...\Genernic drawings\overex.dgn 10/31/2000 09:35:32 AM

APPENDIX-A

SPREAD FOOTING CAPACITY GRAPHS

Ultimate Bearing Capacity -vs- EffectiveFoundation Width For Strength Design

Pier(s): 112th/Gher Road I/C
Abutments & Interior Piers, E-NS Ramp



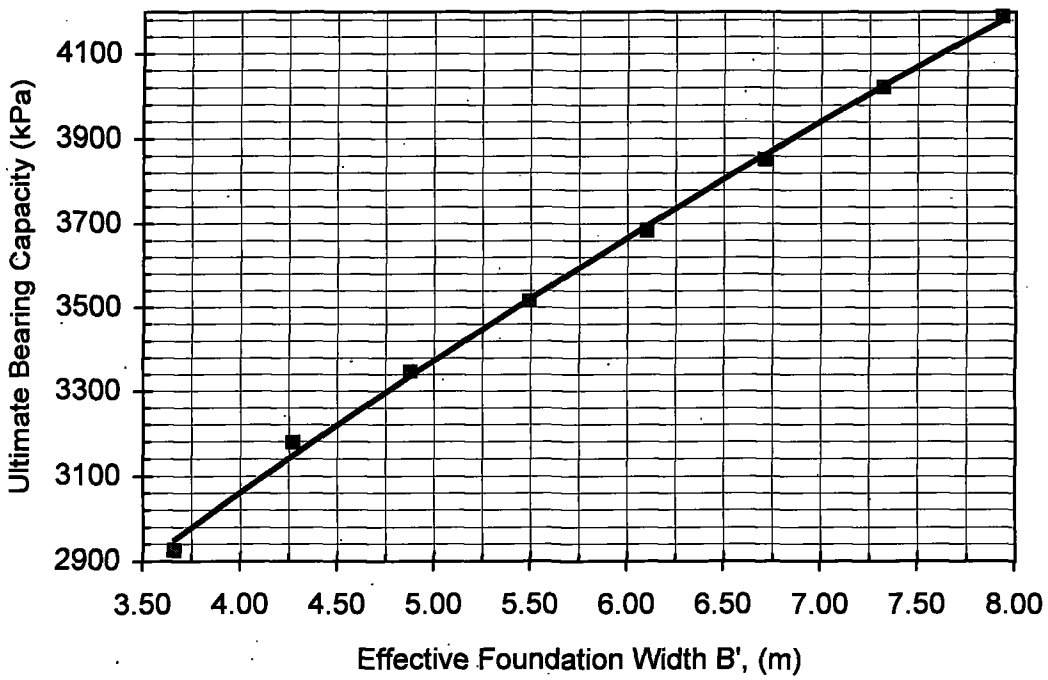
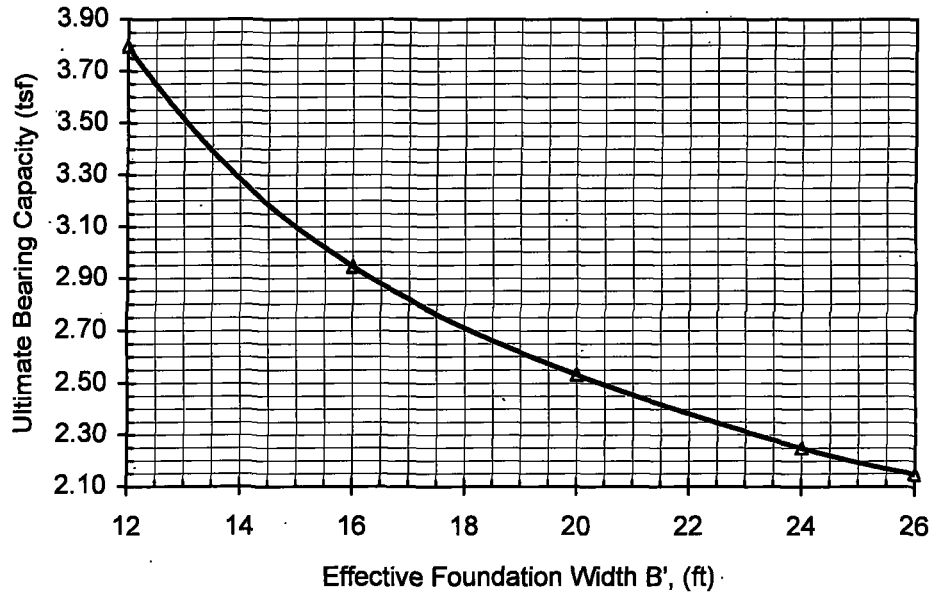


Figure A-1: Bearing Capacity for strength and Extreme Limit States-Abutments Interior Piers

Ultimate Bearing Capacity -vs- EffectiveFoundation Width
For Service Design
Ultimate Capacity for 25 mm (1 in) of Settlement

Pier(s): Pier 1 - 112th/Gher rd E-NS ramp



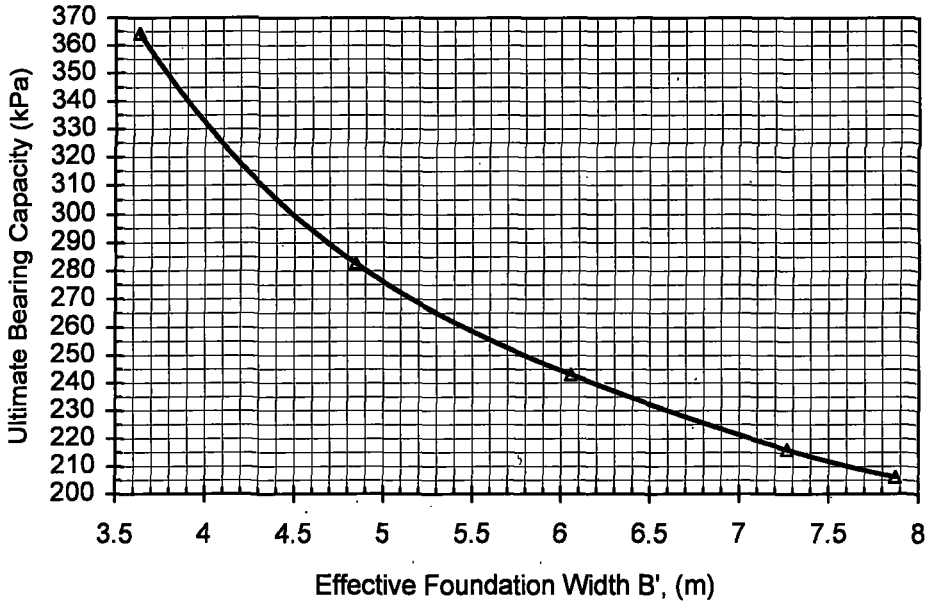
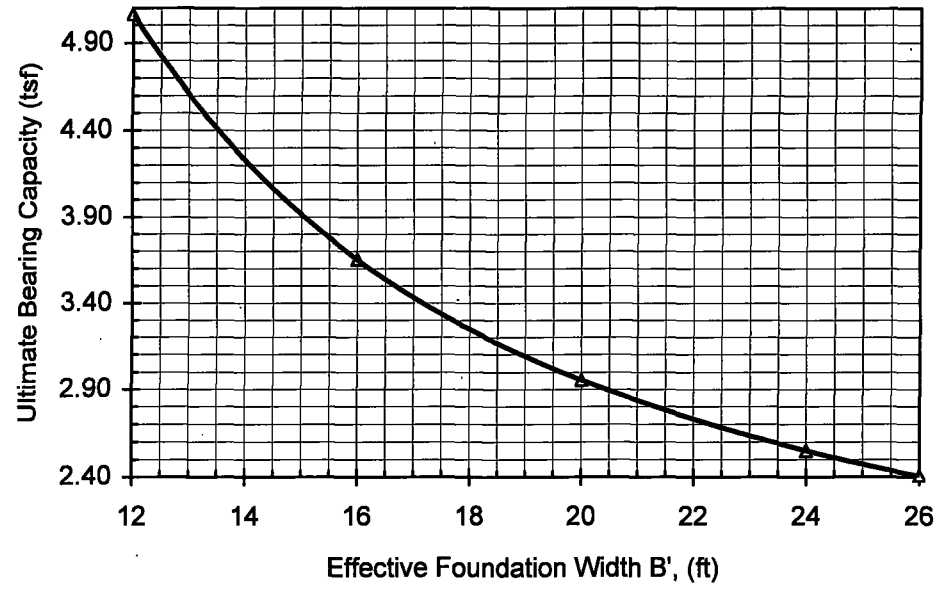


Figure A-2: Bearing Capacity for Service Limit State- Pier 1

Ultimate Bearing Capacity -vs- Effective Foundation Width
For Service Design
Ultimate Capacity for 25 mm (1 in) of Settlement

Pier(s): Pier 2 - 112th ST/Gher Road E-NS Ramp



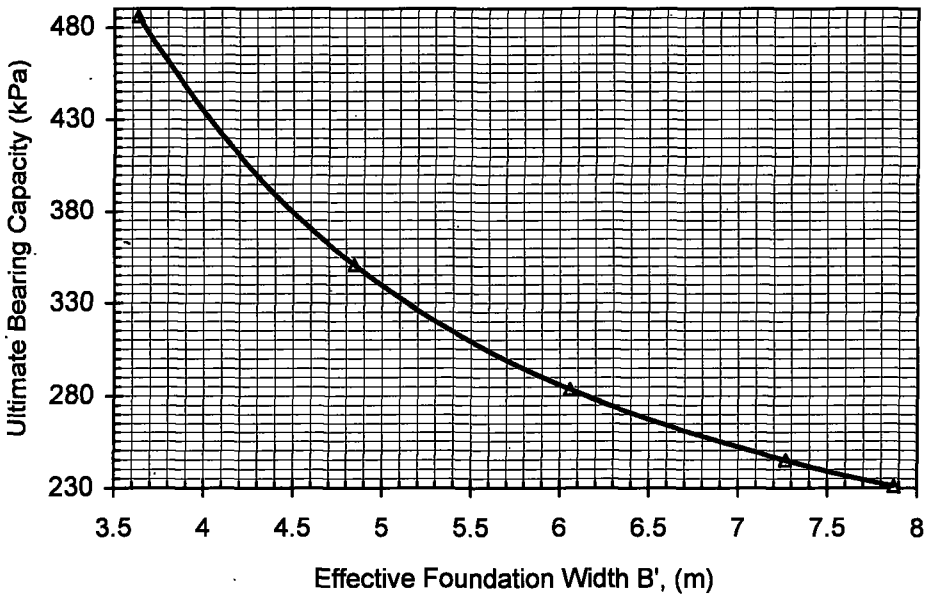
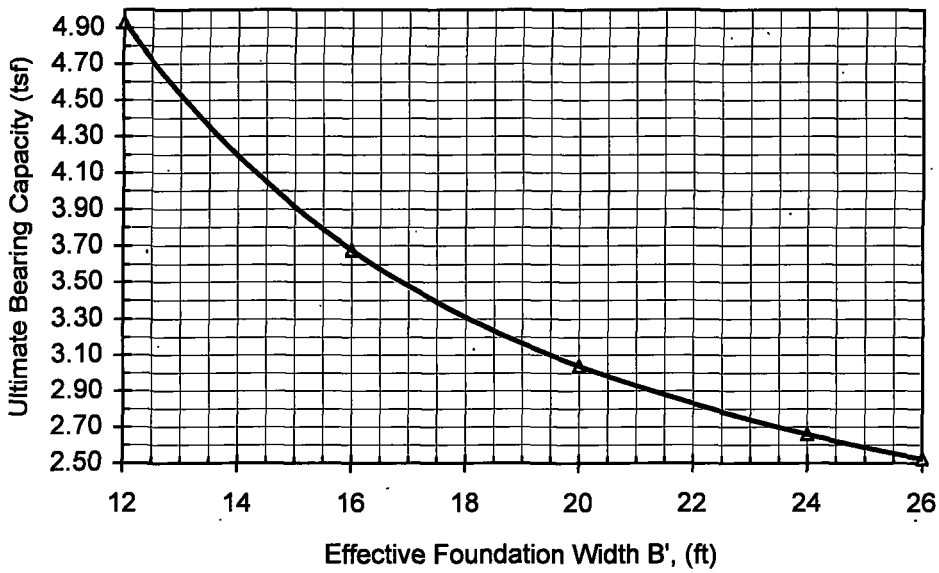


Figure A-3: Bearing Capacity for Service Limit State- Pier 2

Ultimate Bearing Capacity -vs- Effective Foundation Width
For Service Design
Ultimate Capacity for 25 mm (1 in) of Settlement

Pier(s): Pier 3 - 112th ST/Gher Road E-NS Ramp



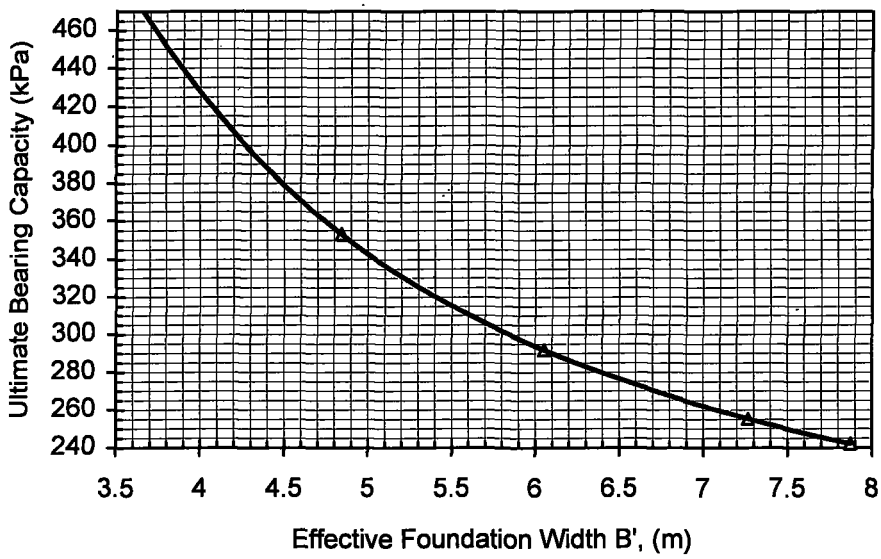
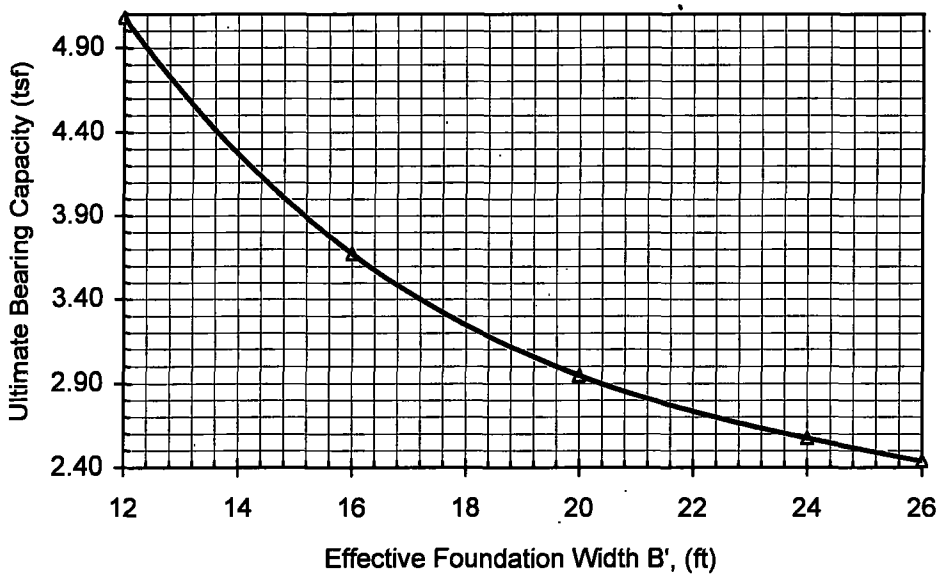


Figure A-4: Bearing Capacity for Service Limit State- Pier 3

Ultimate Bearing Capacity -vs- Effective Foundation Width
For Service Design
Ultimate Capacity for 25 mm (1 in) of Settlement

Pier(s): Pier 4 - 112th ST/Gher Road E-NS Ramp



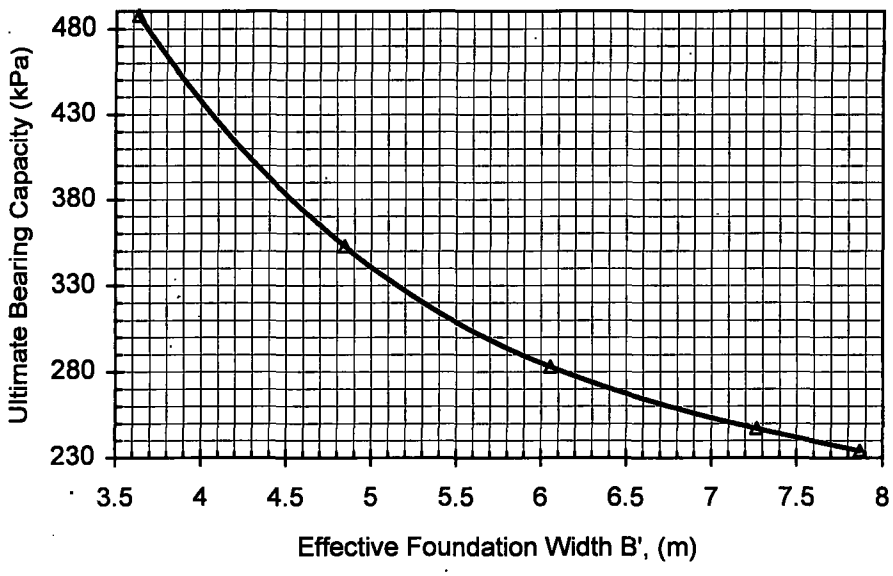


Figure A-5: Bearing Capacity for Service Limit State- Pier 4

APPENDIX-B

AXIAL CAPACITY CHARTS FOR DRILLED SHAFTS

112th ST/ Gher rd O-Xing

Pier(s) 1
Diameter 1.525 m (5 ft)
Casing None

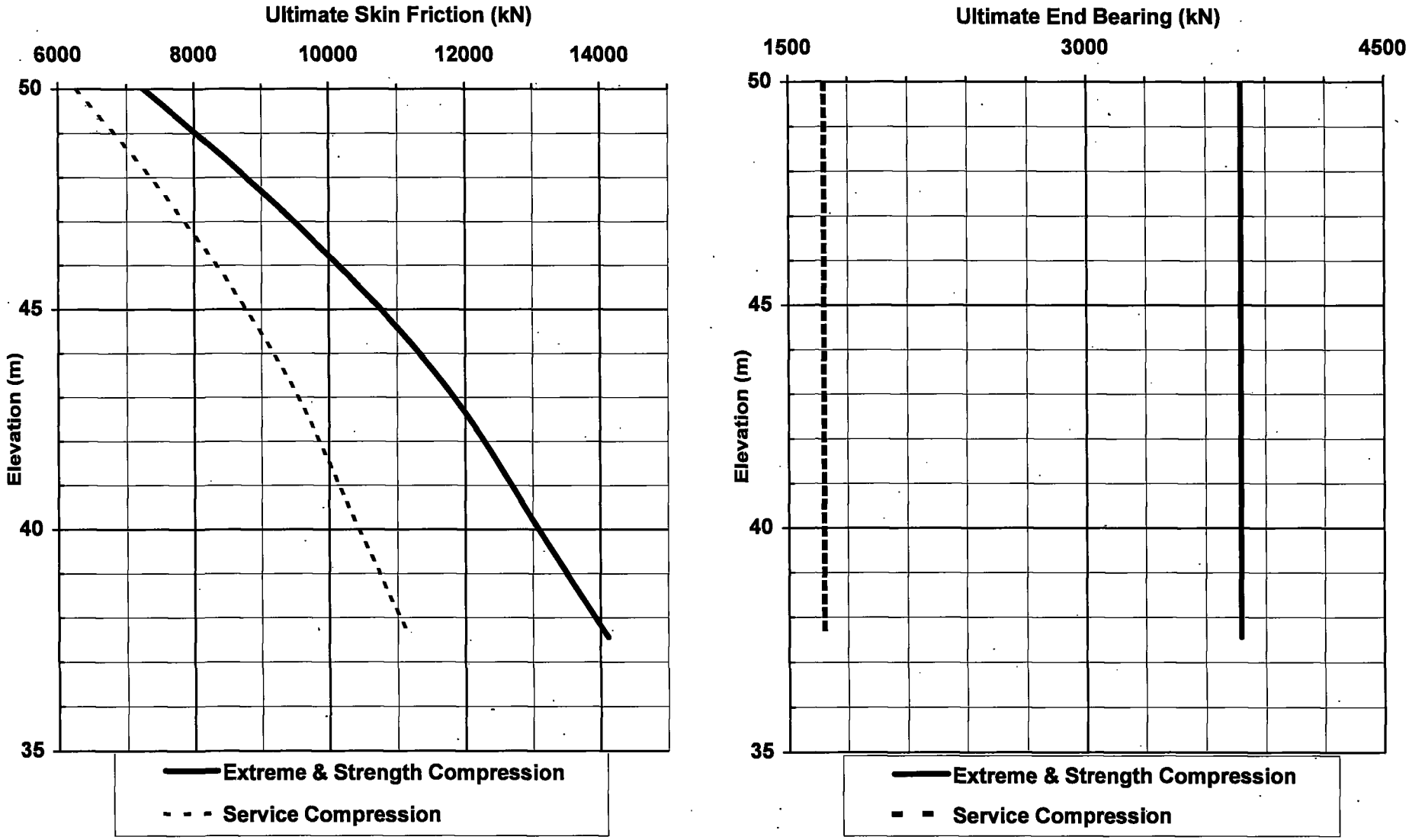
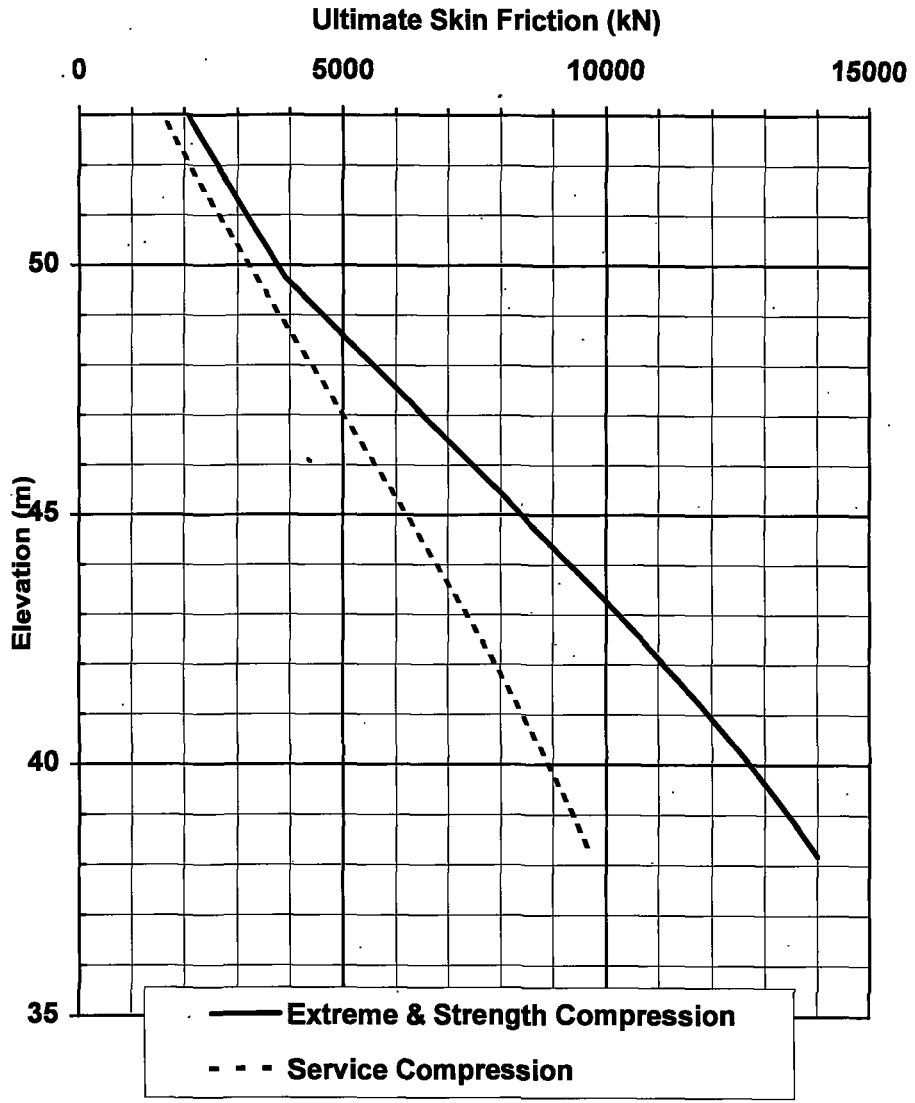


Figure B-1: Unfactored Strength, Service, and Extreme Limit State Capacity for 1.5 m Drilled Shafts (Metric Units)

112th ST/ Gher rd O-Xing

Pier(s) 2
Diameter 2.44 m (8 ft)
Casing None



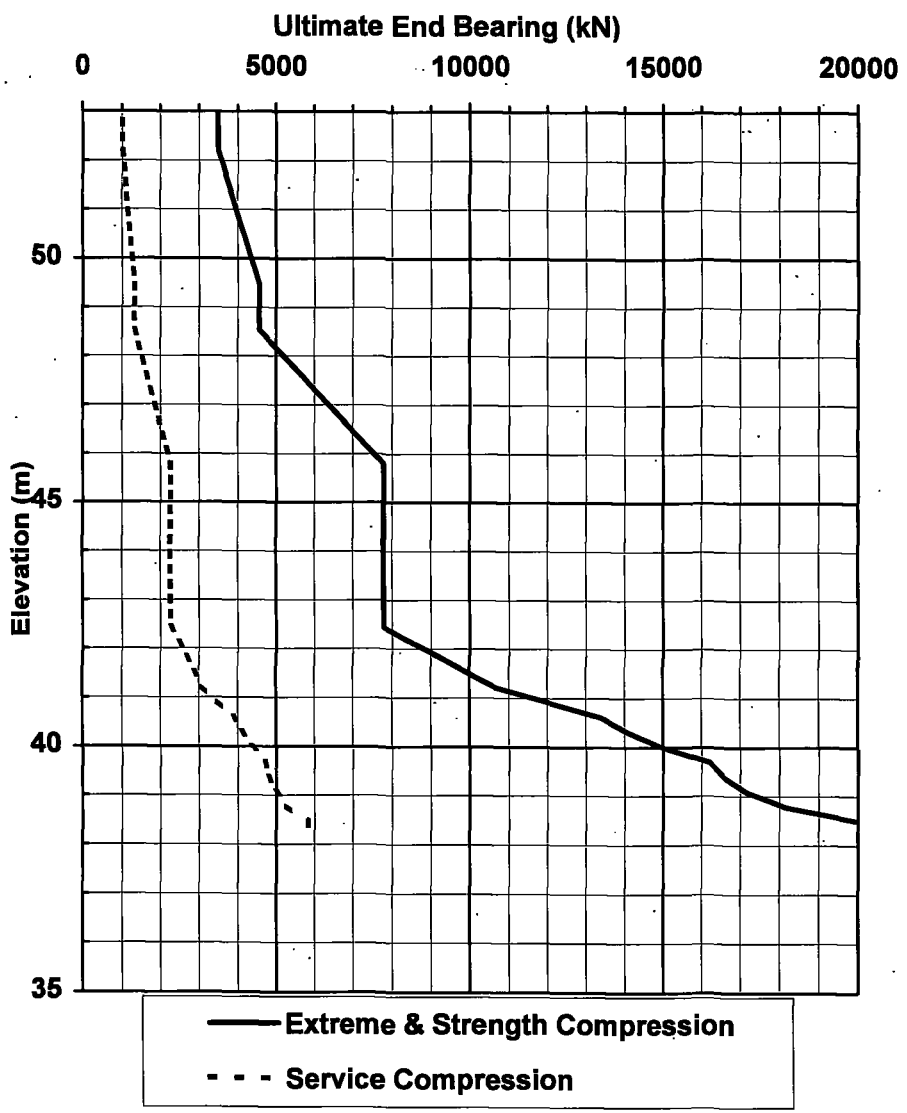
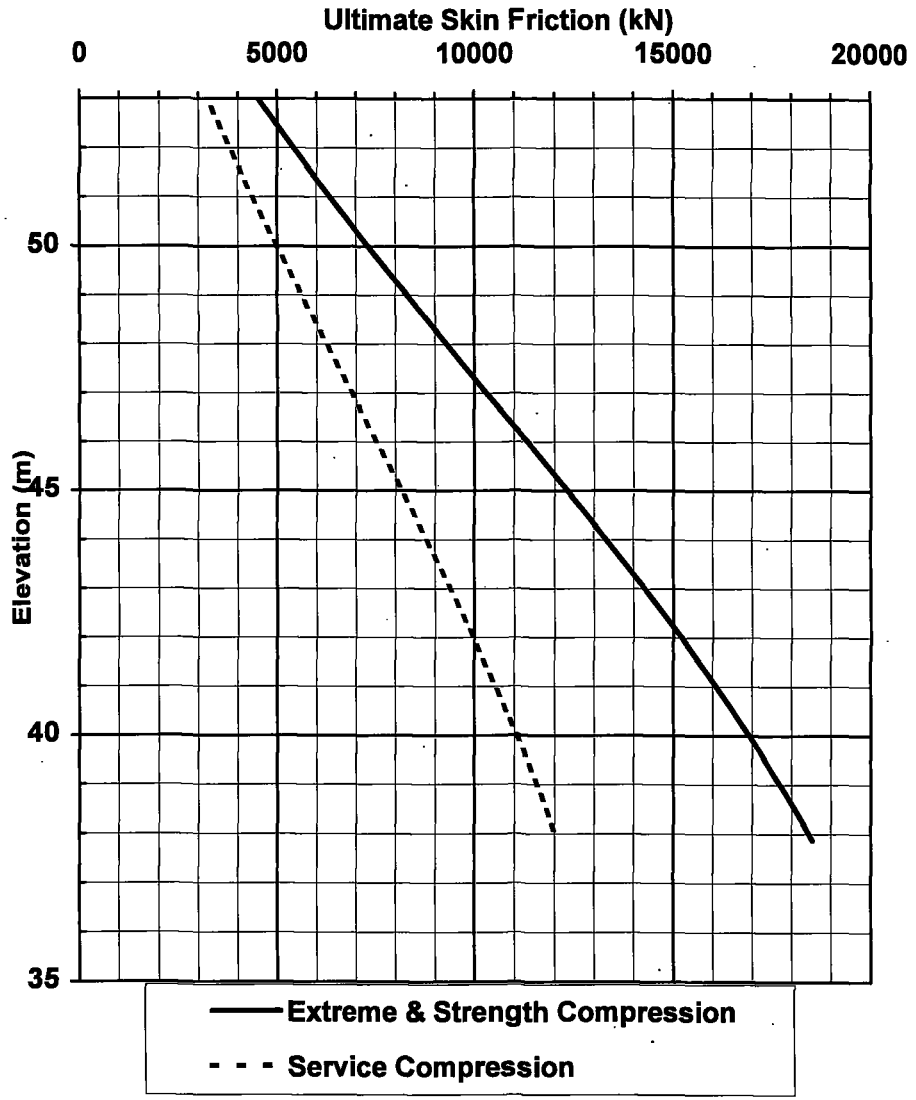


Figure B-2: Unfactored Strength, Service, and Extreme Limit State Capacity for 2.4 m Drilled Shafts (Metric Units)

112th ST/ Gher rd O-Xing

Pier(s) 3
Diameter 2.44 m (8 ft)
Casing None



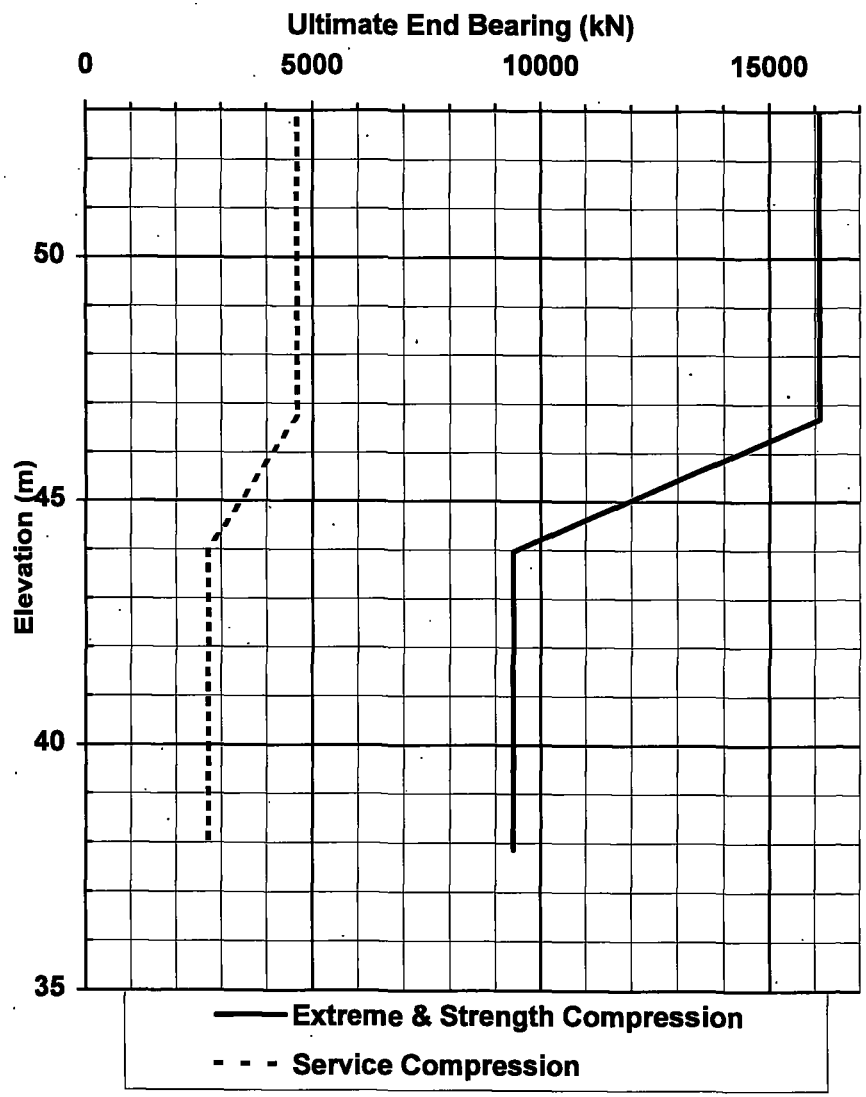
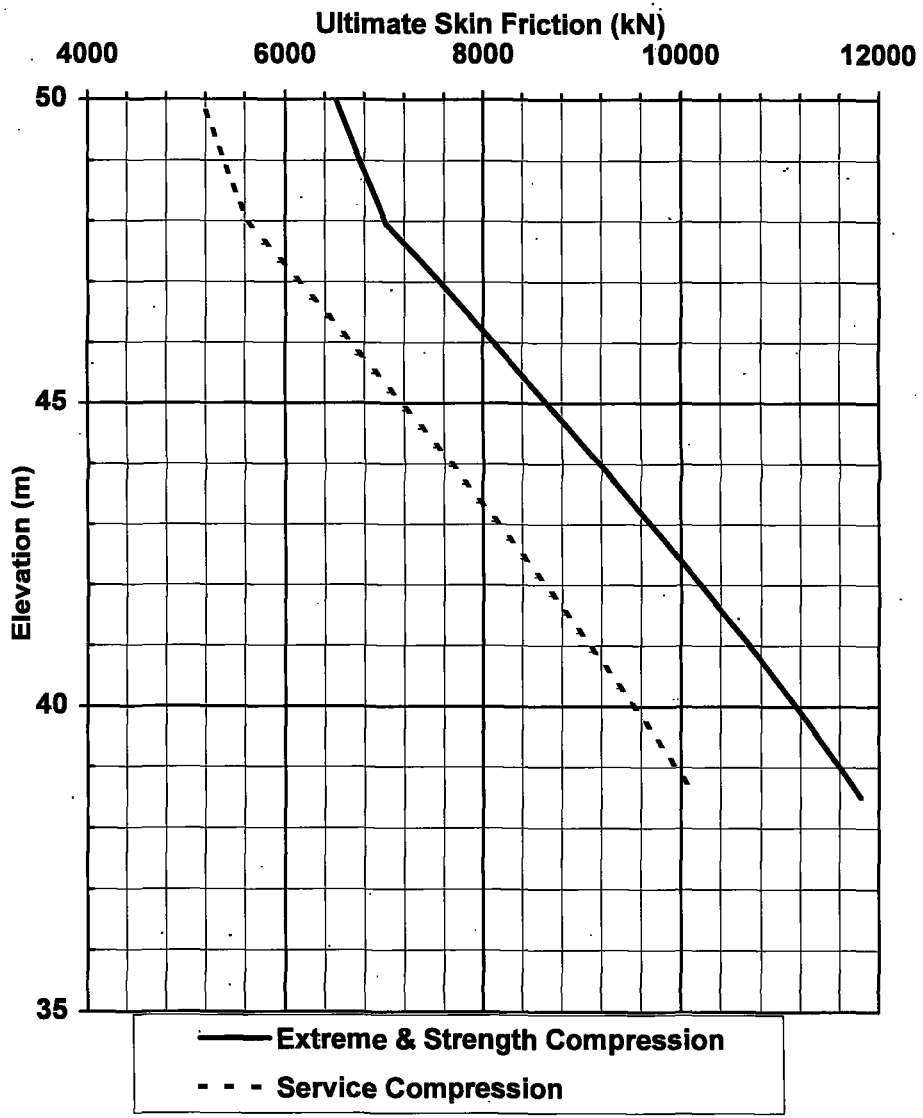


Figure B-3: Unfactored Strength, Service, and Extreme Limit State Capacity for 2.4 m Drilled Shafts (Metric Units)

112th ST/ Gher rd O-Xing

Pier(s) 4
Diameter 1.525 m (5 ft)
Casing None



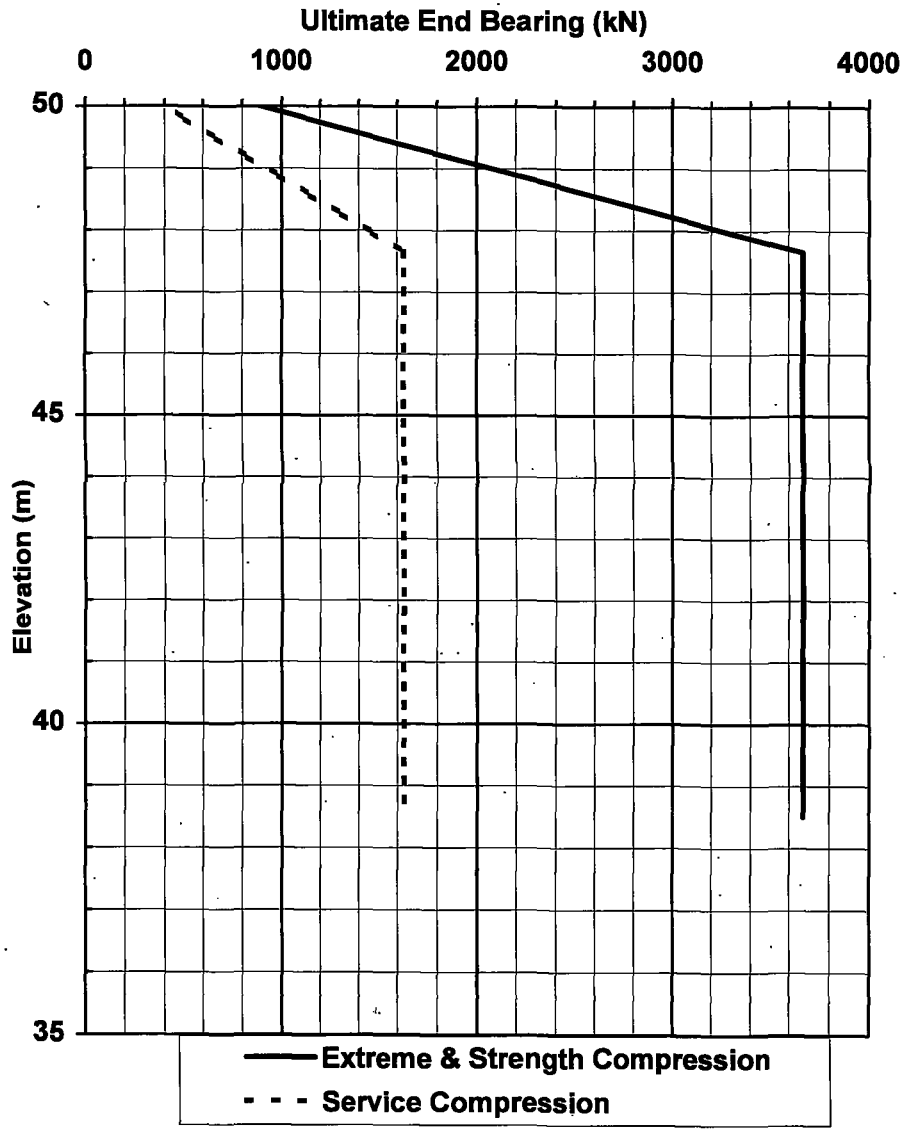


Figure B-4: Unfactored Strength, Service, and Extreme Limit State Capacity for 1.5 m Drilled Shafts (Metric Units)

APPENDIX-C

P-y CURVE SOIL PARAMETERS FOR DRILLED SHAFTS

P-y CURVE SOIL DATA
SR-500, 112th Street/Gher Road Interchange
Pier 1

Ground Surface Elevation (ft): 203 ft

Boring: H-2-98

STATIC ANALYSIS

Soil Layer	Bottom of Layer Eleavtion		Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	59.9	198	SAND	4	18.1	0.07	115	-	-	-	-	34	29.8	110
2	56.6	187	SAND	4	9.1	0.03	58	-	-	-	-	35	21.7	80
3	55.7	184	SAND	4	7.5	0.03	48	-	-	-	-	33	16.3	60
4	52.1	172	CLAY	1	8.3	0.03	53	25.0	3.5	500	0.010	-	-	-
5	43.9	145	SAND	4	10.7	0.04	68	-	-	-	-	40	37.9	140

DYNAMIC ANALYSIS

Soil Layer	Bottom of Layer Eleavtion		Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	kN/m3	pci
1	59.9	198	SAND	4	18.8	0.07	120	-	-	-	-	34	29.8	110
2	56.6	187	SAND	4	9.1	0.03	58	-	-	-	-	35	21.7	80
3	55.7	184	CLAY	1	7.5	0.03	48	15.0	2.1	300	0.020	-	-	-
4	52.1	172	CLAY	1	8.3	0.03	53	25.0	3.5	500	0.010	-	-	-
5	43.9	145	SAND	4	10.7	0.04	68	-	-	-	-	40	37.9	140

Figure C-1: P-y Parameters for Pier 1

P-y CURVE SOIL DATA
SR-500, 112th Street/Gher Road Interchange
Pier 2

Ground Surface Elevation (ft): 205 ft

Boring: H-21-98

					STATIC & DYNAMIC ANALYSIS									
Soil Layer	**Bottom of Layer Eleavtion**		**Soil Type**	**Soil Profile Type (KSOIL)**	**Effective Unit Weight of Soil**			**Saturated Undrained Strength, Su**			**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	59.9	198	SAND	4	18.1	0.07	115	-	-	-	-	34	29.8	110
2	55.1	182	SAND	4	9.1	0.03	58	-	-	-	-	35	21.7	80
3	53.3	176	STIFF CLAY	2	7.5	0.03	48	50.0	6.9	1000	0.005	-	-	-
4	51.5	170	SAND	4	10.7	0.04	68	-	-	-	-	42	43.4	160
5	49.0	162	SAND	4	8.3	0.03	53	-	-	-	-	33	16.3	60
6	37.5	124	SAND	4	10.7	0.04	68	-	-	-	-	38	29.8	110

Figure C-2: P-y curve Parameters for Pier 2

P-y CURVE SOIL DATA
SR-500, 112th Street/Gher Road Interchange
Pier 3

Ground Surface Elevation (ft): 204 ft

Boring: H-22-98

					STATIC & DYNAMIC ANALYSIS									
Soil Layer	**Bottom of Layer Eleavtion**		**Soil Type**	**Soil Profile Type (KSOIL)**	**Effective Unit Weight of Soil**			**Saturated Undrained Strength, Su**			**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	59.9	198	SAND	4	18.1	0.07	115	-	-	-	-	34	29.8	110
2	56.0	185	SAND	4	9.1	0.03	58	-	-	-	-	35	21.7	80
3	54.5	180	STIFF CLAY	2	7.5	0.03	48	50.0	6.9	1000	0.007	-	-	-
4	53.6	177	STIFF CLAY	2	8.3	0.03	53	150.0	20.8	3000	0.005	-	-	-
6	37.2	123	SAND	4	10.7	0.04	68	-	-	-	-	40	37.9	140

Figure C-3: P-y Curve Parameters for Pier 3

P-y CURVE SOIL DATA
SR-500, 112th Street/Gher Road Interchange
Pier 4

Ground Surface Elevation (ft): 203 ft

Boring: H-4-98

STATIC ANALYSIS

Soil Layer	Bottom of Layer Eleavtion		Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	59.9	198	SAND	4	18.1	0.07	115	-	-	-	-	34	29.8	110
2	55.7	184	SAND	4	9.1	0.03	58	-	-	-	-	35	21.7	80
3	52.7	174	SAND	4	7.5	0.03	48	-	-	-	-	33	16.3	60
4	46.0	152	SAND	4	9.1	0.03	58	-	-	-	-	39	35.2	130

DYNAMIC ANALYSIS

Soil Layer	Bottom of Layer Eleavtion		Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	kN/m3	pci
1	59.9	198	SAND	4	18.8	0.07	115	-	-	-	-	34	29.8	110
2	59.0	195	SAND	4	9.1	0.03	58	-	-	-	-	35	21.7	80
3	58.1	192	CLAY	1	7.5	0.03	48	15.0	2.1	300	0.020	-	-	-
4	55.7	184	SAND	4	9.1	0.03	58	-	-	-	-	36	25.7	95
5	52.7	174	SAND	4	7.5	0.03	48	-	-	-	-	33	16.3	60
6	59.9	198	SAND	4	9.1	0.03	58	-	-	-	-	39	35.2	130

Figure C-4: P-y Curve Parameters for Pier 4

APPENDIX-D

BORING LOGS

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-1-98**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C** Job No. **OL-2529**

S.R. **500**

Station **8+694.926** Offset **23.853m RIGHT** C.S. **0633**

Equipment **BK-81 AUTO HAMMER** Casing Ground El **202.8 (61.81 m)**

Method of Boring **WET ROTARY**

Start Date **July 17, 1998** Completion Date **July 22, 1998** Sheet **1** of **4**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 5 5 (10)		D-1	GS MC	GM MC = 33% Silty GRAVEL with sand. Rounded, loose, very dark brown, moist, homogeneous.		
5	1			6 11 11 (22)		D-2		Silty SAND with gravel Medium dense, dark brown, wet, homogeneous.		
	2			13 20 19 (39)		D-3		Silty SAND with gravel Dense, dark brown, wet, homogeneous.		
10	3			9 8 9 (17)		D-4		Silty SAND with gravel Medium dense, dark brown, wet, homogeneous.		
	4			8 7 6 (13)		D-5	GS MC	SM MC = 22% Silty SAND with gravel Medium dense, brown, wet, homogeneous.		
15	5			5 3 3 (6)		D-6	GS MC	SM MC = 29% Silty SAND. Loose, brown, wet, homogeneous.		
	6			4 6 4 4 (10)		D-7	GS MC AL	CL MC = 32% PI = 30 Lean CLAY with sand. Stiff, gray, moist, homogeneous.		
20										

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:28:15 A10

LOG OF TEST BORING

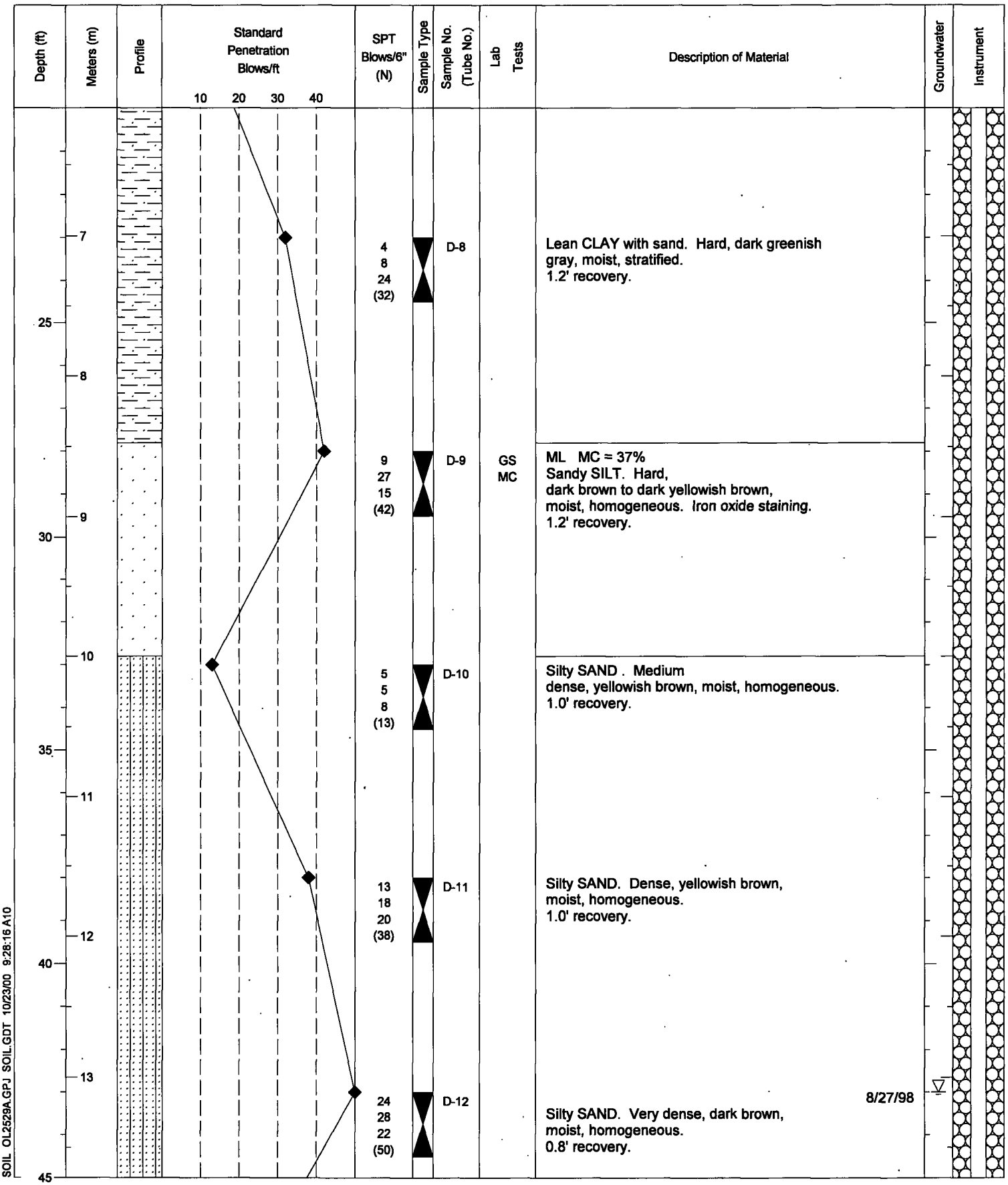
Washington State Department of Transportation

HOLE No. **H-1-98**

Sheet **2** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



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LOG OF TEST BORING

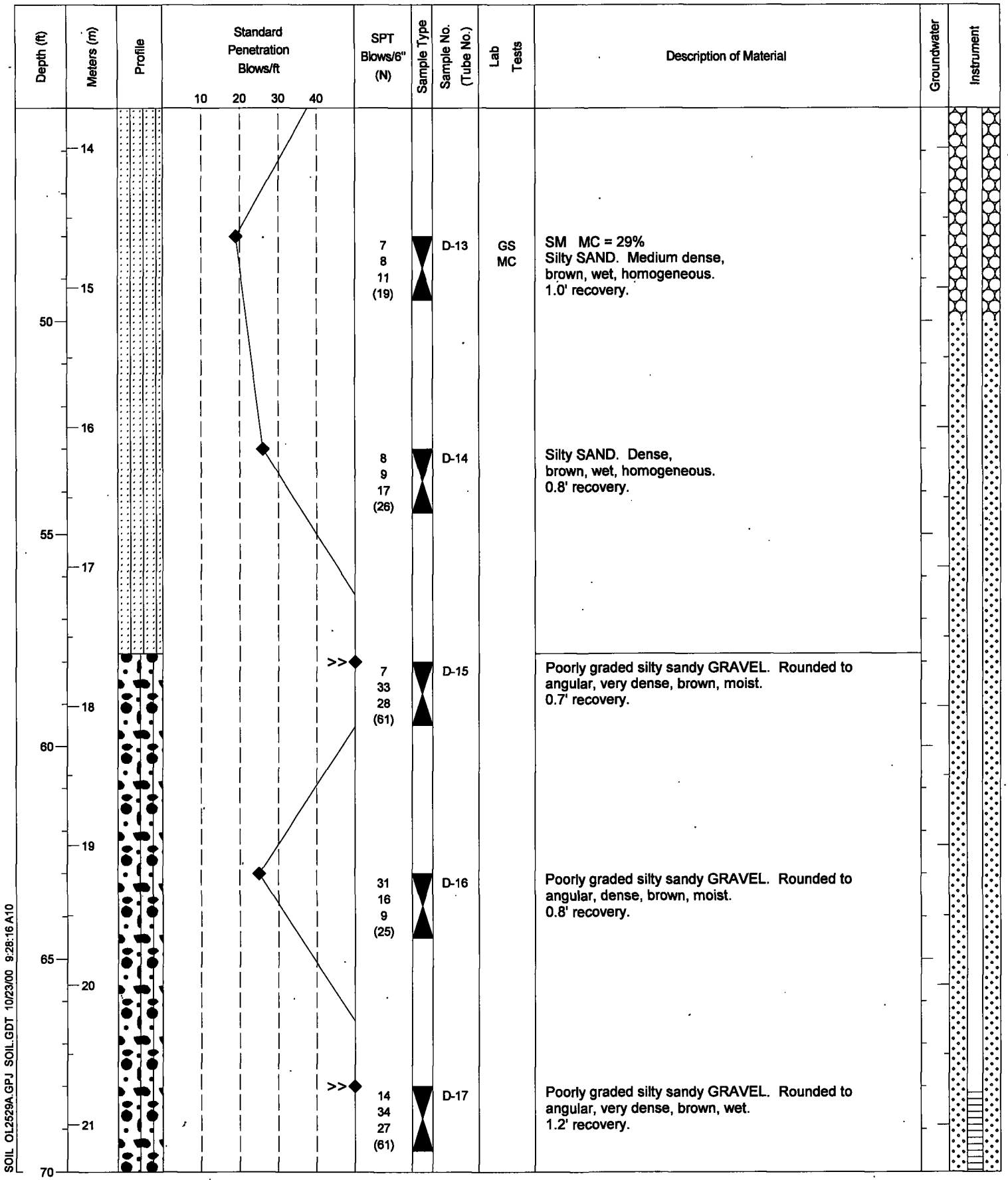
Washington State Department of Transportation

HOLE No. **H-1-98**

Sheet **3** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



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LOG OF TEST BORING

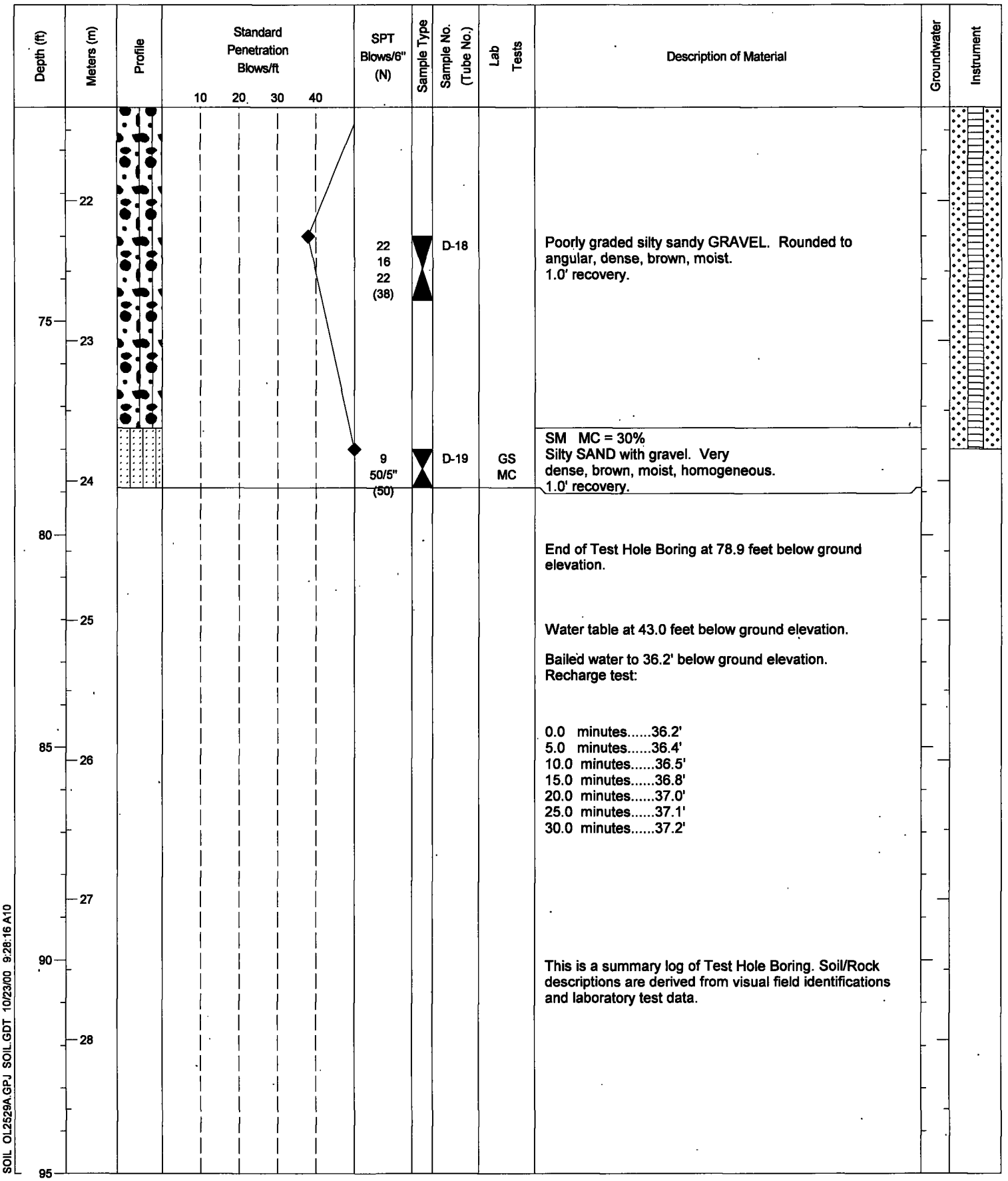
Washington State Department of Transportation

HOLE No. **H-1-98**

Sheet **4** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:28:16 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-2-98**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C** Job No. **OL-2529**

S.R. **500**

Station **8+697.362** Offset **24.173m LEFT** C.S. **0633**

Equipment **BK-81/AUTO HAMMER** Casing Ground El **203.1 (61.91 m)**

Method of Boring **WET ROTORY**

Start Date **July 14, 1998** Completion Date **July 15, 1998** Sheet **1** of **3**

Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	1								
5			5 7 12 (19)		D-1		Silty GRAVEL with sand *Fine grained, sub rounded to angular,* medium dense, dark brown, moist, homogeneous. 0.5' recovery		
	2							8/27/98 ▽	
			7 7 5 (12)		D-2	GS MC	GM MC = 18% Silty GRAVEL with sand Fine grained, rounded to angular, medium dense, dark brown, moist-wet, homogeneous. 0.7' recovery Lost drilling fluid at 8'.		
10	3		2 4 4 (8)		D-3		Silty GRAVEL with sand Fine grained, rounded to angular, loose, *dark brown, moist-wet, homogeneous.* 0.2' recovery		
	4		6 8 7 (15)		D-4		Silty GRAVEL with sand Fine grained, rounded to angular, medium dense, dark brown, moist-wet, homogeneous. 0.7' recovery		
15			10 8 10 (18)		D-5		Silty GRAVEL with sand Fine grained, rounded to angular, medium dense, dark brown, moist-wet, homogeneous. 0.9' recovery		
	5		4 2 2 (4)		D-6	GS MC	SM MC = 35% Silty SAND. Very loose, brown, *moist, homogeneous.* 1.0' recovery		
	6		2 2		D-7	GS MC	CL MC = 31% PI = 11 Lean CLAY with sand. Medium stiff, gray-green to		
20									

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 3:28:45 P10

LOG OF TEST BORING

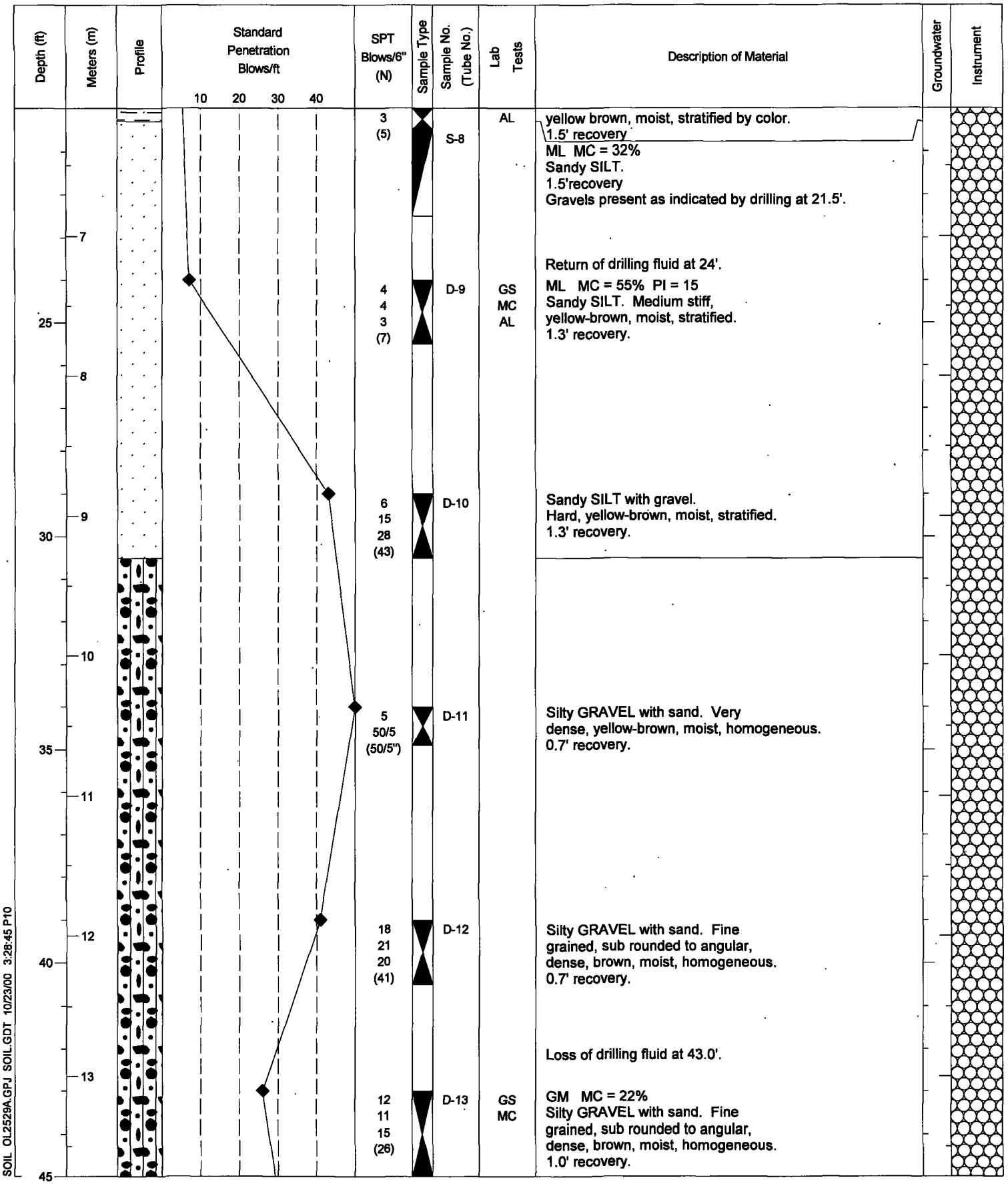
Washington State Department of Transportation

HOLE No. **H-2-98**

Sheet **2** of **3**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 3:28:45 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-2-98**

Sheet **3** of **3**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
	15			12 23 13 (36)		D-14		Poorly graded silty sandy GRAVEL. Fine grained, sub rounded to angular, dense, brown, moist, homogeneous. 1.2' recovery.		
50										
	16									
				11 14 22 (36)		D-15	GS MC	SM MC = 26% Silty SAND with gravel. Fine grained, sub rounded to angular, dense, brown, moist, homogeneous. 1.4' recovery.		
55	17							End of Test Hole Boring at 55.5 feet below ground elevation.		
								Water table at 6.3' below ground elevation.		
	18									
60								This is a summary log of Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	19									
65										
	20									
	21									
70										

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 3:28:46 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-3-98**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C** Job No. **OL-2529**

S.R. **500**

Station **8+825.338** Offset **24.035m LEFT** C.S. **0633**

Equipment **BK-81/AUTO HAMMER** Casing Ground El **204.5 (62.33 m)**

Method of Boring **WET ROTORY**

Start Date **July 9, 1998** Completion Date **July 14, 1998** Sheet **1** of **4**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				4 6 15 (21)		D-1		Poorly graded GRAVEL with silt and sand. Medium dense, dark brown, moist. 0.2' recovery.		
				8 15 14 (29)		D-2	GS MC	GP-GM MC = 9% Poorly graded GRAVEL with silt and sand. Dense, dark brown, moist. 0.7' recovery. Cobbles present as indicated by drilling. Lost drilling fluid at 6.0'	▽ 7/14/98	
				15 14 11 (25)		D-3		Poorly graded GRAVEL with silt and sand. Dense, dark brown, moist. 0.5' recovery. Cobbles present as indicated by drilling. Recovered drilling fluid at 8.5'.		
				11 8 9 (17)		D-4		Poorly graded GRAVEL with sand. Medium dense, dark brown, moist. 0.5' recovery.		
				7 6 7 (13)		D-5		Poorly graded GRAVEL with silt and sand. Medium dense, dark brown, moist. 0.9' recovery.		
				3 4 4 (8)		D-6		Sandy SILT. Loose, red brown, moist, stratified. 0.9' recovery.		
				5 6 8		D-7	GS MC	ML MC = 29% Sandy SILT. Loose, red brown, moist, homogeneous.		

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:45 A10

LOG OF TEST BORING

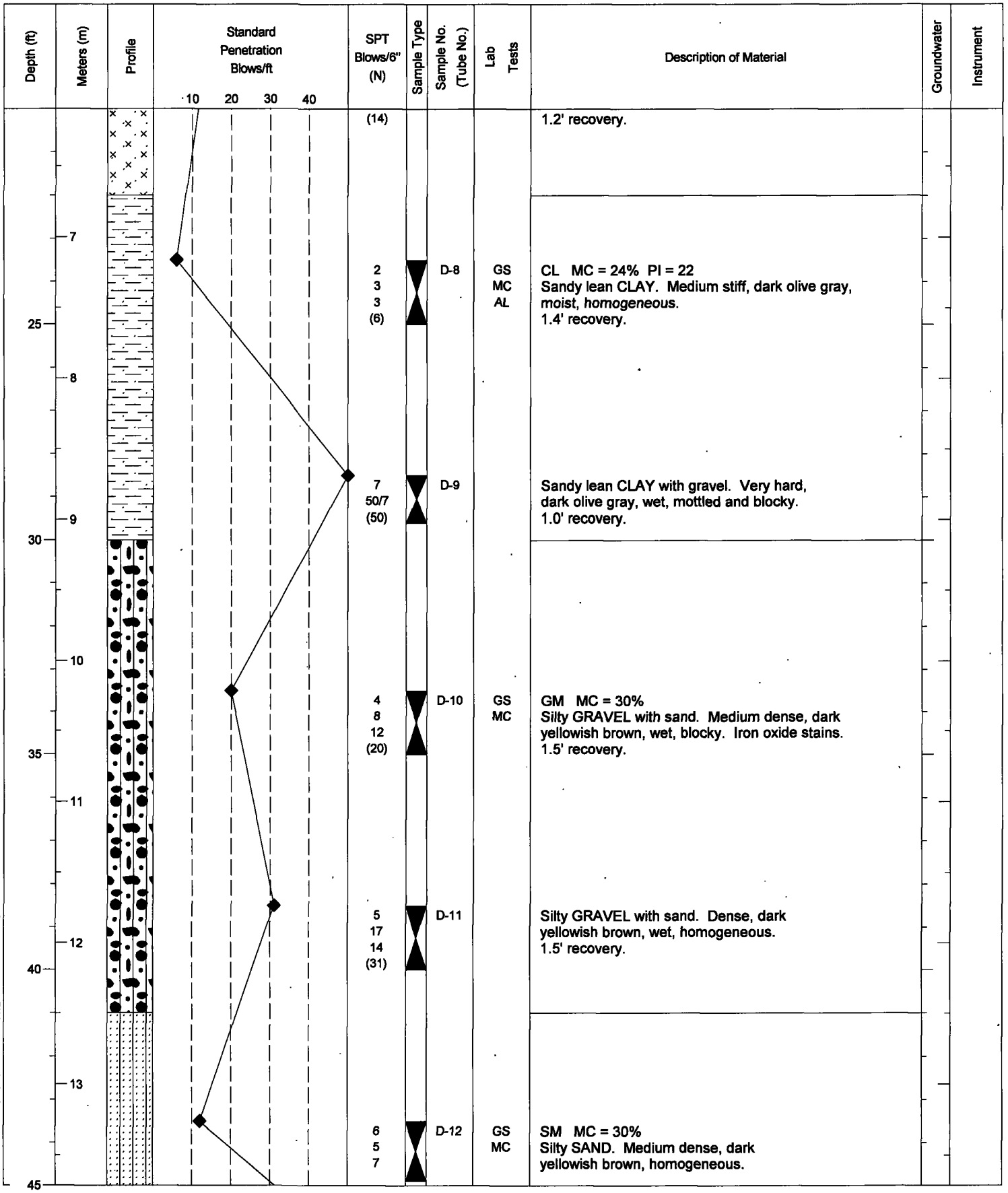
Washington State Department of Transportation

HOLE No. **H-3-98**

Sheet **2** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:45 A10

LOG OF TEST BORING

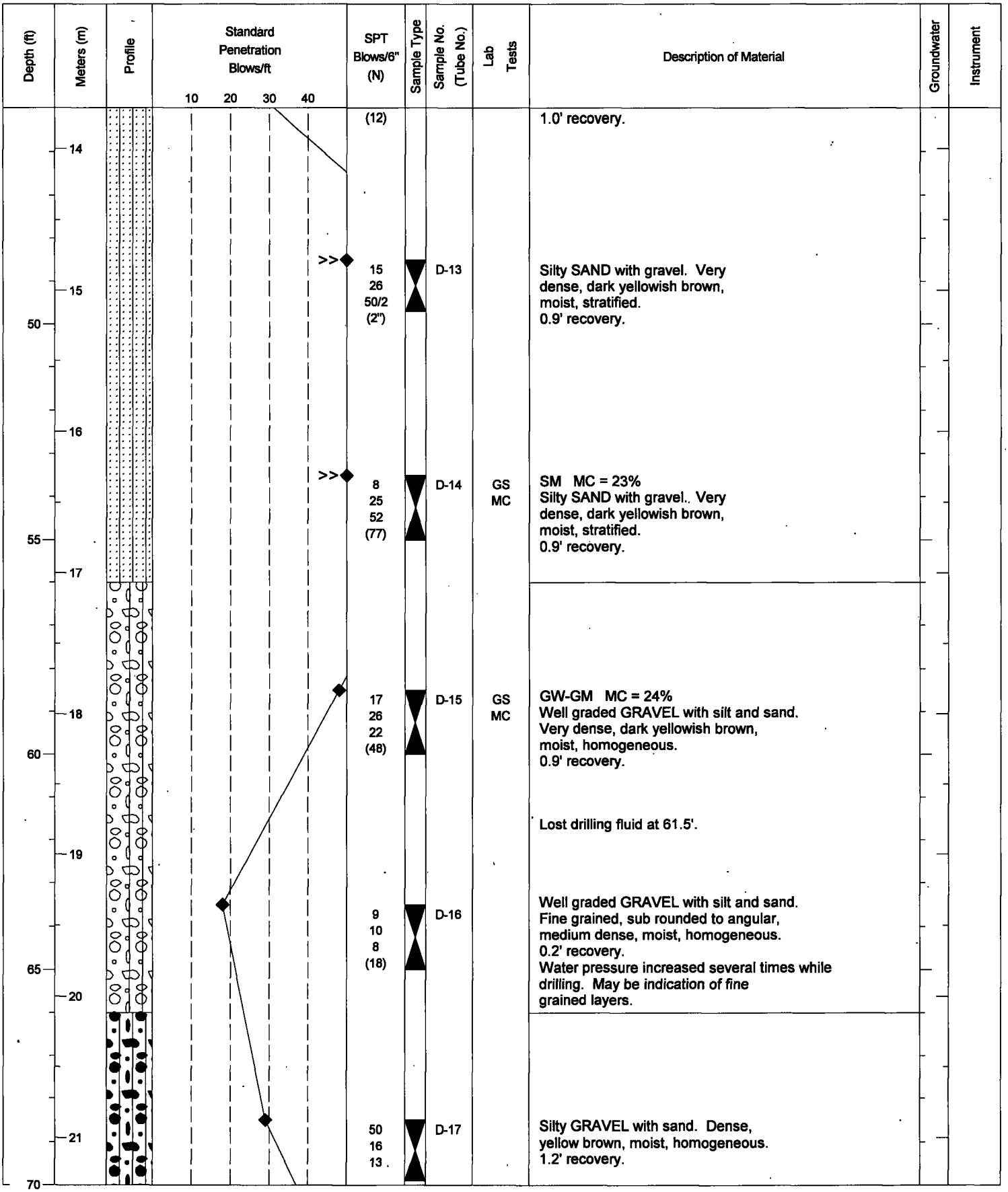
Washington State Department of Transportation

HOLE No. **H-3-98**

Sheet **3** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material
		(12)				1.0' recovery.
	14					
		15		D-13		Silty SAND with gravel. Very
	15	26				dense, dark yellowish brown,
50		50/2 (2")				moist, stratified. 0.9' recovery.
	16					
		8		D-14	GS MC	SM MC = 23%
		25				Silty SAND with gravel.. Very
55		52				dense, dark yellowish brown,
	17	(77)				moist, stratified. 0.9' recovery.
		17		D-15	GS MC	GW-GM MC = 24%
	18	26				Well graded GRAVEL with silt and sand.
60		22				Very dense, dark yellowish brown,
		(48)				moist, homogeneous. 0.9' recovery.
	19					Lost drilling fluid at 61.5'.
		9		D-16		Well graded GRAVEL with silt and sand.
		10				Fine grained, sub rounded to angular,
65		8				medium dense, moist, homogeneous.
	20	(18)				0.2' recovery. Water pressure increased several times while drilling. May be indication of fine grained layers.
		50		D-17		Silty GRAVEL with sand. Dense,
	21	16				yellow brown, moist, homogeneous.
70		13				1.2' recovery.

Standard Penetration Blows/ft: 10, 20, 30, 40

Groundwater

Instrument

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:46 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-3-98**

Sheet **4** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				(29)						
	22									
			>>	25 38 18 (56)		D-18	GS MC	GM MC = 20% Silty GRAVEL with sand. Very dense, yellow brown, moist, homogeneous. 1.2' recovery.		
75	23									
	24		>>	32 54/6 (54)		D-19		Silty GRAVEL with sand. Dense, yellow brown, moist, homogeneous. 0.7' recovery.		
80								End of Test Hole Boring at 79.5 feet below ground elevation.		
	25							Water table at 7.6' below ground elevation.		
85	26							This is a summary log of Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	27									
90										
	28									
95										

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:46 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-4-98**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C** Job No. **OL-2529**

S.R. **500**

Station **8+824.361** Offset **24.657m RIGHT** C.S. **0633**

Equipment **BK-81/AUTO HAMMER** Casing Ground El **203.2 (61.94 m)**

Method of Boring **AUGER**

Start Date **July 7, 1998** Completion Date Sheet **1** of **3**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				4 6 5 (11)		D-1		SILT with sand, gravel, and organics. Stiff, very dark brown, moist, homogeneous. 0.9' recovery. Cobbles present as indicated by drilling.		
	1									
5				9 12 11 (23)		D-2		Poorly graded GRAVEL with silt and sand. Fine grained, rounded to angular, medium dense, dark grayish brown to very dark brown, dry to moist, stratified. 0.5' recovery. Cobbles present as indicated by drilling.		
	2			9 10 6 (16)		D-3		Poorly graded GRAVEL with silt and sand. Fine grained, rounded to angular, medium dense, dark grayish brown, moist to wet, homogeneous. 0.7' recovery. Cobbles present as indicated by drilling.		
10	3			8 3 2 (5)		D-4		Poorly graded GRAVEL with silt and sand. Fine grained, rounded to angular, loose, dark grayish brown, moist to wet, homogeneous. 0.2' recovery. Cobbles present as indicated by drilling.		
				7 11 18 (29)		D-5	GS MC	GP-GM MC = 13% Poorly graded GRAVEL with silt and sand. Fine grained, rounded to angular, dense, dark grayish brown, wet, homogeneous. 1.2' recovery. Cobbles present as indicated by drilling.		
	4			37 22 17 (39)		D-6		Poorly graded GRAVEL with silt and sand. Fine grained, rounded to angular, dense, dark grayish brown, wet, homogeneous. 1.2' recovery. Cobbles present as indicated by drilling.		
15	5			12 8 16 (24)		D-7		Poorly graded GRAVEL with silt and sand. Fine grained, rounded to angular, medium dense, dark grayish brown, wet, homogeneous. 0.5' recovery. Cobbles present as indicated by drilling.		
				8 4		D-8	GS MC	SM MC = 33% PI = Non plastic Silty SAND. Loose, reddish brown,		
20	6									

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 2:05:05 P10

LOG OF TEST BORING

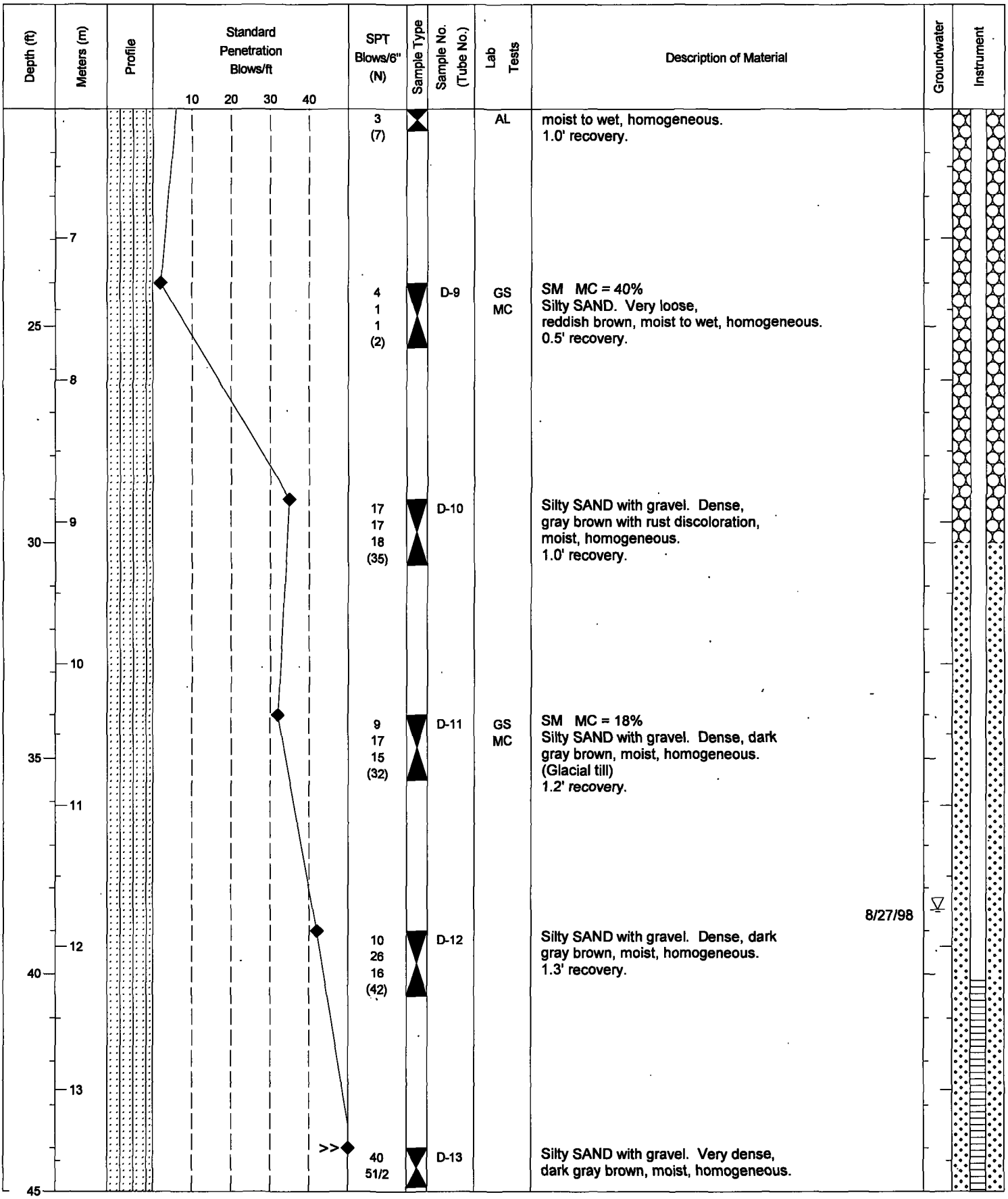
Washington State Department of Transportation

HOLE No. **H-4-98**

Sheet **2** of **3**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 2:05:06 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-4-98**

Sheet **3** of **3**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			(51)				0.7' recovery.		
	15			>> 36 40 51 (91)		D-14		Silty SAND with gravel. Very dense, dark gray brown, moist, homogeneous. 0.6' recovery.		
50								End of Test Hole Boring at 50.5 feet below ground elevation.		
	16							Water table at 38.5 feet below ground elevation.		
55	17							This is a summary log of Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	18									
60										
	19									
65										
	20									
	21									
70										

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 2:05:06 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-21-98**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C** Job No. **OL-2529**

S.R. **500**

Station **8+731.640** Offset **17.638m RIGHT** C.S. **0633**

Equipment _____ Casing _____ Ground El **205.1 (62.51 m)**

Method of Boring **WET ROTARY**

Start Date **September 22, 1998** Completion Date **September 24, 1998** Sheet **1** of **4**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 5 3 (8)		D-1		Gravelly ORGANIC SOIL with sand. Medium stiff, dark brown, moist. 0.7' recovery.		
								Cobbles present as indicated by drilling		
				11 9 13 (22)		D-2		Well graded GRAVEL with silt and sand. Medium dense, brown, moist, homogeneous. 0.7' recovery.		
								Cobbles present as indicated by drilling.		
				10 7 11 (18)		D-3		Well graded GRAVEL with sand. Medium dense, brown, moist. 0.5' recovery.		
								Cobbles present as indicated by drilling.		
				6 16 13		D-4		Well graded GRAVEL with sand. Dense, brown, moist. 0.5' recovery.		

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:28 A10

LOG OF TEST BORING

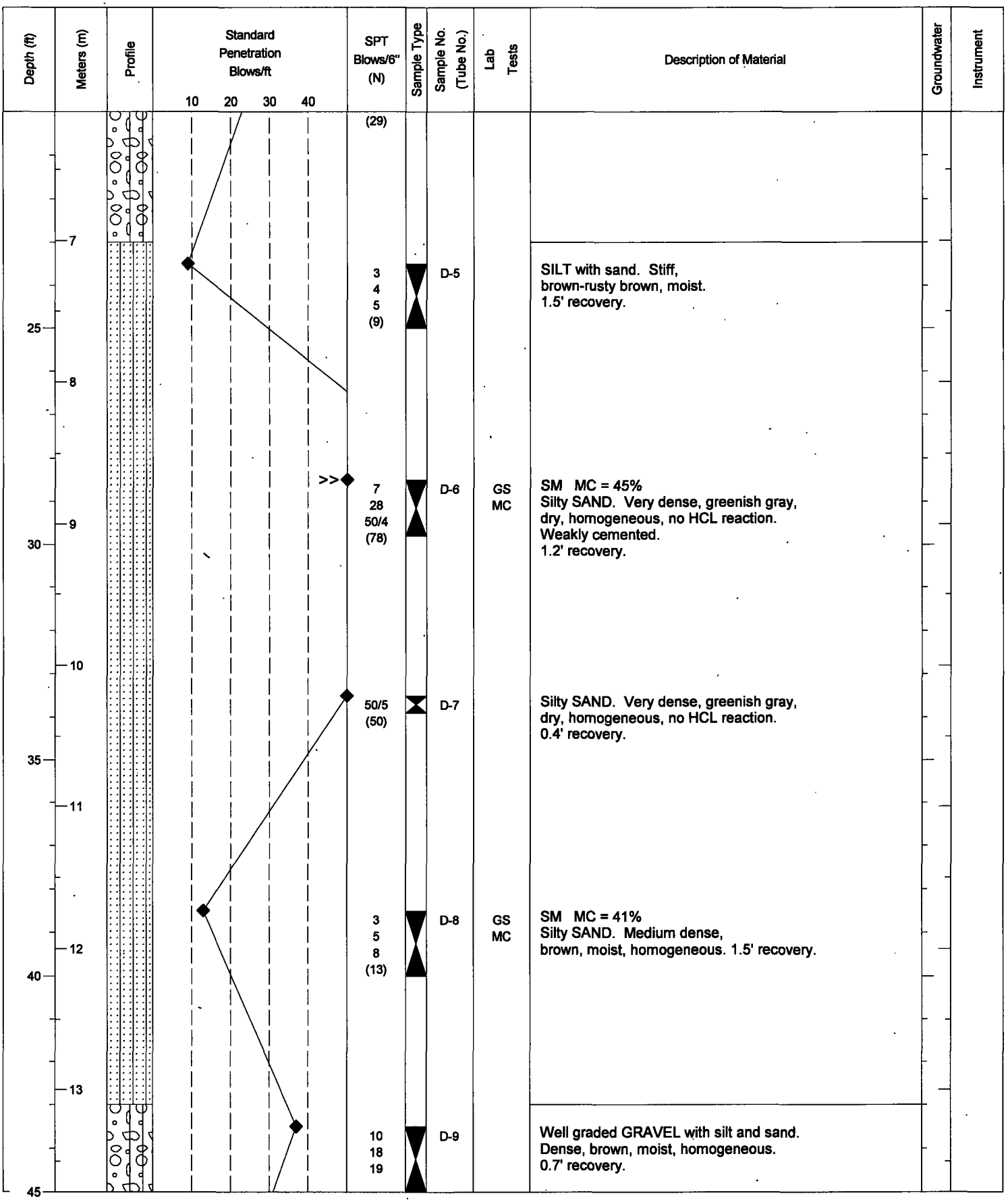
Washington State Department of Transportation

HOLE No. **H-21-98**

Sheet **2** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:28 A10

LOG OF TEST BORING

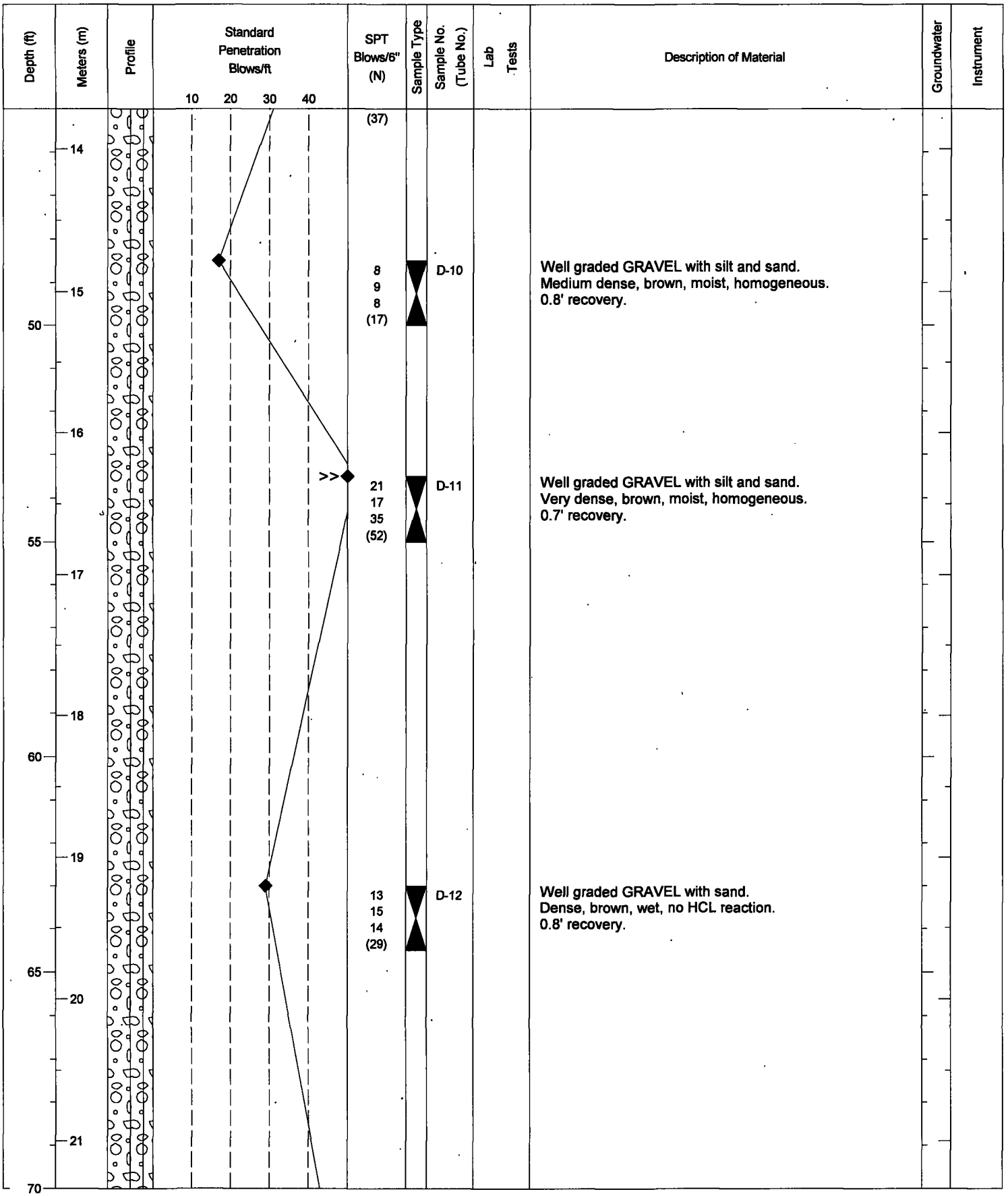
Washington State Department of Transportation

HOLE No. **H-21-98**

Sheet **3** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:29 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-21-98**

Sheet **4** of **4**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22					C-13		Recovered GRAVEL and cobble size material in core barrel. 3.0' recovery.		
75	23		>>	24 26 27 (53)		D-14		Well graded GRAVEL with sand. Very dense, black - brown, moist. 1.2' recovery.		
						C-15		Stratified silty SAND with gravel and well graded GRAVEL with sand. Recovered cobble size material in core barrel. 2.5' recovery.		
	24									
80			>>	33 40 50/3 (90)		D-16		Well graded GRAVEL. Very dense. 1.0' recovery.		
	25							End of Test Hole Boring at 81.2 feet below ground elevation.		
								Water table elevation not determined.		
85	26							This is a summary log of Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	27									
90										
	28									
	95									

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:29 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-22-98**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C** Job No. **OL-2529**

S.R. **500**

Station **8+787.658** Offset **26.920m RIGHT** C.S. **0633**

Equipment _____ Casing _____ Ground El **204.2 (62.24 m)**

Method of Boring **WET ROTARY**

Start Date **September 16, 1998** Completion Date **September 18, 1998** Sheet **1** of **5**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			4 6 10 (16)		D-1		Well graded GRAVEL with silt and sand. Medium dense, brown, moist. 0.7' recovery.		
10	2 3			14 10 12 (22)		D-2		Well graded GRAVEL. Medium dense, black, wet. 0.5' recovery. Cobbles present as indicated by drilling.		
15	4 5			5 6 10 (16)		D-3		Well graded GRAVEL. Medium dense, black, wet. 0.5' recovery.		
20	6			4 7		D-4		Silty SAND and sandy SILT. Stiff, brown, moist, laminated - horizontal.		

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:36 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-22-98**

Sheet **2** of **5**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 (12) A B C D E		U-5		1.2' recovery. 1.6' recovery.		
25	7 8			7 12 27 (39)		D-6	GS MC AL	CL MC = 16% PI = 15 Sandy lean CLAY. Hard, greenish gray and brown, dry, blocky. 1.3' recovery.		
30	9 10		>>	8 22 48 (70)		D-7		Silty GRAVEL with sand. Very dense, brown and gray, moist. 1.5' recovery.		
35	11 12		>>	20 34 22 (56)		D-8		Silty GRAVEL with sand. Very dense, brown, moist. 1.3' recovery.		
40	13		>>	9 42 31 (71)		D-9		Silty GRAVEL with sand. Very dense, brown, moist. 1.2' recovery.		
45			>>	36 29		D-10		Silty GRAVEL with sand. Very dense, brown, moist.		

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:36 A10

LOG OF TEST BORING

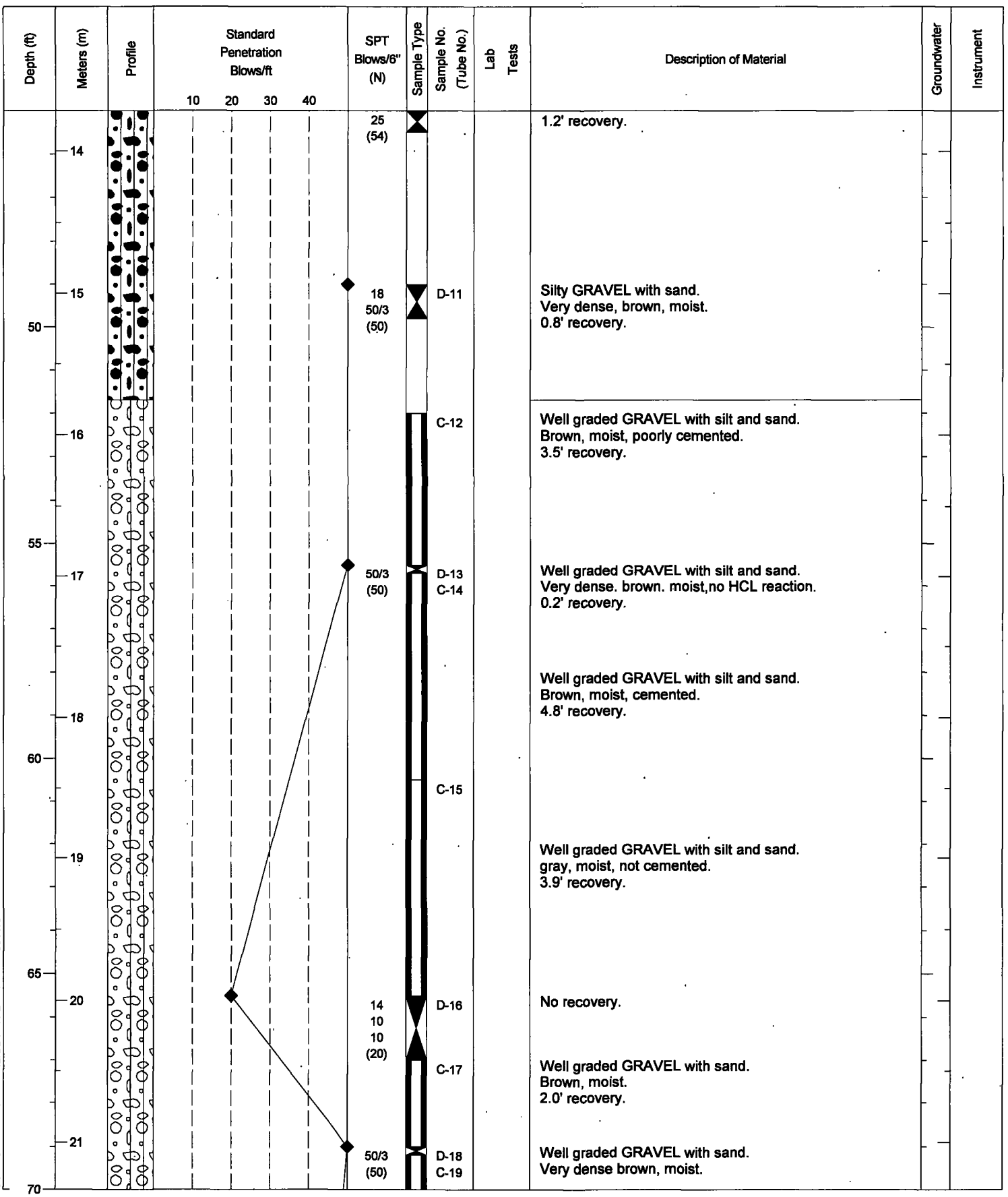
Washington State Department of Transportation

HOLE No. **H-22-98**

Sheet **3** of **5**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:36 A10

LOG OF TEST BORING

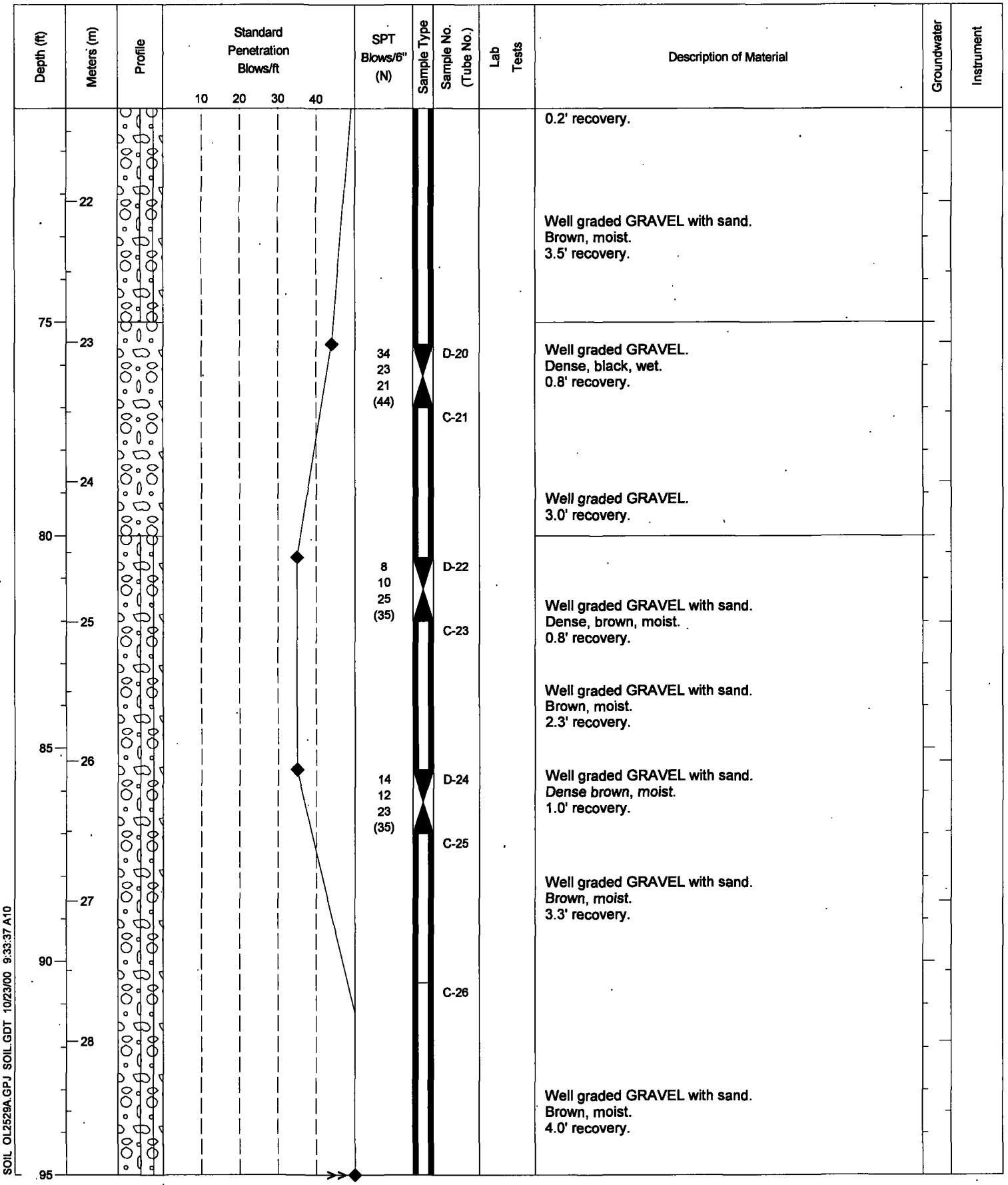
Washington State Department of Transportation

HOLE No. **H-22-98**

Sheet **4** of **5**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**



SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:37 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-22-98**

Sheet **5** of **5**

PROJECT **SR 500 (112TH. ST.) AND GHER RD. I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			60/6 (60)		D-27		No recovery.		
								End of Test Hole Boring at 95.5 feet below ground elevation.		
	30							Water table elevation not determined.		
100								This is a summary log of Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	31									
105	32									
	33									
110										
	34									
115	35									
	36									
120										

SOIL OL2529A.GPJ SOIL.GDT 10/23/00 9:33:37 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-22a-99**

PROJECT **112th & Gher Road I/C** Job No. **OL-2529**

S.R. **500**

Station **8+787.658** Offset **26.9m Rt.** C.S. **0633**

Equipment **BK-81 AUTO HAMMER** Casing **18.5' X HQ** Ground El **204.2 (62.24 m)**

Method of Boring **WET ROTARY**

Start Date **March 17, 1999** Completion Date **March 17, 1999** Sheet **1** of **2**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								1 ft.=0.3048 m. GRAVEL present as indicated by drilling.		
10	3			13 12 7 (19)		D-1		GRAVEL with sand and silt, angular, medium dense, dark grayish brown, wet, homogeneous. Recovered and Retained: 1.0 ft.		
15	5			3 4 19 (23)		D-2		GRAVEL with sand and silt, angular, medium dense, dark grayish brown, wet, homogeneous. Recovered and Retained: 0.5 ft.		
20	6			4 5 4		D-3		SILT with sand, stiff, brown, wet, homogeneous. Recovered and Retained: 1.5 ft.		

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:42:37 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-22a-99**

Sheet **2** of **2**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				(9)				End of Test Hole Boring at 20 feet below ground elevation.		
	7									
25								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	8									
	9									
30										
	10									
35										
	11									
	12									
40										
	13									
45										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:42:37 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-25-99**

PROJECT **112th & Gher Road I/C** Job No. **OL-2529**

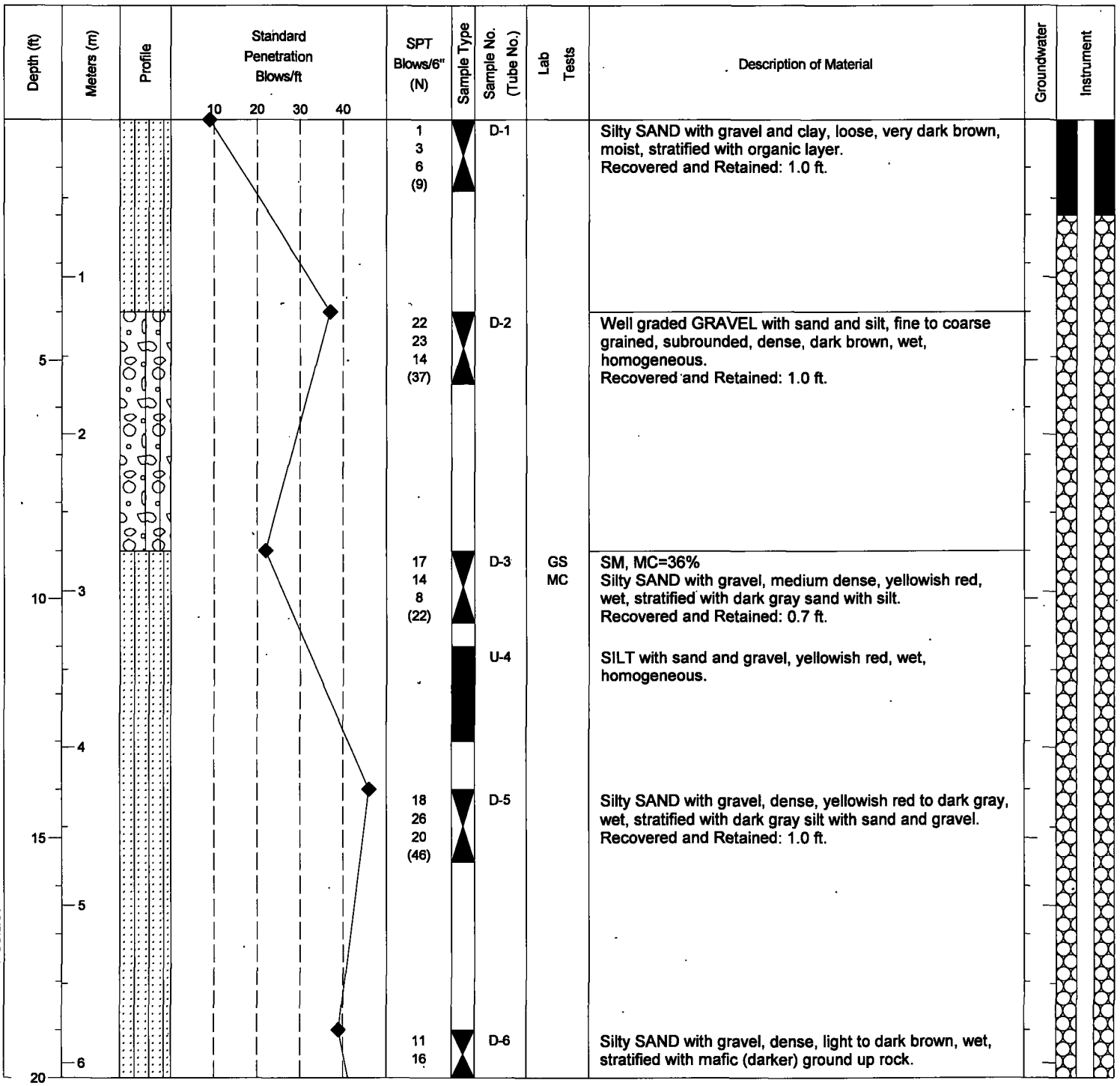
S.R. **500**

Station **E-NS 3+700** Offset **5m Lt.** C.S. **0633**

Equipment **CME 55 w/ autohammer** Casing **HW** Ground El **206.8 (63.04 m)**

Method of Boring **WET ROTARY**

Start Date **May 18, 1999** Completion Date **May 19, 1999** Sheet **1** of **4**



SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:42:45 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. H-25-99

Sheet 2 of 4

PROJECT 112th & Gher Road I/C

Job No. OL-2529

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				23 (39)				Recovered and Retained: 0.5 ft.		
	7									
25				11 19 31 (50)		D-7	GS MC	SM, MC=45% Silty SAND with gravel, very dense, olive brown, moist, fissured and stratified with weak red siltstone. Recovered and Retained: 1.5 ft.		
	8									
				18 18 30 (48)		D-8	GS MC	GW-GM, MC=29% Well graded GRAVEL with silt and sand, fine to coarse grained, subrounded, dense, brown, moist, homogeneous. Recovered and Retained: 1.0 ft.		
30	9									
	10									
				23 15 19 (34)		D-9		Silty SAND with gravel, dense, dark brown, moist, homogeneous. Recovered and Retained: 1.0 ft.		
35	11									
	12			25 (50/4")		D-10		Well graded GRAVEL with silt and sand, fine to coarse grained, subangular to subrounded, very dense, dark brown, wet, homogeneous. Recovered and Retained: 0.5 ft.		
40										
	13									
			>>	26 32		D-11		Well graded GRAVEL with silt and sand, fine to coarse grained, subangular to subrounded, very dense, dark		
45										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:42:46 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-25-99**

Sheet **3** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				40 (72)				brown, wet, homogeneous. Recovered and Retained: 1.3 ft.		
	14									
	15			27 21 24 (45)		D-12		No recovery, Pounded on large cobbles and boulders.		
50										
	16									
				9 8 8 (16)		D-13	GS MC	SW-SM, MC=25% Well graded SAND with silt, medium grained, medium dense, brown, wet, homogeneous. Recovered and Retained: 1.5 ft.		
55										
	17									
	18			7 8 11 (19)		D-14		Well graded SAND with silt, medium dense, brown, wet, homogeneous. Recovered and Retained: 1.2 ft.		
60										
	19									
				10 16 24 (40)		D-15		Well graded SAND with silt, dense, brown, moist. Recovered and Retained: 1.5 ft.		
65										
	20									
	21		>>	46 73		D-16	GS MC	GW-GM, MC=9% Well graded GRAVEL with silt and sand, fine to coarse		
70										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:42:46 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-25-99**

Sheet **4** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				37 (110)				grained, subrounded, very dense, brown, wet, *homogeneous*. Recovered and Retained: 0.5 ft.		
								End of Test Hole Boring at 70.5 feet (21.49m) below ground elevation. Groundwater encountered at 45 feet below ground surface during drilling. Groundwater measurement not taken in piezometer immediately after completion. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	22									
75	23									
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:42:46 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-26-99**

PROJECT **112th & Gher Road I/C** Job No. **OL-2529**

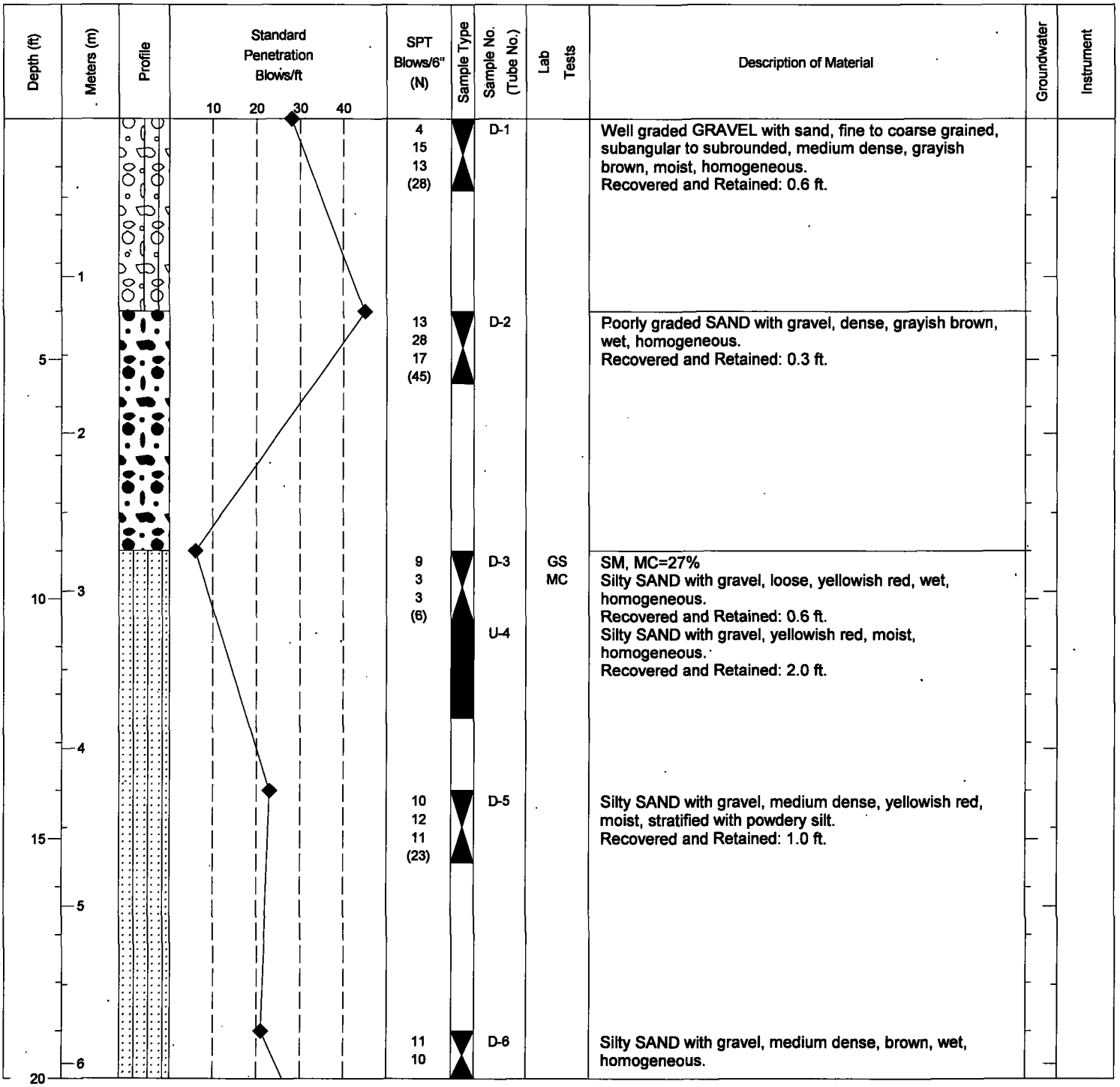
S.R. **500**

Station **E-NS 3+755** Offset **5m Lt.** C.S. **0633**

Equipment **CME 55 w/ autohammer** Casing **HQ** Ground El **207.0 (63.09 m)**

Method of Boring **Wet Rotary**

Start Date **May 25, 1999** Completion Date **May 26, 1999** Sheet **1** of **4**



SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 2:03:53 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-26-99**

Sheet **2** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				11 (21)				Recovered and Retained: 0.5 ft.		
	7								▽	
25				48 28 18 (46)		D-7		Silty SAND with gravel, dense, brown, moist, homogeneous. Recovered and Retained: 0.5 ft.		
	8									
			>>	51 27 25 (52)		D-8	GS MC	SM, MC=20% Silty SAND with gravel, very dense, brown, moist, homogeneous. Recovered and Retained: 1.0 ft.		
	9									
30										
	10									
			>>	18 37 22 (59)		D-9		Silty SAND with gravel, very dense, brown, moist, homogeneous. Recovered and Retained: 0.7 ft.		
35										
	11									
			>>	20 38 42 (80)		D-10		Silty SAND with gravel, very dense, brown, moist, homogeneous. Recovered and Retained: 0.5 ft.		
40										
	12									
	13									
			>>	20 33		D-11		Silty SAND with gravel, very dense, brown, moist, homogeneous.		
45										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 2:03:53 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-26-99**

Sheet **3** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				28 (61)				Recovered and Retained: 1.0 ft.		
	14									
	15			96 29 21 (50)		D-12		Silty SAND, very dense, brown, wet, homogeneous. Recovered and Retained: 0.1 ft.		
50										
	16									
				20 15 14 (29)		D-13	GS MC	SM, MC=21% Silty SAND, medium dense, brown, wet, homogeneous. Recovered and Retained: 1.0 ft.		
55	17									
	18			6 8 8 (16)		D-14		Silty SAND, medium dense, brown, wet, homogeneous. Recovered and Retained: 1.5 ft.		
60										
	19									
				8 14 14 (28)		D-15		Silty SAND with gravel, medium grained, medium dense, brown, wet, homogeneous. Recovered and Retained: 1.5 ft.		
65	20									
	21		>>	47 50		D-16	GS MC	SP-SM, MC=17% Poorly graded SAND with silt and gravel, very dense,		
70										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 2:03:53 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-26-99**

Sheet **4** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				62 (112)				brown, wet, stratified with poorly graded. Recovered and Retained: 1.5 ft.		
			>>	140 80 (80)		D-17		Poorly graded SAND with silt and gravel, very dense, brown, wet, homogeneous. Recovered and Retained: 0.7 ft.		
	22									
								End of Test Hole Boring at 72.5 feet (22.10m) below ground elevation. Groundwater encountered at 22.5 feet below ground surface during drilling.		
75	23							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 2:03:54 P10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-28-00**

PROJECT **112th & Gher Road I/C** Job No. **OL-2529**

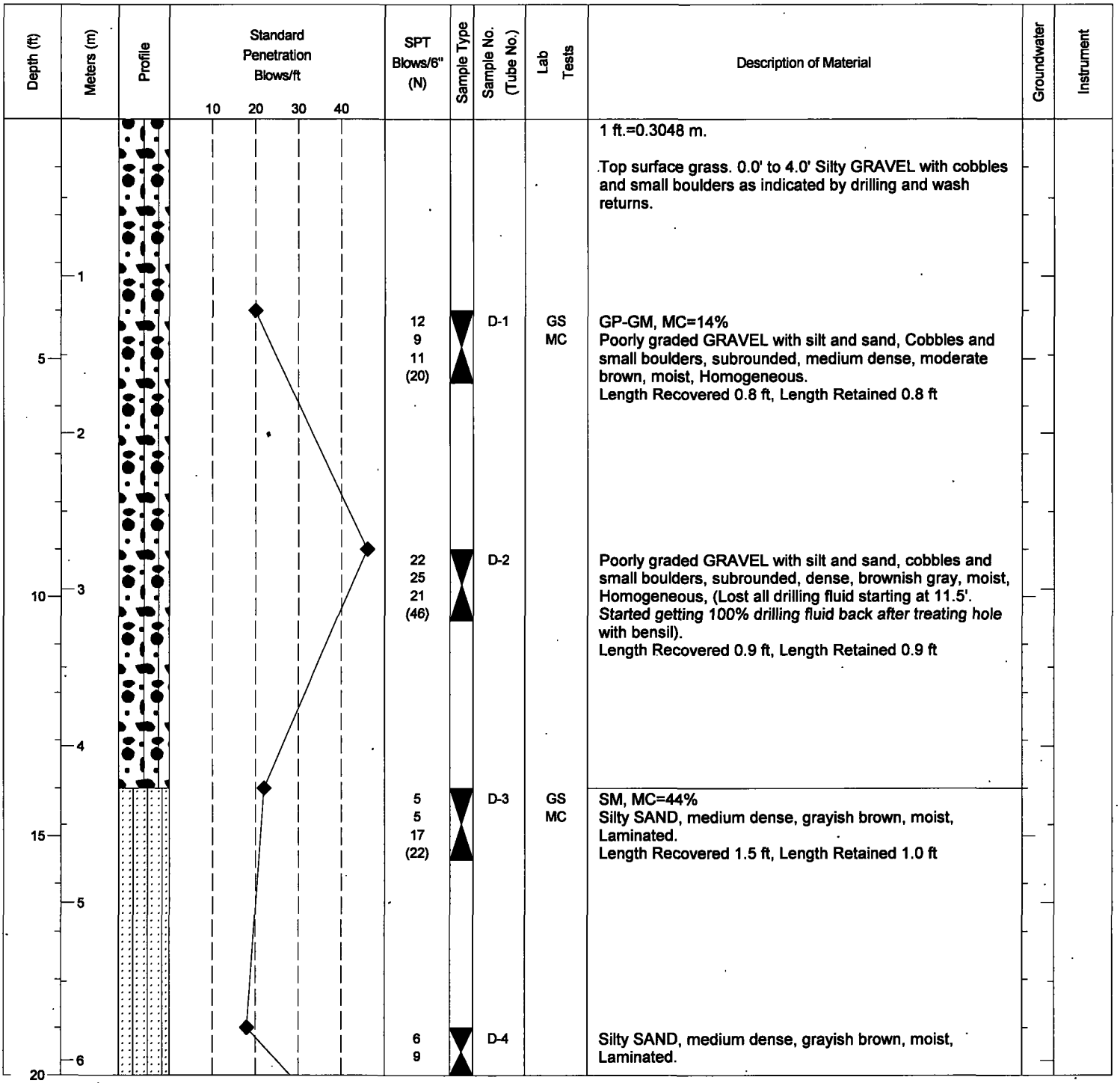
S.R. **500**

Station **E-NS, 3+670.52** Offset **4m Rt.** C.S. **0633**

Equipment **CME 850 w/ autohammer** Casing **(HWT x 28.0)(HQ x 85.0)** Ground El **208.3 (63.48 m)**

Method of Boring **Wet Rotary**

Start Date **March 1, 2000** Completion Date **March 8, 2000** Sheet **1** of **4**



SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:08 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-28-00**

Sheet **2** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				9 (18)				Length Recovered 1.5 ft, Length Retained 1.0 ft		
	7									
			>>	11 31 38 (69)		D-5		Silty GRAVEL with sand, subangular, very dense, grayish brown, moist, Laminated. Length Recovered 0.8 ft, Length Retained 0.8 ft		
25										
	8							GM, MC=24% Silty GRAVEL with sand, subangular, very dense, grayish brown, moist, Laminated. Note refusal at 28.0' with HWT advancer shoe wore out, switched over to NQ core barrel. Length Recovered 1.0 ft, Length Retained 1.0 ft		
			>>	37 64/6 (64/6")		D-6 C-7	GS MC			
	9									
30								Silty GRAVEL with sand, cobble, subrounded, very dense, grayish brown, wet, Stratified, Laminated. Length Recovered 2.0 ft, Length Retained 2.0 ft		
	10									
			>>	46 36 25 (61)		D-8		03/06/2000 Silty GRAVEL with sand, subangular, very dense, grayish brown, wet, Laminated with various color. Length Recovered 1.0 ft, Length Retained 1.0 ft	▽	
35										
	11					C-9		Silty GRAVEL with sand, subangular, very dense, grayish brown, wet, Stratified, Laminated. Length Recovered 2.0 ft, Length Retained 2.0 ft		
			>>	29 25 30 (55)		D-10		Silty GRAVEL with sand, subangular, very dense, grayish brown, wet, Laminated. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	12									
40						C-11		Silty GRAVEL with sand, subangular, very dense, grayish brown, moist, Laminated. Length Recovered 3.0 ft, Length Retained 3.0 ft		
	13									
45				21		D-12		Silty GRAVEL with sand, subangular, dense, grayish		

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:09 A10

LOG OF TEST BORING

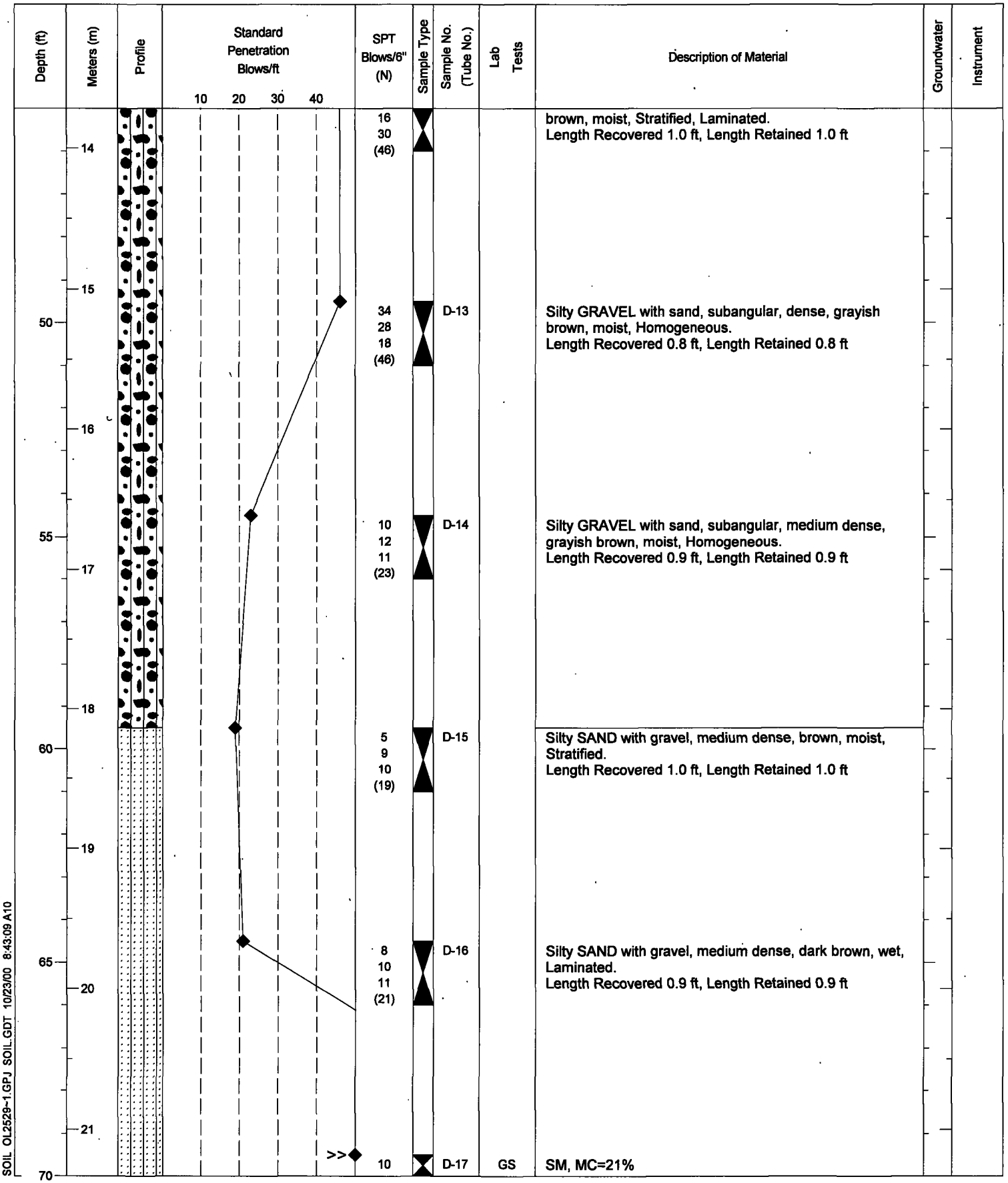
Washington State Department of Transportation

HOLE No. **H-28-00**

Sheet **3** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**



SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:09 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-28-00**

Sheet **4** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22			61 50/3 (111)			MC	Silty SAND with gravel, very dense, moderate brown, moist, Stratified, Laminated, (Note: lost drilling fluid at 72.5'). Length Recovered 1.0 ft, Length Retained 1.0 ft		
75	23		>>	18 53 29 (82)		D-18	GS MC	GP-GM, MC=14% Poorly graded GRAVEL with silt and sand, subangular, very dense, brownish gray, wet, Laminated, Homogeneous. Length Recovered 0.5 ft, Length Retained 0.5 ft		
	24									
80				15 17 15 (32)		D-19		Poorly graded GRAVEL with silt and sand, subangular, medium dense, brown, wet, Laminated. Length Recovered 1.2 ft, Length Retained 1.2 ft		
	25							End of test hole boring at 81 ft below ground elevation. Groundwater table encountered at 34.5ft below ground surface during drilling. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
85	26									
	27									
90										
	28									
95										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:09 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. **H-29-00**

PROJECT **112th & Gher Road I/C** Job No. **OL-2529**

S.R. **500**

Station **E-NS, 3+790** Offset **2m Rt.** C.S. **0633**

Equipment **CME 850 w/ autohammer** Casing **(HWT x 38.0)(HQ x 75.0)** Ground El **202.3 (61.65 m)**

Method of Boring **Wet Rotary**

Start Date **March 8, 2000** Completion Date **March 14, 2000** Sheet **1** of **4**

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								1 ft.=0.3048 m. Top surface. 0.0' to 3.0' Sandy SILT.		
	1			16 9 3 (12)		D-1		Silty GRAVEL with sand, subrounded, medium dense, brownish gray, moist, Stratified, Laminated. Length Recovered 1.5 ft, Length Retained 1.0 ft		
5	2									
				4 8 13 (21)		D-2	GS MC PI	ML, MC=42%, PI=10 Sandy SILT, very stiff, dark reddish brown, moist, stratified with very weak angular pieces of siltstone, laminated with gray yellowish orange and brownish black colors, fine grained. Length Recovered 1.5 ft, Length Retained 1.0 ft		
10	3									
	4			5 10 13 (23)		D-3	GS MC	SM, MC=29% Silty SAND with gravel, medium dense, dark reddish brown, moist, stratified with angular pieces of sandstone, laminated with light gray, dark yellowish orange and reddish brown colors. Length Recovered 1.3 ft, Length Retained 1.0 ft		
15	5									
				15 18 29 (47)		D-4		Silty SAND with gravel, dense, dark reddish brown, moist, stratified with angular pieces of sandstone and siltstone, laminated with various colors. Length Recovered 1.5 ft, Length Retained 1.0 ft		
20	6									

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:16 A10

LOG OF TEST BORING

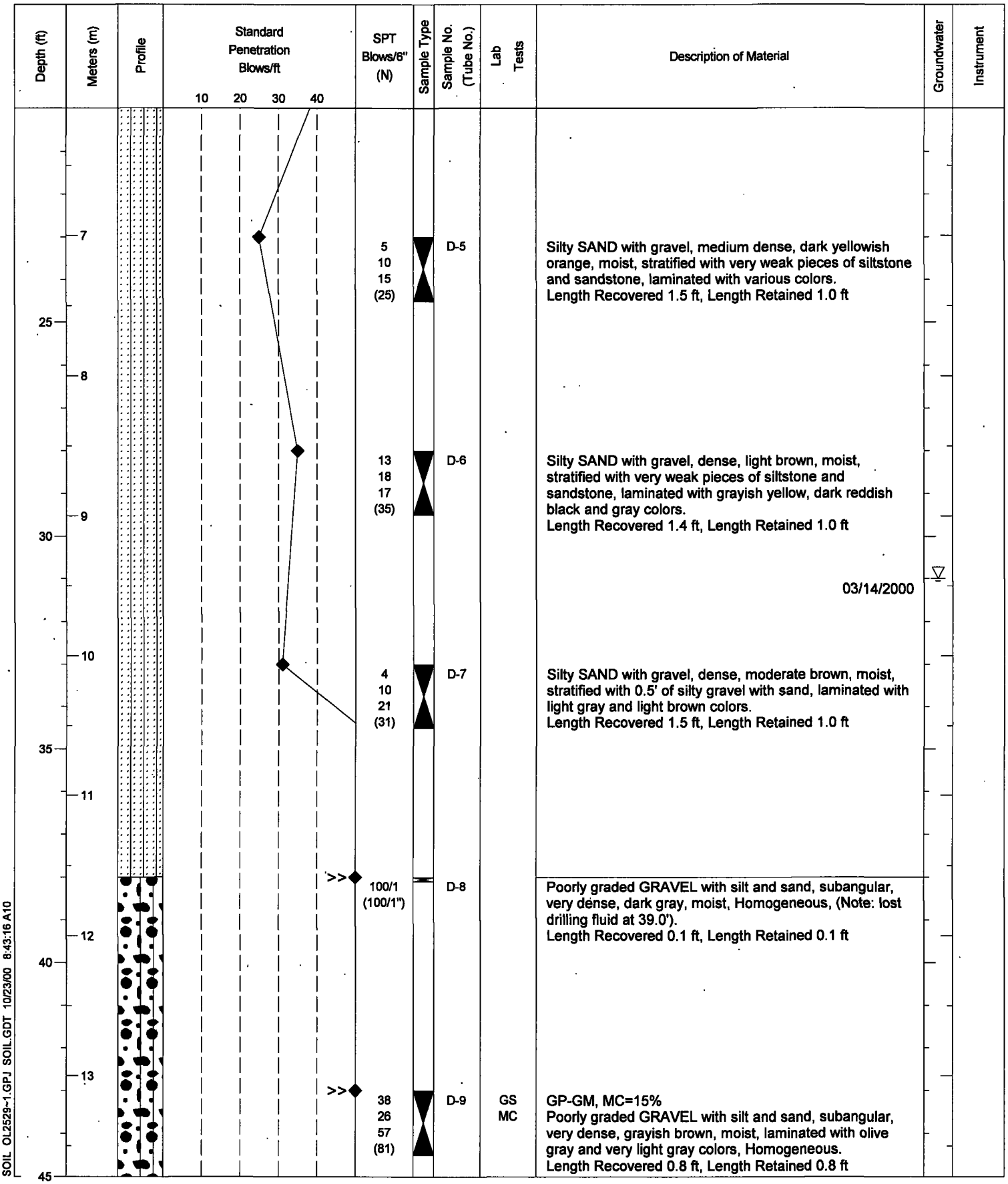
Washington State Department of Transportation

HOLE No. **H-29-00**

Sheet **2** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**



SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:16 A10

LOG OF TEST BORING

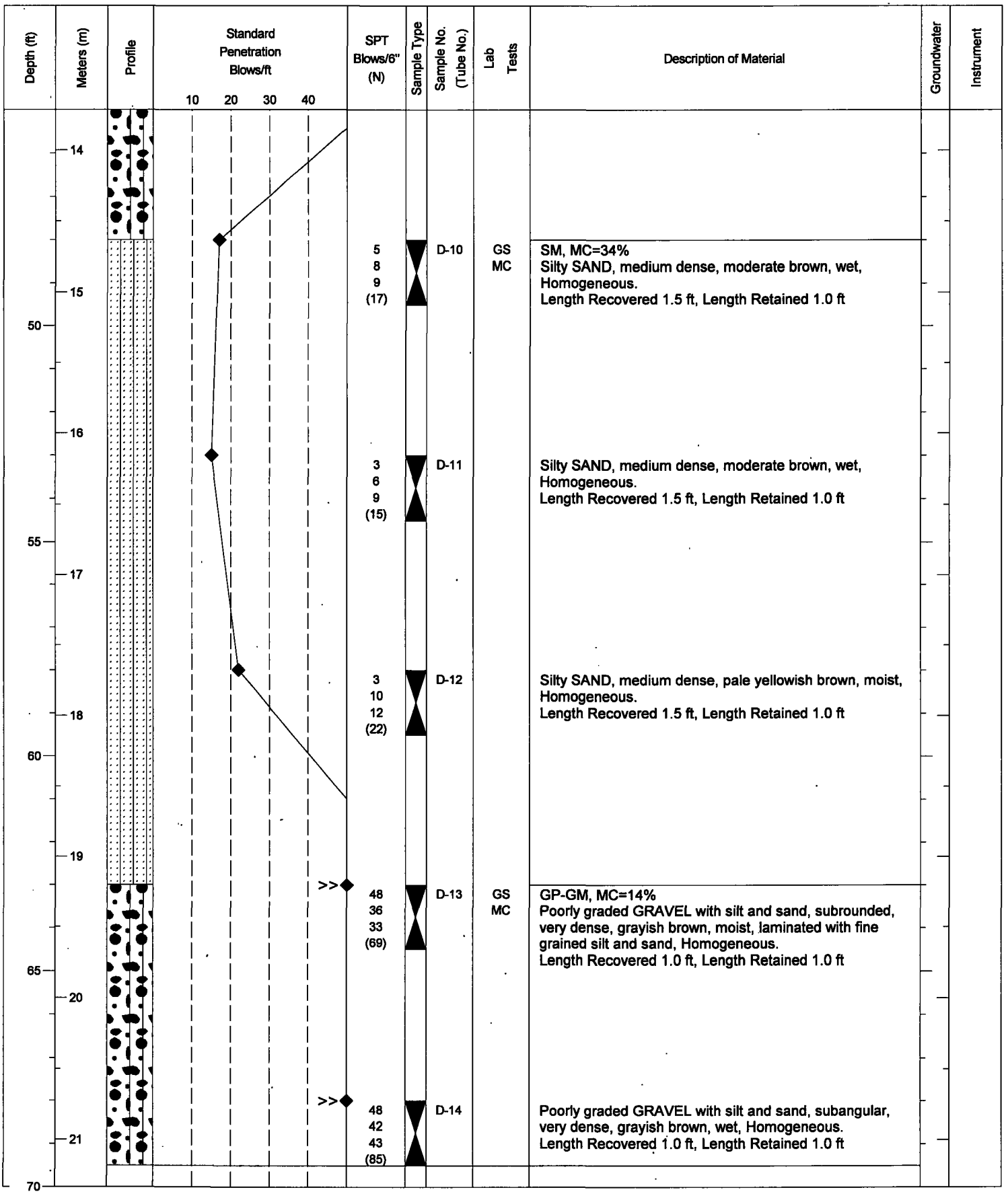
Washington State Department of Transportation

HOLE No. **H-29-00**

Sheet **3** of **4**

PROJECT **112th & Gher Road I/C**

Job No. **OL-2529**



SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:16 A10

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. H-29-00

Sheet 4 of 4

PROJECT 112th & Gher Road I/C

Job No. OL-2529

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22							End of test hole boring at 69.5 ft below ground elevation. Groundwater table encountered at 31.0 ft below ground surface during drilling. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
75	23									
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

SOIL OL2529-1.GPJ SOIL.GDT 10/23/00 8:43:17 A10

APPENDIX-E

LABORATORY TEST DATA

Job No. OL-2529 Date September 28, 2000

Hole No. H-1-98 Sheet 1 of 2

Project SR 500 (112TH. ST.) AND GHER RD. I/C

Laboratory Summary

Washington State Department of Transportation

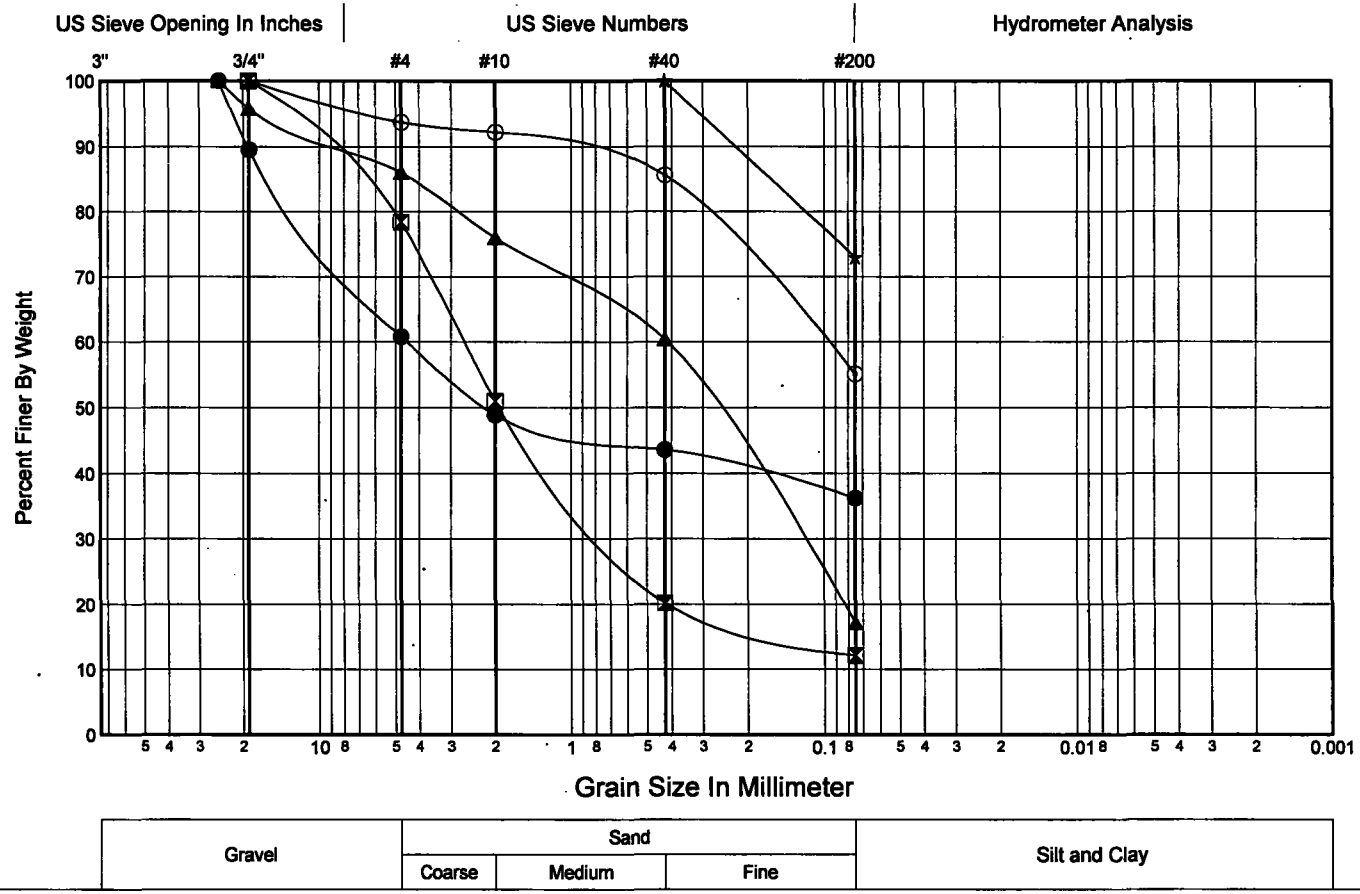
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	3.0	0.91	D-1	GM	SEE BORING LOG	SILTY GRAVEL with SAND		NP	NP	NP
⊠	13.0	3.96	D-5	SM	SEE BORING LOG	SILTY SAND with GRAVEL		NP	NP	NP
▲	15.5	4.72	D-6	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP
★	18.0	5.49	D-7	CL	SEE BORING LOG	LEAN CLAY with SAND		30	17	13
⊙	28.0	8.53	D-9	ML	SEE BORING LOG	SANDY SILT		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	39.2	24.6	36.2		
⊠	21.6	66.3	12.1	3.8	55.5
▲	14.0	68.9	17.1		
★	0.0	27.0	73.0		
⊙	6.3	38.6	55.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	4.48	2.17			
⊠	2.66	1.90	0.70	0.41	
▲	0.42	0.28	0.13	0.08	
★					
⊙	0.10				



Job No. **OL-2529** Date **September 28, 2000**

Hole No. **H-1-98** Sheet **2** of **2**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

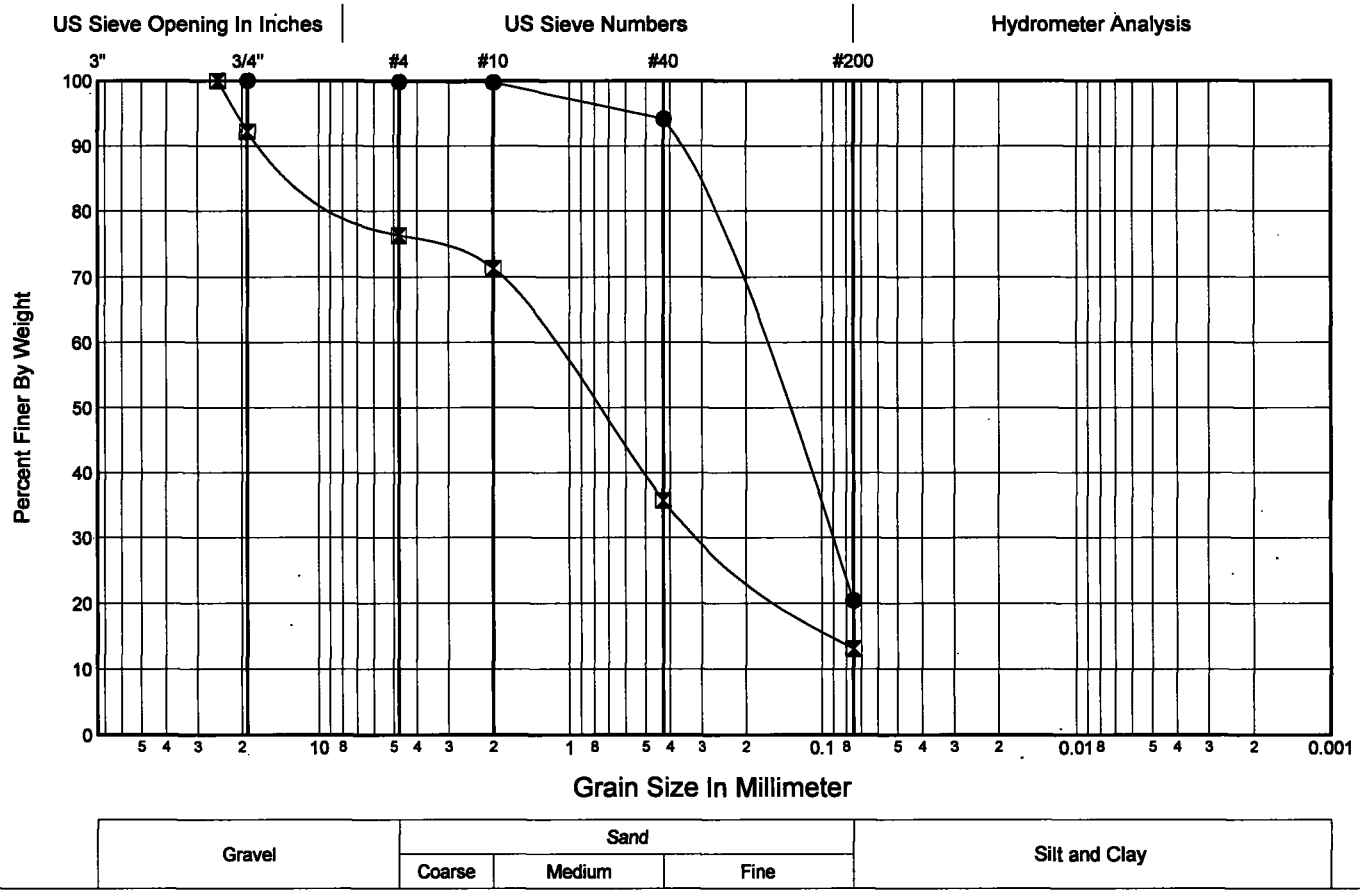
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	48.0	14.63	D-13	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP
⊠	78.0	23.77	D-19	SM	SEE BORING LOG	SILTY SAND with GRAVEL		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.2	79.4	20.4		
⊠	23.7	63.2	13.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.19	0.15	0.09		
⊠	1.22	0.79	0.27	0.13	



Job No. **OL-2529** Date **September 28, 2000**

Hole No. **H-2-98** Sheet **1** of **2**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

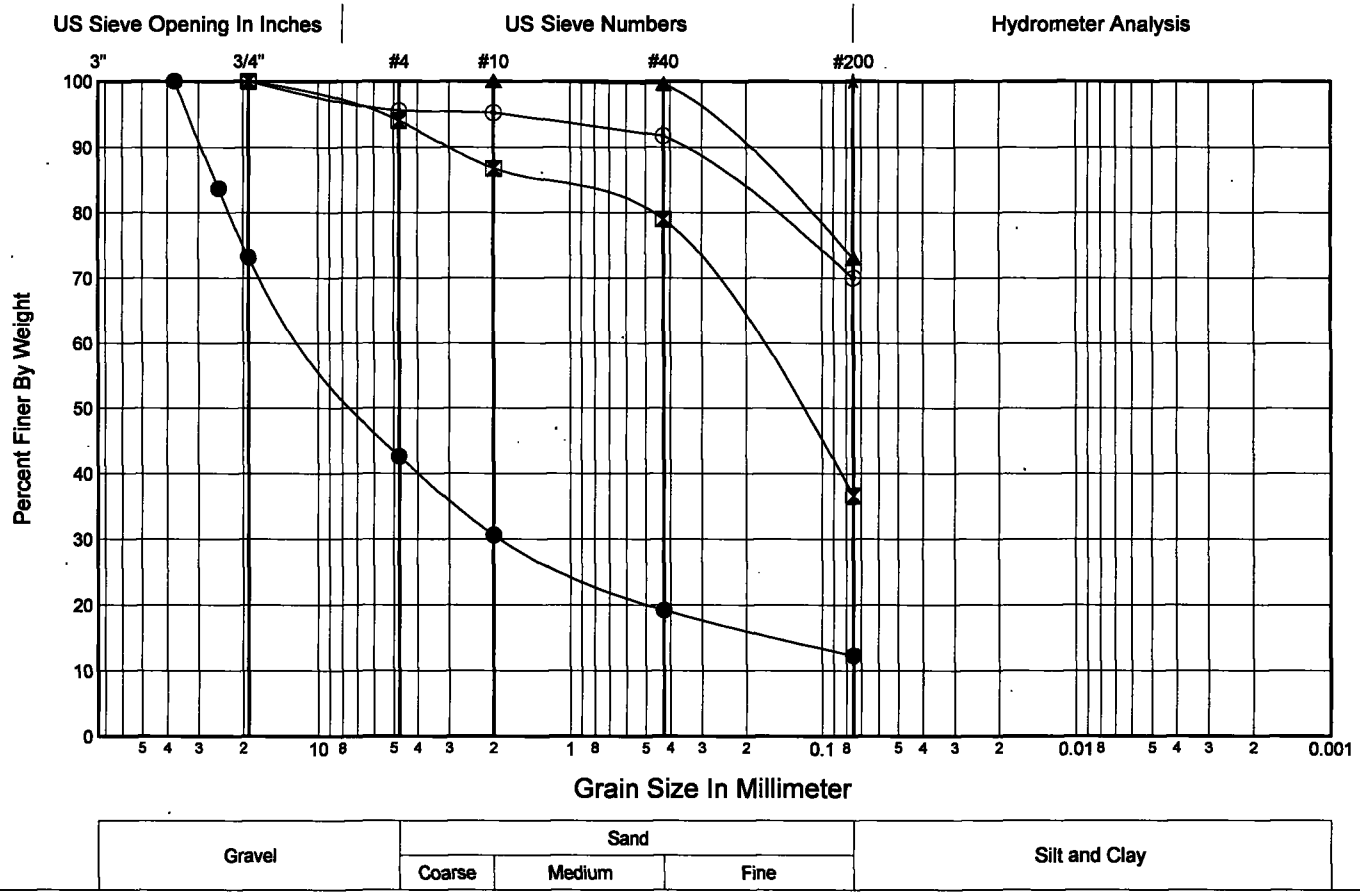
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	6.5	1.98	D-2	GM	SEE BORING LOG	SILTY GRAVEL with SAND		NP	NP	NP
⊠	16.5	5.03	D-6	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP
▲	19.0	5.79	D-7	CL	SEE BORING LOG	LEAN CLAY with SAND		28	17	11
★	20.5	6.25	S-8	ML	SEE BORING LOG	SILT MOISTURE CONTENT TEST ONLY		NP	NP	NP
⊙	24.0	7.32	D-9	ML	SEE BORING LOG	SANDY SILT		46	31	15

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	57.4	30.3	12.3	7.7	248.4
⊠	6.0	57.4	36.6		
▲	0.0	27.0	73.0		
★	0.0	0.0	100.0		
⊙	4.5	25.5	70.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	10.45	6.64	1.84	0.47	
⊠	0.20	0.13			
▲					
★					
⊙					



Job No. **OL-2529** Date **September 28, 2000**

Hole No. **H-2-98** Sheet **2** of **2**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

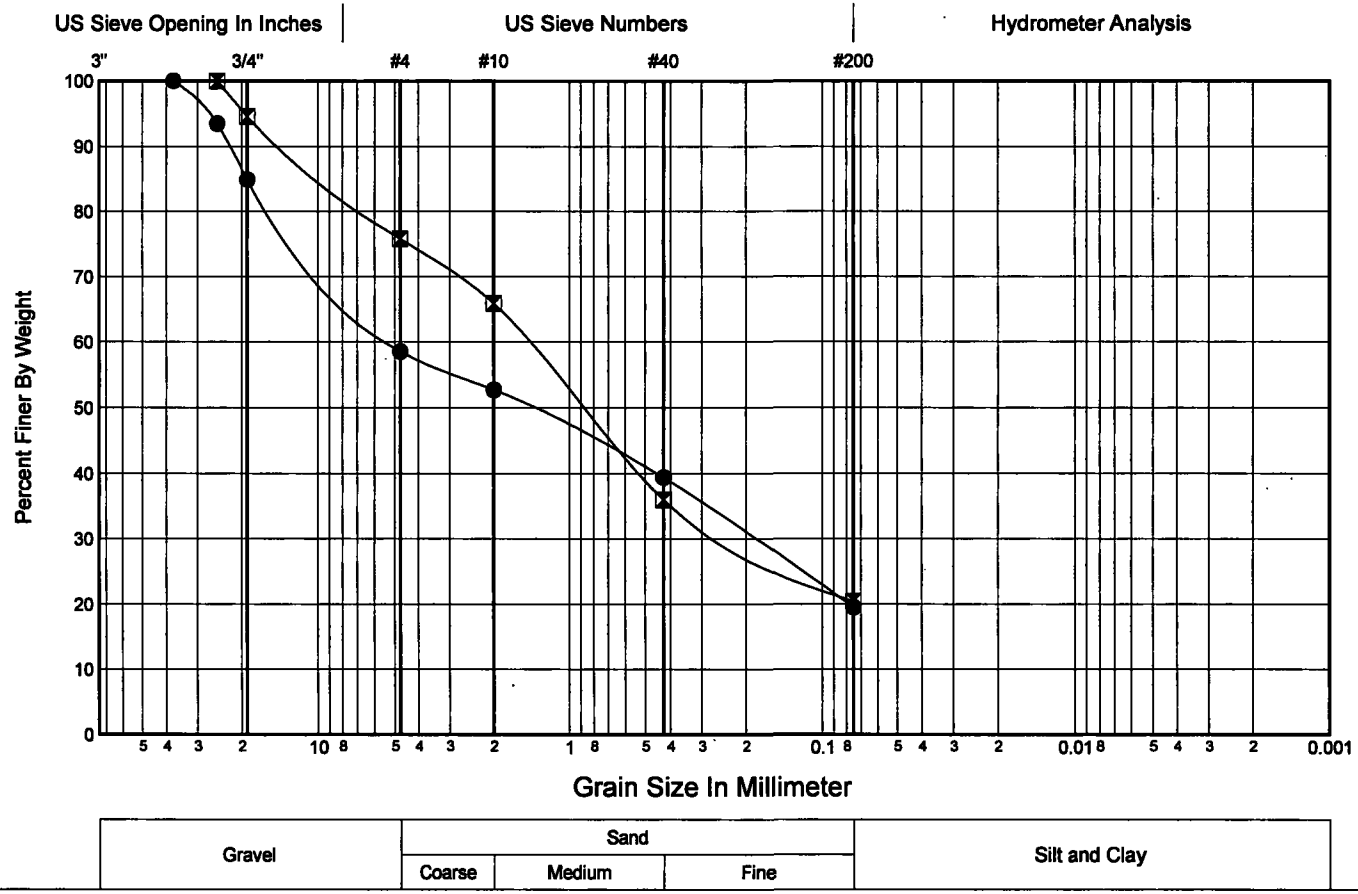
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	43.0	13.11	D-13	GM	SEE BORING LOG	SILTY GRAVEL with SAND		NP	NP	NP
⊠	54.0	16.46	D-15	SM	SEE BORING LOG	SILTY SAND with GRAVEL		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	41.5	39.0	19.5		
⊠	24.2	55.4	20.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	5.14	1.46	0.19	0.08	
⊠	1.47	0.88	0.22		



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Hole No. **H-3-98** Sheet **1** of **2**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

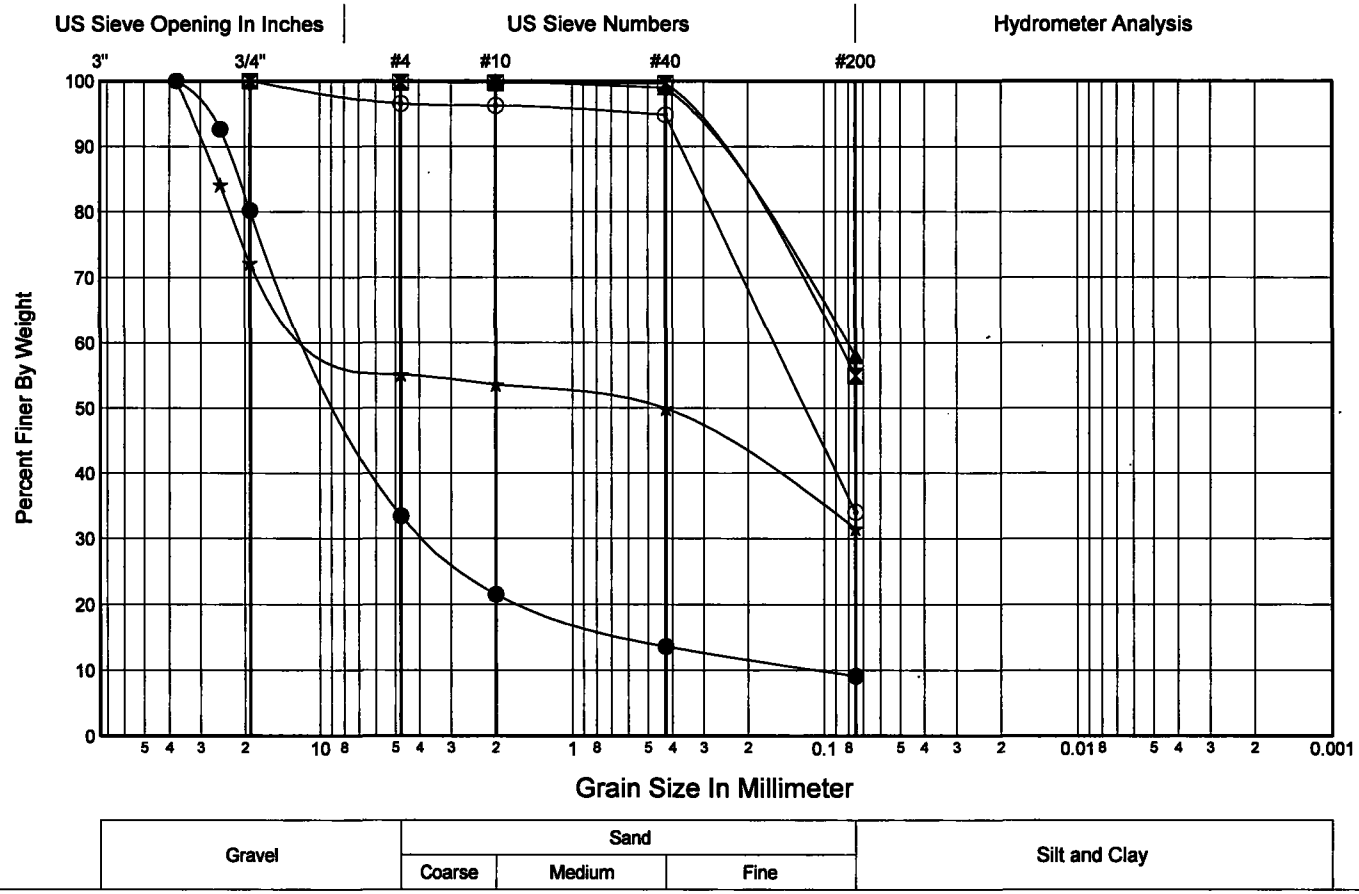
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	6.0	1.83	D-2	GP-GM	SEE BORING LOG	POORLY GRADED GRAVEL with SILT and SAND		NP	NP	NP
⊠	18.5	5.64	D-7	ML	SEE BORING LOG	SANDY SILT		NP	NP	NP
▲	23.5	7.16	D-8	CL	SEE BORING LOG	SANDY LEAN CLAY		22	13	9
★	33.5	10.21	D-10	GM	SEE BORING LOG	SILTY GRAVEL with SAND		NP	NP	NP
⊙	43.5	13.26	D-12	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	66.6	24.3	9.1	12.4	98.4
⊠	0.2	44.9	54.9		
▲	0.0	42.1	57.9		
★	44.9	23.6	31.5		
⊙	3.5	62.5	34.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	10.44	7.77	3.71	1.49	0.11
⊠	0.09				
▲	0.08				
★	7.07	0.44			
⊙	0.16	0.12			



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Hole No. **H-3-98** Sheet **2** of **2**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

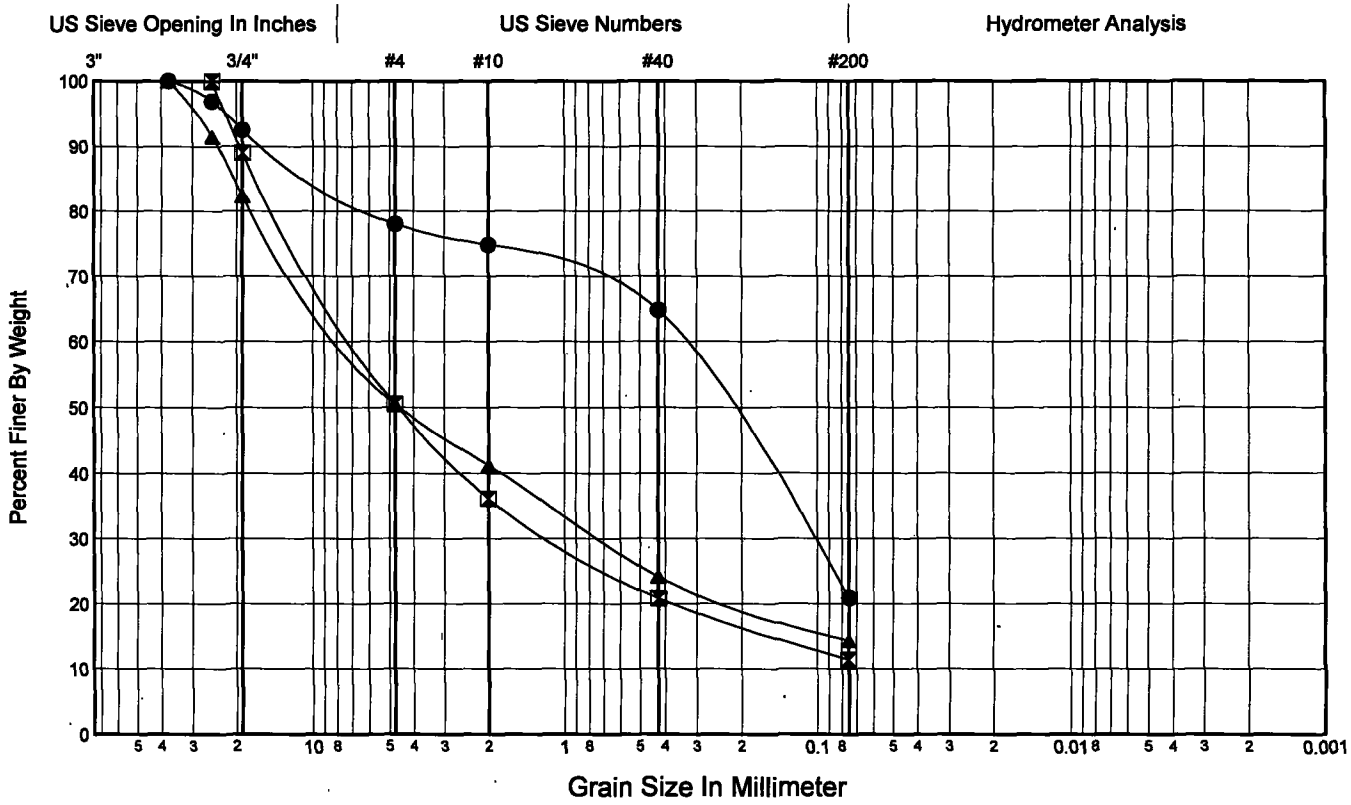
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	53.5	16.31	D-14	SM	SEE BORING LOG	SILTY SAND with GRAVEL		NP	NP	NP
⊠	58.5	17.83	D-15	GW-GM	SEE BORING LOG	WELL-GRADED GRAVEL with SILT and SAND		NP	NP	NP
▲	73.5	22.40	D-18	GM	SEE BORING LOG	SILTY GRAVEL with SAND		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	22.0	57.1	20.9		
⊠	49.5	39.1	11.4	3.0	115.4
▲	49.5	36.2	14.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.35	0.24	0.11		
⊠	6.69	4.61	1.08	0.37	
▲	7.19	4.53	0.73	0.21	



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Hole No. **H-4-98** Sheet **1** of **1**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

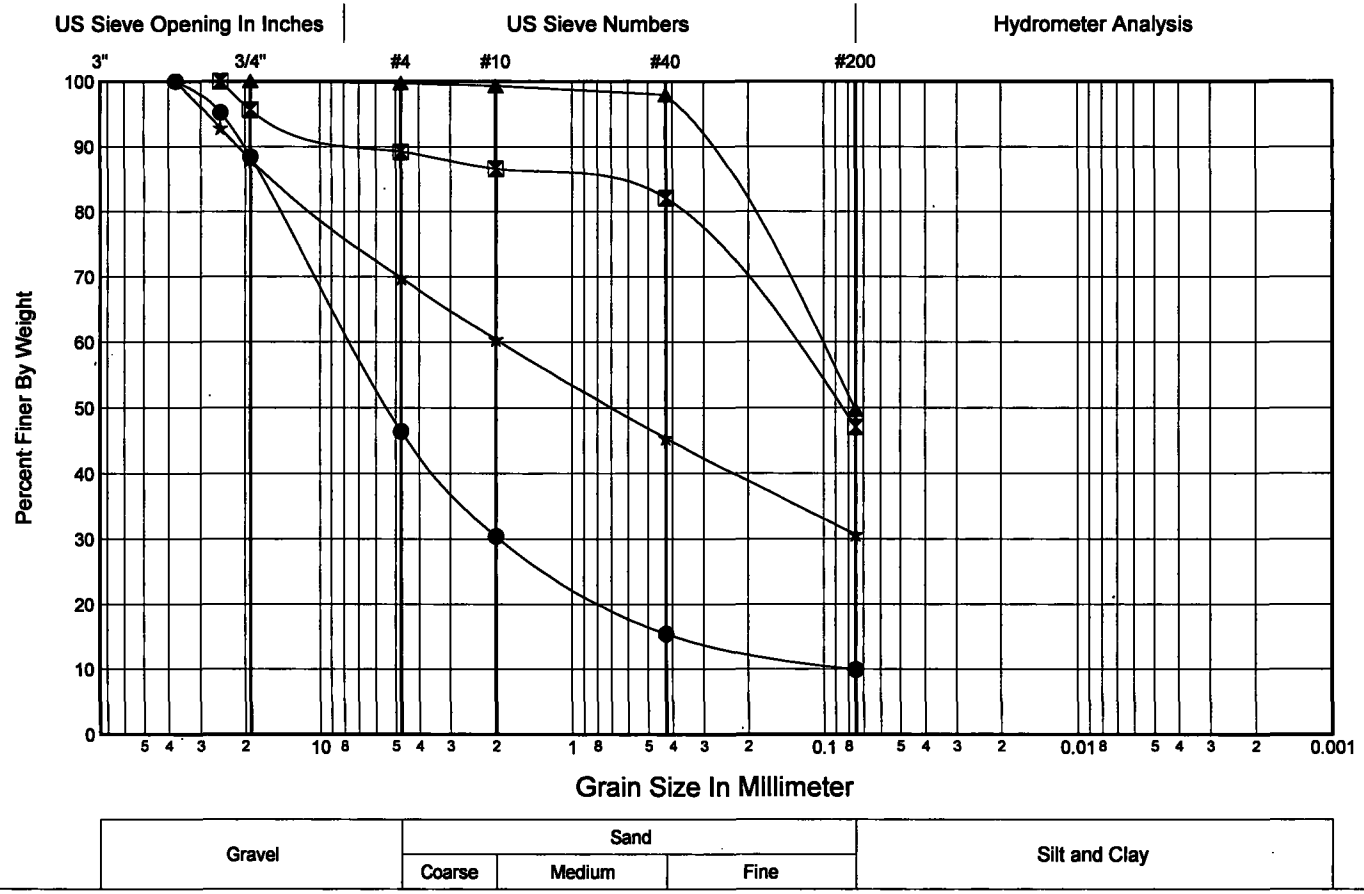
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	11.5	3.51	D-5	GP-GM	SEE BORING LOG	POORLY GRADED GRAVEL with SILT and SAND		NP	NP	NP
⊠	19.0	5.79	D-8	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP
▲	24.0	7.32	D-9	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP
★	34.0	10.36	D-11	SM	SEE BORING LOG	SILTY SAND with GRAVEL		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	53.6	36.5	9.9	6.4	96.1
⊠	10.8	42.1	47.1		
▲	0.3	50.0	49.7		
★	30.2	39.1	30.7		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	7.44	5.35	1.92	0.68	0.08
⊠	0.14	0.09			
▲	0.11	0.08			
★	1.92	0.68			



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Hole No. **H-21-98** Sheet **1** of **1**

Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

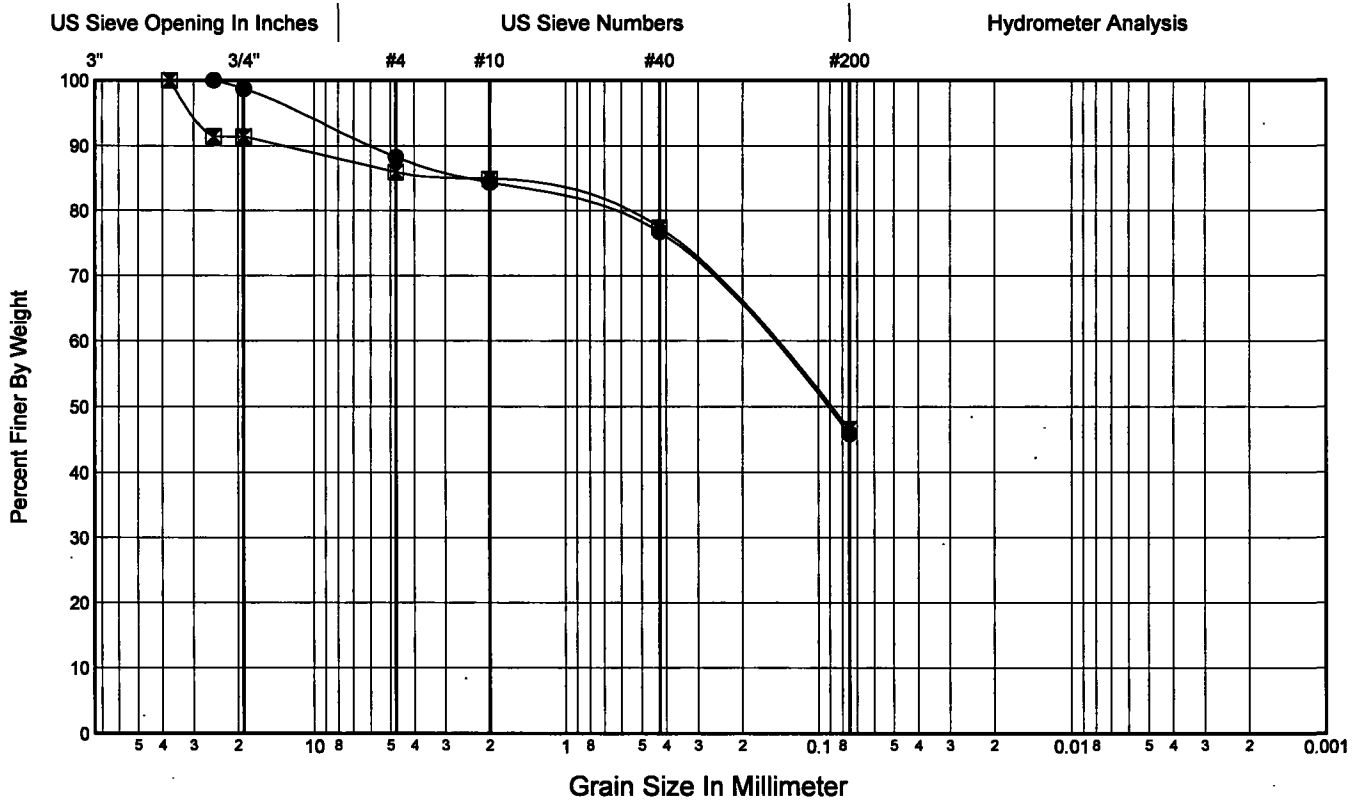
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	28.5	8.69	D-6	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP
⊠	38.5	11.73	D-8	SM	SEE BORING LOG	SILTY SAND		NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	11.8	42.3	45.9		
⊠	14.1	39.3	46.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.17	0.09			
⊠	0.16	0.09			



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Project **SR 500 (112TH. ST.) AND GHER RD. I/C**

Laboratory Summary

Washington State Department of Transportation

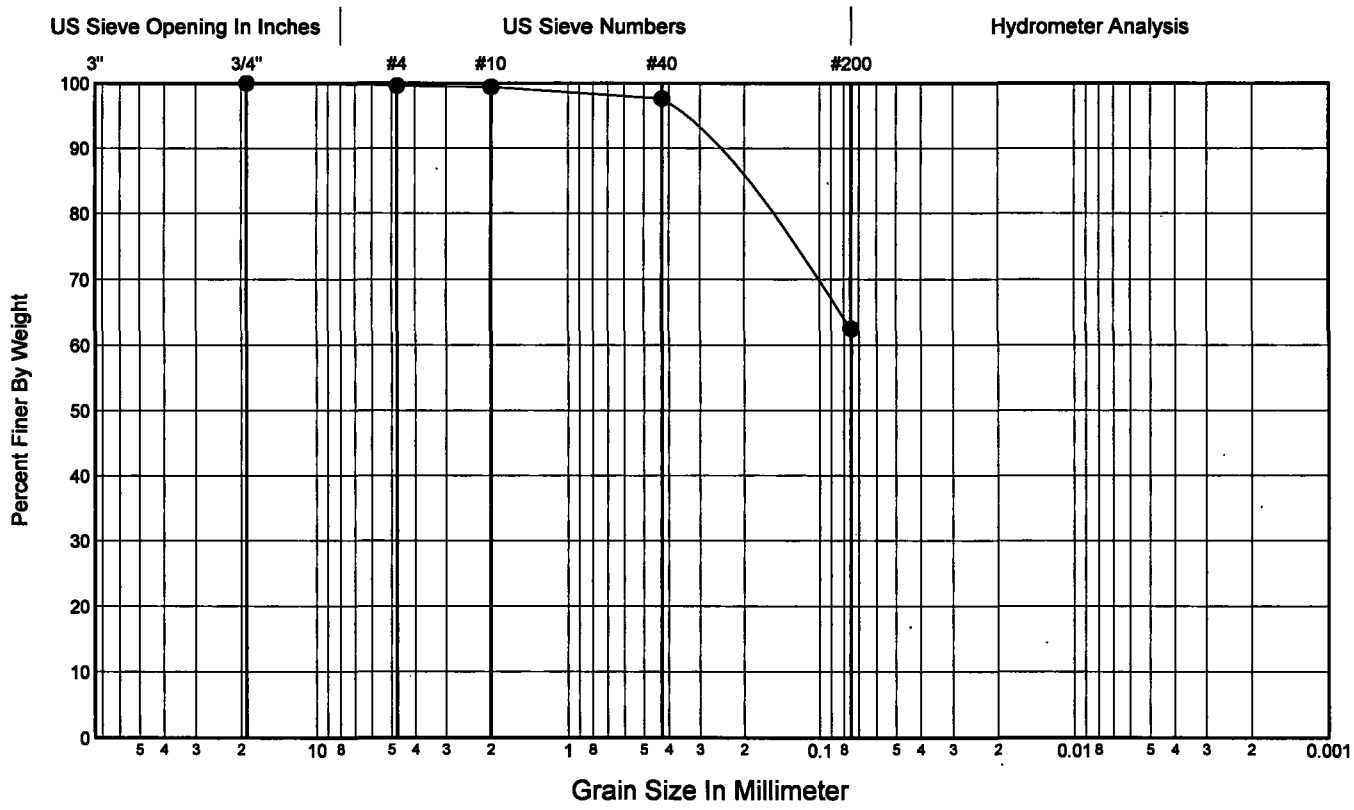
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	24.0	7.32	D-6	CL	SEE BORING LOG	SANDY LEAN CLAY		30	15	15

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.4	37.1	62.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



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Hole No. **H-25-99** Sheet **1** of **1**

Project **112th & Gher Road I/C**

Laboratory Summary

Washington State Department of Transportation

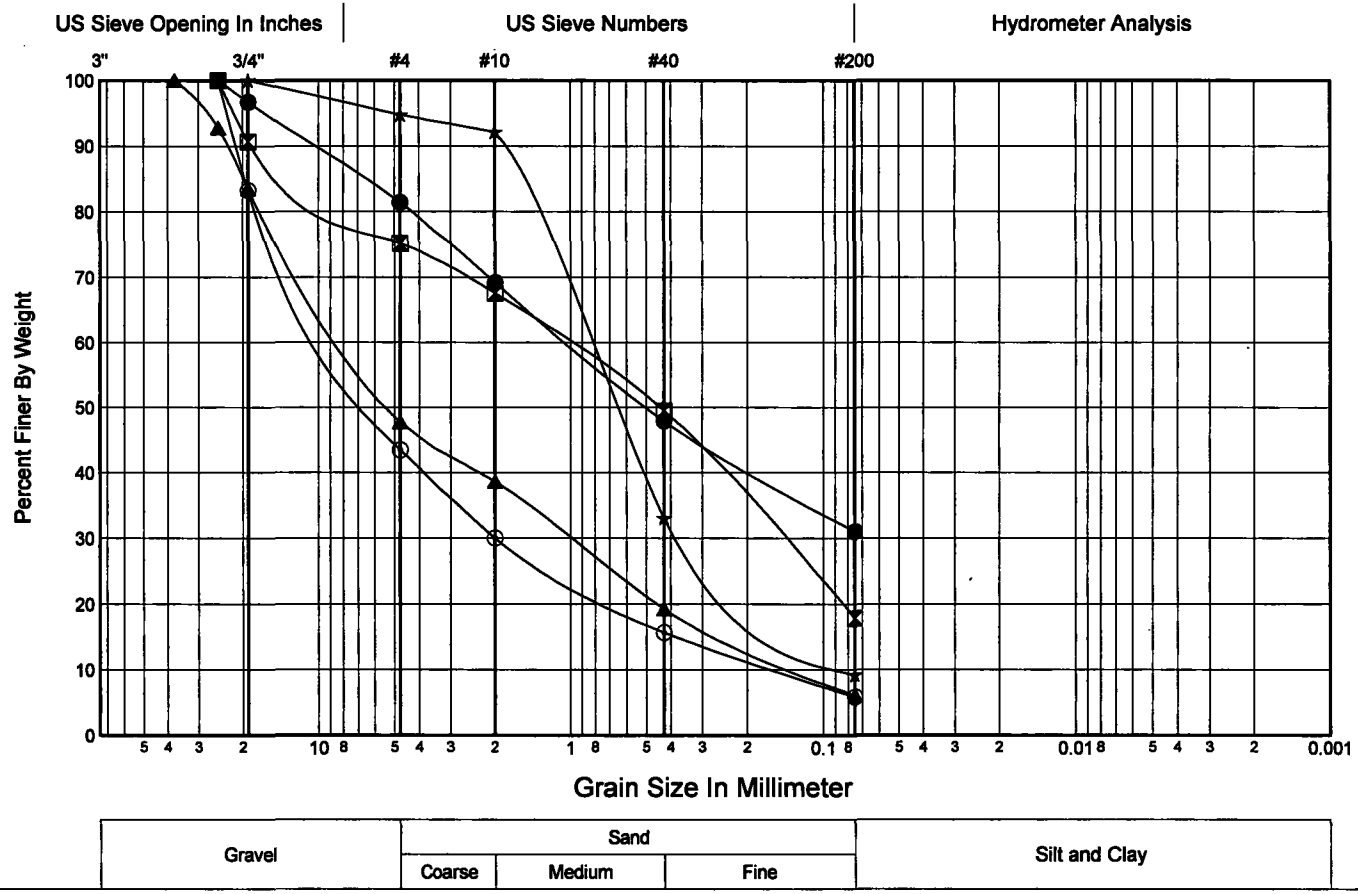
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-3	SM	See Boring Log	SILTY SAND with GRAVEL	36	NP	NP	NP
⊠	24.0	7.32	D-7	SM	See Boring Log	SILTY SAND with GRAVEL	45	NP	NP	NP
▲	29.0	8.84	D-8	GW-GM	See Boring Log	WELL-GRADED GRAVEL with SILT and SAND	29	NP	NP	NP
★	54.0	16.46	D-13	SW-SM	See Boring Log	WELL-GRADED SAND with SILT	25	NP	NP	NP
⊙	69.0	21.03	D-16	GW-GM	See Boring Log	WELL-GRADED GRAVEL with SILT and SAND	9	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	18.6	50.4	31.0		
⊠	24.8	57.3	17.8		
▲	52.3	41.6	6.1	1.1	60.8
★	5.3	85.5	9.2	1.7	10.8
⊙	56.6	37.6	5.8	3.0	54.0

GRADATION VALUES

	D60	D50	D30	D20	D10
●	1.02	0.50			
⊠	1.04	0.44	0.15	0.08	
▲	7.64	5.19	1.01	0.45	0.13
★	0.86	0.66	0.34	0.16	0.08
⊙	8.46	5.97	2.00	0.68	0.16



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Hole No. **H-26-99** Sheet **1** of **1**

Project **112th & Gher Road I/C**

Laboratory Summary

Washington State Department of Transportation

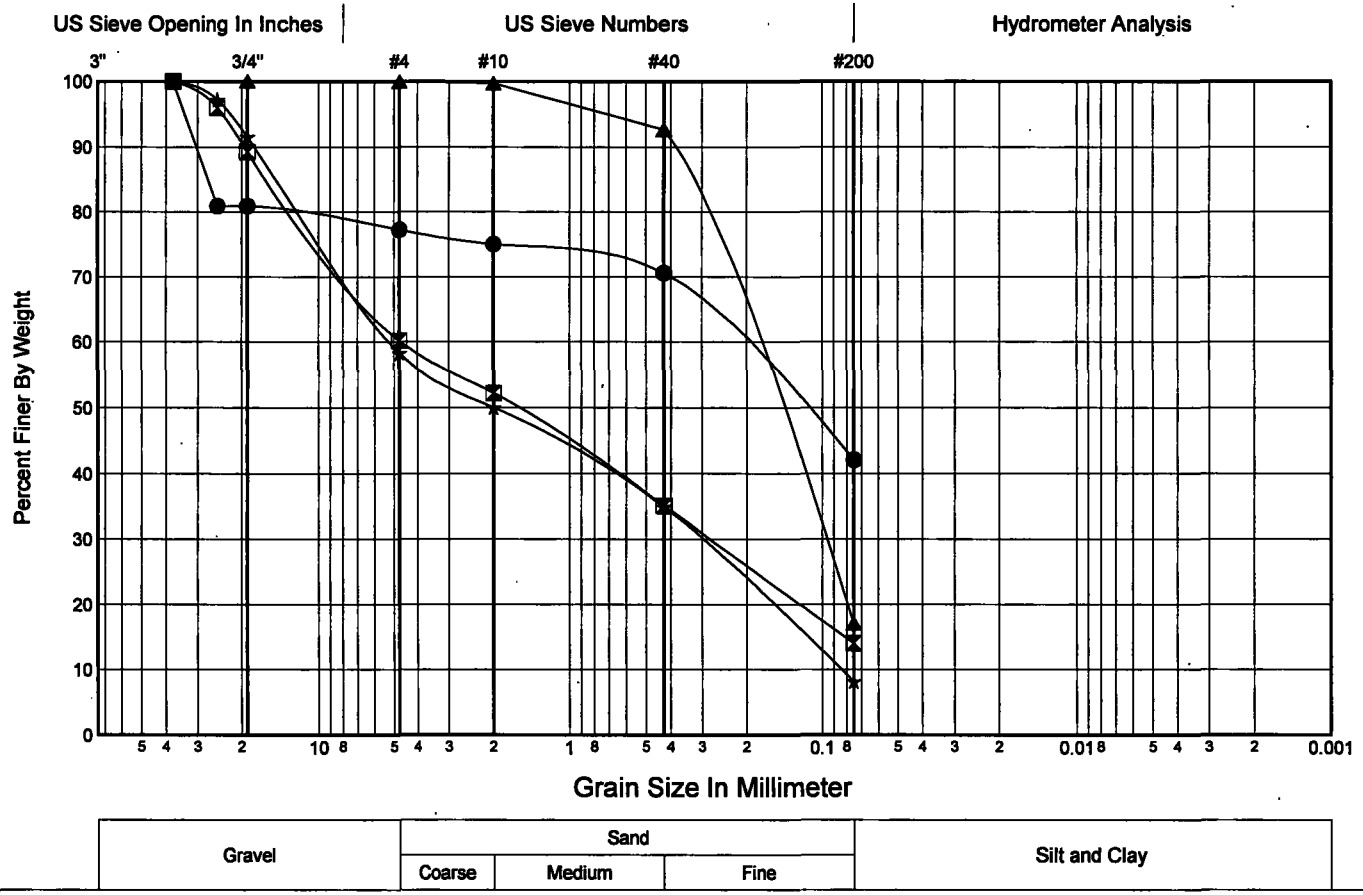
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-3	SM	See Boring Log	SILTY SAND with GRAVEL	27	NP	NP	NP
⊠	29.0	8.84	D-8	SM	See Boring Log	SILTY SAND with GRAVEL	20	NP	NP	NP
▲	54.0	16.46	D-13	SM	See Boring Log	SILTY SAND	21	NP	NP	NP
★	69.0	21.03	D-16	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	17	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	22.7	35.2	42.1		
⊠	39.8	46.2	14.0		
▲	0.0	82.9	17.1		
★	41.8	50.1	8.1	0.2	60.3

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.22	0.12			
⊠	4.67	1.63	0.28	0.12	
▲	0.20	0.16	0.10	0.08	
★	5.11	2.00	0.31	0.16	0.08



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Project **112th & Gher Road I/C**

Laboratory Summary

Washington State Department of Transportation

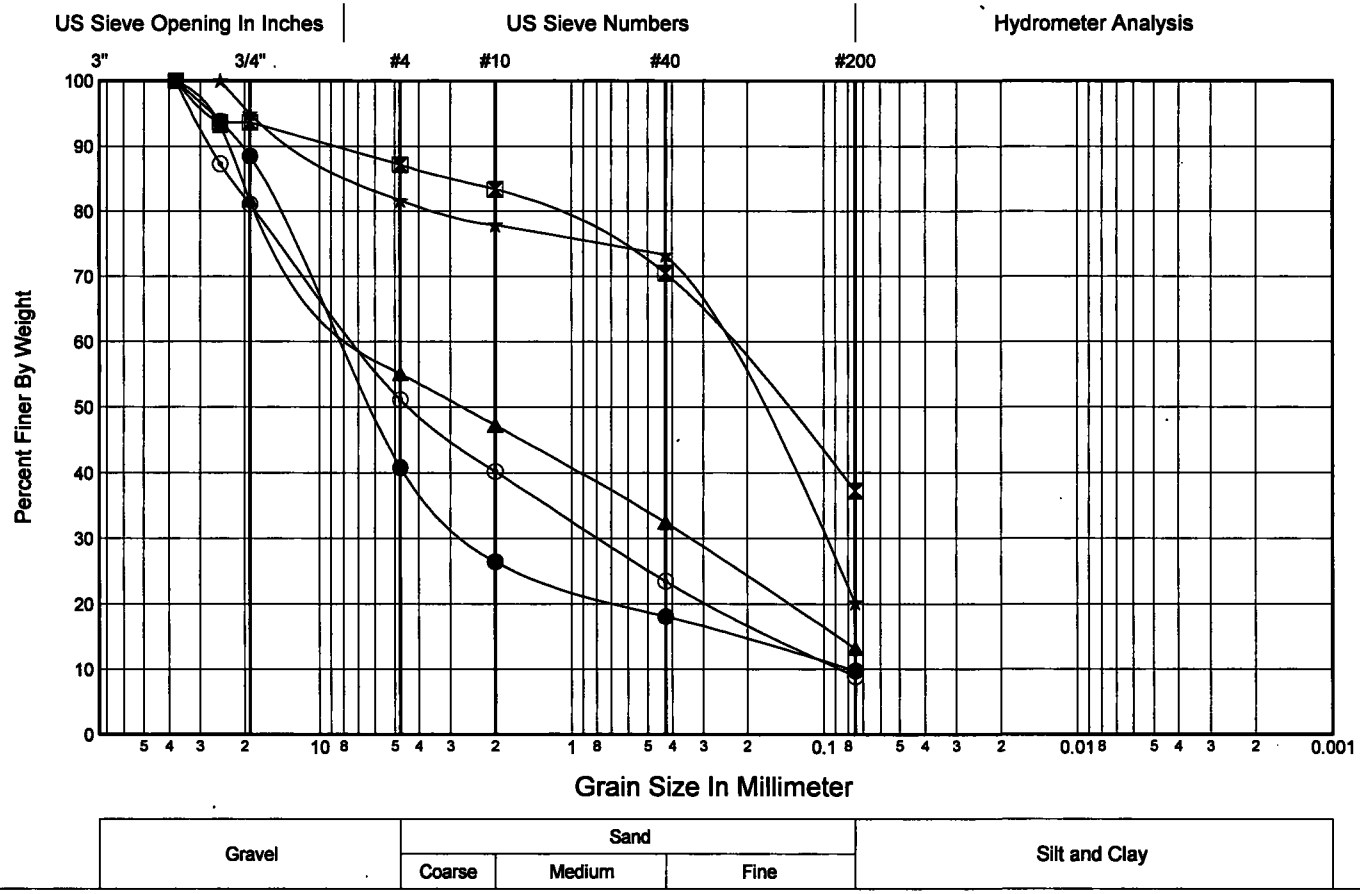
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.0	1.22	D-1	GP-GM	See Boring Log	POORLY GRADED GRAVEL with SILT and SAND	14	NP	NP	NP
⊠	14.0	4.27	D-3	SM	See Boring Log	SILTY SAND	44	NP	NP	NP
▲	28.0	8.53	D-6	GM	See Boring Log	SILTY GRAVEL with SAND	24	NP	NP	NP
★	69.5	21.18	D-17	SM	See Boring Log	SILTY SAND with GRAVEL	21	NP	NP	NP
⊙	74.5	22.71	D-18	GP-GM	See Boring Log	POORLY GRADED GRAVEL with SILT and SAND	14	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	59.2	31.1	9.7	9.4	104.9
⊠	12.8	49.9	37.2		
▲	45.0	41.9	13.2		
★	18.3	61.4	20.2		
⊙	48.9	42.2	8.9	1.0	83.7

GRADATION VALUES

	D60	D50	D30	D20	D10
●	8.30	6.21	2.48	0.61	0.08
⊠	0.25	0.15			
▲	6.15	2.72	0.34	0.14	
★	0.28	0.20	0.10		
⊙	7.17	4.36	0.78	0.28	0.09



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Project **112th & Gher Road I/C**

Laboratory Summary

Washington State Department of Transportation

	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	8.0	2.44	D-2	ML	See Boring Log	SANDY SILT	42	38	28	10
⊠	13.0	3.96	D-3	SM	See Boring Log	SILTY SAND with GRAVEL	29	NP	NP	NP
▲	43.0	13.11	D-9	GP-GM	See Boring Log	POORLY GRADED GRAVEL with SILT and SAND	15	NP	NP	NP
★	48.0	14.63	D-10	SM	See Boring Log	SILTY SAND	34	NP	NP	NP
⊙	63.0	19.20	D-13	GP-GM	See Boring Log	POORLY GRADED GRAVEL with SILT and SAND	14	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	7.8	36.7	55.6		
⊠	30.2	42.6	27.2		
▲	56.7	33.8	9.5	0.6	249.3
★	3.4	78.2	18.4		
⊙	52.5	40.9	6.6	0.6	81.3

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.09				
⊠	1.47	0.58	0.10		
▲	19.70	8.85	0.95	0.24	0.08
★	0.34	0.24	0.11	0.08	
⊙	8.69	5.36	0.74	0.30	0.11