March 13, 2009

Mr. Jon Sebba
Nolte Associates, Inc
5217 S State St, Suite 300
Murray, Utah 84107-4812

Re: Geotechnical Investigation
Raintree Building
Utah Adult Developmental Center
American Fork, Utah

Dear Mr. Sebba,

INTRODUCTION

This report presents the results of our geotechnical investigation for the Raintree Building floor moisture issue at the Utah facilities in American Fork, Utah. The site location is presented on Plate 1, Vicinity Map. A more detailed layout of the site showing the approximate location of the borings in conjunction with this investigation is shown on Plate 2, Site Map.

SCOPE OF WORK

The scope of work for this investigation was authorized by Nolte upon approval from the Utah Developmental Center**.** In general, the purposes for the investigation were to evaluate subsurface soil and groundwater conditions at the site and emplace monitoring wells to help identify surface water and groundwater migration. The soil and water information is then used to address impacts to floor surfacing in the building, to recommend methods to identify sources and migration of perched water, and to recommend remediation options.

In accomplishing this purpose the following services were performed:

1) Advancing and sampling three borings at the site extending to a depth of 10 feet below the existing surface grade.

2) Performing laboratory tests to aid in the determination of soil and moisture conditions.

3) Evaluating available data, performing engineering analyses, and preparation of this final report that includes the following:

   a. A Vicinity Map and Site Map showing the investigation site and the location of exploratory borings.

   b. Logs of borings.

   c. A summary of laboratory test data.

   d. A detailed description of surface and subsurface conditions encountered.

   e. Discussions of site specific soil or geologic conditions that are impacting building floor conditions.

   f. Field observations and options for further investigation and remediation including measuring monitoring wells and recommendations for monitoring and handling perched water.

RAINTREE FLOOR HEAVE

We understand from the client that the Raintree building is experiencing de-bonding or lifting of the floor covering inside part of the building. It is assumed that moisture is permeating up through the slab and raising the new floor covering recently installed.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions at the site were explored by three borings to a maximum depth of 10 feet below the present surface grade. Borings were drilled using a Geoprobe 66DT track drill rig. Approximate boring locations are shown on Plate 2, Site Map.

The field program was conducted and supervised by an experienced engineer from our staff who maintained a continuous log of the subsurface conditions encountered. Boring logs of the materials encountered are presented on Plates 3-5. Drillers obtained soil samples using a direct push sleeve with

each of the three borings. The soils were classified in the field according to the Unified Soil Classification System (Plate 6) and selected samples were re-examined in the laboratory to confirm field classifications.

LABORATORY TESTING

A laboratory testing program was conducted on selected samples to provide data for our engineering analyses. The program included moisture tests, particle size analysis, and Atterberg limits. Index testing is summarized in conjunction with the boring logs on Plates 3-5. A Grain Size Distribution graph is on Plate 7. Laboratory testing results are attached as Appendix A.

SITE CONDITIONS

GEOLOGY

The site geology as described in Machette 1992 is Qalp, Quaternary (uppermost Pleistocene) stream alluvium related to the Provo phase of the Bonneville lake cycle.

SURFACE

Raintree building is located towards the north end of the Utah Adult Developmental Center north of 700 North 860 East in American Fork, Utah. At the time of our investigation the site was grassy lawn in winter repose.

SUBSURFACE

Subsurface conditions as defined by the first boring (B-1), consisted of approximately 1.5 feet of clayey SAND topsoil (SC) underlain by approximately 3 feet of wet lean SILT (ML) with sand. Underlying this lean silt layer is dry, well-graded GRAVEL with silt and sand extending through the maximum depth of our investigation. No groundwater was encountered through the maximum penetration depth of 10 feet, but the lean silt does act as a low-permeability layer which forms a perched water table within or above it.

Subsurface conditions as defined by the second boring (B-2), consisted of approximately 1.5 feet of clayey SAND topsoil (SC) underlain by approximately 6.1 feet of wet lean silty CLAY (CL). Underlying this lean clay layer is a 0.2-foot layer of wet silty SAND, followed by a 0.2-foot layer of wet clayey GRAVEL, followed by 2 feet of dry, poorly-graded GRAVEL with silt and sand extending through the

maximum depth of our investigation. No groundwater was encountered through the maximum penetration depth of 10 feet, but the lean clay does act as a low-permeability layer which forms a perched water table within or above it. Additionally, the silty sand layer at 7.6-7.8 feet acts as a water conduit perched on the thin clayey gravel layer below it.

Subsurface conditions as defined by the third boring (B-3), consisted of approximately 1 foot of clayey SAND topsoil (SC) underlain by approximately 6.5 feet of wet lean silty CLAY (CL). The silt content increases to roughly 50% as the soil grades to a wet, lean silty CLAY to clayey SILT (CL-ML) by a depth of 7.5 feet. The CL-ML layer extends 1.5 feet, and is underlain by dry, poorly-graded GRAVEL with sand extending through the maximum depth of our investigation. No groundwater was encountered through the maximum penetration depth of 10 feet, but the lean silt and clay acts as a low-permeability layer which forms a perched water table within or above it.

The discussions above depict the subsurface conditions encountered at the specific locations investigated. Variations in subsurface between investigation locations should be anticipated.

DISCUSSIONS AND RECOMMENDATIONS

GENERAL

Supporting data upon which the following recommendations are based have been presented in the previous sections of this report. The recommendations presented herein are governed by the physical properties of soils encountered in the three borings and field observations. If subsurface conditions other than those described herein are known, IGES must be informed so that our recommendations can be reviewed and revised as conditions may require.

SITE CONDITIONS AND OBSERVATIONS

Borings indicate a wet low-permeability clay and/or silt layer exists through the middle portion of each 10-foot boring. This confining layer creates a perched water table that flows through the upper 1.5 feet of surface soils. The sandy gravels at the bottom of each hole are dry, so the regional water table is not present within the top 10 feet at this time of year. Groundwater will reach peak elevation in late spring, so semi-monthly measurements are recommended to identify whether the groundwater level will rise above the bottom of the monitoring wells.

There could be several sources for the moisture affecting the floor. The irrigation system supplies water around the building, the building downspouts put roof storm water within 3 feet of the foundation, the

building to the north, Willow Creek building, has downspouts which infiltrate water, and the Provo Reservoir Canal is 0.6 mile north and northeast of and roughly 50-75 feet higher than Raintree building. The first three are more likely to contribute significant water to the building location. Any infiltrating water is likely to perch on the silty clay layer 1.5 feet below ground surface. Perched water and ground water probably travel from the northeast to the southwest with topography, which is why the downspouts from Willow Creek building could also be contributing water to the Raintree building foundation.

RECOMMENDATIONS

These recommendations are for water handling in general because we have not seen or studied the floor heave and moisture problem at the Raintree building. Reducing the water around the Raintree foundation can be done by 1) reducing irrigation, 2) transporting downspout water down slope from Raintree building or discharging it to a storm sewer, 3) transporting Willow Creek building downspout water down slope from both buildings or discharging it to a storm sewer, 4) blocking or redirecting perched water traveling to the building from up slope, and/or 5) installing horizontal vent piping under the building to reduce the moisture.

Details of moisture-reducing options:

1) Reduce the amount of irrigation within 20 feet east, south, and west of the building. Also reduce the amount of irrigation within 200 feet upslope of the building, northwest, north, and northeast of the building.

2) Capture Raintree building roof water coming down the downspouts and transport it a sufficient distance down slope of the building or to a nearby storm drain, or infiltrate it.

3) Capture Willow Creek building roof water coming down the downspouts and transport it a sufficient distance down slope of Raintree building or to a nearby storm drain, or infiltrate it.

4) Drive a barrier or construct a water-handling trench or pipe around the northwest and northeast (upslope) sections of Raintree building. This can entail a subsurface pipe carrying water away from the building and re-infiltrating it, or delivering the water to a storm drain, or trenching down to the sandy gravel layer and placing geosynthetic liner and gravel to infiltrate the perched water into the gravel.

5) Construct horizontal vent piping and attach it to a positive venting system. A powered or passive system could be used to minimize moisture at the floor slab.

Nolte Associates or IGES, Inc. can design water-handling construction plans such as downspout water piping, subsurface wall construction, trenching upslope of the building, or horizontal vent piping.

Placing an impermeable liner on the compacted building excavation before pouring the floor slab can prevent moisture from permeating up through the slab. Presumably this wasn't done for the Raintree building. This concept should be considered in any upcoming construction.

To further identify and clarify the source of the moisture problem, groundwater and perched water conditions should be further monitored by: A) measuring monitoring wells, B) placing shallow wells or trenches around Raintree building to monitor water perched on the confining silty clay layer.

A) Groundwater ordinarily reaches peak elevation in late spring, so semi-monthly measurements are recommended to identify whether the groundwater level will rise above the bottom of the monitoring wells. See Appendix B for well measuring guidelines.

B) Whether irrigation water or Willow Creek building water are major contributors to the Raintree moisture conditions could be determined by constructing short wells or trenches upslope of Raintree at the top of the confining layer. IGES can be retained for recommended construction.

CLOSURE AND LIMITATIONS

The recommendations contained in this report are based on limited field exploration, and our understanding of the Raintree building floor issue. This report was prepared in accordance with the generally accepted standard of practice at the time the report was written. No warranty, expressed or implied, is made.

REFERENCES

Machette, Michael N., 1992 US Geological Survey, Miscellaneous Investigations Series map I-2095.

oOo

Respectfully Submitted,
IGES, Inc.

LICENSED PROFESSIONAL GEOLOGIST
3/13/09
SHEILA M. KLUCK
6158972-2250
STATE OF UTAH

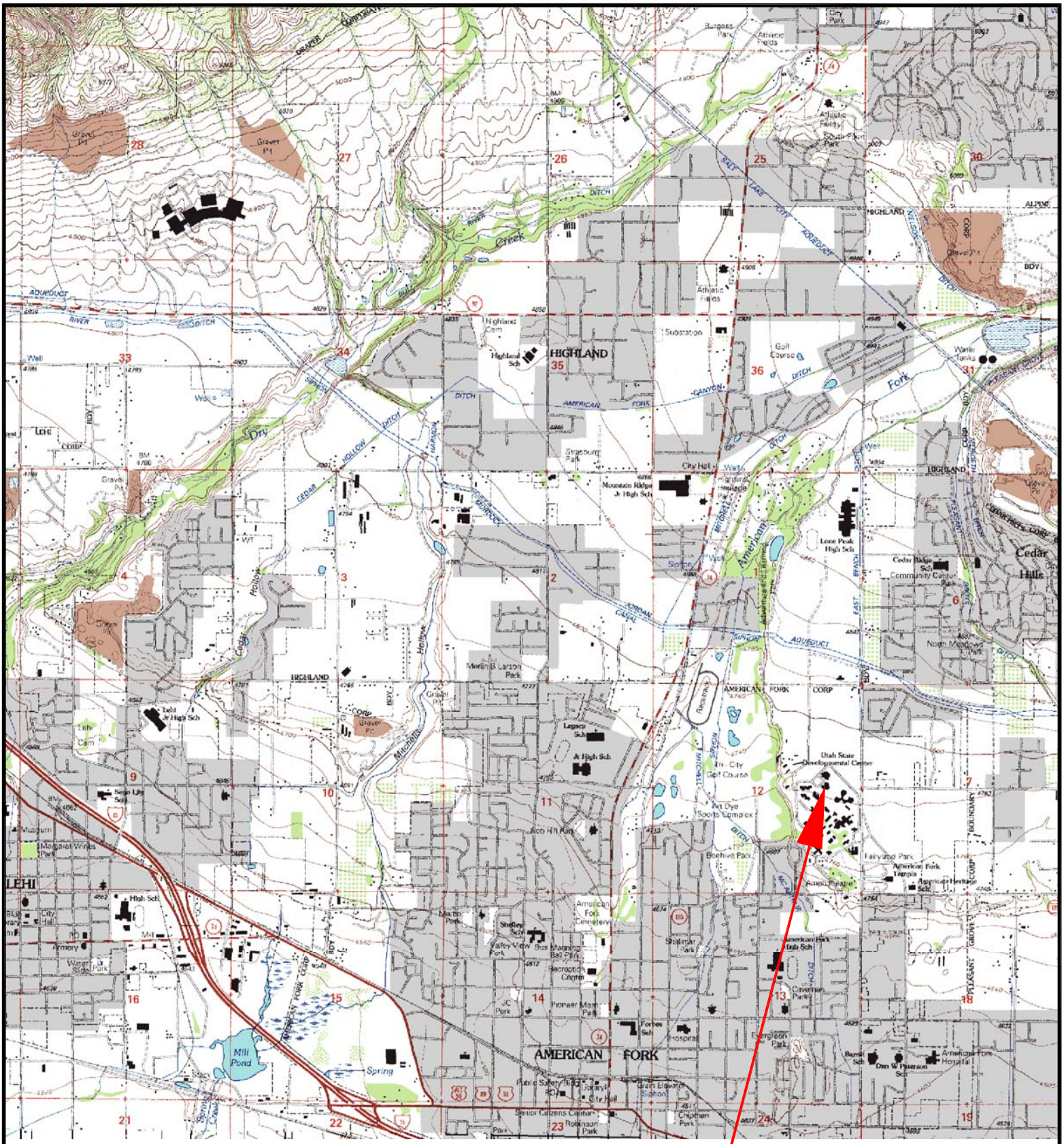
Sheila M. Kluck, P.E.I, P.G.
Project Engineer

Reviewed By:

John F. Wallace, P.E.
Principal

The following plates are attached and complete this report:

Plate 1 – Vicinity Map
Plate 2 – Site Map
Plate 3-5 – Boring Logs
Plate 6 – Unified Soil Classification System
Plate 7 – Grain Size Distribution
Plate 8 – Well Construction Detail
Appendix B: Monitoring Well Measurement Instructions
Appendix C: Laboratory Testing Results



Scale

0 50' 100'

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No.	Revision/Issue	Date

NOLTE ASSOCIATES, INC
RAINTREE BUILDING
UTAH ADULT DEVELOPMENTAL CENTER
AMERICAN FORK, UTAH

01266-001

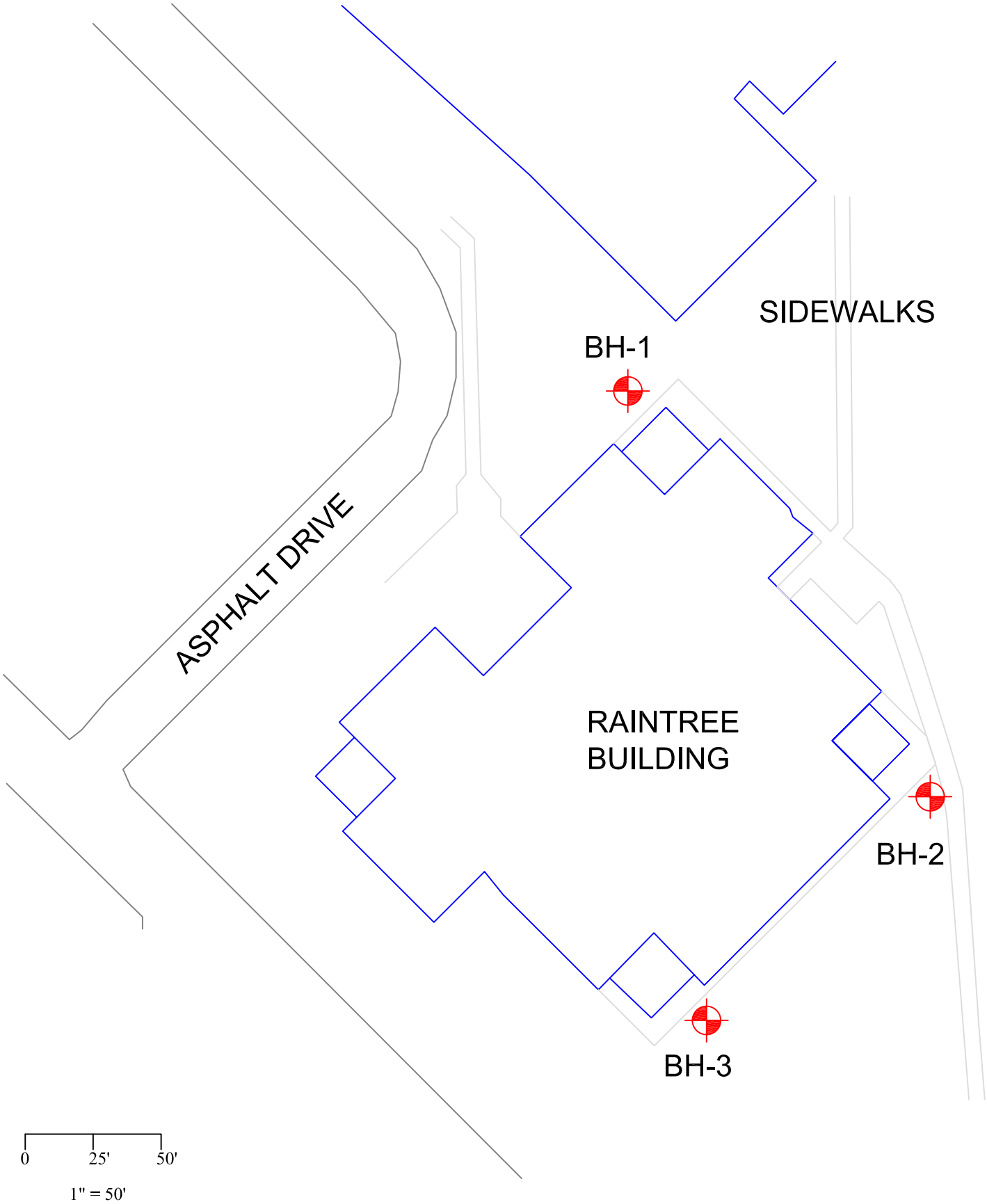
LOCATION MAP

Drawing Notes

PLATE

1

N



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No.	Revision/Issue	Date

NOLTE ASSOCIATES, INC
RAINTREE BUILDING
UTAH ADULT DEVELOPMENTAL CENTER
AMERICAN FORK, UTAH

01266-001

SITE MAP

Drawing Notes

PLATE

2

N

DATE	
STARTED:	3/2/09
COMPLETED:	3/2/09
BACKFILLED:	

Nolte Associates, Inc.
Raintree Building
Utah Adult Developmental Center, Am. Fork, UT

IGES Rep: Sheila
Rig Type: Track 66DT
Boring Type: Direct Push
Project Number 01266-001

BORING NO: **BH-1**

Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION 4,790.00
North building corner

METERS	FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT (10 20 30 40 50 60 70 80 90)	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit; 10 20 30 40 50 60 70 80 90)
0	0				SC	Clayey SAND topsoil, dark brown, moist									
					ML	SILT with sand, grayish brown, wet, pin holes, medium stiff, tree roots									
1											26.7	79.2	22	2	
	5				GW-GM	Well-graded GRAVEL with Silt and Sand, grayish brown, dry, moderately dense									
2											2.7	6.9			
						- less dense									
3	10		▼								3.1	7.3			
						Bottom of Boring @ 10 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- ☒ - 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- ☒ - 3.25" O.D./2.42" I.D. U SAMPLER
- ⧄ - 3" O.D. THIN-WALLED SHELBY SAMPLER
- ▯ - GRAB SAMPLE
- ◪ - Modified California Sampler

NOTES:
moisture seeping out of silt

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 3

DATE	
STARTED:	3/2/09
COMPLETED:	3/2/09
BACKFILLED:	

Nolte Associates, Inc.
Raintree Building
Utah Adult Developmental Center, Am. Fork, UT

IGES Rep: Sheila
Rig Type: Track 66DT
Boring Type: Direct Push
Project Number 01266-001

BORING NO: **BH-2**

LOCATION
NORTHING EASTING ELEVATION
East building corner

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0				SC	Clayey SAND topsoil, dark brown, moist, grass roots					19.9				
					CL	Silty CLAY, brown, moist to wet									
1											23.7		25	8	
	5														
2						- more dense starting at 6.5'									
						7.6-7.8' silty SAND, dark brown, wet									
						Clayey GRAVEL, brown, wet									
					GP-GM	Poorly graded GRAVEL with silt and sand, brownish gray, dry, with dark gray limestone					2.1	8.2			
3	10					Bottom of Boring @ 10 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:
dry

WATER LEVEL
- MEASURED
- ESTIMATED

Plate 4

DATE	
STARTED:	3/2/09
COMPLETED:	3/2/09
BACKFILLED:	

Nolte Associates, Inc.
Raintree Building
Utah Adult Developmental Center, Am. Fork, UT

IGES Rep: Sheila
Rig Type: Track 66DT
Boring Type: Direct Push
Project Number 01266-001

BORING NO: **BH-3**

Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION
South building corner

METERS	FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0				SC	Clayey SAND topsoil, dark brown, moist									
					CL	Silty CLAY, brown, wet, soft									
1											24.0				
	5														
2					CL-ML	Silty CLAY to clayey silt, wet, more stiff. Finely laminated 1/8" layers of brown, reddish brown, and gray.					27.7		24	6	
					GP	Poorly graded GRAVEL with sand, brownish gray, dry, moderately dense									
3	10		▼			Bottom of Boring @ 10 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- ☒ - 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- ☒ - 3.25" O.D./2.42" I.D. U SAMPLER
- ⧄ - 3" O.D. THIN-WALLED SHELBY SAMPLER
- ▯ - GRAB SAMPLE
- ◪ - Modified California Sampler

NOTES:
dry

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 5

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

LOG KEY SYMBOLS

- BORING SAMPLE LOCATION
- TEST-PIT SAMPLE LOCATION
- WATER LEVEL (level after completion)
- WATER LEVEL (estimated)

CEMENTATION

DESCRIPTION	DESCRIPTION
WEAKELY	CRUMBLES OR BREAKS WITH HANDLING OR SLIGHT FINGER PRESSURE
MODERATELY	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE
STRONGLY	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE

OTHER TESTS KEY

C	CONSOLIDATION	SA	SIEVE ANALYSIS
AL	ATTERBURG LIMITS	DS	DIRECT SHEAR
UC	UNCONFINED COMPRESSION	T	TRIAXIAL
S	SOLUBILITY	R	RESISTIVITY
O	ORGANIC CONTENT	RV	R-VALUE
CBR	CALIFORNIA BEARING RATIO	SU	SOLUBLE SULFATES
COMP	MOISTURE/DENSITY RELATIONSHIP	PM	PERMEABILITY
CI	CALIFORNIA IMPACT	-200	% FINER THAN #200
COL	COLLAPSE POTENTIAL	Gs	SPECIFIC GRAVITY
SS	SHRINK SWELL	SL	SWELL LOAD

MODIFIERS

DESCRIPTION	%
TRACE	<5
SOME	5 - 12
WITH	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST	DAMP BUT NO VISIBLE WATER
WET	VISIBLE FREE WATER, USUALLY SOIL BELOW WATER TABLE

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2"
LAYER	1/2 - 12"

DESCRIPTION	THICKNESS
OCCASIONAL	ONE OR LESS PER FOOT OF THICKNESS
FREQUENT	MORE THAN ONE PER FOOT OF THICKNESS

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.
2. No warranty is provided as to the continuity of soil conditions between individual sample locations.
3. Logs represent general soil conditions observed at the point of exploration on the date indicated.
4. In general, Unified Soil Classification designations presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory tests) may vary.

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT (blows/ft)	MODIFIED CA. SAMPLER (blows/ft)	CALIFORNIA SAMPLER (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
VERY LOOSE	<4	<4	<5	0 - 15	EASILY PENETRATED WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
LOOSE	4 - 10	5 - 12	5 - 15	15 - 35	DIFFICULT TO PENETRATE WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
MEDIUM DENSE	10 - 30	12 - 35	15 - 40	35 - 65	EASILY PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
DENSE	30 - 50	35 - 60	40 - 70	65 - 85	DIFFICULT TO PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
VERY DENSE	>50	>60	>70	85 - 100	PENETRATED ONLY A FEW INCHES WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE UNTRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
VERY SOFT	<2	<0.125	<0.25	EASILY PENETRATED SEVERAL INCHES BY THUMB. EXUDES BETWEEN THUMB AND FINGERS WHEN SQUEEZED BY HAND.
SOFT	2 - 4	0.125 - 0.25	0.25 - 0.5	EASILY PENETRATED ONE INCH BY THUMB. MOLDED BY LIGHT FINGER PRESSURE.
MEDIUM STIFF	4 - 8	0.25 - 0.5	0.5 - 1.0	PENETRATED OVER 1/2 INCH BY THUMB WITH MODERATE EFFORT. MOLDED BY STRONG FINGER PRESSURE.
STIFF	8 - 15	0.5 - 1.0	1.0 - 2.0	INDENTED ABOUT 1/2 INCH BY THUMB BUT PENETRATED ONLY WITH GREAT EFFORT.
VERY STIFF	15 - 30	1.0 - 2.0	2.0 - 4.0	READILY INDENTED BY THUMBNAIL.
HARD	>30	>2.0	>4.0	INDENTED WITH DIFFICULTY BY THUMBNAIL.

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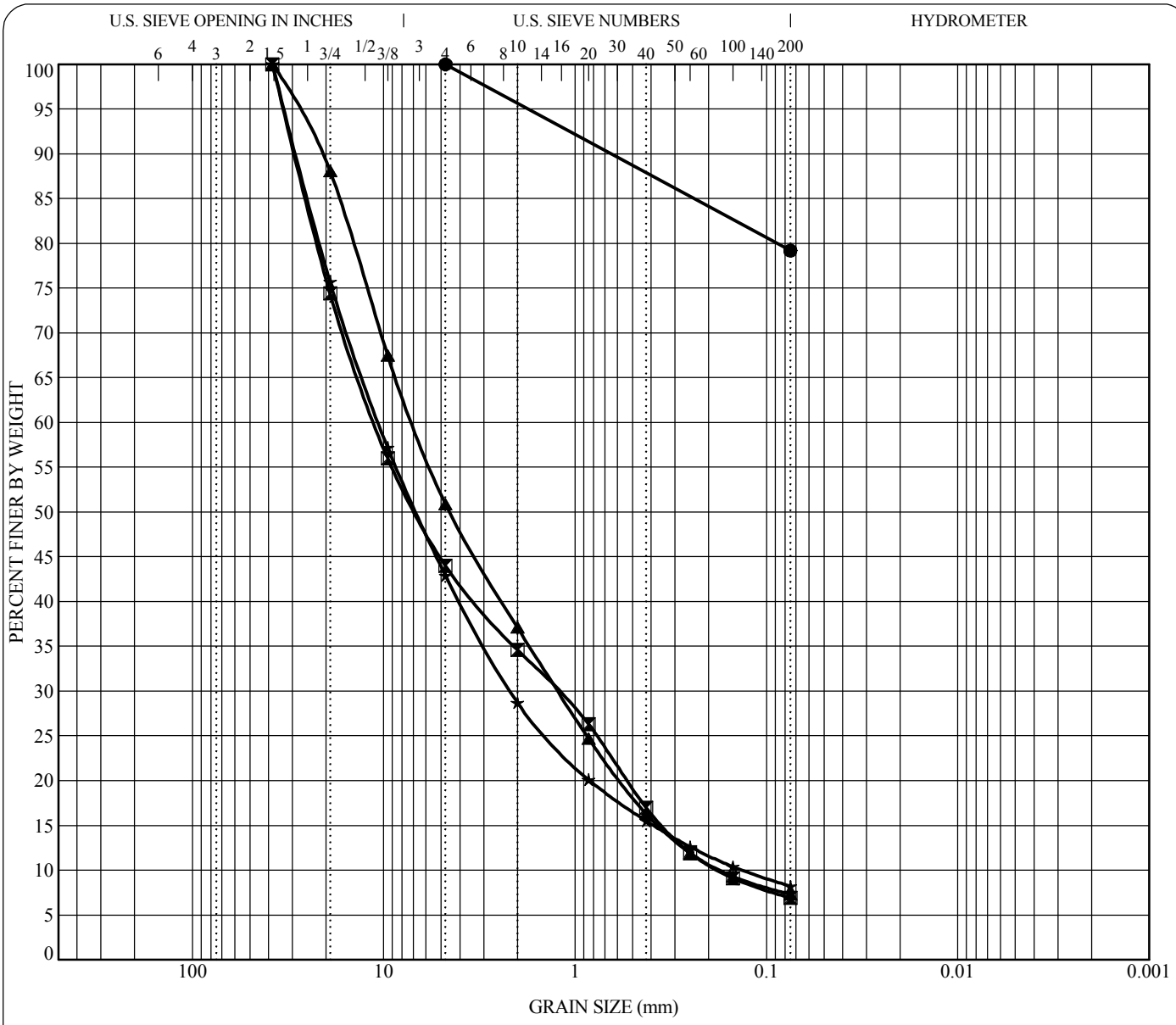
KEY TO SOIL SYMBOLS AND TERMINOLOGY

Project Number 01266-001

Plate 6



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Location	Depth	Classification	LL	PL	PI	Cc	Cu
●	**BH-1**	**2.5**	**ML SILT with sand**	**22**	**20**	**2**		
⊠	**BH-1**	**6.0**	**GW-GM Well-graded Gravel with silt and sand**				**0.79**	**62.65**
▲	**BH-1**	**9.0**	**GW-GM Well-graded Gravel with silt and sand**				**1.25**	**40.41**
★	**BH-2**	**8.5**	**GP-GM Poorly-graded GRAVEL with silt and sand**				**3.35**	**80.00**

	Sample Loctaion	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-1**	**2.5**	**4.75**				**0.0**	**20.8**	**79.2**	
⊠	**BH-1**	**6.0**	**38.1**	**11.074**	**1.245**	**0.177**	**56.0**	**37.1**	**6.9**	
▲	**BH-1**	**9.0**	**38.1**	**6.956**	**1.225**	**0.172**	**49.1**	**43.6**	**7.3**	
★	**BH-2**	**8.5**	**38.1**	**10.579**	**2.165**	**0.132**	**57.1**	**34.7**	**8.2**	

A_GSD 01266-001.GPJ IGES.GDT 3/13/09

IGES

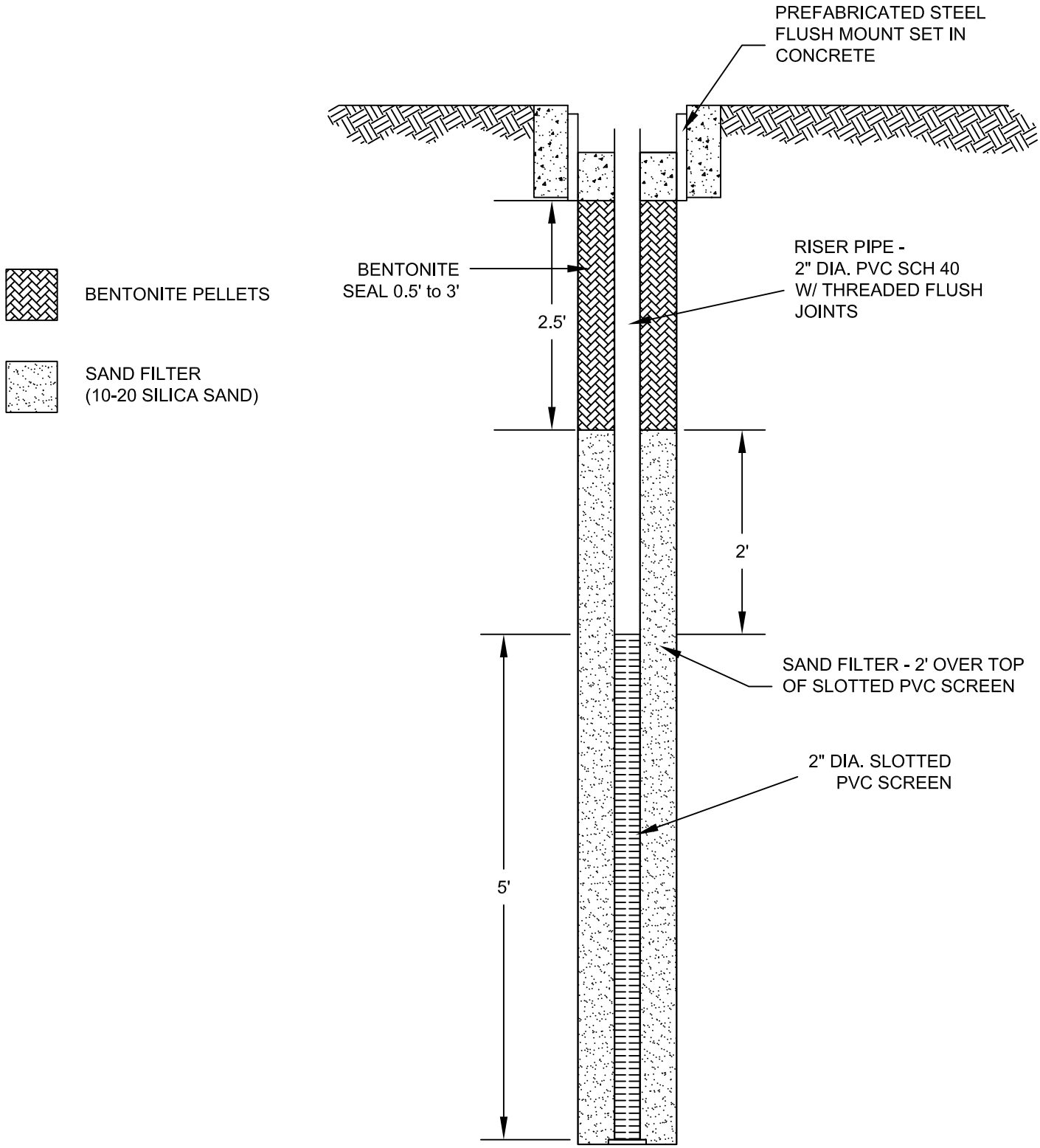
GRAIN SIZE DISTRIBUTION

Nolte Associates, Inc.
Raintree Building
Utah Adult Developmental Center, Am. Fork, UT
Project Number: 01266-001

Attachment

7

MONITORING WELL INSTALLATION DETAIL



X:\Projects\01266 Nolte Assoc\001 Raintree building\site map.dwg

03-09-09

SMK

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No.	Revision/Issue	Date

NOLTE ASSOCIATES, INC.
RAINTREE BUILDING
UTAH ADULT DEVELOPMENTAL CENTER
AMERICAN FORK, UTAH

01266-001

WELL CONSTRUCTION

Drawing Notes

PLATE

8

Intermountain GeoEnvironmental Services Inc.
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APPENDIX B

From: Sheila Kluck
To: Nolte Associates
Date: 3/12/09
Re: Monitoring Well Measurement Instructions:

Groundwater will reach peak elevation in late spring, so semi-monthly measurements are recommended to identify whether the groundwater level will rise above the bottom of the 10-foot deep monitoring wells. A schedule such as the first and third Monday of the month could be used. We request that the sounder and 100-foot tape measure we provided be used, as it is more accurate and reliable than some other methods, particularly because there is moisture on the walls of the PVC. The monitoring wells are numbered on the flush mount cap; 1, 2, and 3 for MW-1, MW-2, and MW-3. There is an arrow mark on the north side of the PVC so the depth to water should be consistently measured from that point. Document on the log that the sounder actually extends 4.5 inches below the tape measure, but record the tape measure actual measurement. If water is encountered contact IGES and increase measurement frequency to weekly until the water level drops. Keep in mind the PVC cap at the bottom of the wells could collect an inch or two of water from moisture, but this is not the actual water table.

Record when the irrigation system is started and stopped for the season, and what weekdays and time it operates near Raintree building. If groundwater is encountered in the wells, a record of local precipitation could be helpful if readily available. It is available online if needed. Maintain a log of measure dates and readings to submit to IGES personnel. If no groundwater has been present in the wells for at least a couple of months when the irrigation system is shut off in the fall, it may be possible to discontinue measurements through the winter.

Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

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Project: Nolte Raintree
No: 01266-001
Location: American Fork
Date: 3/3/2009
By: JDF/JA

Sample Info.	Boring No.	BH-1	BH-1	BH-1	BH-2	BH-2	BH-2	BH-3	BH-3
	Sample:								
	Depth (ft):	2.5-4	6-8	9-10	0.5-1	3-5	8.5-10	3.5-5	7.5-8
Unit Weight Info.	Sample height, H (in)								
	Sample diameter, D (in)								
	Sample volume, V (ft^3)								
	Wt. rings + wet soil (g)								
	Wt. rings/tare (g)								
	Moist soil, Ws (g)								
	Moist unit wt., γ_m (pcf)								
Moisture	Wet soil + tare (g)	606.13	970.00	975.60	644.75	775.51	1431.15	694.72	582.29
	Dry soil + tare (g)	510.36	948.21	950.91	561.03	654.02	1405.25	587.51	488.64
	Tare (g)	151.74	140.60	151.53	140.03	140.90	167.69	139.90	150.78
Moisture Content, w (%)		**26.7**	**2.7**	**3.1**	**19.9**	**23.7**	**2.1**	**24.0**	**27.7**
Dry Unit Wt., γ_d (pcf)									

Entered by:_____

Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES © IGES 2004

Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/5/2009
By: JA

Boring No.: BH-1
Sample:
Depth: 2.5-4.0'
Description: Brown silt with sand

Preparation method: Air Dry
Liquid limit test method: Multipoint

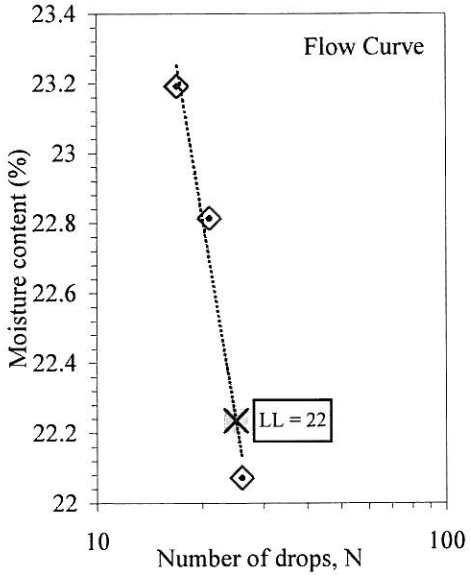
Plastic Limit

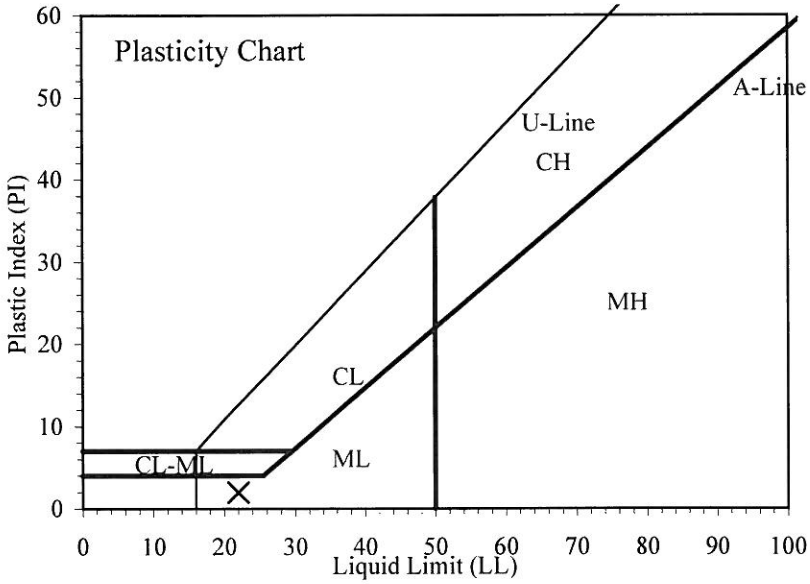
Determination No	1	2				
Wet Soil + Tare (g)	11.12	10.97				
Dry Soil + Tare (g)	9.5	9.39				
Moisture Loss (g)	1.62	1.58				
Tare (g)	1.34	1.33				
Dry Soil (g)	8.16	8.06				
Moisture Content, w (%)	19.85	19.60				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	26	21	17			
Wet Soil + Tare (g)	13.17	15.43	15.35			
Dry Soil + Tare (g)	11.04	12.82	12.72			
Moisture Loss (g)	2.13	2.61	2.63			
Tare (g)	1.39	1.38	1.38			
Dry Soil (g)	9.65	11.44	11.34			
Moisture Content, w (%)	22.07	22.81	23.19			
One-Point LL (%)	22	22				

Liquid Limit, LL (%)	**22**
Plastic Limit, PL (%)	**20**
Plasticity Index, PI (%)	**2**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/5/2009
By: JA

Boring No.: BH-2
Sample:
Depth: 3-5'
Description: Brown clay with sand

Preparation method: Air Dry
Liquid limit test method: Multipoint

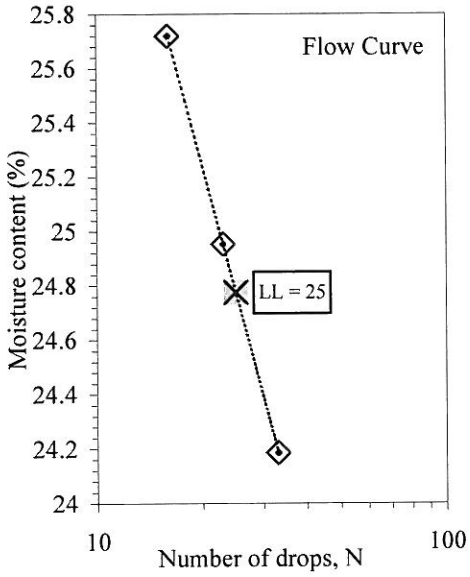
Plastic Limit

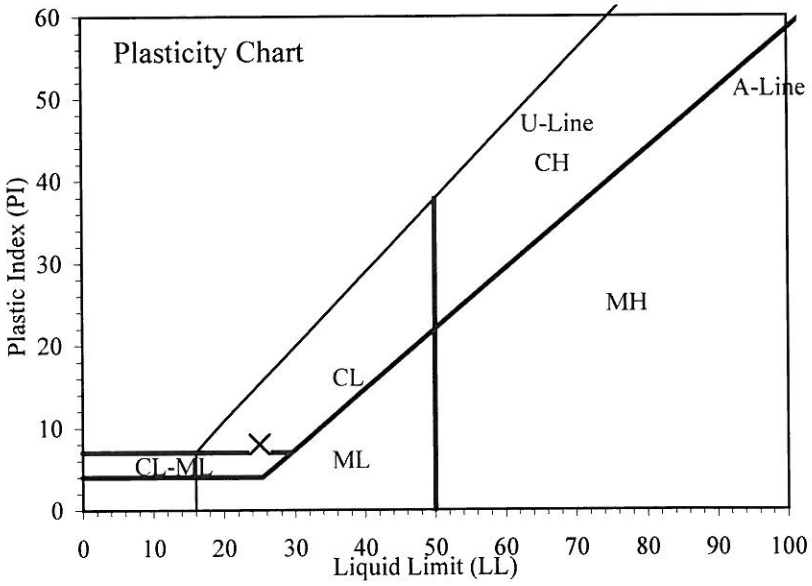
Determination No	1	2				
Wet Soil + Tare (g)	10.93	9.71				
Dry Soil + Tare (g)	9.55	8.5				
Moisture Loss (g)	1.38	1.21				
Tare (g)	1.38	1.38				
Dry Soil (g)	8.17	7.12				
Moisture Content, w (%)	16.89	16.99				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	33	23	16			
Wet Soil + Tare (g)	13.2	14.8	14.05			
Dry Soil + Tare (g)	10.9	12.12	11.46			
Moisture Loss (g)	2.3	2.68	2.59			
Tare (g)	1.39	1.38	1.39			
Dry Soil (g)	9.51	10.74	10.07			
Moisture Content, w (%)	24.19	24.95	25.72			
One-Point LL (%)		25				

Liquid Limit, LL (%)	**25**
Plastic Limit, PL (%)	**17**
Plasticity Index, PI (%)	**8**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/5/2009
By: JA

Boring No.: BH-3
Sample:
Depth: 7.5-8.8'
Description: Brown silty clay with sand

Preparation method: Air Dry
Liquid limit test method: Multipoint

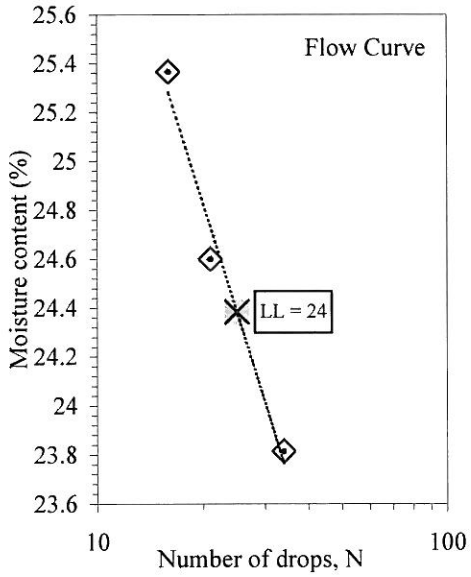
Plastic Limit

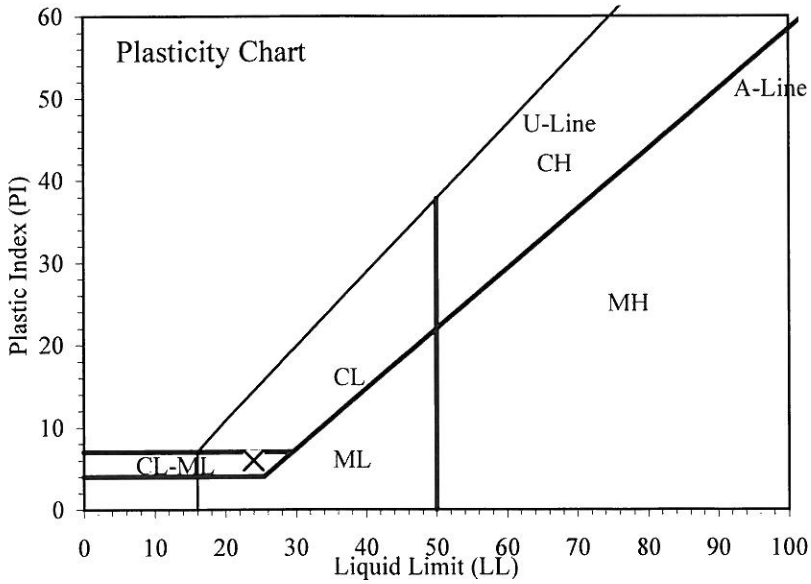
Determination No	1	2				
Wet Soil + Tare (g)	9.42	9.27				
Dry Soil + Tare (g)	8.18	8.04				
Moisture Loss (g)	1.24	1.23				
Tare (g)	1.39	1.34				
Dry Soil (g)	6.79	6.70				
Moisture Content, w (%)	18.26	18.36				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	21	16			
Wet Soil + Tare (g)	13.92	14.61	15.9			
Dry Soil + Tare (g)	11.51	12	12.96			
Moisture Loss (g)	2.41	2.61	2.94			
Tare (g)	1.39	1.39	1.37			
Dry Soil (g)	10.12	10.61	11.59			
Moisture Content, w (%)	23.81	24.60	25.37			
One-Point LL (%)		24				

Liquid Limit, LL (%)	**24**
Plastic Limit, PL (%)	**18**
Plasticity Index, PI (%)	**6**





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Particle-Size Analysis of Soils

(ASTM D422)

IGES © IGES 2004

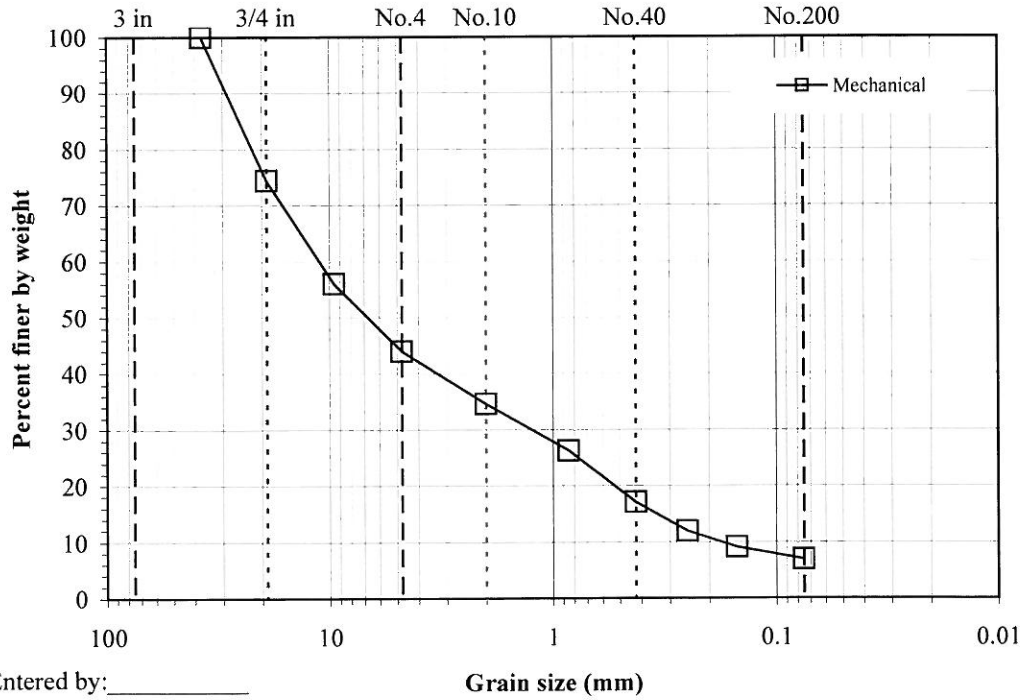
Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/2/2009
By: JDF & JA

Boring No.: BH-1
Sample:
Depth: 6'-8'
Description: Brown gravel with silt and sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	830.30	807.6
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	970.90
Dry soil + tare (g):	-	948.21
Tare (g):	-	140.60
Moisture content (%):	0.0	2.8

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	206.85	19	74.4
3/8"	355.11	9.5	56.0
No.4	452.58	4.75	44.0
No.10	527.98	2	34.6
No.20	595.22	0.85	26.3
No.40	670.20	0.425	17.0
No.60	711.42	0.25	11.9
No.100	734.06	0.15	9.1
No.200	751.69	0.075	6.9



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Particle-Size Analysis of Soils
(ASTM D422)

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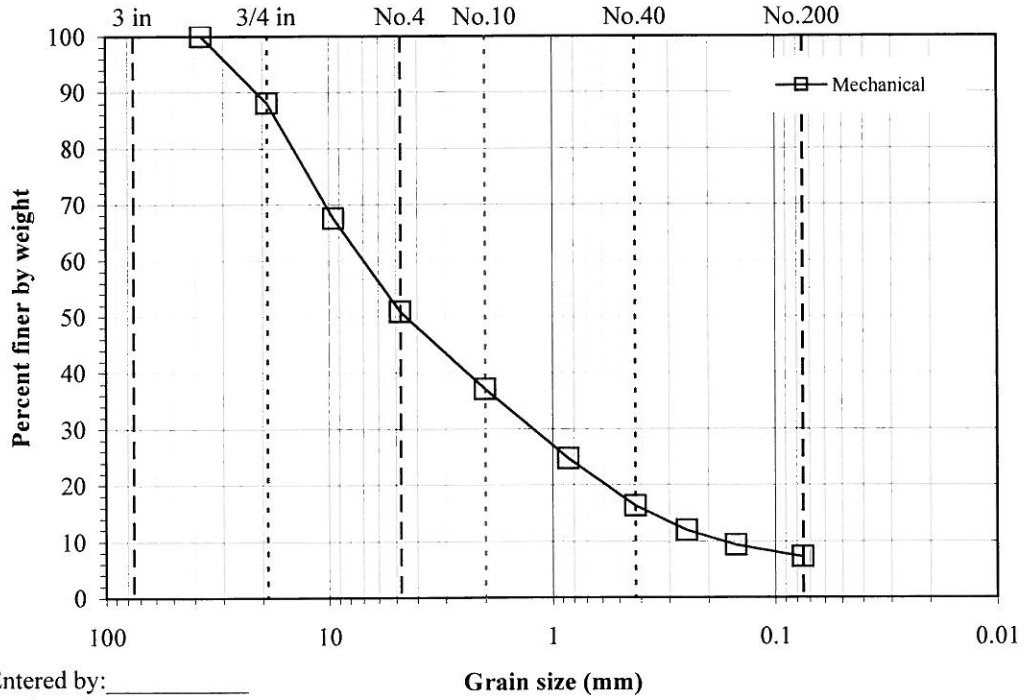
Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/2/2009
By: JDF & JA

Boring No.: BH-1
Sample:
Depth: 9'-10'
Description: Brown gravel with silt and sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	824.07	799.4
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	975.60
Dry soil + tare (g):	-	950.91
Tare (g):	-	151.53
Moisture content (%):	0.0	3.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	95.50	19	88.1
3/8"	259.47	9.5	67.5
No.4	392.31	4.75	50.9
No.10	502.85	2	37.1
No.20	602.08	0.85	24.7
No.40	668.94	0.425	16.3
No.60	703.99	0.25	11.9
No.100	724.85	0.15	9.3
No.200	741.28	0.075	7.3



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Particle-Size Analysis of Soils

(ASTM D422)

IGES © IGES 2004

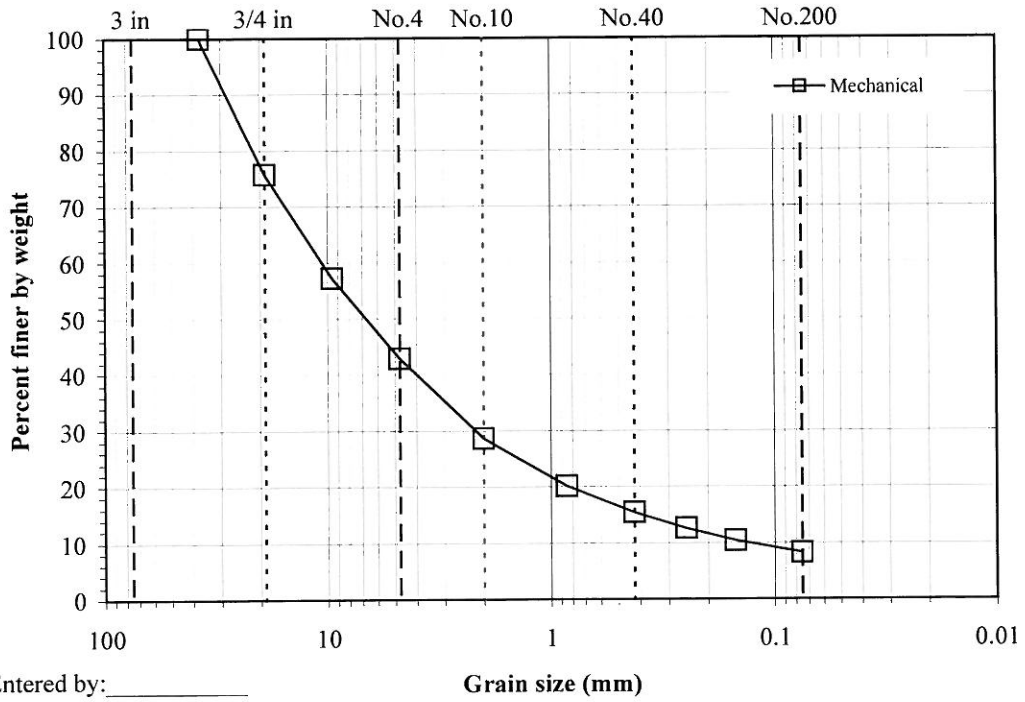
Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/2/2009
By: JDF & JA

Boring No.: BH-2
Sample:
Depth: 8.5'-10'
Description: Gray gravel with silt and sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	1263.46	1237.6
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	1431.15
Dry soil + tare (g):	-	1405.25
Tare (g):	-	167.69
Moisture content (%):	0.0	2.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	300.23	19	75.7
3/8"	529.65	9.5	57.2
No.4	706.39	4.75	42.9
No.10	882.75	2	28.7
No.20	988.58	0.85	20.1
No.40	1046.28	0.425	15.5
No.60	1082.15	0.25	12.6
No.100	1109.12	0.15	10.4
No.200	1136.21	0.075	8.2



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Amount of Material in Soil Finer than the No. 200 (75μm) Sieve

(ASTM D1140)

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Project: Nolte Raintree
No: 01266-001
Location: American Fork, UT
Date: 3/2/2009
By: JDF & JA

Sample Info.	Boring No.	BH-1							
	Sample								
	Depth	2.5'-4'							
	Split	No							
	Split Sieve*								
Moist total sample wt. (g)		454.39							
Moist coarse fraction (g)									
Dry split fraction (g)									
No. 200 Dry wt. retained (g)		74.77							
Split sieve* Dry wt. retained (g)									
Dry total sample wt. (g)		358.62							
Coarse Fraction	Moist soil + tare (g)								
	Dry soil + tare (g)								
	Tare (g)								
	Moisture content (%)								
Split Fraction	Moist soil + tare (g)	606.13							
	Dry soil + tare (g)	510.36							
	Tare (g)	151.74							
	Moisture content (%)	26.71							
Percent passing split sieve* (%)									
Percent passing No. 200 sieve (%)		**79.2**							

Entered by:_____

Reviewed:_____