



Geo & Environmental Consulting
Wetlands
Natural Resource Management

EnviroSound Consulting Inc.

Project Information

Project Name: Blue Heron
Client: Team 4
Project #: 08-G006
Project Location: Poulsbo, Washington
Date: 2/18/2008

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PLANNING

Company Information

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EnviroSound Consulting Geotechnical Consulting • Wetlands • Natural Resource Management

18 February 2008

Project: ESC08-G006

Team 4 Engineering
5823 N. E. Minder Road
Poulsbo, Washington 98370

Attention: Mark Kuhlman

Subject: Geotechnical Engineering Infiltration Report
Blue Heron Development
Blue Heron Lane
Poulsbo, Washington

Dear Mr. Kuhlman:

Submitted herewith is a report for EnviroSound Consulting, Inc's geotechnical infiltration investigation for the subject project. The report presents our findings from our limited geotechnical investigation and provides recommendations for geotechnical infiltration aspects of project design and construction.

We appreciate the opportunity to work with you on this project. If we can be of further assistance, or if you have any questions regarding this project, please contact our office.

Sincerely yours,

Shawn E. Williams, L.E.G
Senior Engineering Geologist

Enclosures



Shawn E. Williams

2-18-08

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1.0 INTRODUCTION

EnviroSound Consulting, Inc. (EnviroSound) was retained by Team 4 Engineering to conduct a limited geotechnical investigation for the proposed Blue Heron PRD/Plat at Heron Pond Lane NE in Poulsbo, Washington. The purpose of this investigation was to determine the general subsurface conditions by excavating test pits at the site and provide recommendations for the geotechnical infiltration aspects of the project in accordance with the City of Poulsbo Aquifer Recharge criteria.

1.1 Site Location

The site is located in Poulsbo in Kitsap County, Washington. The subject property is located on the east side of Noll Road NE and bordered on the south by Heron Lane NE. Currently the site is a working horse ranch, with various structures supporting this enterprise. There are also two residences on the subject property. The site is located in Section 24, Township 26 North, Range 1 East of the Willamette Meridian, as shown on Figure 1.

1.2 Proposed Construction

EnviroSound understands that the proposed development consists of constructing eighty four single family residences and associated parking, roadways, and landscaping. Foundation loads were not provided, as this report is to address infiltration on the proposed site only. It is our understanding that stormwater from the project will be directed to a proposed stormwater detention pond on the southeastern portion of the property.

1.3 Purpose

The purpose of this investigation was to estimate general subsurface conditions by performing explorations at the project site and to provide recommendations for the possible infiltration aspects of the project.

2.0 SITE INVESTIGATION

2.1 Site Description

The site is currently a working horse ranch. It currently is pasture and vegetated with both evergreen and deciduous trees, grasses, scotch broom, and blackberry hedges. Single family residences (SFR) lie to the east and north. To the west is Noll Road NE with SFRs beyond. To the south is Heron Pond Lane with SFRs beyond.

2.2 Geologic Setting

The subject site lies within the central Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved with a depositional and erosional history including at least four separate glacial advance/retreats. The Puget Lowland is bounded on the west by the Olympic Mountains and on the east by the Cascade Range. The lowland is filled with glacial and nonglacial sediments consisting of interbedded gravel, sand, silt, till, and peat lenses.

The Washington Division of Geology and Earth Resource (WDGER), Geologic Map of Washington – Northwest Quadrant, dated 2002, indicates that the site is mapped as Glacial Till (Qgt). Till is described as an unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel, and boulders deposited by glacial ice.

The Geologic map of surficial deposits in the Seattle 30' by 60' quadrangle, Washington, by Yount et al., dated 1993 indicates the site is mapped as Vashon Till (Qvt). Vashon Till is described similarly to the WDGER description for Glacial Till.

The USDA-NRCS Soil Survey of Kitsap County Area, Washington, 2006, indicates the following soil types are found on the property:

- Kapowsin gravelly loam (0-6% slopes) on the northeastern and central 50% of the property
- Poulsbo gravelly sandy loam (0-6% slopes) on the western and southeastern 50% of the property

The soil survey description of these soil types is summarized in the following table.

USDA Soil Survey Name	22—Kapowsin gravelly loam	39—Poulsbo gravelly sandy loam 0-6%
USDA Textural Classification & USCS Soil Type	0-5 inches, Gravelly loam, GM, ML, SM 5-23 inches, Gravelly loam, Loam, Silt Loam, ML, SM 23-60 inches, Very gravelly sandy loam, GM, SM	0-2 inches, Gravelly sandy loam, SM 2-24 inches, Gravelly sandy loam, gravelly loam, SM 24-60 inches, Very gravelly sandy loam, GM, SM
Origination	Glacial till	Glacial till
Permeability	Moderate above hardpan, very slow through pan	Moderate above hardpan, very slow through pan
Drainage	Excessively drained	Moderately well drained
Surface Runoff	Slow	Slow
Erosion Hazard	Slight	Slight
Capability Subclass	IIIw	IVw

A review of “Slope Stability, Kitsap County, Washington”, Jerry Deeter, 1979, was performed in conjunction with preparing this study. The subject property and surrounding area has been mapped as Stable (S). Stable slopes are generally less than 15 percent but can include areas of steeper slopes that are stable due to low groundwater concentration or competent bedrock. The stable slope designation also includes areas underlain by weak material such as peat, which are stable because they have no significant slope.

2.3 Subsurface Exploration

Subsurface exploration consisted of twelve test pits (TP-1 through TP-12) excavated on 30 January 2008. Test pits were located on the property as shown on Figure 2. Test pits were excavated using a back hoe provided by Hemley’s Excavation. Test pits were excavated to depths of 5 to 10 feet below the ground surface (bgs). Grab soil samples were collected from each test pit.

A summary of the test pits is presented in Table 1 and logs can be found in Appendix A. No laboratory tests were performed.

2.3.1 Soil

The soils encountered in the test pits were mostly sands with varying amounts of gravel, silt, and organic matter, and sandy gravel underlain by cemented Glacial Till. Cemented Glacial Till was encountered between 2 feet and five feet overlain by sands with varying amounts of silt, organics and gravels in all test pits, with the exception of TP-4 and TP-11. In test pit TP-4 sand with varying amounts of silt, organics and gravels underlain by Glacial Till at a depth of 8 feet was encountered. In test pit TP-11 sandy cobble with a trace of silt was encountered at 2 feet overlain by sand with varying amounts of silt and gravel.

2.3.2 Laboratory Testing

No laboratory testing was performed as part of this investigation. In general soil types were relative consistent with area mapping.

2.3.3 Groundwater

Ground water seepage was encountered at a depth of 5 feet bgs in test pit TP-4, at 1.5 feet in test pit TP-5, at 3 feet in test pit TP-6 and at 2 feet in test pits TP- 7 and 11. In two test pits a French Drain was encountered which probably impacted groundwater seepage. Fluctuations in the groundwater level may occur due to variations in rainfall, temperature, site development, and other factors not evident at the time that these observations were made.

3.0 CONCLUSIONS & RECOMMENDATIONS

General

The soils encountered in the excavated test pits generally consisted of sandy silts underlain by cemented Glacial Till. The sandy silts ranged from two to five feet in thickness with the exception of test pit TP-5 (8.0 feet). Groundwater seepage was encountered in test pits TP-1, TP-4, TP-5, TP-6, TP-7, TP-9 and TP-11. The proximity of the cemented Till to the surface soils as well as the water seepage encountered makes the use of on site stormwater infiltration non-practical as a method to handle stormwater runoff. The stratigraphy of the soils encountered across the parcel was relatively consistent. The test pits indicate that the site is not an Aquifer Recharge Area of Concern (ARAC).

3.1 Stormwater Infiltration

The proposed method of directing the stormwater from the Blue Heron development to a proposed detention pond on the southeastern portion of the site appears to be a practical approach. This will be a suitable alternative, given the limited capacity of the near surface soils for infiltration due to the proximity of either cemented Till or water seepage.

3.2 Groundwater Concerns

Groundwater was encountered in test pits TP-1, TP-4, TP-5, TP-6, TP-7, TP-9 and TP-11 at depths ranging from 1.0 to 5.0 feet (Table 1). French Drains were encountered in test pits TP-9 and TP-10 which probably impacted groundwater seepage in those test pits. Although the water seepage encountered in the test pits was generally slight in nature it should be taken into consideration during the construction of building foundations as well as utility trench excavations.

3.3 Erosion Control

Best management practices should be used to prevent sediment from leaving the site and entering storm water sewer systems or surface waters. Best management practices for erosion control include silt fences at the site perimeter, protection of existing storm drains using "silt socks" or hay bales, and control of construction traffic to minimize transport of sediment off-site on vehicle tires.

4.0 LIMITATIONS

This report has been prepared for Team 4 Engineering regarding the subject project. Information presented in this report has been collected and interpreted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions, and in accordance with sound and

generally accepted principles consistent with normal consulting practice. No other warranty, expressed or implied, including (but not limited to) any warranty or merchantability or fitness for a particular use has been made.

Team 4 Engineering and EnviroSound discussed the risks and rewards associated with this project, as well as EnviroSound's fee for services. Team 4 Engineering and EnviroSound agreed to allocate certain of the risks so that, to the fullest extent permitted by law, EnviroSound's total aggregate liability to EnviroSound is limited to \$50,000 or the fee, whichever is greater, for any and all injuries, claims (including any claims for costs of defense or other incurred costs), losses, expenses, or damages whatsoever arising out of or in any way related to EnviroSound's services for this project, from any cause or causes whatsoever, including but not limited to, negligence, errors, omissions, strict liability, breach of contract, breach of warranty, negligent misrepresentation, or other acts giving rise to liability based upon contract tort, or statute.

In the event that change in the nature, design, or location of the proposed construction is made, or any physical changes to the site occur, recommendations are not be considered valid unless the changes are reviewed by EnviroSound and conclusions of this report are modified or verified in writing.

The subsurface exploration logs and related information depicts conditions only at the specific locations and at the particular time designated on the logs. The passage of time may result in a change of subsurface conditions at these exploration locations. Subsurface conditions at other locations may differ from conditions occurring at the exploration locations. The nature and extent of variations of subsurface conditions between explorations are not known. If variations appear during additional explorations or construction, reevaluation of recommendations in this report may be necessary.

Stratification lines designating the interface between soil types in subsurface exploration logs represent approximate boundaries. The transition between materials may be gradual.

Analyses and recommendations provided in this report are based in part upon the data obtained from the subsurface explorations.

The scope of EnviroSound's services in this report did not include an environmental assessment for the presence or absence of 1) hazardous and/or toxic materials, in the soil, groundwater, surface water, or atmosphere, and 2) wetlands. Any statements or absence of statements in this report on any subsurface exploration log regarding staining or odor of soil, groundwater, or surface water, unusual or suspicious items, or conditions observed are strictly descriptive information for Team 4 Engineering

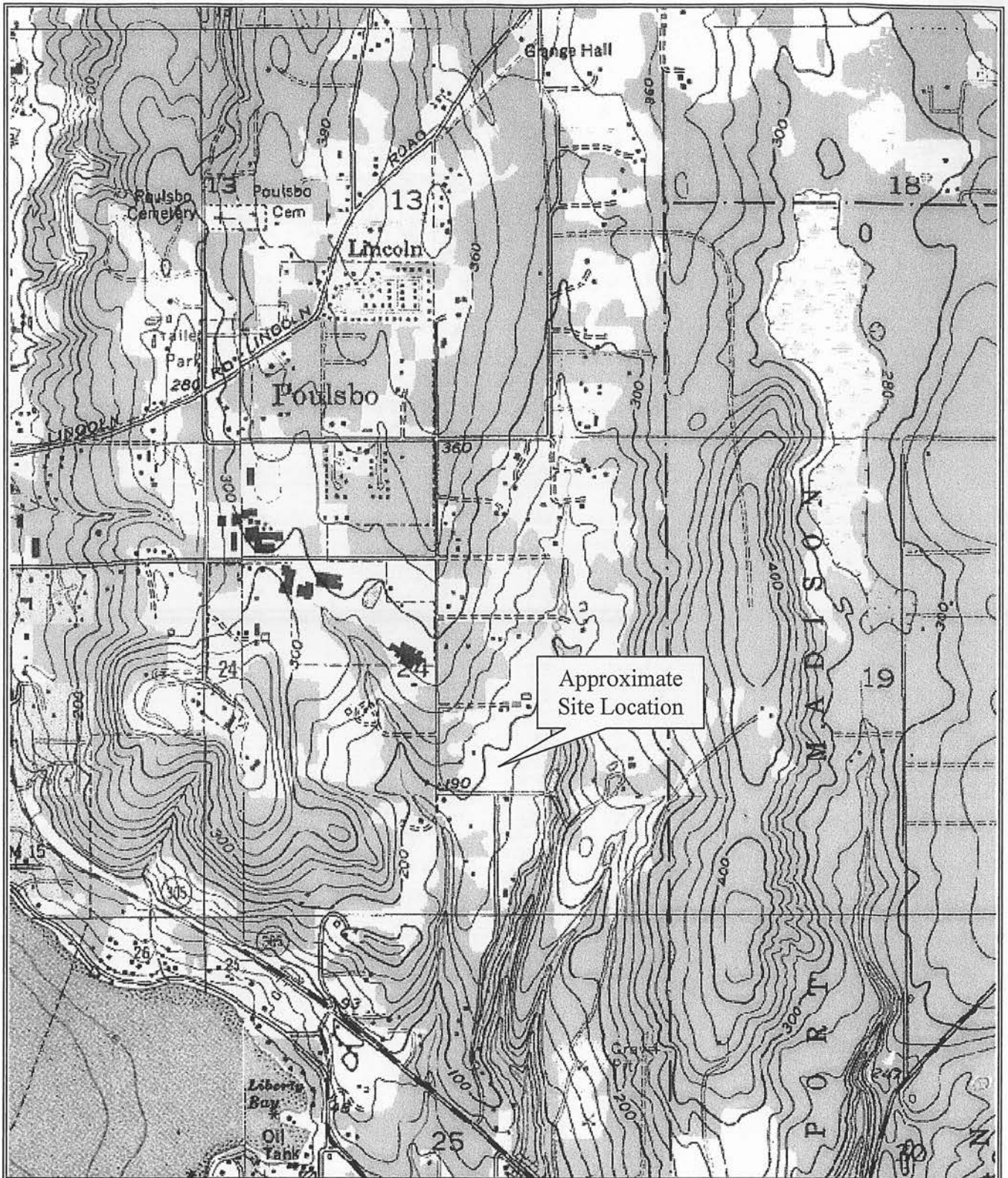


FIGURE 1 SITE VICINITY MAP

PROJECT: Blue Heron
 CLIENT: Team-4 Engineers
 NUMBER: ESC08-G006
 DATE: February 2008



Appendix A

APPENDIX A

EnviroSound Test Pit Logs with Key

TEST PIT LOG EXPLANATION SHEET

Visual Physical Description: Description including Unified Soil Classification System (USCS) Classification, density consistency, moisture, and geologic interpretation.

Soils are identified by the criteria of the USCS, with the appropriate group symbol in parenthesis for each soil description.

Soil density determined by penetration test with ½ inch T-Handle Probe and/or digging action with excavation equipment.

Laboratory testing results: M.C. = Moisture content

P.L. = Plastic Limit

L.L. = Liquid Limit

P.I. = Plasticity Index

Gravel: Material passing the 3-inch sieve but retained on the #4 standard sieve.

Sand : Material passing the # 4 standard sieve but retained on the # 200 standard sieve.

- # 200 = Fines content. Material (clay and silt) passing the # 200 U.S. standard sieve.

Line Legend

————— Solid Line: Indicates contact between two geologic units.

..... Dashed Line: Indicates change in USCS classification within the same geologic unit.

TEST PIT TP- 1

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 192
 Test Pit Location: Lot 2
 Depth to Groundwater: Seepage @ 1', 2' & 3'

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)				
	SW	Gray brown fine to medium SAND with a trace of silt (moist to wet) (medium dense)	S-1	Grab	3	
5	SM	Gray silty SAND with ferrous stains (moist) (cemented) (TILL)				
		BOE 7.5' No sloughing.				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
 Page 1 of 1

TEST PIT TP- 2

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 192
 Test Pit Location: Lot 6
 Depth to Groundwater: No Seepage

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)				
	SW	Gray brown fine to medium SAND with a trace of silt (moist to wet) (medium dense)	S-1	Grab	3	
5	SM	Gray silty SAND with ferrous stains (moist) (cemented) (TILL)				
10		BOE 10.0' No sloughing.				
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 3

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 188
 Test Pit Location: Lot 54
 Depth to Groundwater: No Seepage

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	3	
	SW	Gray brown fine to medium SAND with a trace of silt (moist to wet) (medium dense)				
5	SM	Gray silty SAND with ferrous stains (moist) (cemented) (TILL) No sloughing.				
10		BOE 10.0'				
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
 Page 1 of 1

TEST PIT TP- 4

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 182
 Test Pit Location: Tract H
 Depth to Groundwater: Seepage @ 5'

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	OL	Topsoil (saturated) (soft)				
	SW	Gray brown fine to medium SAND with a trace of silt (moist to wet) (medium dense)	S-1	Grab	1.5	
	SP	Gray medium SAND (moist to wet) (medium dense)	S-2	Grab	4	
5	GW	Brown sandy GRAVEL (wet) (medium dense)	S-3	Grab	7	
	SM	Gray silty SAND (moist) (medium dense to dense)(TILL)				
10		BOE 10.0' No sloughing.				
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 5

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 192
 Test Pit Location: Lot 51
 Depth to Groundwater: Seepage @ 1.5'

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Gray fine to medium SAND with a trace of silt and gravel (moist to wet) (medium dense)				
5	SW	Gray brown fine to medium SAND with a trace of silt (moist to wet) (dense)	S-1	Grab	3.5	
	SW	Gray brown silty SAND with ferrous stains(moist) (cemented) (TILL) BOE 6.5' Sloughing @ 2'				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 6

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 204
 Test Pit Location: Lot 80
 Depth to Groundwater: Seepage @ 3'

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	3	
5	SM	Gray silty SAND with ferrous stains (moist) (cemented)(TILL) BOE 4.5' No sloughing.				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 7

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 222
 Test Pit Location: Lot 40
 Depth to Groundwater: Seepage @ 2'

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	2	
5	SM	Gray silty SAND with ferrous stains (moist) (cemented)(TILL)				
		BOE 5.0' No sloughing.				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 8

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 207
 Test Pit Location: Lot 46
 Depth to Groundwater: No seepage

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	2	
5	SM	Gray silty SAND with ferrous stains (moist) (cemented)(TILL)				
		BOE 6.0' No sloughing.				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 9

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 212
 Test Pit Location: Lot 75
 Depth to Groundwater: No seepage

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	2	
	SM	Gray silty SAND with ferrous stains (moist) (cemented)(TILL)				
5		BOE 4.5' No sloughing. *@ 3' a French drain was encountered piping water				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 10

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 217
 Test Pit Location: Lot 35
 Depth to Groundwater: No seepage

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	2	
	SM	Gray silty SAND with ferrous stains (moist) (cemented)(TILL)				
5		BOE 5.0' No sloughing. *@ 4.5' a French drain was encountered piping water				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 11

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 214
 Test Pit Location: Lot 13
 Depth to Groundwater: Seepage @ 2'

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	1.5	
	SM	Gray sandy COBBLE with a trace of silt (moist to wet) (medium dense to dense)				
5		BOE 6.0' No sloughing.				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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TEST PIT TP- 12

Project Name: Blue Heron
 Client: Team-4 Engineers
 Project Number: ESC08-G006

Test Pit Elevation: 236
 Test Pit Location: Lot 29
 Depth to Groundwater: No seepage

DEPTH (FT.)	USCS Classification	VISUAL PHYSICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE DEPTH (FT.)	LABORATORY TESTING RESULTS FOR SAMPLE
0	SW	Reddish brown fine to medium SAND with a trace of silt and gravel (moist to wet) (loose)	S-1	Grab	2	
	SM	Gray silty SAND with ferrous stains (moist) (cemented)(TILL)				
5		BOE 6.0' No sloughing.				
10						
15						

Excavation Contractor: Hemley's
 Equipment: Back hoe
 Operator: Randy

Excavation Date: 01/30/08
 ESC Representative: JE
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