

FINAL ADDENDUM 1 REPORT

ADDENDUM 1
FISHER SLOUGH RESTORATION
PROJECT
SKAGIT COUNTY, WASHINGTON

REPORT OF GEOTECHNICAL
INVESTIGATION

URS JOB NO. 33761856

Prepared for

Tetra Tech Inc.

1420 5th Avenue, Suite 550

Seattle, Washington 98101

December 15, 2009

URS

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December 15, 2009

Addendum 1 to
Report of Geotechnical Investigation
Fisher Slough Restoration Project
Skagit County, Washington
URS Job No. 33761856

Dear Mr. Cline,

This letter provides Addendum 1 to our Final "Report of Geotechnical Investigation, Fisher Slough Restoration Project" dated December 15, 2009 (URS Project No. 33760911). Work on this portion of the project was performed in accordance with the Task 2 scope identified in the September 18, 2009 email from you to Rod Denherder of URS. A draft version of the report was submitted for review on October 2, 2009.

Please contact the undersigned if questions arise or additional information is required.

Sincerely,



URS CORPORATION

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**ADDENDUM 1 - REPORT OF GEOTECHNICAL INVESTIGATION
FISHER SLOUGH RESTORATION PROJECT
SKAGIT COUNTY, WASHINGTON**

1.0 INTRODUCTION

This is Addendum 1 to the original URS Final “Report of Geotechnical Investigation, Fisher Slough Restoration Project” dated December 15, 2009. This addendum presents the results of an additional geotechnical investigation at the site of the proposed setback levee along the big ditch and Smith B property at Fisher Slough, one mile south of the Town of Conway in Skagit County, Washington.

Following a meeting at The Nature Conservancy (TNC) with Dike District # 3, engineering design review consultant Bob Boudinot, and other associated parties on September 18, 2009, TNC requested that an additional geotechnical investigation be performed and design recommendations provided to address, as needed, any permeable foundation zones along the proposed setback levee, and particularly along the Smith B property in the south half of the levee.

This Addendum 1 provides the results of the additional field explorations and laboratory testing as well as geotechnical recommendations for design and construction of the proposed setback levee. Unless noted otherwise, the following recommendations shall supersede the previous recommendations. However, all other existing recommendations and findings in the original report remain applicable and valid.

2.0 FIELD EXPLORATION PROGRAM

The field exploration program was initiated and completed on September 25, 2009. Nineteen new test pits (TP-7 through TP-25) were excavated and sampled to investigate the subsurface conditions at the site. The numbering of the new test pits is continuous with our previous test pit sequence. Locations of current and previous geotechnical exploratory borings/test pits performed by URS are shown in the attached Figure 1A. The test pits were excavated with a John Deere 410E excavator. The test pit logs are presented in Appendix A1. The test pits were excavated to depths of about 2.5 to 10 feet below existing grade.

The new test pits revealed subsurface conditions at the new locations that are generally consistent with those encountered in our 2008 exploratory borings, and hence are consistent with the estimated soil profile shown in Figure 3 of the January 14, 2009 URS report. An exception is that a zone of gravel or silty gravelly fill (GP/GM) was encountered in the upper approximately 2 feet of the soil profile between Station 24+00 to Station 25+50. This limited gravel/silty gravel zone will be referred to as “Stratum 1A” to distinguish it from the brown silt fill previously identified as Stratum 1 at the site.

This “Stratum 1A” gravel zone was encountered in Test Pits TP-14, TP-17, TP-18 and TP-21, and was typically 2 feet thick. This material was medium dense in character and is expected to be free draining.

The additional test pits did suggest that the upper 1-foot of the Stratum 1 Silt may contain more gravel than originally identified in the previous borings and test pits, but is still essentially a fine grained soil.

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Lab test result on samples in the upper 1-foot of Stratum 1 indicated fines contents ranging from 49 to 93 percent.

Along the Smith B property and south end of setback levee, no groundwater was encountered in the test pits excavated during the current investigation to the maximum 10-foot depth explored. However, water was encountered at a depth of 9.5 feet (Elevation -3.5) in test pit (TP-25) along big ditch near the north end of the proposed levee. The water inflow rate was moderate, presumably originating from a sandy zone (Stratum 2B) at the bottom of a pit where primarily fine grained soil from Stratum 1 and Stratum 2A (or a finer zone within Stratum 2B) occupied the upper 9.5 feet of the profile.

3.0 FIELD AND LABORATORY TESTING

Soil samples were obtained from the test pits for visual classification and laboratory testing for physical properties. Tests were performed to measure moisture content, percent fines, and plasticity (Atterberg Limits test). The results of all tests are presented in Table 1 in Appendix B1. Results of the moisture content and percent fines tests are presented on the test pit logs opposite the sample location. The detailed lab data sheets and plotted results are also presented in Appendix B1. All tests were performed in general accordance with the latest ASTM standards.

Laboratory sieve analysis tests on fourteen samples of Stratum 1 and six samples of Stratum 2A indicate fines contents ranging from 49 to 99 percent and from 58 to 100 percent, respectively. Atterberg Limits tests produced plasticity index (PI) values from 16 to 26 for Stratum 1 (MH) samples and a PI of 12 for a sample of Stratum 2A (ML).

Natural moisture content values for the Stratum 1 Silt ranged from only 6 percent, i.e. much lower than the estimated optimum value, to 55 percent, i.e. much higher than the estimated optimum value as measured in Proctor compaction tests presented in the original geotechnical report.

Pocket penetrometer tests were conducted on fine grained soils to measure the approximate unconfined compressive strength of samples with only minor amounts of sand and gravel. The results are shown on the test pit logs at the depth of the sample tested. The unconfined strength values were typically greater than 1000 psf in the upper 2 feet, dropping to less than about 200 psf (estimated) below a depth of 5 feet. It should be noted that measurements stated as "0 tsf" in the logs don't mean zero strength, but just that the instrument was not sufficiently sensitive to measure the lower strength levels accurately.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The new test exploration program confirmed that the estimated soil profile presented in Figure 3 of the original January 14, 2009 URS geotechnical report for this project is generally accurate for the proposed levee alignment. However, a localized zone of relatively free draining gravel or silty gravel fill was encountered in the upper 2 feet of the soil profile from approximately Station 24+00 to 25+50 in the south half of the levee alignment. This gravel material is being referred to here as Stratum 1A. The Stratum 1A gravel was not encountered in every test pit within the station limits referenced above, thereby suggesting it may not be continuous throughout that area. Elsewhere in this portion of the alignment, the foundation soil consists of low permeability Stratum 1 Silt overlying the Stratum 2A Silt to Clayey Silt. The new test pits have suggested that the gravel content in the upper 1-foot of Stratum 1 may be as high as 51 percent

at some locations, although the considerable portion of fines is expected to dominate the permeability characteristics.

The presence of the zone of Stratum 1A gravel is expected to result in unimpeded seepage beneath the levee in the vicinity of Stations 24+00 to 25+50. Consequently, removal of the material or construction of a shallow cutoff trench using low permeability soils is recommended for this interval. The 4-foot deep by minimum 6-foot wide cutoff recommended in the original URS geotechnical report would be appropriate. Considering the apparently limited thickness of the Stratum 1A gravel, an acceptable alternative would be to reduce the depth of the cutoff to 3 feet, but increasing the minimum width to 8 feet would be prudent in that case.

Since the measured natural moisture content of the foundation soil for proposed levee is at some locations much higher than its optimum moisture content, URS recommends that vibratory compaction methods be avoided to minimize the potential for causing deterioration of foundation soil engineering properties. A sheepsfoot or clubfoot roller is recommended for compaction of the primarily fine grained soil planned for this project.

FIGURES

<u>BORINGS</u>		<u>BEST PITS</u>			
B-1	59ft	TP-1	13ft	TP-16	2.5ft
B-2	39ft	TP-2	13ft	TP-17	2.5ft
B-3	39ft	TP-3	9ft	TP-18	2.5ft
B-4	39ft	TP-4	11ft	TP-19	2.5ft
		TP-5	13ft	TP-20	8ft
AB-1	39ft	TP-6	13ft	TP-21	4ft
AB-2	39ft	TP-7	9ft	TP-22	8ft
AB-3	27.5ft	TP-8	10ft	TP-23	8ft
AB-4	59ft	TP-10	10ft	TP-24	9ft
		TP-11	10ft	TP-25	10ft
		TP-12	10ft		
<u>GROUNDWATER WELLS</u>					
GW-1	20ft	TP-13	10ft	ATP-1	10ft
GW-2	20ft	TP-14	10ft	ATP-2	14ft
GW-3	20ft	TP-15	10ft	ATP-3	12.5ft

Date	
Designed	D. HAWK/D. CLINE/ AUG 2008
Drawn	S. BALENDRA AUG 2008
Checked	R. DENHERDER AUG 2008
Approved	MARTIN MC CABE OCT 2008
Title	

FISHER SLOUGH RESTORATION PROJECT

INVESTIGATION PLAN

SOIL INVESTIGATION PLAN
SKAGIT COUNTY, WASHINGTON



Tetra Tech, Inc.

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File Name

Drawing No.
FIGURE 1A

Sheet 1 of 1

NOT FOR CONSTRUCTION

Appendix A1

Field Exploration

Key to Log of Boring and Descriptive Terms for Soil

Logs of Test Pits TP-7 to TP-25

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Key to Log of Boring and Descriptive Terms for Soil

Unified Soil Classification System (ASTM D2487 & D2488)

Major Divisions			Symbols		Typical Descriptions
			Graph	Letter	
Coarse Grained Soils More than 50% of No. 200 Sieve Size	Gravels More than 50% of Coarse Fraction Retained in No. 4 Sieve	Clean Gravels (less than 5% fines)		GW	Well-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
				GP	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
		Gravels with Fines (more than 12 % fines)		GM	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sands More than 50% of Coarse Fraction Passing through No. 4 Sieve	Clean Sand (less than 5% fines)		SW	Well-Graded Sands, Gravelly Sands, Little or no Fines
				SP	Poorly Graded Sands, Gravelly Sands, Little or no Fines
		Sands with Fines (more than 12 % fines)		SM	Silty Sands, Sand-Clay Mixtures
				SC	Clayey Sands, Sand-Clay Mixtures
Fine Grained Soils More than 50% of Material is Smaller than No. 200 Sieve Size	Silts and Clays Liquid Limit Less than 50%			ML	Inorganic Silts and very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
				CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
				OL	Organic Silts and Organic Silty Clays of Low Plasticity
	Silts and Clays Liquid Limit Greater than 50%			MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils
				CH	Inorganic Clays of High Plasticity, Fat Clays
				OH	Organic Clays of Medium to High Plasticity, Organic Silts
		Highly Organic Soils			PT

Abbreviations

SA	Sieve Analysis
M	Moisture
DD	Dry Density
AL	Atterberg Limits
HA	Hydrometer Analysis
C	Consolidation
Pc	Constant Head Permeability
Pf	Falling Head Permeability
DS	Direct Shear
TX	Triaxial
TV	Torvane Shear
LV	Laboratory Vane Shear
PP	Pocket Penetrometer
OVA	Organic Vapor Analyzer
OC	Organic Content
N	Number of hammer blows for last 12 inches sampled

Sampler Symbols

	3" O.D. Split Spoon Sample with brass rings		3" O.D. Shelby Tube Sample
	Core		Piston Sample
	Non-standard penetration test		Grab Sample
	2" O.D. Split Spoon with 140lb Hammer and 30-inch drop (SPT)		

Typical Well Graphic Symbols

	One pipe in bentonite pellets		One slotted pipe in filter pack
	One pipe in filter pack		Bentonite Seal

Relative Density or Consistency

Coarse-Grained Soils		Fine-Grained Soils	
Relative Density	N, SPT Blows / ft	Relative Consistency	N, SPT Blows / ft
Very loose sand	0 - 4	Very soft	< 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Medium stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very dense	Over 50	Very stiff	15 - 30
		Hard	Over 30

Minor Descriptors

Trace	0 - 5%
Slightly (clayey, silty, sandy, gravelly)	5 - 12%
Clayey, silty, sandy, gravelly	12 - 30%
Very (clayey, silty, sandy, gravelly)	30 - 50%

Moisture Content

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

NOTES:

- Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.
- Dual Symbols are used to indicate borderline soil classifications

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-7

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	9.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	8.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	Recovery - Inches	Graphic Log	USCS						
0						ML/ CL	Brown clayey SILT/SILT with trace sand/gravel, Medium Stiff, dry [Fill]		92.5	30.1		PP = 0.5 ~0.75 tsf
						ML/ CL	Brown clayey SILT/SILT with trace sand, Very Soft to Soft, moist to dry [Fill]					PP = 0 ~0.25 tsf
5												
	5					ML/ SM	Gray sandy SILT/silty SAND, Very Soft/Loose, moist		50.8	28.6		PP = 0 tsf
0						ML	Gray SILT with gravel, moist, Very Stiff to Hard					PP = 4 tsf
10							terminated at 9 feet at 9.15 Am on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-2

Project: Fisher Slough
 Project Location: Skagit County, Washington
 Project Number: 33760911

Log of Boring TP-8

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.5 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	Recovery - Inches	Graphic Log	USCS						
0						MH/ CH	Brown clayey SILT/SILT with trace sand/gravel, Stiff to Very Stiff, dry [Fill]		94.5	48		PP = 1.5 ~2.5 tsf
5						MH/ CH	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					PP = 0.25 ~0.5 tsf
5						ML	Gray SILT to sandy SILT ,Very Soft, moist			35.6		PP = 0 tsf
0												
10							terminated at 10 feet at 9.45 Am on Friday, 25 th September 2009. No groundwater was encountered during excavation.			29.2		
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-3

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-9

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	6.5 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0							ML/ CL	Brown clayey SILT/SILT with sand/gravel, Stiff to Very Stiff, dry [Fill]			15.7		
5							ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					
5													
0							ML	Gray SILT ,Very Soft, moist					
10													
-5								terminated at 10 feet at 10.15 Am on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
15													
-10													
20													
-15													
25													
-20													
30													

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Figure 1-4

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-10

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% #200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	Recovery - Inches	Graphic Log	USCS					
0						ML/ GM		48.9	10.7		PP = 2.4 tsf
5						MH/ CH		95.5	28.9		PP = 1.5 -2.5 tsf
5											
5											
0						ML			38.7		PP = 0 tsf
10											
-5											
-5											
-10											
-10											
-15											
-15											
-20											
-20											
-25											
-25											
-30											
-30											

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Figure 1-5

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-11

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							ML/ CL			16.4		PP = 2.5 -4 tsf
5							ML/ CL					PP = 1.5 -2.5 tsf
5							ML					PP = 0 tsf
0												
10							terminated at 10 feet at 11.15 Am on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-6

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-12

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							ML/CL		79.2	18.5		PP = 3 ~4 tsf
5							ML/CL		99.2	39.9		PP = 1 ~2.5 tsf
5												
0							ML			41.6		PP = 0 tsf
10												
-5							terminated at 10 feet at 11.25 Am on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-7

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-13

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							ML/CL		64.8	12.4		PP = 3 ~4 tsf
5							ML/CL					PP = 0.5 ~1.25 tsf
5												
0							ML					PP = 0 tsf
10												
-5							terminated at 10 feet at 12.00 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-8

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-14

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% < #200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0							GP	Brown, Poorly graded sandy GRAVEL with silt, Medium Dense, dry [Fill]					
5							MH/ CH	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]		97.7	55.4		PP = 0.25 -0.5 tsf
5							ML	Gray SILT, Very Soft, moist					PP = 0 tsf
0													
10								terminated at 10 feet at 12.15 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
-5													
15													
-10													
20													
-15													
25													
-20													
30													

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Figure 1-9

Project: Fisher Slough
 Project Location: Skagit County, Washington
 Project Number: 33760911

Log of Boring TP-15

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	Recovery - Inches	Graphic Log	USCS						
0						ML/ CL	Brown clayey SILT/SILT with sand/gravel, Very Stiff to Hard, dry [Fill]		84.2	9.7		PP = 2.24 tsf
5						ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					PP = 0.25 -0.75 tsf
5						ML	Gray SILT, Very Soft, moist					PP = 0 tsf
0												
10							terminated at 10 feet at 12.30 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-10

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-16

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	2.5 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0							ML/ CL	Brown clayey SILT/SILT with sand/gravel, Very Stiff to Hard, dry [Fill]			6.8		
5							ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					
								terminated at 2.5 feet at 12.40 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
5													
0													
10													
-5													
15													
-10													
20													
-15													
25													
-20													
30													

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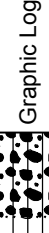

Figure 1-11

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-17

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	2.5 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES				USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							GM					
5							ML/ CL					
							Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill] terminated at 2.5 feet at 12.50 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
5												
10												
15												
20												
25												
30												

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Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-18

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	2.5 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES				USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0						GP/ SP	Brown Poorly graded sandy GRAVEL/gravelly SAND, Medium Dense, dry [Fill]					
5						ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					
							terminated at 2.5 feet at 1.00 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
5												
0												
10												
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-13

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-19

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	2.5 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES				USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0						ML/ CL	Brown clayey SILT/SILT with sand/gravel, Very Stiff to Hard, dry [Fill]			6.7		
5						ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					
							terminated at 2.5 feet at 1.10 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
5												
0												
10												
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-14

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-20

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	8.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0							ML/ CL	Brown clayey SILT/SILT with sand/gravel, Very Stiff to Hard, dry [Fill]					PP = 2 ~4 tsf
5							ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					PP = 0.5 ~1.0 tsf
5													
5													
0							ML	Gray SILT ,Very Soft, moist					PP = 0 tsf
10								terminated at 8 feet at 1.30 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
10													
-5													
15													
15													
-10													
20													
20													
-15													
25													
25													
-20													
30													

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Figure 1-15

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-21

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	4.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES				USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0						GP	Brown Poorly graded sandy GRAVEL with trace silt, Medium Dense, dry [Fill]			13.9		
5						ML/ CL	Brown clayey SILT/SILT with trace sand, Soft to Medium Stiff, moist to dry [Fill]					
5							terminated at 4 feet at 2.00 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
0												
10												
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-16

Project: Fisher Slough
 Project Location: Skagit County, Washington
 Project Number: 33760911

Log of Boring TP-22

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	8.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							ML/ CL					PP = 2-3 tsf
5							ML/ CL					PP = 1-2 tsf
5												
0							ML					PP = 0 tsf
							Gray SILT , Very Soft, moist					
							terminated at 8 feet at 2.30 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
10												
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-17

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-23

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	8.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.0 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							ML/ CL					PP = 2-3 tsf
5							ML/ CL					PP = 1-2 tsf
5												
0							ML					PP = 0 tsf
							Gray SILT ,Very Soft, moist					
							terminated at 8 feet at 2.45 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
10												
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-18

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-24

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	9.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	7.5 feet
Groundwater Level	Not Observed	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log						
0							ML/CL Brown clayey SILT/SILT with/with out trace sand/gravel, Stiff to Very Stiff, dry [Fill]					PP = 2 ~ 3 tsf
5							ML/CL Brown clayey SILT/SILT with trace sand, Medium Stiff to Stiff, moist to dry [Fill]					PP = 1 ~ 1.5 tsf
5												
0							ML Gray SILT ,Very Soft, moist					PP = 0 tsf
0							ML Gray sandy SILT ,Very Soft, moist Hit @ 9 ft: Gray SILT with gravel, moist, Very Stiff to Hard					
10							terminated at 9 feet at 3.30 Pm on Friday, 25 th September 2009. No groundwater was encountered during excavation.					
-5												
15												
-10												
20												
-15												
25												
-20												
30												

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Figure 1-19

Project: Fisher Slough
Project Location: Skagit County, Washington
Project Number: 33760911

Log of Boring TP-25

Sheet 1 of 1

Date(s) Drilled	9/25/09	Logged By	S.Balendra	Checked By	WMM
Drilling Method		Drill Bit Size/Type		Total Depth of Borehole	10.0 feet
Drill Rig Type	John Deere 410E	Drilling Contractor	Catapult Heavy Construction	Approximate Surface Elevation	6.0 feet
Groundwater Level	9.5 feet on 9/25/09	Sampling Method(s)	Grab Sample	Hammer Data	
Borehole Completion		Location			

Elevation feet	Depth, feet	SAMPLES					USCS	MATERIAL DESCRIPTION	Well Completion Schematic	Fines Content (% <#200 Sieve)	Moisture Content, %	Dry Density, (pcf)	REMARKS AND OTHER TESTS
		Type	Number	Blows/ 6in.	Recovery - Inches	Graphic Log							
0							ML	Brown SILT , Soft to Medium Stiff, moist [Fill]					
5							ML	Gray SILT , very soft, moist					
0							ML	Gray Sandy SILT , very soft, moist to wet Large flow & heave @ 10 ft, estimated silty SAND/poorly graded SAND @ 10 ft		58	35.5		
10								9.5 ft ▼					
-5								terminated at 10 feet at 4.30 Pm on Friday, 25 th September 2009. Groundwater was encountered at 9.5' below ground surface (large inflow rate).					
15													
-10													
20													
-15													
25													
-20													
30													

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Figure 1-20

Appendix B1

Laboratory Tests

Table 1: Summary of Laboratory Test Results

Atterberg Limits Results of TP-8, TP-12, TP-12, and TP-14

Table 1: Summary of Laboratory Test Results

Test Pit Number	Sample Depth (ft)	USCS Soil Classification	Stratum No.	Moisture Content (%)	% Fines	Liquid Limit	Plastic Limit	Plasticity Index
TP-7	0-1	ML/CL	1	30.1	92.5			
	5-6	ML/SM	2B	28.6	50.8			
TP-8	0-4	MH	1	48.0	94.5	65	40	25
	5-6	ML	2A	35.6	92.1			
	9-10	ML	2A	29.2	69.3			
TP-9	0-1	ML	1	15.7	76.3			
TP-10	0-1	ML/GM	1	10.7	48.9			
	1-4	MH	1	28.9	95.5	51	35	16
	6-8	ML	2A	38.7	97.2			
TP-11	0-1	ML/CL	1	16.4	78.3			
TP-12	0-1	ML/CL	1	18.5	79.2			
	1-4	ML/CL	1	39.9	99.2			
	6-7	ML	2A	41.6		42	30	12
TP-13	0-1	ML/CL	1	12.4	64.8			
TP-14	2-4	MH	1	55.4	97.7	68	43	25
	5-6	ML	2A	44.9	99.8			
TP-15	0-1	ML/CL	1	9.7	84.2			
TP-16	0-1	ML/CL	1	6.8				
TP-19	0-1.5	ML/CL	1	6.7				
TP-21	0-2	ML/CL	1	13.9				
TP-25	7.5-8.5	ML	2A	35.5	58.0			

