



RECEIVED

Date: December 14, 2005 DEC 19 2005

TO: Dawn Yankauskas/Kate Nichols NB82-7^{WSDOT NWR}/₄₁₂₃₅₈

FROM: ^{NO} N. Dbaibo/^{RW}R. Wilson NB82-29

SUBJECT: Quite Cove Rd. Vic. to SR-20 Spur
XL-0832
Results of Soil Borings for Detention Ponds

This memorandum provides soil and groundwater conditions and recommendations for the design and construction of the subject project. This project will construct three (3) detention ponds along the SR-20 corridor between Sharps Corner and Meadow Creek. The ponds are being constructed to accommodate the additional water runoff that will be created as part of the safety improvements along the corridor.

The conclusions and recommendations contained in this memorandum are based upon the project description, site conditions, as they exist at the time of our subsurface investigation, and subsurface information in our files. It is further assumed that the subsurface conditions, as interpreted from the test borings are representative of the subsurface conditions in the vicinity of the test borings. If during construction, subsurface conditions are different from those encountered in the test borings, or appear to be present beneath or beyond the excavations, we should be contacted so we can assist you and the Construction Office and re-evaluate our recommendations.

Field Investigation

The field investigation program for this project consisted of drilling two (2) test borings in the vicinity of the ponds at each proposed location. The approximate locations of the test borings are shown on Plots 1, 2, and 3 of the Boring Location Plan, attached to this report. With the exception of test borings P2-1-05 and P2-2-05, which were drilled using a CME 45 track drill rig, all test borings completed for this study utilized a CME 850 track drill rig. Soil samples were recovered and selected samples laboratory tested for particle size gradation (Sieve Analysis), pH and resistivity.

Subsurface Conditions

Subsurface conditions in the vicinity of the detention pond were assessed using information from the exploratory borings, sieve analyses results, and groundwater monitoring. Table 1 (see appendix) lists the type of soils encountered in each of the exploratory borings and their respective infiltration rates. A review of Table 1 indicates that soils in the vicinity of the proposed ponds consist predominately of silt, silty sand, and sand. With the exception of soils encountered at a depth of 21-feet below the ground surface (bgs) in boring P1-1-04 and 14-feet bgs in boring P4-2-04, soils underlying the

proposed pond locations have poor infiltration characteristics based on Washington Department of Ecology criteria (WDOE 2001) and WSDOT Highway Runoff Manual, Chapter 4.

The results of groundwater monitoring for the period between June 2004 and November 2005 are summarized in Table 2 and 3 (see appendix). A review of the tables indicates that the depth to groundwater in the vicinity of Pond A exceeded 25.5-feet. In the vicinity of Pond B, groundwater was encountered at depths ranging between 3.8- to 7.4-feet bgs in monitoring well P2-1-04 and at depths ranging between 1.0- to 12.0-feet bgs in monitoring well P2-2-04. In the vicinity of Pond C, groundwater was encountered at depths ranging between 0.5- and 7.4-feet bgs in monitoring well P3-1-04 and at depths ranging between 3.5- and 5.5-feet bgs in monitoring well P3-2-04.

Using an estimated pond invert elevation depth of 56.1-feet for Pond B and 74.1 feet for Pond C (based on ground surface elevations referenced from preliminary pond details obtained from project office), it appears that the groundwater elevation was above the pond invert elevation for Pond B approximately 67 percent of the time based on groundwater elevations measured in monitoring wells P2-1-04 and P2-2-04. For Pond C, the groundwater elevation was above the pond invert elevation approximately 27 percent of the time based on groundwater elevations measured in monitoring well P3-1-04. All groundwater measurements taken in monitoring well P3-2-04 indicate the groundwater level was below the pond invert elevation for Pond C.

pH and Resistivity

Six (6) soil samples were recovered at depths of about 2- to 5-feet below existing grades and tested for pH and resistivity to assist your office in evaluating pipe alternatives. The lab results are summarized in the following table:

Test Hole No.	pH	Resistivity (Ω -cm)
P1-1-04	5.51	12,000
P1-2-04	5.73	6,900
P2-1-04	6.16	5,300
P2-2-04	5.73	3,300
P3-1-04	5.72	7,000
P3-2-04	5.85	12,000

Conclusions and Recommendations

Three detention ponds are planned for the project. Soils in the vicinity of the three ponds are primarily silts, silty sand and sands. Groundwater occurs at a relatively deep depth (>25.5-feet below grade) in the vicinity of Pond A. Groundwater occurs at relatively shallow depths in the vicinity of Ponds B and C and it appears that groundwater levels will be above the proposed invert elevations of Ponds B and C during a portion of each year.

If ponds B and C are built to the current proposed pond invert elevations we recommend that the ponds be lined with a geomembrane liner or a geosynthetic clay liner (GCL) to

separate stored water from groundwater. The liner should be placed at the pond bottom and the side slopes. The geomembrane should consist of a 40-mil PVC liner and separated from the excavated silty and sandy silty subgrade by geotextile for separation and soil stabilization (2006 Standard Specification, Table 3, Section 9-33.2), after the subgrade has been proofrolled. The advantage of using the PVC liner is its extremely low permeability. However its placement will require specialty construction work to ensure proper placement and seaming and the liner needs to be protected from damage during construction and during maintenance operations. As an alternative, a GCL can be used in the same way as a geomembrane. The GCL is a composite material made up of bentonite clay and geotextile. One of the advantages of the GCL is its ability to swell and close any holes in the liner from maintenance operations. In addition, the GCL liner is easier to install than a geomembrane, since no specialty seaming is required.

The liner should be protected with 6-inches of clean sand and another 12-inches of common borrow. In addition, since the water level has the potential to rise above the bottom of the excavation in Ponds B and C, thereby creating hydrostatic uplift pressure on the liner, the hydraulic design needs to ensure that the dead storage in the pond is high enough to counteract the uplift pressures. If the water storage is not high enough, then additional soil should be placed over the liner at a rate of 6-inches of soil for every 12-inches of water head. The ponds side slopes should also be inclined at 3H:1V or flatter to achieve stability.

Pond A can also be constructed using liner options discussed above or as an alternative, fine grained soils excavated during the construction of Pond A may be used as a liner subject to approval from the field inspector.

For ponds with raised embankments, we recommend that the embankments be built using select borrow, per sections 2-03.3(14) B and 9-03.14(2) and compacted using Method C compaction per 2-03.3(14) C. Embankment side slope should be 2H:1V and 3H:1V for the outside and inside slopes, respectively. The inside slopes and bottom of the pond should be lined as described previously.

Depending on the construction season, pond dewatering might be required. Based on the monitoring well data, the water levels are below or close to the proposed invert of the pond between June and September. We recommend that the pond excavations occur between these months to avoid construction dewatering. Some water seepage will probably occur between the sandy and silty layers, however this seepage could be handled by directing the flow into sumps and pumping the water out.

Have to do
one of
these
things?
(for raised
embankments)

Quite Cove Rd. vic. To SR-20 Spur
December 14, 2005

XL-0832
Page-4

We trust the information contained in this report is sufficient so you can complete the design of your project. If you have any questions or require additional information, contact Roger Wilson at (206) 768-5942 or Nabil Dbaibo at (206) 768-5905.

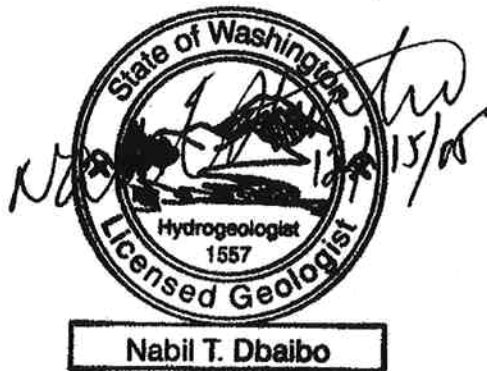
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File: SR-20, XL-0832

Serial No: 05-172

Attachments:

- Table 1. Summary of Soil Types and Soil Infiltration Rates
- Table 2. Summary of Groundwater Monitoring Results (depth in feet below grade)
- Table 3. Summary of Groundwater Monitoring Results (elevations in feet)
- Boring Location Plan Sheets
- Preliminary Pond Detail Sheets
- Boring Test Logs
- Infiltration Calculation Sheets



ATTACHMENTS

Table 1. Summary of Soil Types and Infiltration Rates

POND	Boring Number	Sample Number	Sample Depth (ft)	Soil Type (USCS)	% Passing # 200 Sieve	Infiltration Rates				Hydraulic Conductivity 2003 WSDOT (in/hr)	
						2001 WDOE (in/hr)	Silty Inflow, Lower Bound (in/hr)	Filtered Inflow, Upper Bound (in/hr)	98 WSDOT (in/hr)		Average Value (in/hr) *
A	P1-1-04	D-2	5	ML	59.9	N/A	N/A	N/A	N/A	N/A	2.2
		D-4	9	ML	79.7	N/A	N/A	N/A	N/A	N/A	0.8
		D-7	19	SM	36.7	N/A	N/A	N/A	N/A	N/A	5.9
	P1-2-04	D-8	21	SP-SM	8	1.4	0.3	5.2	1.9	2.3	25.1
		D-1	0	SM	22.9	N/A	N/A	N/A	N/A	N/A	11.3
		D-4	9	ML	61.9	N/A	N/A	N/A	N/A	N/A	1.9
		D-6	14	SM	45.6	N/A	N/A	N/A	N/A	N/A	3.6
		D-7	19	SM	28.8	N/A	N/A	N/A	N/A	N/A	5.5
B	P2-1-04	D-8	24	SM	28.8	N/A	N/A	N/A	N/A	N/A	5.5
		D-1	2	ML	59.8	N/A	N/A	N/A	N/A	N/A	2
		D-3	7	ML	77	N/A	N/A	N/A	N/A	N/A	0.9
	P2-2-04	D-6	14	ML	85.7	N/A	N/A	N/A	N/A	N/A	0.6
		D-10	34	SM	34.1	N/A	N/A	N/A	N/A	N/A	6.9
		D-9	30	ML	78.8	N/A	N/A	N/A	N/A	N/A	0.8
C	P3-1-04	D-1	0	SM	33.7	N/A	N/A	N/A	N/A	N/A	7.5
		D-3	7	ML	71.2	N/A	N/A	N/A	N/A	N/A	1.2
		D-5	12	ML	81.2	N/A	N/A	N/A	N/A	N/A	0.8
	P3-2-04	D-6	14	ML	90	N/A	N/A	N/A	N/A	N/A	0.5
		D-8	24	ML	91.4	N/A	N/A	N/A	N/A	N/A	0.5
		D-10	34	ML	64.5	N/A	N/A	N/A	N/A	N/A	2.8

* Average Value is for 2001 WDOE, Silty Inflow, and Filtered Inflow.

Table 2. Summary of Groundwater Monitoring Results *

Pond	Piezometer	Jun-04	Jul-05	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05
A	P1-1-04	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	nm	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
	P1-2-04	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	nm	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
	P2-1-04	-7.4	-6.9	-7	-6.9	-6.4	-5.6	-5.2	-4.4	nm	-4.1	nm	-3.8	-4.2	-4.6	-5	-5.3	-5.5	-5.4
B	P2-2-04	-11.3	-11.8	-12	-7.9	-8.5	-3.4	-3.3	-3.1	nm	-3	-3.4	-2.6	-2.1	-1.5	-1.5	-1.7	-3.1	-1
	P3-1-04	-3.75	-5.45	-6.95	-7	-3.85	-0.5	-0.6	-0.5	nm	-0.85	-1.4	-3	-4.1	-5.5	-7	-7.1	-3.8	-7.4
C	P3-2-04	-4.75	-5.1	-5.5	-5.5	-5.2	-4.2	-3.9	-3.5	nm	-3.5	-3.5	-3.9	-4.3	-4.8	-5.2	-5.5	-4.6	-5

nm = not measured

*Depths are in feet below the ground surface

Table 3. Summary of Groundwater Monitoring Results *

Pond	Piezometer	Jun-04	Jul-05	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05
A	P1-1-04	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	nm	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
	P1-2-04	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	nm	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
B	P2-1-04	55.2	55.7	55.6	55.7	56.2	57	57.4	58.2	nm	58.5	nm	58.8	58.4	58	57.6	57.3	57.1	57.2
	P2-2-04	51.3	50.8	50.6	54.7	54.1	59.2	59.3	59.5	nm	59.6	59.2	60	60.5	61.1	61.1	60.9	57.5	61.6
C	P3-1-04	72.85	71.15	69.65	69.6	72.75	76.1	76	76.1	nm	75.75	75.2	73.6	72.5	71.1	69.6	69.5	72.8	69.2
	P3-2-04	71.85	71.5	71.1	71.1	71.4	72.4	72.7	73.1	nm	73.1	73.1	72.7	71.3	71.8	71.4	71.1	72	71.6

nm = not measured

*Elevations are in feet and are referenced from elevations obtained from design drawings



LOG OF TEST BORING

Start Card RE00893

Job No. XL-0832 SR 20 Elevation ft (m)

HOLE No. P1-1-04

Sheet 1 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson Lic# 2637T

Site Address _____

Inspector Brian M Breck

Start June 10, 2004 Completion June 10, 2004 Well ID# AHB-995 Equipment CME 850 w/ autohammer

Station 20+77 Offset 135' Rt Casing HQ x 27 Method Wet Rotary

Northing _____ Easting _____ Latitude _____ Longitude _____

County Skagit Subsection SW 1/4 of the SE 1/4 Section 18 Range 2E Township 34

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
0	0									TOPSOIL			
1	0.3					1	▲	D-1		Sandy SILT with gravel, loose, gray and brown, moist, Homogeneous. Length Recovered 1.2 ft			
5	1.5					5	▲	D-2		Sandy SILT with gravel, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
10	3.0					5	▲	D-3		Sandy SILT, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
15	4.5					8	▲	D-4		Sandy SILT, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
20	6.0					11	▲	D-5		Sandy SILT, loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
25	7.5					4	▲	D-6		Sandy SILT with gravel, very loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
30	9.0					6	▲	D-7		Silty SAND with gravel, dense, gray, moist, Homogeneous.			
35	10.5					9	▲						
40	12.0					15	▲						

SOIL XL-0832.GPJ SOIL.GDT 12/8/05,4:08:45 P.12



LOG OF TEST BORING

Start Card RE00893

Job No. XL-0832

SR 20

Elevation ft (m)

HOLE No. P1-1-04

Sheet 2 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson

Lic# 2637T

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
		x x x					30 (45)				Length Recovered 1.5 ft		
7													
25							11 18 26 (44)	D-8			Poorly graded SAND, dense, gray, wet, Homogeneous. Length Recovered 1.5 ft		
8											End of test hole boring at 25.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
9													
30													
10													
35													
11													
40													
12													
45													

SOIL XL-0832.GPJ SOIL.GDT 12/9/05,4:08:45 P:12



LOG OF TEST BORING

Start Card RE00893

Job No. XL-0832 SR 20 Elevation ft (m)

HOLE No. P1-2-04

Sheet 1 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson Lic# 2637T

Site Address _____

Inspector Brian M Breck

Start June 9, 2004 Completion June 9, 2004 Well ID# AHB-996 Equipment CME 850 w/ autohammer

Station 21+01 Offset 82' Rt. Casing HQ x 27 Method Wet Rotary

Northing _____ Easting _____ Latitude _____ Longitude _____

County Skagit Subsection SW 1/4 of the SE 1/4 Section 18 Range 2E Township 34

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
0 - 1	0 - 0.3	(Symbol: x)					1	D-1		Silty SAND with gravel, very loose, brown, moist, Homogeneous. Length Recovered 1.5 ft. Note - Contacted medium dense SILT at - 3.0'.			
1 - 5	0.3 - 1.5	(Symbol: x)					6	D-2		Sandy SILT with gravel, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
5 - 8	1.5 - 2.4	(Symbol: x)					9	D-3		Sandy SILT, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
8 - 10	2.4 - 3.0	(Symbol: x)					7	D-4		Sandy SILT with gravel, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
10 - 14	3.0 - 4.3	(Symbol: x)					4	D-5		Sandy SILT, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
14 - 15	4.3 - 4.6	(Symbol: x)					3	D-6		Silty SAND			
15 - 20	4.6 - 6.1	(Symbol: x)					12	D-7		Silty SAND with gravel, dense, gray, moist, Homogeneous.			

SOIL XL-0832.GPJ SOIL.GDT 12/9/05 4:08:47 P12

06/09/2004



LOG OF TEST BORING

Start Card RE00893

Job No. XL-0832

SR 20

Elevation ft (m)

HOLE No. P1-2-04

Sheet 2 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson

Lic# 2637T

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
7		x x x x x x					22 (43)				Length Recovered 1.5 ft		
25		•••••					15 25 34 (59)	D-8			Poorly graded SAND, very dense, gray, wet, Homogeneous. Length Recovered 1.5 ft		
8											End of test hole boring at 25.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
9													
10													
35													
11													
12													
40													
13													
45													

SOIL_XL-0832.GPJ SOIL.GDT 12/8/05 4:08:47 P12



Washington State
Department of Transportation

LOG OF TEST BORING

Start Card RE00893

Job No. XL-0832

SR 20

Elevation ft (m)

HOLE No. P2-1-04

Sheet 1 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson Lic# 2637T

Site Address _____

Inspector Brian M Breck

Start June 15, 2004

Completion June 16, 2004

Well ID# AHB-997

Equipment CME 45 w/ autohammer

Station 24+40

Offset 118' Lt

Casing HQ x 37

Method Wet Rotary

Northing _____

Easting _____

Latitude _____

Longitude _____

County Skagit

Subsection SW 1/4 of the SE 1/4

Section 18

Range 2E

Township 34

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
										Sod			
1						4		D-1		Sandy SILT with gravel, medium dense, brownish gray, moist, Homogeneous. Length Recovered 1.1 ft			
5						5		D-2		Sandy SILT, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
2						4		D-2					
						5							
						9							
						(14)							
						7		D-3		SILT, medium dense, gray, moist, Homogeneous. Length Recovered 1.5 ft			
						7							
						7							
						(14)							
10						3		D-4		SILT, loose, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft			
						3							
						4							
						(7)							
						1		D-5		Elastic SILT, medium stiff, gray, moist, Homogeneous. Length Recovered 1.5 ft			
						2							
						3							
						(5)					06/15/2004		
						1		D-6		Elastic SILT, soft, gray, moist, Homogeneous. Length Recovered 1.5 ft			
						1							
						1							
						(3)							
						0		D-7		Elastic SILT, very soft, gray, moist, Homogeneous. Length Recovered 1.5 ft			
						0							

SOIL XL-0832.GPJ SOIL.GDT 12/8/05.4:08:49 P12



LOG OF TEST BORING

Start Card RE00893

Job No. XL-0832 SR 20 Elevation ft (m)

HOLE No. P2-2-04

Sheet 1 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson Lic# 2637T

Site Address _____

Inspector Brian M Breck

Start June 14, 2004 Completion June 14, 2004 Well ID# AHB-998 Equipment CME 45 w/ autofammer

Station 23+82 Offset 191' Lt. Casing HQ x 37 Method Wet Rotary

Northing _____ Easting _____ Latitude _____ Longitude _____

County Skagit Subsection SW 1/4 of the SE 1/4 Section 18 Range 2E Township 34

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
1						3	▲	D-1		Sod			
5						4 4 (8)	▲	D-1		Sandy SILT, with sand layers, loose, gray, moist, Homogeneous. Length Recovered 1.0 ft			
2						2 3 3 (6)	▲	D-2		Sandy SILT, with sand layers, loose, brownish gray, moist, Stratified. Length Recovered 1.5 ft			
10						2 2 3 (5)	▲	D-3		SILT, loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
3						1 1 2 (3)	▲	D-4		SILT, very loose, gray, wet, Homogeneous. Length Recovered 1.5 ft			
4						1 1 1 (2)	▲	D-5		SILT, very loose, gray, wet, Homogeneous. Length Recovered 0.2 ft	06/14/2004		
15						0 0 0 (0)	▲	D-6		Elastic SILT, very soft, gray, moist, Homogeneous. Length Recovered 1.5 ft			
6													
20													

SOIL XL-0832.GPJ SOIL.GDT 12/8/05,4:08:51 P12



LOG OF TEST BORING

Start Card RE00893

Job No XL-0832 SR 20 Elevation ft (m)

HOLE No. P3-1-04

Sheet 1 of 2

Project Quiet Cove Rd. to SR-20 Spur.

Driller Jody Dickson Lic# 2637T

Site Address _____

Inspector Brian M Breck

Start June 23, 2004 Completion June 23, 2004 Well ID# AHB-962 Equipment CME 850 w/ autohammer

Station 35+43 Offset 179' Lt. Casing HQ x 37 Method Wet Rotary

Northing _____ Easting _____ Latitude _____ Longitude _____

County Skagit Subsection SW 1/4 of the SE 1/4 Section 18 Range 2E Township 34

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft				SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			10	20	30	40							
0	0												
0.4	0.12					2 3 4 (7)	▲	D-1		Silty SAND, with organics, loose, dark brown, moist, Homogeneous. Length Recovered 0.4 ft			
1.5	0.46					2 4 5 (7)	▲	D-2		Sandy SILT with gravel, loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
2	0.61					2 4 5 (9)	▲	D-3		Sandy SILT with gravel, loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
3	0.91					2 4 4 (8)	▲	D-4		Sandy SILT with gravel, loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
4	1.22					0 0 0 (0)	▲	D-5		Sandy SILT, very loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
5	1.52					0 1 1 (2)	▲	D-6		SILT, very loose, gray, moist, Homogeneous. Length Recovered 1.5 ft			
6	1.83					0 0	▲	D-7		Elastic SILT, very soft, gray, moist, Homogeneous, no HCl reaction			
20	6.10												

SOIL_XL-0832.GPJ SOIL_GDT_12/8/05 4:08:53 P.12

Project	Quiet Cove Rd. to SR-20 Spur		
Project No.	XL-0832		
Boring No.	P1-1-04		
Sample No.	D-2	depth	0.5 to 7.0
Station	Offset		

US Sieve (in./#)	Metric Sieve (mm)	Percent Passing
6	152.5	100
4	101.6	100
2	50.8	100
1 1/2	38.1	100
1 1/4	31.75	100
3/4	19.05	100
3/8	9.5	98
4	4.75	97
10	2	96
20	0.85	94
40	0.425	93
80	0.18	85
200	0.075	59.9

	Infiltration Rate (in/hr)	Infiltration Rate (cm/sec)
D10 (mm)	0.000	N/A
2001 DOE	N/A	N/A
Silty Inflow, Lower Bound	0.000	N/A
Filtered Inflow, Upper Bound	0.000	N/A
98 WSDOT	N/A	N/A
Average Value	0.000	N/A

Hydraulic Conductivity	
	in/hr
2003 WSDOT	2.2
K sat=	1.52E-03

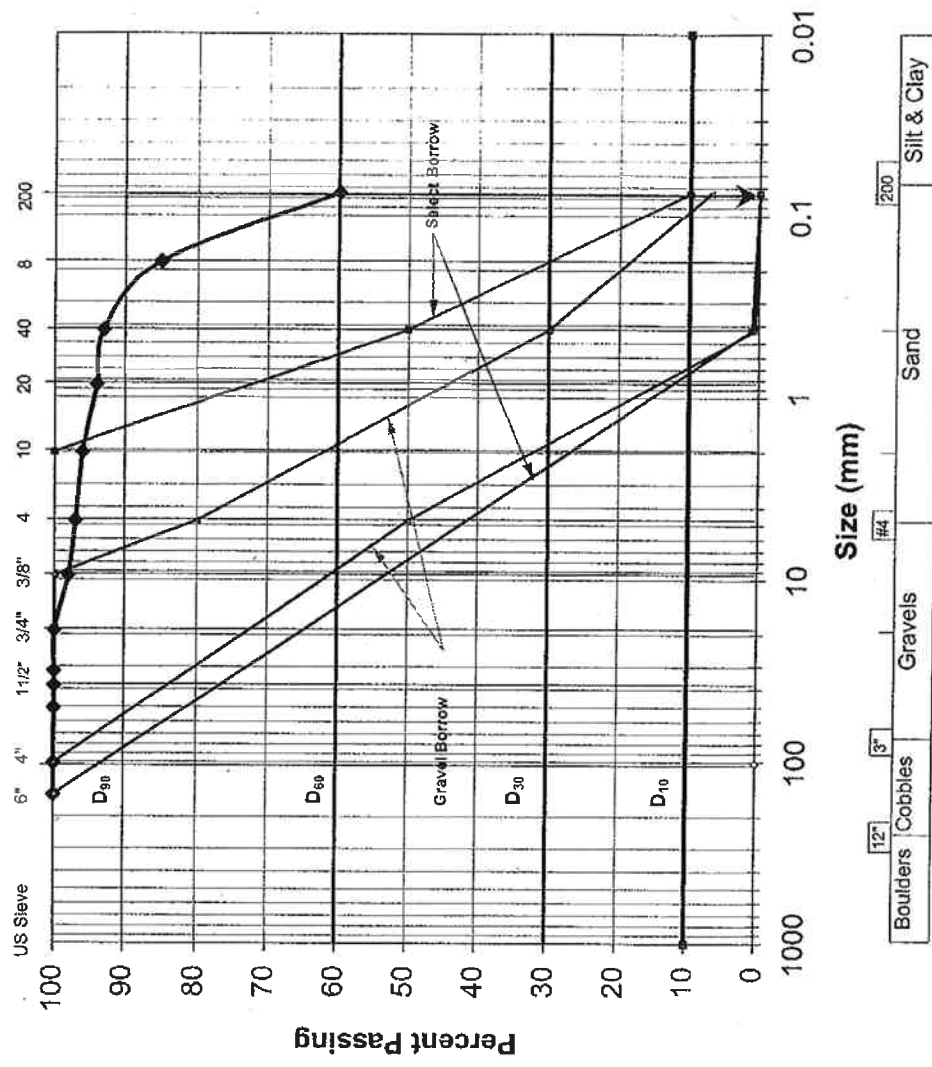
D90 (mm)	0.28
D60 (mm)	0.08
D30 (mm)	
D10 (mm)	0.00

Coefficient of Uniformity	Cu=	N/A
Coefficient of Gradation	Cc=	N/A

Liquid Limit	LL=	
Plastic Limit	PL=	
Plasticity Index	PI=	

Soil Classification: ML

P1-1-04, 0.5 to 7.0 ft



Project	Quiet Cove Rd. to SR-20 Spur		
Project No.	XL-0832		
Boring No.	P1-1-04		
Sample No.	D-4	depth	9 to 10.5
Station	Offset		

US Sieve (in / #)	Metric Sieve (mm)	Percent Passing
6	152.5	100
4	101.6	100
2	50.8	100
1 1/2	38.1	100
1 1/4	31.75	100
3/4	19.05	100
4	9.5	99
10	4.75	98
20	0.85	98
40	0.425	97
80	0.18	93
200	0.075	79.7

D10 (mm)	Infiltration Rate (in/hr)	Infiltration Rate (cm/sec)
0.000	NA	N/A
0.000	N/A	N/A
0.000	N/A	N/A
0.000	N/A	N/A
0.000	N/A	N/A
Average Value	N/A	N/A

Hydraulic Conductivity	
in/hr	cm/sec
K sat= 0.8	5.89E-04

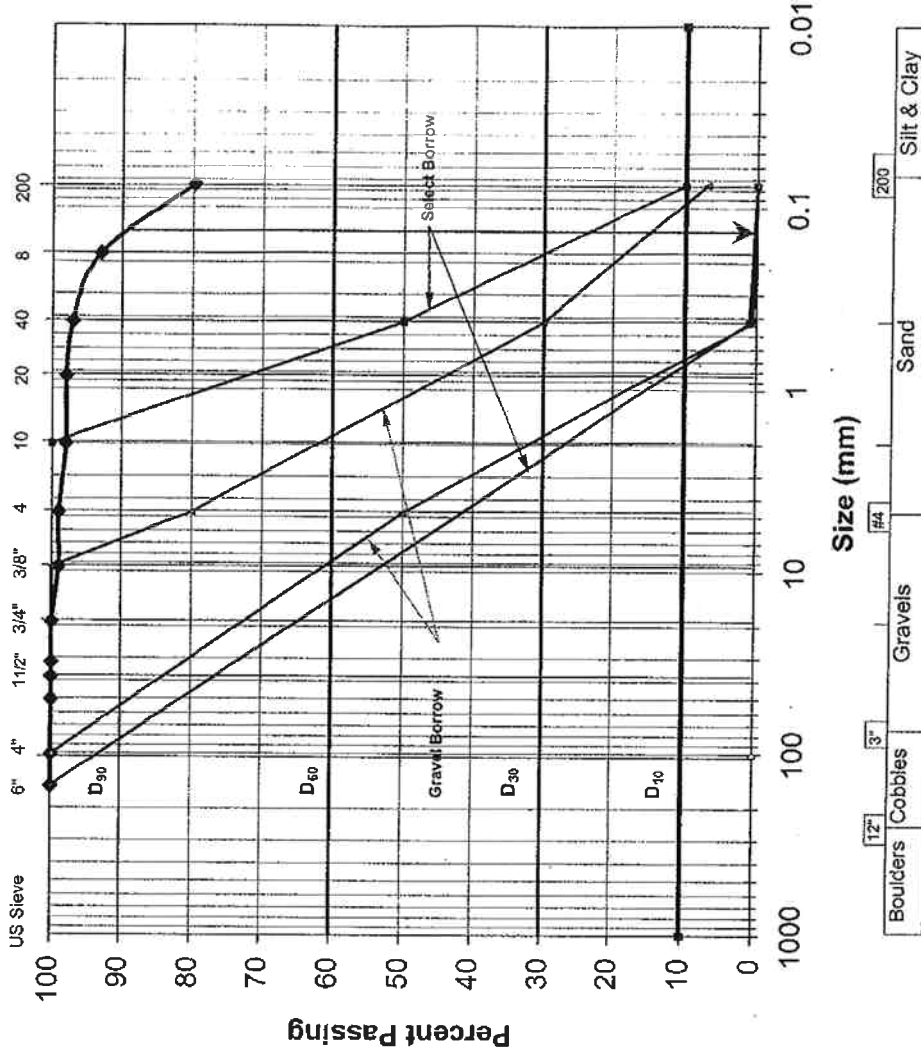
D90 (mm)	0.15
D60 (mm)	
D30 (mm)	
D10 (mm)	0.00

Coefficient of Uniformity	Cu = N/A
Coefficient of Gradation	Gc = N/A

Liquid Limit	LL =
Plastic Limit	PL =
Plasticity Index	PI =

Soil Classification: ML

P1-1-04, 9 to 10.5 ft



Project	Quiet Cove Rd. to SR-20 Spur		
Project No.	XL-0832		
Boring No.	P1-1-04		
Sample No.	D-7	depth	19 to 20.5
Station	Offset		

US Sieve (in / #)	Metric Sieve (mm)	Percent Passing
6	152.5	100
4	101.6	100
2	50.8	100
1 1/2	38.1	100
1 1/4	31.75	100
3/4	19.05	100
3/8	9.5	96
4	4.75	91
10	2	87
20	0.85	83
40	0.425	77
80	0.18	55
200	0.075	36.7

D10 (mm)	Infiltration Rate (in/hr)	Infiltration Rate (cm/sec)
0.000	NA	N/A
0.000	N/A	N/A
0.000	N/A	N/A
0.000	N/A	N/A
0.000	N/A	N/A
Average Value	N/A	N/A

Hydraulic Conductivity	
in/hr	cm/sec
K sat= 5.9	4.16E-03

D90 (mm)	3.90
D60 (mm)	0.21
D30 (mm)	0.00
D10 (mm)	0.00

Coefficient of Uniformity	Cu = N/A
Coefficient of Gradation	Cc = N/A

Liquid Limit	LL =
Plastic Limit	PL =
Plasticity Index	PI =

Soil Classification: SM

P1-1-04, 19 to 20.5 ft

