GEOTECHNICAL INVESTIGATION AND FOUNDATION RECOMMENDATION REPORT BIA ROUTE N11 BIA PROJECT N11(1A)1,2&4 NEAR CROWNPOINT, NEW MEXICO KLEINFELDER PROJECT NO. 105884

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August 2, 2010

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Subject:

Geotechnical Investigation and Foundation

Recommendation Report

BIA Route N11, BIA Project N11(1A)1,2&4

Crownpoint, New Mexico

Dear Ms. LeVee:

Kleinfelder West, Inc. (Kleinfelder) is pleased to present our geotechnical evaluation report for the proposed design and construction of new asphalt pavement and a new bridge structure on the southern portion of Route N11 on the Navajo Nation near Crownpoint, New Mexico. This report presents the results of our observations and analyses, and our recommendations for subgrade preparation and earthwork, pavement sections, drainage and bridge foundations. Additionally, our report presents a short discussion regarding construction considerations related to the geotechnical conditions disclosed by the borings.

We appreciate the opportunity to be of service to you. Should any questions arise concerning this report or if you require any additional information regarding this project, please contact us.

Respectfully submitted,

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TABLE OF CONTENTS

SECT	TION	PAGE
1. IN	NTRODUCTION	1
1.1	GENERAL	1
1.2	PROJECT DESCRIPTION	
1.3	PURPOSE AND SCOPE	2
2. E	VALUATION PROCEDURES	
2.1	FIELD EXPLORATION	
2.2	LABORATORY TESTING	4
	2.1 Geotechnical Laboratory Testing	4
3. G	ENERAL SITE CONDITIONS	6
3.1	SURFACE CONDITIONS	6
3.2	GEOLOGIC SETTING	6
3.3	ROADWAY CONDITIONS	7
	3.1 Subsurface Conditions	
~~~	3.3.1.1 Road Alignment	7
	3.3.1.2 Proposed Bridge Location.	*0
2	3.2 Groundwater Conditions	
	3.3 Collapse Potential of Soils	11
0.71		
4. C	ONCLUSIONS AND RECOMMENDATIONS	13
4.1	GENERAL	
4.2	GEOTECHNICAL CONSIDERATIONS	
4.	2.1 General Considerations	13
4.	2.2 Use of Mancos Shale during Construction	14
4.3	BRIDGE FOUNDATIONS	
	3.1 Foundation Type and Loading	15
9.54	3.2 Pile Casing	16
	3.3 Pre-Boring	
	3.4 Scour Potential	
	3.5 Axial Capacity of Piles	
	3.6 Lateral Capacity of Piles	
	3.7 Bridge Abutments	
4.4	PAVEMENTS	19
1000	4.1 Anticipated Pavement Subgrade Material	
	4.2 Drainage Coefficient	
	4.3 Design Traffic Loadings	
4.	4.4 Design Sections	21
4.5	CONSTRUCTION CONSIDERATIONS	21
4.	5.1 Site Preparation	21
4.	5.2 Drainage	22
4.	5.3 Engineered Fill	
	4.5.3.1 Acceptable Materials	22
	4.5.3.2 Engineered Fill Placement and Compaction	24
	4.5.3.3 Shrinkage Factor	
		25
	4.5.3.5 Drainage Pipe Bedding and Backfill	
	4.5.3.6 Hot Mix Asphalt Concrete	26
	5.4 Construction in Wet or Cold Weather	27
1	5.5 Construction Testing and Observation	
5. C	LOSURE	29
5.1	LIMITATIONS	29
5.2	ADDITIONAL SERVICES	
6 R	FFFFFNCFS	and the second of the second o

## **APPENDICES**

**APPENDIX A - Figures** 

Figure 1 – Borehole Location Map (Sheets 1 through 17)

**APPENDIX B – Boring Logs** 

Unified Soil Classification System Logs of Exploratory Borings

**APPENDIX C – Laboratory Test Results** 

Summary of Laboratory Test Results Particle Size Distribution Results Atterberg Limits Test Results Direct Shear test Results

**APPENDIX D – Road Condition Photographs** 

**APPENDIX E – Lateral Capacity of Piles for Bridge Foundations** 

**APPENDIX F – Pavement Design Calculations** 

### 1. INTRODUCTION

#### 1.1 GENERAL

This report presents the results of the geotechnical exploration by Kleinfelder West, Inc. (Kleinfelder) for the proposed design and construction of the southern portion of BIA Route N11, BIA Project N11(1A)1,2&4, on the Navajo Nation near Crownpoint, New Mexico. The general location of the project site is shown on Figure 1, Sheet 1 in Appendix A of this report.

The purpose of this investigation was to characterize the subsurface soil and evaluate its engineering properties for use in the design of the proposed construction of the southern portion of Route N11. The investigation included a site reconnaissance, subsurface exploration, selected soil sampling, field and laboratory testing, engineering design and analyses, and preparation of this report. The recommendations contained in this report are subject to the limitations presented herein.

The recommendations and conclusions of this report are based on the subsurface conditions found at the locations of our exploratory borings at the time our exploration was performed. They also are subject to the provisions stated in the following specific sections of this report: "Additional Services" and "Limitations". Our findings, conclusions, and recommendations for this evaluation may not be extrapolated to other adjacent sites or used for other projects without our written approval.

#### 1.2 PROJECT DESCRIPTION

The current alignment of the southern portion of Route N11 consists of a two-lane compacted dirt road approximately 10.6 kilometers (6.6 miles) long; the road primarily carries local traffic. The beginning of project (BOP) is located at station 0+002.298 at the intersection of Route N11 and Route N49. The end of project (EOP) is located at station 10+620 approximately 8.8 kilometers (5.5 miles) miles from at the intersection of Route N11 and Route N9. The roadway crosses the Puerco River at approximate station 3+965. The Site Location Map is presented as Figure 1, Sheet 1 of Appendix A.

The purpose of the project is to reconstruct Route N11, which will include grading, drainage improvements, and asphalt paving. The proposed project also includes a new bridge structure over the Puerco River. We understand that the structure will be a single span bridge with a span length of 27.4 m (90 ft). We understand that the current phase of the project will consist of all pre-construction tasks including design, survey and environmental assessment.

We understand that the majority of the new road will be close to the horizontal alignment of the existing roadway as shown in Figure 1, Sheets 2 through 17 of Appendix A. However, the horizontal alignment will be located northwest of the existing alignment near the crossing of the Puerco River. At the time of this report, we

understand that the vertical alignment of the proposed road will be modified from the existing roadway as shown in Figure 1, Sheets 2 through 17.

### 1.3 PURPOSE AND SCOPE

The purpose of our investigation was to explore and evaluate subsurface conditions at Route N11 and develop recommendations relating to the geotechnical aspects of project design and construction. The conclusions and recommendations in this report are based on analysis of the data from our field exploration and laboratory tests. Specifically, our scope included:

- Drilling of fifty-eight (58) exploratory borings and sampling of subsurface materials.
- Geotechnical and analytical laboratory testing of selected samples obtained during the field exploration to evaluate relevant physical and engineering properties of the soil.
- Evaluation and engineering analysis of the field and laboratory data to develop our geotechnical conclusions and recommendations.
- Preparation of this report.

### 2. EVALUATION PROCEDURES

#### 2.1 FIELD EXPLORATION

The subsurface conditions on Route N11 were explored by drilling fifty-eight (58) total borings at the subject site. The boring locations are shown in Figure 1, Sheets 2 through 17, of Appendix A of this report. Logs of the borings are presented in Appendix B. The borings were advanced by hollow stem auger drilling using a truck-mounted drill rig.

Kleinfelder performed traffic control during subsurface exploration drilling conducted along the existing Route N11. Traffic control consisted of "Road Work Ahead" signs placed near the beginning and end of the work zone and an exclusion zone formed from orange traffic cones placed around the drill rig and Kleinfelder field vehicle.

For all borings drilled during the exploratory boring program, the soil and rock encountered was continuously examined, visually classified, and logged. Logs of the borings are presented in Appendix B. Visual classifications of the soil and rock encountered in our exploratory borings were made in general accordance with the Unified Soil Classification System (ASTM: D2487). A key for the classification of the soil is presented in Appendix B.

A total of 305 lineal meters (1000 lineal feet) of hollow stem auger drilling was performed utilizing a truck-mounted drill rig. Hollow stem auger drilling was accomplished using a truck-mounted CME-75 drill rig equipped with 3½ in, 83 mm I.D. hollow-stem auger. Soil samples were obtained using a modified California (ring) sampler (2.5 in, 64 mm I.D.) and a standard split-spoon sampler (1.375 in, 35 mm I.D.). The sampler was driven with a 140-pound, 63.5-kilogram CME automatic hammer free-falling through a distance of 30 inches, 0.76 m. The sampler driving resistance was recorded as the number of blows per one foot (305 mm) of penetration (referred to as blow counts or N-values), the results of which are presented on the boring logs in Appendix B.

Due to the relatively hard nature of the subsoils, Shelby tube samples were not practical at this site and modified California samples were therefore substituted in lieu of Shelby tubes. This sampler consists of a series of brass rings placed inside a steel tube that is lowered to the bottom of the borehole and driven through the soil by means of hammer blows at the top of the drilling rod. Because the rings are encased inside a steel tube, they do not crumple when driven through hard materials. This substitution was necessary to obtain in-situ densities in order to fulfill the objectives of the Statement of Work (SOW) per contract requirements. The density values that we obtained from soils sampled by the ring sampler compared well with published textbook values and additional sampling would not change any of Kleinfelder's recommendations provided in our geotechnical report.

Rock samples were obtained using an HQ core barrel sampler (2.5-inch, 64 mm I.D.) typically advanced in 1.5-meter (5-foot) runs. Kleinfelder calculated the percent recovery and Rock Quality Designation (RQD) for each run and noted these on the boring logs. The RQD is a modified core recovery percentage in which all of the pieces of sound core greater than 4 inches, 100 mm long are summed and divided by the length of the core run. RQD is expressed as a percentage and categorized according to Table 2.1.

TABLE 2.1 - Classification of Rock by RQD Value

RQD	Rock Quality
less than 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

The individual boring logs and a legend to the logs (including a summary of the Unified Soil Classification System used to describe the soil and the rock classification key sheet) are included in Appendix B of this report. The lines defining boundaries between soil strata are approximate and are based on the observations of the field engineer or geologist and interpolation between samples. Samples obtained during the field exploration were transported to our laboratory for further examination and testing.

### 2.2 LABORATORY TESTING

### 2.2.1 Geotechnical Laboratory Testing

The laboratory testing program consisted of performing visual soil classifications and index property testing on the recovered samples. Soil classification was aided with laboratory tests performed in general accordance of ASTM and AASHTO specifications. As shown in Table 2.2, the following tests were performed according to the corresponding ASTM methods and comparable AASHTO methods:

**TABLE 2.2 – Summary of Geotechnical Laboratory Tests** 

Test	ASTM Method	Comparable AASHTO Method
Moisture Content	D 2216	T 265
Particle Size Analysis	D 422	T 88
Atterberg Limits	D 4318	T 89 and T 90
Direct Shear	D 3080	T236

The results of these tests are presented in Appendix C of this report.

### 3. GENERAL SITE CONDITIONS

#### 3.1 SURFACE CONDITIONS

The overall Route N11 alignment is shown in Figure 1, Sheet 1, with detailed plan and profile drawings shown on Sheets 2 through 17 of Appendix A. Photographs showing the surface conditions of Route N11 are shown in Appendix D of this report. Surface soils on the unpaved roadway consist of very stiff to hard sandy clay and clayey sand with occasional outcrops of moderately weathered to highly weathered shale and sandstone and sandstone boulders. Vegetation in the area primarily consists of sagebrush and high grasses with areas of juniper and piñon trees. Erosion of soils along the alignment was generally observed approximately 6 to 15 m (20 to 50 ft) away from the roadway, with occasional washboarding on the roadway.

The Puerco River crosses the existing Route N11 alignment approximately 65 m (213 ft) south of station 3+965. Water generated from the wash is channeled through a drainage culvert passing under the roadway at this station. The majority of the wash was dry during our site reconnaissance in February of 2009 and follow-up visits during the fall of 2009. However, a small amount of standing water was observed on either side of the drainage culvert in August of 2009, which was likely caused by rains in the area.

#### 3.2 GEOLOGIC SETTING

Prior to drilling, site geology was evaluated by reviewing the Geologic Map of New Mexico (New Mexico Bureau of Geology and Mineral Resources, 2003). The surface geology of the proposed Route N11 realignment consists of five Cretaceous age geologic units as shown in the geologic map in Figure 3.1 below. The northern end of the N-11 (1A) realignment is comprised of the Mulatto Tongue of Mancos Shale (Kmm) and the Crevasse Canyon Formation (Kcc), which contains various sandstone and coalbearing (lignite) units. The Gallup Sandstone (Kg) unit is also present in the northern portion of the alignment. The majority of the southern portion of the N-11(1A) alignment is comprised of Lower Mancos Shale (Kml) materials, with the southernmost tip of the alignment consisting of combined Mancos Shale and Dakota Sandstone (Kmd). During our field activities, sandstones, shales, siltstones and occasional coal seams were observed along the project site.

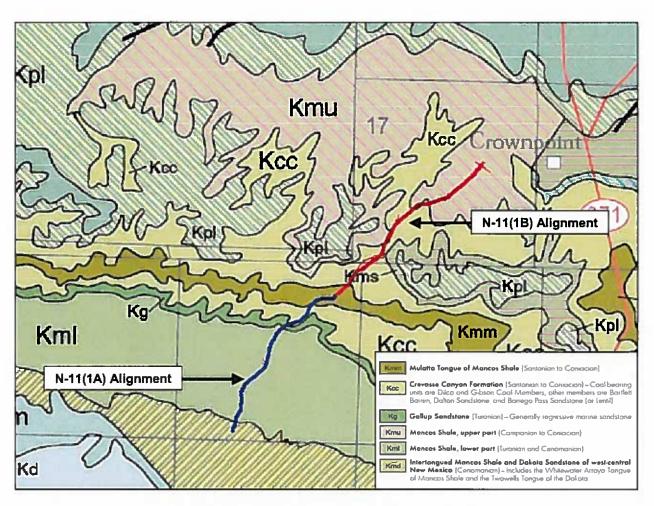


Figure 3.1 – Project Vicinity Geologic Map

#### 3.3 ROADWAY CONDITIONS

Subsurface conditions encountered at the boring locations are described using general conditions below. For specific information at each soil boring location, please refer to the actual soil boring logs presented in Appendix B.

#### 3.3.1 Subsurface Conditions

## 3.3.1.1 Road Alignment

## BOP to Approximate Station 2+000 (borings GR-1 to GR-11)

<u>Stratum 1: Alluvium</u> – Stratum 1 (as described in the following sections), was not observed in our geotechnical borings from BOP to approximate station 2+000.

Stratum 2: Claystone and Siltstone (Kml and Kcc geologic units) – Stratum 2 consisted of highly weathered to decomposed claystone and siltstone with intermittent clay and siltstone with a siltstone with intermittent clay and siltstone with a silts

layers. This layer was light brown to gray in color, moist with occasional gypsum crystals and iron oxide staining. This stratum was encountered to the total depth of borings GR-1 through GR-11, approximately 3.5 m, 11.5 ft below ground surface (bgs). Blow counts for this stratum ranged from 9 blows per foot (305 mm) to 50 blows for 4 inches (100 mm) with an average blow count of 39 blows per foot. The plasticity of the material was low to high. Liquid limit values ranged from 29 to 54, and plasticity indices ranged from 9 to 23.

<u>Stratum 3: Shale</u> – Stratum 3 (as described in the following sections), was not observed in our geotechnical borings from BOP to approximate station 2+000.

Stratum 4: Sandstone (Kg geologic unit) – A layer of weathered sandstone with siltstone was encountered in borings GR-8 and GR-9. The layer was encountered at ground surface in boring GR-8 and 1.1 m (3.5 ft) below ground surface in boring GR-9. This layer was approximately 0.6 m (2 ft) to 1.2 m (4 ft) thick and contained silt and clay seams.

## Approximate Station 2+000 to 3+980 (borings GR-12 to GR-20)

<u>Stratum 1: Alluvium</u> – Stratum 1 consisted of a thin soil layer approximately 0.2 m to 1 m (0.5 to 3.5 ft) thick consisting of sandy lean clay (CL) to high plasticity clay (CH). This clay layer exhibited a stiff to hard consistency and was brown in color. The moisture content in this layer ranged from 9.6% to 11.6%. N-values ranged from 11 to 40.

Stratum 2: Claystone and Siltstone (Kml geologic unit) – Stratum 2 consisted of highly weathered to decomposed claystone and siltstone to the total depth of the general roadway borings (generally 3.5 m, 11.5 ft bgs, ranging to 6.6 m, 21.5 ft bgs in boring GR-17). This stratum was generally brown to gray, moist with iron oxide staining and occasional gypsum crystals and calcite. Plasticity was low to high, with liquid limits values ranging from 47 to 54 and plasticity indices ranging from 19 to 23. Occasional clay or silt layers were observed in Stratum 2. Occasional sandy layers were also observed. Thin sandstone layers were observed in boring GR-20 at 2.3 m, 7.5 ft bgs and GR-17 at 4.9 m, 16 ft bgs.

# Approximate Station 3+980 to 5+700 (borings GR-21 to GR-29)

Stratum 1: Alluvium – This soil layer consisted of silty sand (SM) to sandy silt (ML). This layer was usually encountered at the ground surface and generally ranged from 1.2 to 3.5 m (4 to 11.5 ft) thick. Intermittent layers of poorly-graded sand (SP) with varying silt content were also observed in the borings. N-values in this soil layer ranged from 5 to 27 with an average value of 13. Moisture contents ranged from 3.6% to 8.5% with an average moisture content of 6%. Loose zones were encountered in borings GR-28 and GR-29 at a depth of 0.8 to 3.5 m (2.5 to 11.5 ft) with N-values ranging from 5 to 7. Moisture contents in this loose zone ranged from 5.1% to 7.2%.

A layer of sandy lean clay (CL) was also encountered in Stratum 1 in borings GR-21, GR-22, GR-24, GR-27, and GR-28. This soil layer was usually encountered below Stratum 1 at a depth of 1.2 to 3.4 m (4 to 11 ft) bgs. However, this soil layer was encountered at the ground surface at borings GR-27 and GR-28 and was 1.4 to 2.1 m (4.5 to 7 ft) thick. N-values in this soil layer ranged from 9 to 22 with an average value of 22. Moisture contents ranged from 7.1% to 12.8% with an average moisture content of 10.4%. The layer had an average liquid limit of 44 and an average plasticity index of 19.

## Approximate Station 5+700 to EOP (borings GR-30 to GR-54)

<u>Stratum 1: Alluvium</u> – A layer of silty sand (SM) to clayey sand (SC) was encountered at the ground surface and ranged from 0.3 to 3.7 m (1 to 12 ft thick). N-values in this soil layer ranged from 2 to 37 with an average value of 13. Moisture contents ranged from 7.2% to 16.3% with an average moisture content of 11.2%.

Approximately 7 m (23 ft) of clayey sand (SC) was encountered in boring GR-46. N-values ranged from 2 to 25 with an average value of 8. Moisture contents ranged from 10.7% to 14.8% with an average moisture content of 13%. Clayey sand (SC) was also encountered in borings GR-31 and GR-32 from 1.5 to 3.5 m (5 to 11.5 ft) bgs. N-values in this layer ranged from 3 to 19 with a moisture content of 16.1%. Average liquid limit and plasticity index values were 30 and 10, respectively.

A layer of sandy lean clay (CL) was encountered in boring GR-31 from 0.6 to 1.7 m (2 to 5.5 ft) bgs. This clay layer had an N-value of 18 with a moisture content of 13%. This clay layer was also encountered in boring GR-33 from 0 to 1.8 m (6 ft) bgs with N-values ranging from 15 to 46 and moisture contents ranging from 9.4% to 11.2%. The layer had a liquid limit of 32 and a plasticity index of 14.

<u>Lose Soil Zones</u>: Intermittent zones of very loose to loose soil (N-values less than 10) were encountered in silt (ML) and sand (SM to SC) layers in borings GR-35 to GR-51. These zones were located at depths ranging from ground surface to 7 m (23 ft) bgs.

Stratum 2: Claystone and Siltstone (Kcc and Kmm geologic units) – Highly weathered to decomposed claystone and siltstone were encountered below Stratum 1. This stratum was generally brown to gray, moist, with ferric staining and occasional gypsum crystals and calcite. Occasional clay, silt and sand layers were observed in Stratum 2. Slightly weathered claystone and siltstone were observed in borings GR-40, GR-41, GR-42, GR-44, and GR-53. Liquid limit values ranged from 24 to 43 and plasticity index values ranged from 5 to 19 in this layer.

Stratum 3: Shale (Kml geologic unit) – Shale was encountered in borings GR-37 and GR-38. The shale layer exhibited high blow counts (50 for 125 mm, 5 in), was gray and brown in color, exhibited iron oxide staining and was in a moist condition. The liquid limit and plasticity index values were 33 and 12, respectively. In addition, intermittent seams of weathered shale were encountered in our exploratory borings from approximate station 8+000 to 9+600.

Stratum 4: Sandstone (Kg and Kcc geologic units) – Intermittent sandstone layers were observed in the borings at depths ranging from ground surface to 3.2 m (10.5 ft) below ground surface. The layer ranged from 0.3 m (1 ft) thick to greater than 8.2 m (27 ft) in boring GR-42. The sandstone was fine grained, poorly to moderately cemented and very weathered to slightly weathered. A coal (lignite) seam was encountered within this layer in boring GR-38.

## Approximate Station 8+600 (Cut Area, boring GR-45)

According to the vertical road profile provided by WHPacific, a cut section is planned near station 8+600. The subsurface conditions at this cut area were explored by advancing boring GR-45 to a depth of 21.9 m (72 ft). The subsurface conditions encountered in this boring are described below.

Stratum 1: Alluvium - Stratum 1 was not observed in boring GR-45.

Stratum 2: Claystone and Siltstone (Kcc and Kmm geologic units) — Thin beds of alternating claystone, siltstone and sandstone layers were encountered through hollow stem auger drilling in boring GR-45 to a depth of 3 m (10 ft) bgs. These beds were light brown to light gray with blow counts ranging from 32 to 50 blows per 3 inches (75 mm). Practical auger refusal was met at a depth of 3 m (10 ft) bgs. Rock coring was used to explore below this depth in boring GR-45.

<u>Stratum 3: Shale</u> – Stratum 3 was not observed in boring GR-45. However, intermittent, thin seams of shale were observed in Stratum 4 as described below.

Stratum 4: Sandstone (Kcc geologic unit) – Stratum 4 consisted of slightly weathered sandstone. This stratum was weak to medium strong, light gray in color, fine grained and slightly fractured. Intermittent shale and coal (lignite) seams were encountered in this layer. The rock core recovery in this stratum ranged from 56% to 100% with an average recovery of 63%. Rock quality designation (RQD) values ranged from 87% to 100% with an average RQD value of 98%.

# 3.3.1.2 Proposed Bridge Location

# Approximate Station 3+950 to 3+980 (bridge borings BR-1 to BR-4)

<u>Stratum 1: Alluvium</u> – A sandy lean clay (CL) layer was encountered in the bridge borings from 0 to 5.3 m (17.5 ft) bgs. This soil layer exhibited an increased plasticity in borings BR-1 and BR-3 from 1.2 to 1.5 m (4 to 5 ft) bgs and 3.8 to 5.3 m (12.5 to 17.5 ft) bgs, respectively. Stratum 1 also contained gravel in boring BR-3 from 4.4 to 4.9 m (14.5 to 16 ft) bgs. N-values in this soil layer ranged from 18 to 71 with an average value of 39 and an average moisture content of 16.5%.

A layer of silty sand (SM) to sandy silt (ML) was encountered in the bridge borings with the exception of boring BR-2. This layer was 1.4 to 1.8 m (4.5 to 6 ft) thick and located at the approximate mid-point of Stratum 1 in borings BR-1 and BR-3. Stratum 2 was

located below Stratum 1 in boring BR-4 from 3.7 to 4.9 m (12 to 16 ft) bgs. N-values in this soil layer ranged from 14 to 43 with an average value of 26 and an average moisture content of 12.8%.

Stratum 2: Claystone (Kml geologic unit) — Stratum 2 consisted of highly weathered to decomposed claystone of a hard clay consistency. This claystone layer was encountered in the bridge borings at an average depth of 4.4 m (14.5 ft) and had an average thickness of 4.1 m (13.5 ft). This stratum was generally brown with gray brown iron oxide staining, thickly bedded, moderately fractured, with calcite fracture infilling and occasional fine to medium gravel inclusions. Occasional thin sandstone layers and clay layers were also encountered in Stratum 3. N-values in this decomposed rock layer ranged from 21 to 54 with an average value of 39.

Stratum 3: Shale (Kml geologic unit) – Stratum 3 consisted of slightly weathered, weak shale. Rock coring was used to explore this stratum in borings BR-1 to BR-4. Stratum 4 was encountered in the bridge borings at an average depth of 8.5 m (28 ft) and extended to the total depth of each boring (approximately 16.8 m, 55 ft). This stratum was generally gray to light yellow brown in color, laminated, with calcite infilling the bedding planes. The rock core recovery in this stratum ranged from 18% to 95% with an average recovery of 67%. Rock quality designation (RQD) values ranged from 9% to 92% with an average RQD value of 62%.

A layer of weathered to decomposed shale and claystone was observed along the eroded western bank of the Puerco River. This profile is shown in log EB-1 in Appendix B. The layer was highly weathered to decomposed, extremely weak to weak with thin sandstone and clay lenses.

Stratum 4: Sandstone (Kml geologic unit) – A thin layer of extremely weak and fractured sandstone was encountered in all of the bridge borings within Stratum 3. This layer was encountered at depths ranging from 11.1 m (36.5 ft) to 13.0 m (42.5 ft) in borings BR-1 through BR-4. The thickness of this layer ranged from 25 mm (1 inch) to 0.6 m (2 ft).

#### 3.3.2 Groundwater Conditions

Groundwater was encountered in all exploratory borings located at the bridge abutment locations (borings BR-1 through BR-4) during our geotechnical exploration. Detailed groundwater readings are shown on the borehole logs in Appendix B. A summary of the groundwater readings are shown in the following table.

TABLE 3.1 - Depth to Groundwater Summary

Borehole	Borehole	ximate e Surface ation		nate Depth Indwater	Groun	ximate dwater ation
	(m)	(ft)	(m)	(ft)	(m)	(ft)
BR-1	2165.5	7104.7	7.6	25.0	2157.9	7079.7
BR-2	2165.5	7104.7	6.9	22.5	2158.6	7082.2
BR-3	2162.0	7093.2	7.6	25.0	2154.4	7068.2
BR-4	2163.0	7096.5	9.3	30.5	2153.7	7066.0

The groundwater levels recorded in the borings and presented in this section represent conditions at the time the borings were drilled. The groundwater conditions at the time of construction may vary. In addition, surface runoff may vary throughout the year. The depth to groundwater in the Puerco River wash area may fluctuate depending on the amount of water generated by surface runoff.

### 3.3.3 Collapse Potential of Soils

Hydro-collapse potential is the potential for vertical settlement caused by inundation of the foundation bearing soils after construction. Soils with possible hydro-collapse potential were identified for the N-11(1A) alignment based on unit weight values obtained from laboratory test results and consideration of SPT blow counts. Soils with collapse-potential were identified in borings GR-21, GR-25, GR-29, GR-35, GR-41, GR-46 and GR-49 in silty sand (SM), clayey sand (SC) and sandy silt (ML) soils at depths ranging from 0.8 m to 1.8 m (2.5 ft to 6 ft) below ground surface. In addition, soils with possible collapse potential were identified in bridge boring BR-4 where poorly-graded sand with silt (SP-SM) soils were encountered at an approximate depth of 3.8 m (12.5 ft) below ground surface.

If the potentially collapsible soils in these areas are subjected to concentrated moisture, differential settlements can occur, resulting in premature pavement distress. In this regard, positive subgrade drainage and avoiding ponding conditions along the road alignment will be essential in these areas to avoid the risk of premature pavement distress due to hydro-collapsible conditions.

Isolated areas of hydro-collapsible soils located in the top few meters of the soil profile are a common occurrence in the desert southwest and could be present in other areas of the alignment. These soils become mildly cemented by calcium minerals. When the soils become wetted the cementation breaks down and the soils can experience sudden large settlements. In this regard, adequate subsurface drainage in the final design and protection from possible surface water ponding and/or infiltration during construction is very important to the structural performance of the pavement.

#### 4. CONCLUSIONS AND RECOMMENDATIONS

#### 4.1 GENERAL

Based on the information presented herein, it is Kleinfelder's opinion that the site may be developed as proposed and described in this report, provided that the recommendations presented in this report are incorporated into design and construction. These opinions, conclusions, and recommendations are based on our field investigation and review of the logs, engineering analysis, the properties of the soil encountered in our borings, the results of the laboratory testing program, and our understanding of the proposed development of the site.

Kleinfelder's borehole depths and locations were determined based on the vertical and horizontal alignment shown in Figure 1 of this report. If the alignment is significantly changed from that presented in Figure 1, a representative of the geotechnical engineer should review the new alignment to ensure that the recommendations presented in this report still apply. We have been notified about the reduction of the cut area at station 8+600 that resulted in a change in the vertical alignment; this alignment change does not affect our recommendations.

#### 4.2 GEOTECHNICAL CONSIDERATIONS

#### 4.2.1 General Considerations

One of the principal geotechnical concerns for pavement subgrade support is the significant variation of geologic materials and their corresponding stiffness values along the project alignment as indicated by the borings logs, geologic reconnaissance and test data. The variation of subgrade support between the different soil types encountered in our geotechnical investigation is further discussed in Section 4.4.1. While alternate pavement sections are often used to provide thicker pavement sections in poorer subgrade support areas, it was possible to utilize the same pavement design section for this project due primarily to the projected low traffic volume. As discussed in Section 4.4.4, a BIA minimum pavement section of 76 mm (3.0 inches) of asphalt over 150 mm (6 inches) of aggregate base course is recommended for the pavement design.

Another geotechnical concern associated with the site is loose and/or hydro-collapsible soil zones encountered in our exploratory borings as discussed in Sections 3.3.1 and 3.3.3, respectively. Intermittent zones of very loose to loose soil (N-values less than 10) were encountered in our borings from approximate stations 5+600 to 5+750 and stations 6+600 to 9+800. While the majority of the loose soil zones are located in proposed cut or fill areas, several areas may have loose soil zones located near the existing vertical alignment. These locations include approximate station 5+720, stations 7+300 to 7+600 and stations 8+950 to 9+700. Zones of potentially hydro-collapsible soils are discussed in Section 3.3.3. It is important to note that Kleinfelder's

geotechnical borings sampled a small portion of the subsurface conditions at the site and that additional loose soil zones may be encountered at other locations along the N11(1A) alignment during construction.

Layers of strong sandstone were encountered in borings GR-42 and GR-45, which are located in the proposed cut sections between approximate stations 7+600 to 9+000. While much of the sandstone material may be rippable using conventional equipment, some zones may be strong enough and sufficiently widely-jointed so as to resist ripping and removal may require heavy-duty excavation equipment such as rock saws or hoerams. It may be necessary to perform ripping tests or seismic tests to evaluate the required method of removal for the sandstone material.

## 4.2.2 Use of Mancos Shale during Construction

As discussed in Section 3.3.1, intermittent layers of claystone, siltstone and soft, fissile shale (referred to herein as the Mancos Shale unit) were encountered in the alignment profile.

The challenge of using shale as structural fill centers around the potential for excessive post construction settlement and for large slope instabilities. The root cause of this poor performance is generally attributable to infiltration of water after construction causing either a degradation of the shale material properties or causing water induced settlements. Shales, such as Mancos shale, that are nondurable and that are placed as rock fill are particularly susceptible to post construction settlement and large slope instabilities. In addition, shales that are mixed with harder rock that prevents adequate compaction can experience post construction settlement. In terms of the use of shales in embankments, the most conservative approach is to break them down into small fragments and place them in thin lifts as soil.

A secondary concern for the use of shale in embankments is the potential for surface erosion that can form shallow slides on outer slopes that can progress over time into deeper slides and eventually lead to large slope instabilities.

Based upon our previous experiences with this material it is the opinion of Kleinfelder that Mancos Shale in the vicinity of the project can be successfully used in roadway embankment construction provided that it is treated as a soil and broken down and compacted in thin lifts to eliminate the potential for large voids. In addition, the shale should be placed in the embankment away from exposed surfaces and the slopes should be covered with soil or crushed sandstone so that the shale is not subjected to surface runoff erosion.

The primary concern for the design engineer when using Mancos Shale as a compacted soil is to prevent the shale from having access to water that can further degrade its properties or create excessive settlements. While post construction swelling/settlement

potential may exist (due to the moisture conditioning during placement), the majority of these movements should take place over relatively short periods of time and should be essentially completed within 1 to 3 months after placement.

Mancos Shale should be broken down into pieces no larger than 5 cm (2 in) in diameter prior to placement as soil. A bulldozer with a disk and a sheepsfoot roller working on lifts with a maximum thickness of 15 cm (6 in) should be able to break down the intact Mancos Shale. Road embankment construction could proceed as follows:

- 1) Following excavation of the shale and other overburden soils, the shale and/or overburden soils should be transported to the embankment area to be placed in the bottom 20 percent of the fill height and at least 2.4 m (8 ft) from the final surface of the embankment slope.
- 2) The excavated Mancos Shale should be laid out in a lift of not more than 15 cm (6 in) thick and broken down using a bulldozer or sheepsfoot roller. The material should be broken down into pieces not greater than 5 cm (2 in) in diameter. The Mancos Shale will then be moisture conditioned, and compacted with a sheepsfoot roller to the target compactive effort as developed by the laboratory experimental results.
- 3) The process should be repeated for each additional lift.

### 4.3 BRIDGE FOUNDATIONS

## 4.3.1 Foundation Type and Loading

Based on information provided by Mr. Mike Zwolinski, P.E. of WHPacific, the new bridge structure over the Puerco River will consist of a single span bridge with a span length of 27.4 m (90 ft) and two abutments. It is our understanding that driven piles are the preferred foundation system, with driven steel H-piles oriented with the X-X (strong) axis of the pile oriented in the direction perpendicular to the bridge (i.e. the direction of river flow). The planned design with the weak axis in the longitudinal direction will accommodate thermal expansion and contraction without the use of expansion joints at the abutments. Passive earth pressure against the abutment backwalls will be relied upon to resist the longitudinal tractive and seismic loads parallel to the longitudinal axis of the bridge.

It is our understanding that five (5) HP360X152 (HP14X102, imperial units) piles will be utilized at each abutment. Foundation reactions for four different loading cases were provided by Mr. Mike Zwolinski as shown in Table 4.1.

TABLE 4.1 – Pile Foundation Reactions (reactions for single HP360X152 pile)

Loading	Maximum Axial Load		Shear Force about x-x axis		Shear Force about y-y axis		Moment about y-y axis	
Case	(kN)	(kips)	(kN)	(kips)	(kN)	(kips)	(kN-m)	(kip-ft)
Case 1, Str la	1233.0	277.2	0.0	0.0	32.9	7.4	22.4	16.5
Case 2, Str V	1159.7	260.7	11.6	2.6	27.1	6.1	17.4	12.8
Case 3, Ext Event	926.6	208.3	48.0	10.8	13.3	3.0	8.4	6.2
Case 4, Str lb	970.2	218.1	0.0	0.0	33.4	7.5	15.9	11.7

### 4.3.2 Pile Casing

It is our understanding that piles in the upper 3 m (10 ft) may be sleeved (unsupported laterally), with a corrugated metal pipe (CMP) casing for additional flexibility and in order to better distribute bending moments along the pile length. The results of our lateral analysis presented in the following sections account for this scenario. Based on conversations with Mr. Mike Zwolinski, the annular space between the casing and the piles must be filled to prevent concrete from leaking into the annulus. We recommend that annular backfill in the upper 3 m (10 ft) consist of a loose foam (such as Styrofoam packaging "peanuts" or similar) to provide backfill while still maintaining flexibility. The top of the annular space may then be capped to prevent concrete from flowing into the backfill material.

## 4.3.3 Pre-Boring

As discussed in Section 3.3.1, the stratum encountered in our exploratory borings (BR-1 through BR-4) at the bridge abutment locations consisted of a layer of slightly weathered shale overlain by highly weathered to decomposed claystone and alluvial material (sands, silts and clays). During our exploratory drilling, auger or SPT refusal was not encountered in the soils and weak claystone overlying the shale bedrock layer. Based on the information obtained from the borings, pre-boring should not be required in the weak claystone layer. However, zones of boulders or resistant shale are possible in the bridge area and may require pre-boring in some cases.

#### 4.3.4 Scour Potential

In order to indentify the potential for scour on the bridge foundations, Kleinfelder performed gradation tests on select soil samples from the borings located in the proposed bridge location (borings BR-1 through BR-4). These test results are presented in Appendix C of this report. The results from the gradation tests were

provided to WHPacific and a maximum scour depth of 4.2 m (13.8 ft) was subsequently determined by WHPacific. Based on preliminary design drawings provided by Mr. Mike Zwolinski, the river slopes are designed to be protected with wire enclosed riprap. At the request of WHPacific, Kleinfelder's lateral and axial pile capacity calculations considered no scour for normal conditions and 4.2 m (13.8 ft) of scour potential for the Q500 event.

## 4.3.5 Axial Capacity of Piles

Kleinfelder evaluated the axial capacity of the piles at the bridge abutments using the AASHTO computer program Driven. Based on the borehole logs from our geotechnical evaluation, a generalized subsurface profile was compiled for the bridge location. Axial capacity of the piles was calculated assuming support from skin friction in the upper alluvium and weathered claystone layers and end-bearing in the shale material located below these layers; a friction component of axial capacity was not considered in the shale material.

Due to the relatively softer nature of the materials overlying the bearing strata, steel piles should be checked for compact section (buckling). Estimated axial pile capacities for use in LRFD strength design, as a function of depth, are shown in Figure 4.1. Results are presented for no scour and 4.2 m (13.8 ft) of scour.

Piles driven into shale materials, as shown on the boring logs, should be driven to capacity as determined by final blow counts per foot. Based on our borings at the proposed bridge location, the depth to shale material on the north bridge abutment (at boring locations BR-03 and BR-04) ranged from approximately 8.5 m to 10.1 m (28 ft to 33 ft) bgs. This depth corresponds to approximate elevations of 2,153.5 m (7,065 ft) to 2153 m (7064 ft). The depth to shale on the south bridge abutment (at boring locations BR-01 and BR-02) was approximately 7.8 m (25.5 ft) bgs. These depths correspond to an approximate elevation of 2,154.7 m (7,069 ft).

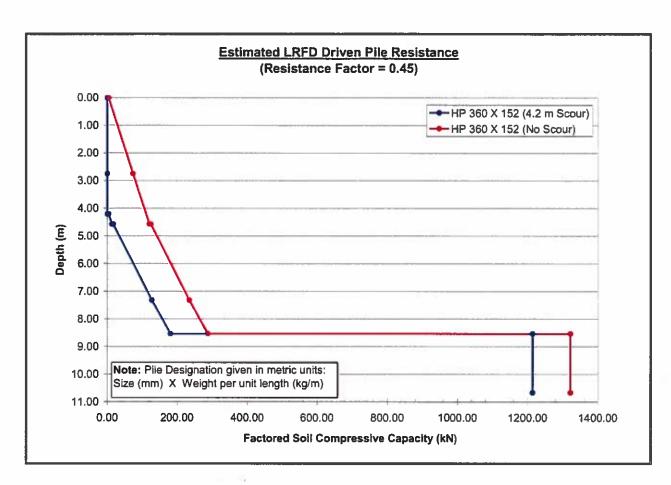


Figure 4.1 – Axial Capacity of Piles

### 4.3.6 Lateral Capacity of Piles

Kleinfelder evaluated the lateral capacity of the piles at the bridge abutments using the computer program LPILE PLUS 5.0. The LPILE calculations were made using soil and rock properties obtained or estimated from the test borings and laboratory tests. Based on information received from the WHPacific bridge design engineers, LPILE calculations for the piles were made using the assumption that the X-X axis of the piles (the stiffer direction in bending) would be oriented in the direction perpendicular to the bridge (i.e. the direction resisting river flows). Analyses were performed to determine *ultimate* lateral load capacity. *Allowable* lateral pile capacities should be reduced based on allowable lateral deflection at the pile head.

The LPILE analyses were performed for a total of 8 cases in which the lateral and axial loads for the four loading cases were applied. As discussed above, pile loads were provided for a single, HP360X152 (HP14X102, imperial units) pile based on five piles per abutment. All analyses were performed assuming a laterally-unsupported length in the upper 3 m (10 ft) of the pile to account for the CMP casing. Analyses were performed for no scour and a 4.2 m (13.8 ft) scour depth. A typical soil profile as was found at borings BR-01 through BR-04 was utilized in our analysis. Results for the lateral capacity of piles for the bridge foundation are presented in Appendix E. The

results of the lateral analysis do not account for passive earth resistance. The equivalent fluid pressure for passive earth resistance presented in Section 4.3.7 may be applied to the pile cap.

## 4.3.7 Bridge Abutments

Lateral earth pressures acting against abutments, columns, and wing walls can be estimated using the earth pressures presented in Table 4.2. The earth pressures are based on engineered fill material modeled with a friction angle ( $\Phi$ ) of 32 degrees and a moist unit weight ( $\gamma$ ) of 2,000 kg/m³ (125 pounds lb/ft³)

**TABLE 4.2 – Earth Pressures** 

Lateral Earth	Equivalent Fluid Pressure		
Pressure Case	(kg/m³)	(lb/ft ³ )	
Active Earth Pressure	560	35	
Passive Earth Pressure	4,805	300	

The earth pressures provided above were calculated assuming vertical walls backfilled with materials that meet the specifications for structural fill and engineered fill as described in Section 704.04 of the FP-03 Specifications. Proper drainage should be designed behind the walls to allow for drained conditions in the backfill soils and to prevent hydrostatic pressure behind the abutments and walls.

#### 4.4 PAVEMENTS

Kleinfelder performed the pavement design calculations in accordance with the BIA Requirements specified in the design analysis report for Route N11. Detailed pavement design calculations are provided in Appendix F of this report. General pavement design recommendations for the proposed project are provided in the following sections.

## 4.4.1 Anticipated Pavement Subgrade Material

The subsurface soils encountered at the proposed pavement subgrade depth in the borings generally ranged from lean clay to low plasticity silt (CL to ML) to clayey and silty sands (SC to SM). Weathered rock (sandstone, siltstone, claystone and shale) with occasional layers of fat clay (CH) were also encountered throughout the alignment profile. In addition, lignite seams were observed in borings GR-38 and GR-45. Based on the range of geologic materials encountered and the highly variable N values from Standard Penetration Tests (SPT), variable subgrade support is anticipated. Therefore, our calculations were performed utilizing a conservative composite CBR estimate to account for weaker materials such as the clay and silt materials encountered in our borings. For specific information at each soil boring location, please refer to the actual soil boring logs presented in Appendix B.

CBR values were estimated based on the general soil types encountered in our field exploration as shown in Table 4.3. As previously discussed, there is significant lateral variation of soil types along the project section.

TABLE 4.3 – Estimated CBR Values Based on Material

туре	
Soil Type	Estimated CBR
Lean Clay (CL) to Fat Clay (CH) and Low Plasticity Silt (ML)	8
Clayey Sand (SC) and Silty Sand (SM)	17
Sandstone, Siltstone Claystone and Shale	50+

Because the overall performance of this road section will be more affected by the poorer subgrade soil sections, we recommend a composite CBR value of 8 be utilized for the design section of Route N11. The selected value represents a lower-end value that will govern the overall behavior of the pavement section. Using this value, a correlated subgrade resilient modulus of 65.5 MPa (9,500 psi) was used in our calculations.

## 4.4.2 Drainage Coefficient

A drainage coefficient of 1.0 for the asphalt crushed base course was used in our calculations. These values assume that positive drainage controls will be designed and constructed.

# 4.4.3 Design Traffic Loadings

Based on traffic count data in a BIA design analysis report for Route N11 (dated 06/27/05, revised 10/11/05) provided by WHPacific, it is our understanding that the average daily traffic (ADT) value was 371 vehicles per day (vpd) in 2002, with a projected ADT of 453 vpd for 2022. Based on a growth factor of 1.0% (provided in the BIA design analysis report), Kleinfelder calculated a 2009 ADT value of 398 vpd for 2-way traffic.

Based on information provided by Ms. Rachel LeVee of WHPacific, the anticipated percentage of heavy vehicles is 2%. The total ADT value was subdivided based on anticipated vehicle type as shown in Table 4.4. Using the ADT values for each vehicle type as shown in Table 4.4, a design period of 20 years, a growth factor of 1.0%, a direction factor of 1, and a lane distribution factor of 0.5, a total of 103,524 18-kip ESALs were estimated.

Table 4.4—Percent Annual Daily Traffic Values (ADT)

Vehicle Type	Percent of Total ADT	ADT Value (vpd)
Light Duty	93 %	370
Medium Duty	5 %	20
Heavy Duty	2 %	8
	Total ADT:	398

## 4.4.4 Design Sections

A hot mix asphalt and base course pavement section will involve treatment of the exposed subgrade soils as described in Section 4.5.1 "Site Preparation" of this report. An imported aggregate base course as described in Section 4.5.3.4 of this report is then placed over the treated subgrade soils. A hot mix asphalt pavement is then placed over the aggregate base course material.

The asphaltic concrete pavement sections were calculated using the 1993 AASHTO method. Based on our calculations a pavement section consisting of 76 mm (3 inches) asphalt over 150 mm (6 inches) of aggregate base would be sufficient for the anticipated traffic loads. This pavement section corresponds to the minimum required section specified in the BIA design analysis report. We therefore recommend the minimum BIA pavement section for Route N11 presented in the following table.

Table 4.5- Design Pavement Section

Traffic Loading	Asphaltic Concrete Pavement (ACP)	Aggregate Base
103,524 18-kip ESAL	76 mm (3 in) ACP	150 mm (6 in) Base

#### 4.5 CONSTRUCTION CONSIDERATIONS

The following sections summarize the recommendations relating to construction. The recommendations are based on the subsurface conditions encountered and are in general accordance with the design guides presented in FP-03, the Standard Specifications for the Construction of Roads and Bridges on Federal Highway Projects. Specific recommendations for use of Mancos Shale during construction are provided in Section 4.2.2.

## 4.5.1 Site Preparation

All site preparation and earthwork operations should be performed in accordance with applicable codes, safety regulations and other local, State or Federal guidelines. In general, all the subgrade preparation work and earth moving should be performed

according the specifications in Section 204 "Excavation and Embankment", of the FP-03 Specifications.

Once the subgrade is exposed, we recommend it be tested and observed and all surface debris, trees, stumps, roots, organic matter and other objectionable protruding obstructions be cleared or removed as required. The subgrade should be cleared of unsuitable soils or debris, including coal (lignite) layers. Where lignite is exposed at the proposed final subgrade elevation, it should be undercut a minimum of 30 cm (12 in) to reduce the potential for future pavement distress. Any voids or holes in the subgrade resulting from the removal of unsuitable soils or lignite shall be backfilled and compacted in accordance with the recommendations in this report.

The subgrade should be graded to slope a minimum of 2% from the center to the edge. The subgrade should then be scarified to a minimum depth of 30 cm (12 in) and recompacted to a density not less than 95% of the maximum dry density and within 2% of the optimum moisture content as determined by AASHTO T 99, Method C or AASHTO T 180. Next a proof-roll test should be performed on the prepared subgrade to identify any soft areas in the subgrade that need additional compaction or stabilization.

Subgrade compaction shall be verified by field density tests taken at locations in accordance with the FP-03 minimum testing standards. The densities should be determined in accordance with AASHTO T 310, by nuclear methods or by other approved methods. In addition to the density tests, a proof-roll test should be performed once each layer has been placed.

Strong sandstone rock layers were encountered in the borings performed during our geotechnical exploration between approximate stations 7+600 to 9+000. Since these areas are located in proposed cut sections, it may be necessary to perform ripping tests or seismic tests to determine the required method of removal for the sandstone material.

### 4.5.2 Drainage

Long-term performance of pavement will require that the subgrade soils and engineered fill be protected against excessive water infiltration and/or saturation. We recommend the civil engineering design include measures to keep the subgrade dry and to include measures to divert water generated by drainage channels crossing the roadway, which could fluctuate throughout the year.

## 4.5.3 Engineered Fill

# 4.5.3.1 Acceptable Materials

The definition of "Engineered fill" is soil that is placed; moisture conditioned, compacted to a specified minimum density, and tested by the geotechnical engineer. The material

selected for engineered fill should be free of frozen soil, root mat material, organic and deleterious matter. In addition, some blending of soils and removal of debris may be required to achieve a uniform soil consistency.

Based on our visual identification of the soils, supplemented with laboratory testing, it is our opinion much of the on-site soils are acceptable for re-use as engineered fill provided they are suitably moisture conditioned prior to compaction and provided the soils meet the previously described criteria. Lignite layers (encountered in borings GR-38 and GR-45) should NOT be re-used as fill material due to its organic content and high potential for future pavement distress.

Lean to high-plasticity clay (CL to CH) and silty soils (ML to MH) observed at the boring locations were not confined to a single area of the alignment; rather, these soils were encountered throughout the alignment. While these soils are less desirable as a subgrade support layer and should not be imported from an off-site location, they may be used for engineered fill or blended with imported fill meeting the criteria specified in Table 4.6.

Table 4.6– Engineered Fill Requirements
From FP-03 Section 704.06, Unclassified Borrow

Soil Classification, AASHTO M 145	Approximate Equivalent USCS Soil Classification
A-1	GP, GW, GM, GC
A-3	SP,SW, SP-SM
A-2-4	SC, SM

The weathered shale, siltstone and claystone of the Mancos Shale Unit encountered in our borings along the southern portion of the alignment are generally not preferred material for engineered fill and may result in lowered subgrade performance over the design life of the road. The owner should consider this lowered performance versus the cost for using imported fill. Although it will be more labor intensive and require engineering support to successfully construct, a methodology to utilize a portion of Mancos Shale material in deep fill locations is presented in Section 4.2.2., "Use of Mancos Shale during Construction" of this report

If additional fill soils must be imported to the site, we recommend that the material for fill should consist of soils that meet the gradation requirements shown in Table 4.6.

## 4.5.3.2 Engineered Fill Placement and Compaction

If Mancos shale is used as engineered fill, the requirements described in section 4.2.2 "Use of Mancos Shale during Construction" of this report should be followed. Placement and compaction requirements for other fill material are as follows.

Any fill placed for the subbase where fill is required to raise the grade of the roadbed should be placed in horizontal layers not exceeding 300 mm (12 in), compacted measurement, and shall be compacted in accordance with the recommendations presented in this section and in Section 204 of the FP-03 Specifications. As discussed in Section 204.10 of the FP-03 Specifications, oversized boulders or rock fragments too large for a 30 cm (12 in) layer should be reduced in size or placed individually as discussed in Part (c) to prevent nested zones. Any subgrade areas disturbed by the construction activities should be repaired prior to placement of the next lift of fill. If lean to high-plasticity clay (CL to CH) and silty (ML to MH) soils are utilized for engineered fill, they should be used as lower fill layers placed near the soil subgrade. Fill materials conforming to the soils shown in Table 4.6 should be utilized for subsequent upper fill layers in contact with the base course layer.

Each lift of engineered fill should be compacted to not less than 95% of maximum density. The moisture content of the soil at the time of compaction should not exceed the optimum or be less than the optimum minus two percentage points as determined by AASHTO T 99, Method C or AASHTO T 180. If the moisture content at the time of compaction is not within the specified range, the material shall be either moistened or dried and thoroughly mixed by reprocessing, to the full depth of the lift, before recompaction.

Maximum densities should be determined by AASHTO T 99, Method C or AASHTO T 180, and field densities should be determined by AASHTO T 310 or other approved methods. Densities shall be taken at each lift just prior to placing fill on the succeeding lift.

We recommend that a representative of the geotechnical engineer provide continuous on-site observation and testing during over-excavation, subgrade preparation, and placement of engineered fill to document compliance with the recommendations contained herein.

## 4.5.3.3 Shrinkage Factor

A shrinkage factor relates the decrease in volume of soils once they are compacted. Laboratory testing to determine the shrinkage factors of the onsite soils was not part of the scope of this project. A general shrinkage factor of 10 to 15 percent as described in the NAVFAC Design Manual 7.02 may be used for estimating purposes.

## 4.5.3.4 Aggregate Base Course

The aggregate base course should conform to Section 703.05 of the FP-03 Specifications. The base course should be composed of crushed stone material meeting the requirements specified in Table 703-2 of the FP-03 Specifications for Grading D Base as shown in the following table.

Table 4.7– Base Course Requirements From FP-03 Table 703-2

Standard Sieve Size	Percent Passing by Mass				
25 mm (1.0 in)	100				
19 mm (3/4 in)	86 (±6) - 100 (±6)				
9.5 mm (3/8 in)	51 (±6) – 82 (±6)				
4.75 mm (No. 4 sieve)	36 (±6) – 64 (±6)				
425 μm (No. 40 sieve)	12 (±4) – 26 (±4)				
75 μm (No. 200 sieve)	4 (±3) – 7 (±3)				
Plasticity I	Plasticity Requirements				
Liquid Limit	25 or less				

The base course should be placed and compacted in accordance with Sections 301.05 of the FP-03 Specifications. The aggregate base course should be compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with AASHTO T-99 or T-180 Method D. Moisture content, at the time of compaction, should be within 2 percent of the optimum moisture content.

## 4.5.3.5 Drainage Pipe Bedding and Backfill

Pipe bedding material shall conform to Section 704.02 of the FP-03 Specifications. Gradation requirements for pipe bedding are given in Table 4.8. Pipe backfill material shall conform to Section 704.03 of the FP-03 Specifications. Gradation requirements for pipe bedding are provided in Table 4.9. Pipe bedding and backfill should be placed and compacted in accordance with Section 209.09 and 209.10, respectively of the FP-03 Specifications.

Table 4.8– Bedding Material Requirements From FP-03 Section 704.02, Bedding Material

Soil Classification, AASHTO M 145	Approximate Equivalent USCS Soil Classification
A-1	GP, GW, GM, GC
A-2-4	SC, SM
A-2-5	GM, SM
A-3	SP, SW
Max Particle Size	12.5 mm or half the corrugation depth, whichever is smaller

Table 4.9– Backfill Material Requirements for Structures and Pipes From FP-03 Section 704.03, Backfill Material

Soil Classification, AASHTO M 145	Approximate Equivalent USCS Soil Classification
A-1	GP, GW, GM, GC
A-2	GM, GC, SM, SC
A-3	SP, SW
Max Particle Size	75 mm

Geo-chemical soil testing for corrosion potential was not part of this investigation's scope. Therefore, geo-chemical testing will need to be done prior to construction to determine the appropriate culvert type or thickness of galvanization.

# 4.5.3.6 Hot Mix Asphalt Concrete

Asphalt concrete materials quality and construction requirements should conform to Section 403 of the FP-03 Specifications. Asphalt binder should conform to Sections 702.01 and 702.04 of FP-03. Asphalt aggregate should conform to Section 703.07 of

FP-03 Specifications. Recommended asphalt aggregate gradation is summarized in the Table 4.10.

Table 4.10– Asphalt Aggregate Gradation Requirements
From FP-03 Table 703-4

Standard Sieve Size	Percent Passing by Mass
25 mm (1.0 in)	100
19 mm (3/4 in)	97 – 100
12.5 mm (1/2 in)	76 (±5) – 88 (±5)
4.75 mm (No. 4 sieve)	49 (±7) – 59 (±7)
2.36 mm (No. 8 sieve)	36 (±5) – 45 (±5)
600 μm (No. 30 sieve)	20 (±4) – 28 (±4)
300 μm (No. 50 sieve)	13 (±3) – 21 (±3)
75 μm (No. 200 sieve)	3 (±2) - 7 (±2)

According to the New Mexico Department of Transportation Pavement Design Directive (IDD-2008-05) Table A-6, an asphalt binder grade of PG 58-28 is applicable for roads in McKinley County, New Mexico near the Thoreau, New Mexico station. As described in the NMDOT IDD-2008-05 Table A-7, an adjustment to the asphalt binder grade is then made to account for the traffic loading and traffic speed of the roadway. Using a traffic loading of 103,524 18-kip ESALs as described in Section 4.4.3 of this report and a traffic speed range of greater than 15 mph, no adjustment is necessary. Thus, an asphalt binder grade of PG 58-28 may be used for this project.

### 4.5.4 Construction in Wet or Cold Weather

Grading fill, structural fill or other fill should not be placed on frosted or frozen ground, nor should frozen material be placed as fill. Frozen ground should be allowed to thaw or be completely removed prior to placement of fill. If earthwork is performed during the winter months when freezing is a factor, a good practice is to cover the compacted fill with a "blanket" of loose fill each evening to help prevent the compacted fill from freezing. Prior to commencement of fill placement operations the next morning, the loose fill blanket must be entirely removed and allowed to thaw before incorporating it into the fill.

During construction, grade the site so that surface water can drain readily away from the pavement areas. Ponding of water in or near excavations should be avoided. Promptly pump out or otherwise remove water that accumulates in excavations or on subgrades, and allow these areas to dry out before resuming construction. Use berms, ditches, and similar means to prevent storm water from entering work areas and to convey it off-site efficiently.

## 4.5.5 Construction Testing and Observation

Field testing and construction observation should take place under the observation of Kleinfelder to support our engineer's professional opinion as to whether the earthwork does or does not substantially conform to the recommendations in this report.

Furthermore, the opinions and conclusions of a geotechnical report are based on interpretation of a limited amount of information obtained from the field exploration. It is therefore common to find that actual site conditions differ somewhat from those indicated in the report. Kleinfelder should remain involved throughout the project to evaluate such differing conditions as they appear, and to modify or add to the geotechnical recommendations as necessary.

## 5. CLOSURE

#### 5.1 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee or warranty, expression or implication, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

The scope of our services does not include services related to construction safety precautions and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures except as specifically described in our report for consideration in design. The scope of our services for this report did not include any environmental assessment or evaluation regarding the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, air, or below or around the site.

This report may be used only by the Client and the registered design professional in charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report.

The work performed was based on project information provided by the Client. If the Client does not retain Kleinfelder to review any plans and specifications, including any revisions or modifications to the plans and specifications, Kleinfelder assumes no responsibility for the suitability of our recommendations. In addition, if there are any changes in the field to the plans and specifications, the Client must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations.

#### 5.2 ADDITIONAL SERVICES

The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be performed during the construction to verify compliance with these recommendations. These tests and observations should include, but not necessarily be limited to, the following:

- Observations and testing during site preparation and earthwork operations.
- Slope stability of proposed soil and rock cuts
- Consultation as may be required during construction.

It is also recommended that the project plans and specifications be reviewed by Kleinfelder to verify compatibility with the conclusions and recommendations presented in this report. Additional information concerning the scope and cost of these services can be provided by this office upon request.

## 6. REFERENCES

American Association of State Highway and Transportation Officials (AASHTO), "AASHTO Guide for Design of Pavement Structures", Washington, D.C., 1993.

Department of the Interior, Bureau of Indian Affairs, Navajo Region Office, Division of Transportation, Highway design Unit, "Design Analysis Report for Project: N11(1)1,2&4", June 27,2005, revised October 11, 2005.

Email from Ms. Rachel LeVee of WHPacific, August 31, 2009, subject "Re: N11 Traffic Counts".

Naval Facilities Engineering Command (NAVFAC) Design Manual 7.02, Foundations and Earth Structures, September 1986.

New Mexico Department of Transportation (NMDOT) Infrastructure Design Directive, Pavement Design Directive (IDD-2008-05), July 2008.

Pavement Analysis Software (PAS), American Concrete Pavement Association, Version 5.0, 1993.

U.S. Department of Transportation, Federal Highway Administration, "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03, Metric Units".

# APPENDIX A

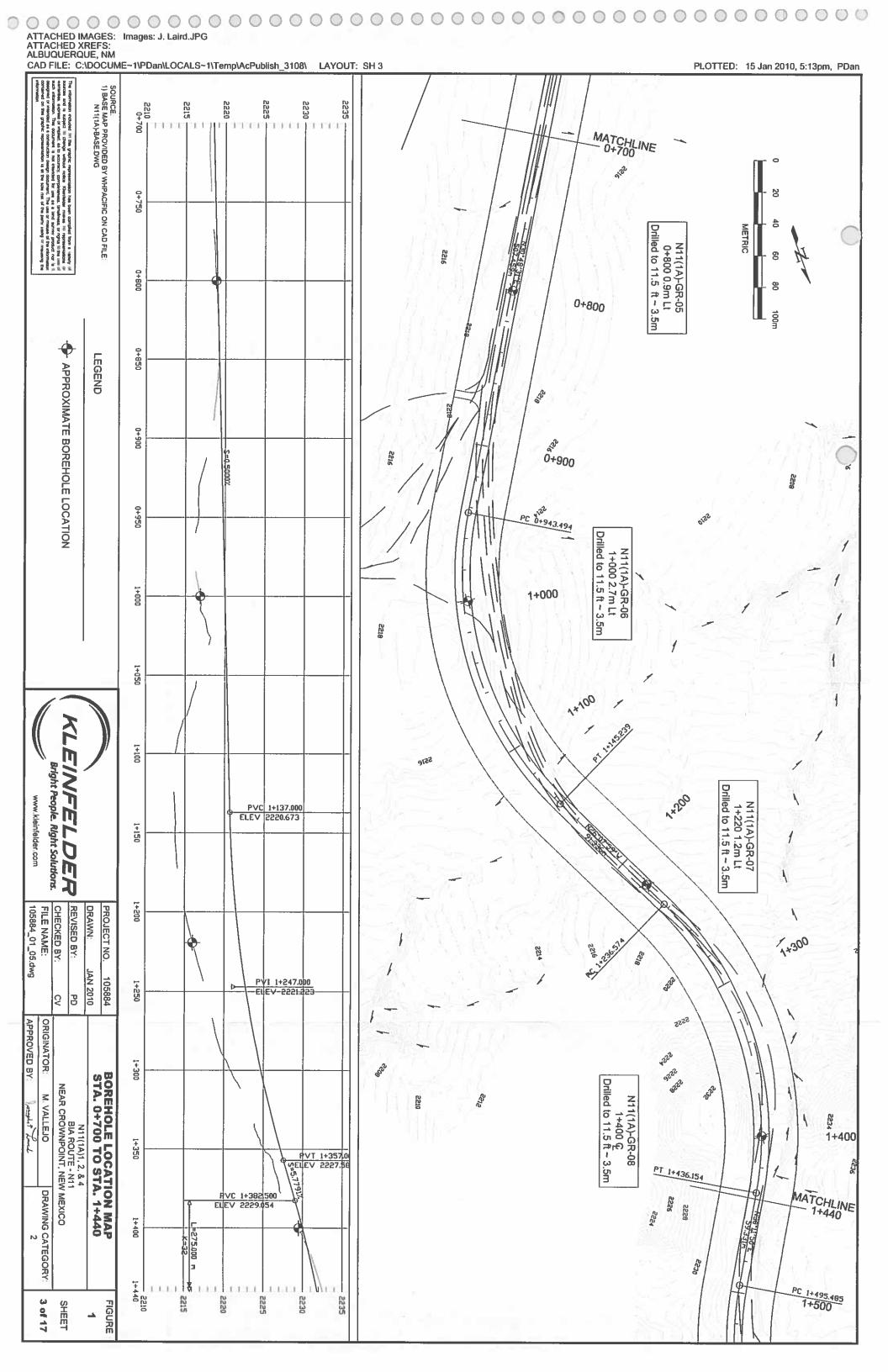
Figure 1 – Borehole Location Map (Sheets 1 through 17)

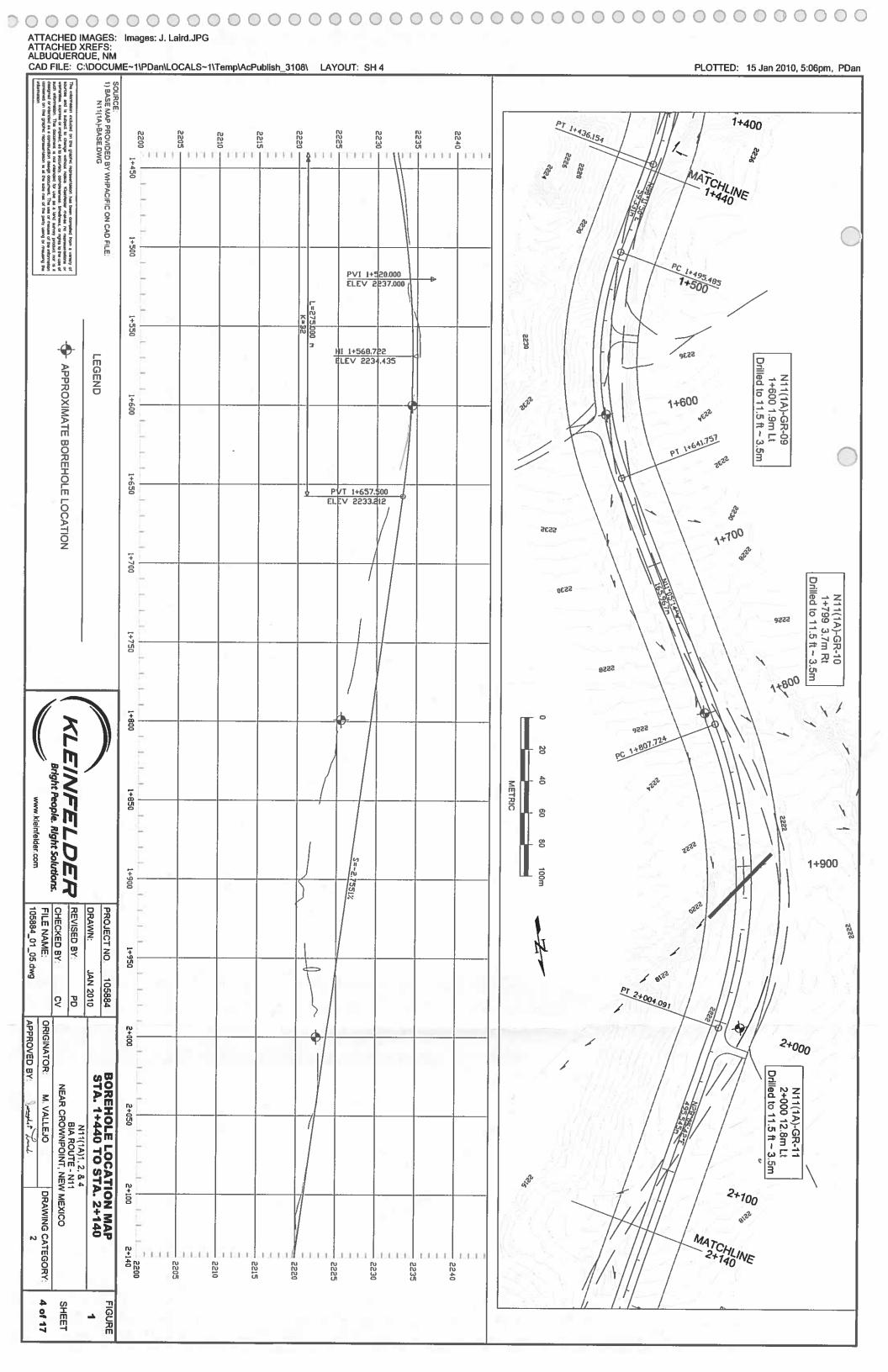
OKLAHOMA Sheet 14 Sheet 13 ARIZONA Sheet 12 TEXAS LLANO ESTACADO Sheet 11 Sheet 10 Sheet 9 CHIHUAHUA MEXICO NTS SOURCE: Base map provided my nationalatias.gov. Sheet 8 Sheet 7 Sheet 16 **LEGEND** * APPROXIMATE SITE LOCATION Sheet # APPROXIMATE N11(1A) PROPOSED ALIGNMENT **CURRENT APPROXIMATE N11 EXISTING ROADWAY** Sheet 3 Sheet 2 SOURCES:
1) N11(1A) ALIGNMENT PROVIDED BY WHPACIFIC ON CAD FILES:
A) N11(1A)-Base-09.30.09.dwg
2) TOPO MAP CREATED FROM MAPCARD.COM, 1:35000 SCALE. FIGURE SITE LOCATION MAP PROJECT NO. 105884 DRAWN: JAN 2010 N11(1A)1, 2, & 4 BIA ROUTE - N11 NEAR CROWNPOINT, NM DRAWN BY: PD KLEINFELDER SHEET Bright People. Right Solutions. CHECKED BY: MV FILE NAME: ORIGINATOR: M. VALLEJO DRAWING CATEGORY: 1 of 17 www.kleinfeider.com 105884_SL_01.dwg APPROVED BY: Joseph Think

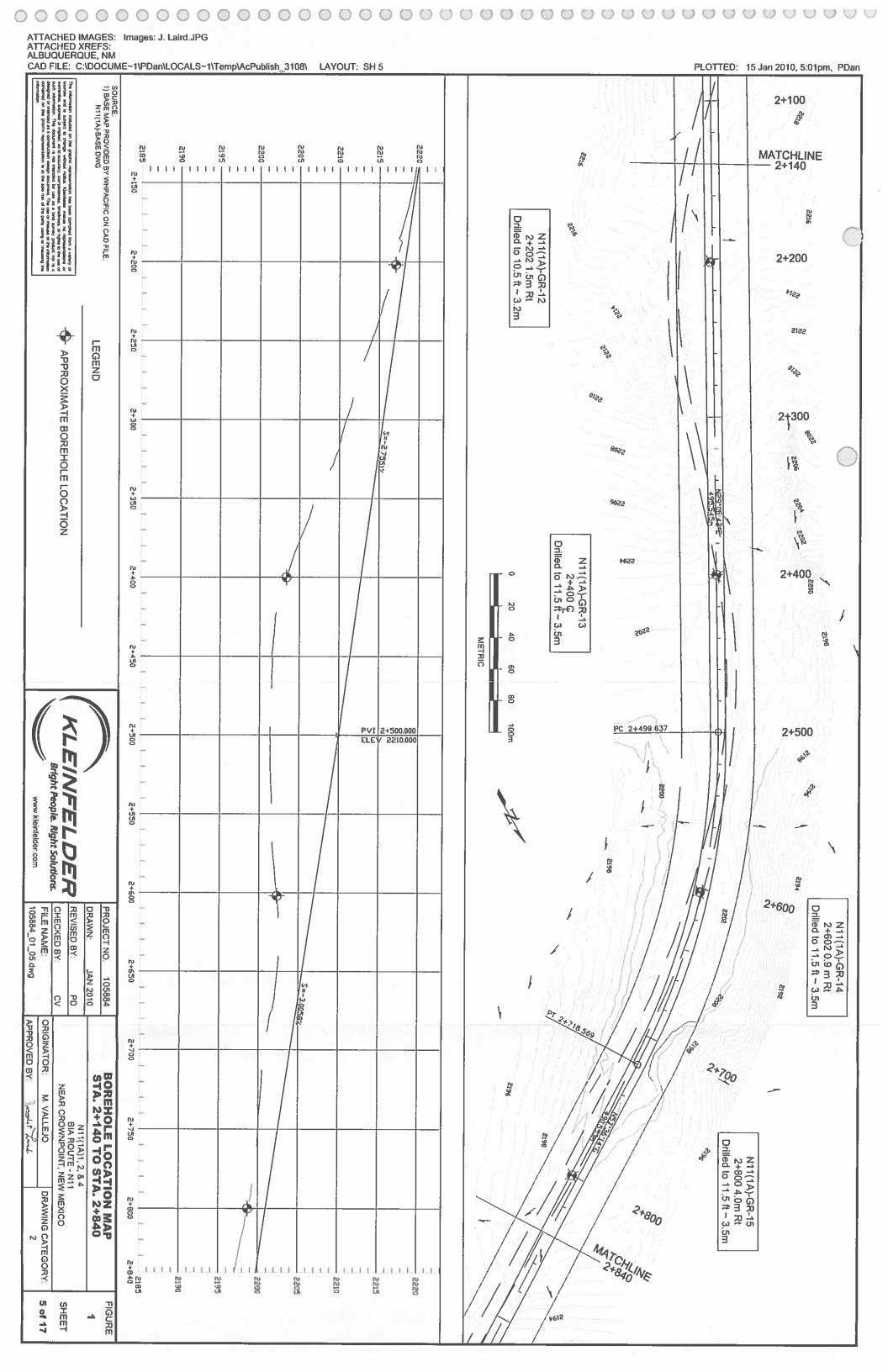
0

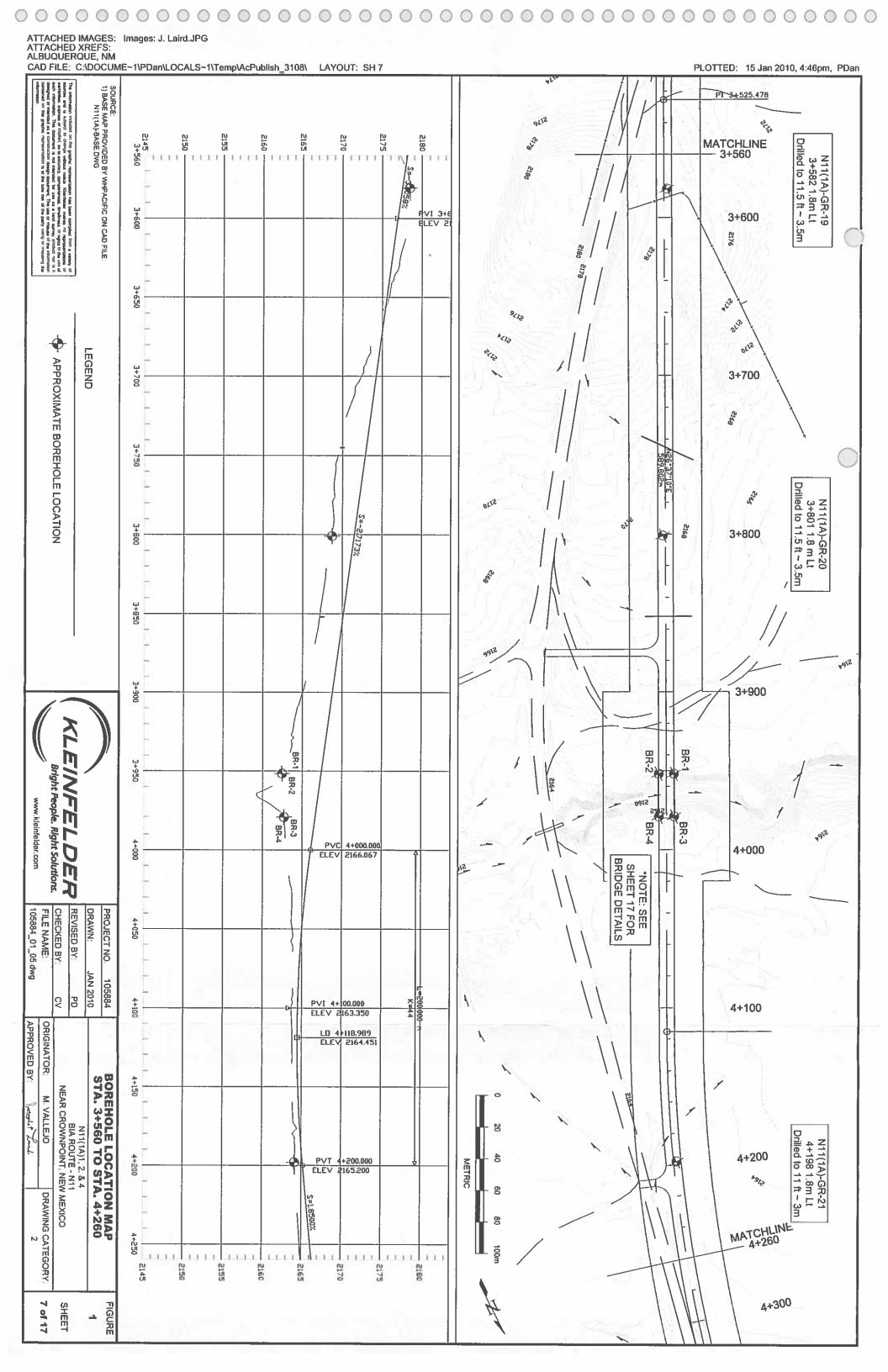
ATTACHED IMAGES: Images: J. Laird.JPG ATTACHED XREFS: ALBUQUERQUE, NM CAD FILE: G:\Geolech\Projects\105884- WHP N11(1A) Reconstruction\4.0 Technical Information\4.8 Figures\ LAYOUT: SH 2 PLOTTED: 02 Aug 2010, 2:14pm, PDan SOURCE:

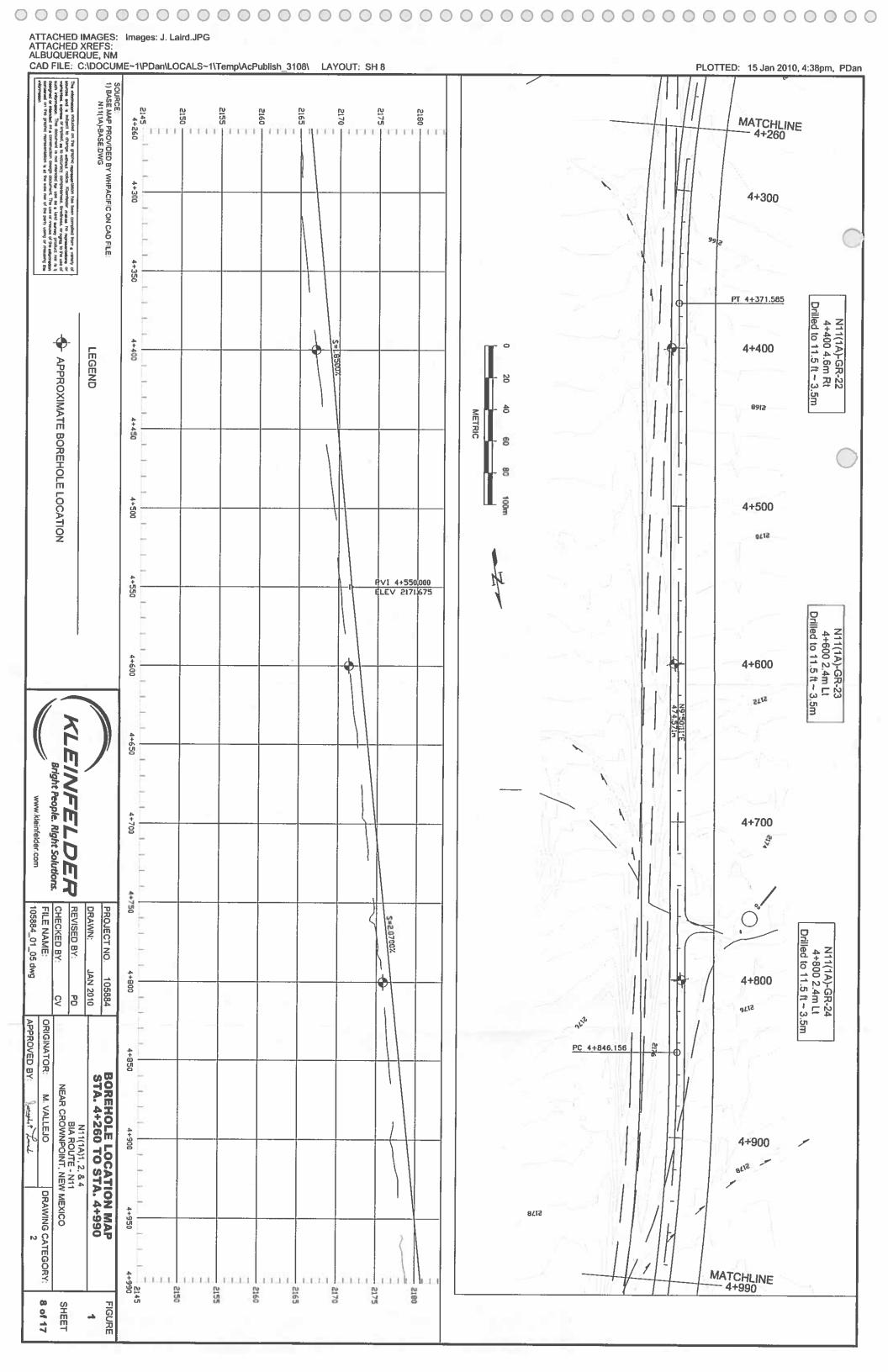
1) BASE MAP PROVIDED BY WHPACIFIC ON CAD FILE:
N11(1A)-BASE.DWG 2180 ----5813 2195 5222 883 5122 1111 1111 1111 1111 31111311113 1.1.1113 2196 0+000 PVC 0-005.000 ELEV 2194.194 N11(1A)-GR-01 0+041 0.6m Lt Drilled to 11.5 ft ~ 3.5m OL LD 0+039.468 ELEV 2193.549 0+050 PVI 0+055000 CLEV 2194.324 -Existing Powerline 0+100 LEGEND PVT 0+105.000 Q+100. APPROXIMATE BOREHOLE LOCATION ELEY 2195.879 0+111-231 Vaterline Vaterline 0+150 N11(1A)-GR-02 0+200 1.2m Rt Drilled to 11.5 ft ~ 3.5m 0+200 0+202.0 ELE / 2202.77 0+250 0+300 04300 METRIC 0+350 0+400 K=61 ELEV 2216.998 04400 N11(1A)-GR-03 0+401 0.9m Rt Drilled to 11.5 ft ~ 3.5m 0+450 CHECKED BY: FILE NAME: 105884_01_05.dwg REVISED BY: PROJECT NO. DRAWN: JAN 2010 105884 8 몽 ₹ terline APPROVED BY: ORIGINATOR: N11(1A)-GR-04 0+600 0.9m Rt Drilled to 11.5 ft ~ 3.5m 핲 0+550 BOREHOLE LOCATION MAP BOP STA. 0+000 TO STA. 0+700 N11(1A)1, 2, & 4
BIA ROUTE - N11
NEAR CROWNPOINT, NEW MEXICO M. VALLEJO 0+600 9+600 ELEV 2217.998 DRAWING CATEGORY: 2 0+650 MATCHINE 0+700 INE 002+0 0812 2 of 17 SHEET FIGURE 5812 2190 2195 2200 2205 5155 2220 2225 5210



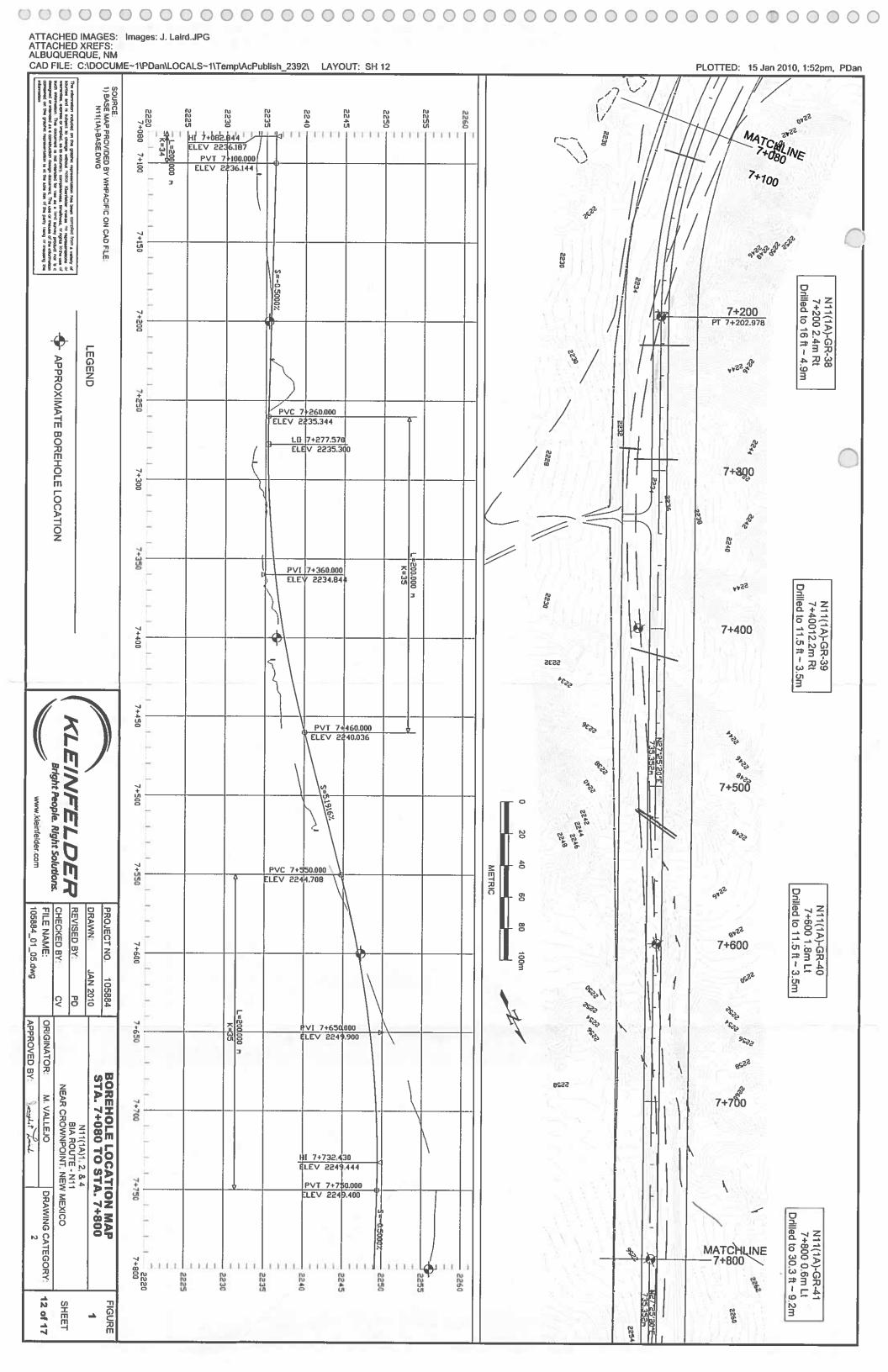




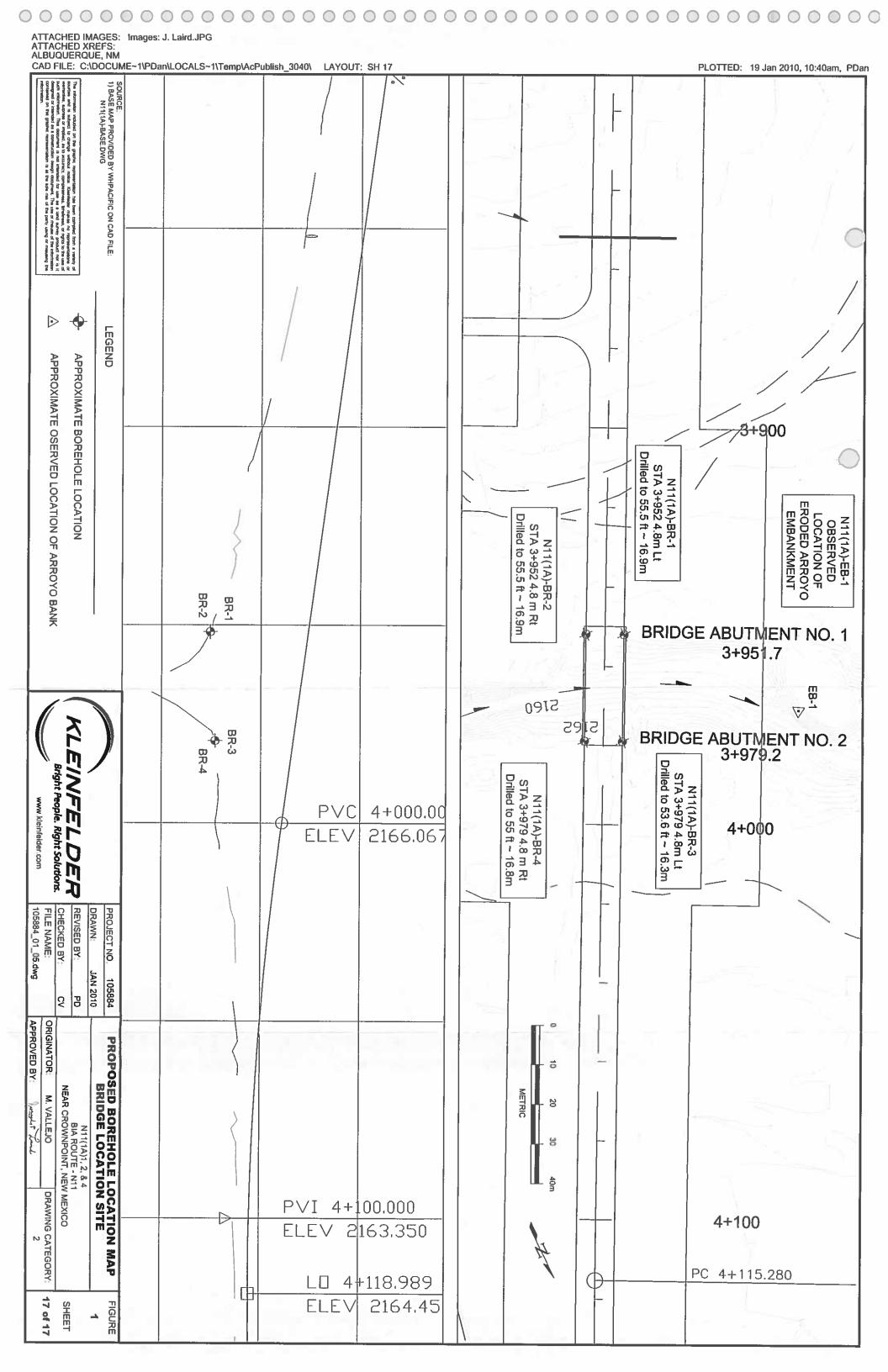




ATTACHED IMAGES: Images: J. Laird.JPG ATTACHED XREFS: ALBUQUERQUE, NM CAD FILE: C:\DOCUME~1\PDan\LOCALS~1\Temp\AcPublish_3108\ LAYOUT: SH 9 PLOTTED: 15 Jan 2010, 4:33pm, PDan SOURCE:
1) BASE MAP PROVIDED BY WHPACIFIC ON CAD FILE:
N11(1A) BASE.DWG MATCHLINE 4+990 2175 5/18 5872 2612 5025 2170 5180 5190 2200 N11(1A)-GR-25 5+004 0.9m Rt Drilled to 11.5 ft ~ 3.5m 5+000 TITT TITLITIES TELL 1131 5+000 2178 5+050 2180 5+100 5+100 N11(1A)-GR-26 5+201 2.7m Lt Drilled to 11.5 ft ~ 3.5m LEGEND APPROXIMATE BOREHOLE LOCATION METRIC 5+150 8 2180 8 8212 30% 100m 5+200 5+200 5+250 5180 2982 2184 5+300 PVI 5+300.000 ELEV 2187.200 5+300 181 5+350 KLEINFE Bright People. Right Solutions. 5+400 N11(1A)-GR-27 5+400 2.1m Lt Drilled to 11.5 ft ~ 3.5m 5+400 DER 5+450 CHECKED BY: FILE NAME: 105884_01_05.dwg REVISED BY: PROJECT NO. DRAWN: 2122 5+500 5188 5+500 OCT 2009 105884 8 5 N PERSONAL PROPERTY. 2190 ORIGINATOR 5+550 APPROVED BY: BASIT/ROCK-OWICEOR STA. 4+990 TO STA. 5+680 N11(1A)1, 2, & 4
BIA ROUTE - N11
NEAR CROWNPOINT, NEW MEXICO N11(1A)-GR-28 5+600 1.2m Lt Drilled to 11.5 ft ~ 3.5m 5+600 JAN 2010 5+600 2208 PI 5+669.628 5+650 DRAWING CATEGORY: 2 MATCHLINE 5+680 5+7 5+680 2175 2185 5190 2195 5180 2200 2055 186 5+700 FIGURE 9 of 17 Sel 500 SHEET 4



ATTACHED IMAGES: Images: J. Laird.JPG ATTACHED XREFS: ALBUQUERQUE, NM CAD FILE: C:\DOCUME~1\PDan\LOCALS~1\Temp\AcPublish_2392\ LAYOUT: SH 13 PLOTTED: 15 Jan 2010, 1:45pm, PDan SOURCE: 1) BASE MAP PROVIDED BY WHPACIFIC ON CAD FILE: N11(1A)-BASE.DWG 2235 — 7+800 MATCHLINE 7+800 2245 2265 5260 5550 I I I IN11(1A)-GR-41 7+800 1.6m Lt Drilled to 30.3 ft ~ 9.2m 2260 7+850 2258 20 2252 2260 7+900 7+900 METRIC 2250 60 APPROXIMATE BOREHOLE LOCATION LEGEND 5256 7+950 PC 7+938.330 225 N11(1A)-GR-42 8+000 7.3m Rt Drilled to 31.5 ft ~ 9.6m 8+000 000+8 8+050 8+100 8+100 PT 8+135.281 8+150 KLEINFEL 8+200 Bright People. Right Solutions. N11(1A)-GR-43 8+200 1.2m Lt Drilled to 10.5 ft - 3.2m 8+200 0422 www.kleinfelder.com 8+250 DER i g 4455 CHECKED BY: REVISED BY: PC 8+308.506 105884_01_05.dwg DRAWN PROJECT NO. 9+300 8+300 N11(1A)-GR-44 8+400 4.6m Lt Drilled to 26 ft ~ 7.9m JAN 2010 105884 δ 8 8+350 9122 APPROVED BY: ORIGINATOR BOREHOLE LOCATION MAP STA. 7+800 TO STA. 8+520 8+400 N11(1A)1, 2, & 4
BIA ROUTE - N11
NEAR CROWNPOINT, NEW MEXICO dry. M. VALLEJO 8+400 AT 8,501 8+450 5524 DRAWING CATEGORY: 2 9+500 8×500 —— 2235 8+520 2245 2260 2240 2250 2255 2265 2270 13 of 17 FIGURE SHEET



#### **APPENDIX B**

Unified Soil Classification System Logs of Exploratory Borings



۸	MAJOR DIVISIONS			USCS YMBOL	TYPICAL DESCRIPTIONS
		CLEAN GRAVELS WITH LITTLE	0000	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
	GRAVELS (More than half of coarse fraction	OR NO FINES		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
	is larger than the #4 sieve)	GRAVELS WITH OVER		GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
COARSE GRAINED SOILS		12% FINES		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
(More than half of material is larger than	SANDS	CLEAN SANDS WITH LITTLE		sw	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
the #200 sieve)	(More than half of coarse fraction is smaller than	OR NO FINES		SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
	the #4 sieve)	SANDS WITH		SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
		OVER 12% FINES		sc	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
				ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
FINE		ND CLAYS less than 50)		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
GRAINED SOILS				OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
(More than half of material is smaller than				МН	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
the #200 sieve)		ND CLAYS reater than 50)		СН	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				ОН	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
	LOAMS				UNDER USDA SOIL CLASSIFICATION SYSTEM, SOIL OF APPROXIMATELY EQUAL SAND/SILT/CLAY



8300 Jefferson NE, Suite B Albuquerque, NM 87113

#### **UNIFIED SOIL CLASSIFICATION SYSTEM**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

Project Number: 105884



Boring # BR-1 Sheet 1

of

Revision: 0 Started: 12/14/2009 **Project Number Project** N11(1A)1,2,4 Completed: 12/14/2009 105884 Backfilled: 12/14/2009 Rig Type: CME 75 Surface Elevation: 2162.5 m (7094.8') Logged By: R. Stump Longitude: 108°18.9408' Latitude: 35°36.7048' Location: N11(1A) Sta. 3+952 4.8m Lt AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified California Sample SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3 " O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube Groundwater Passing Sieve Ê Plasticity Index Graphical Log Depth, m (ft.) Date Penetration Resistance (Blows / 0.3 n Groundwater Depth (m) Depth (m) Sample Type Liquid Limit Dry Density (kN/cu. m) Recovery 7.6 (25) 12/14/2009 Percent I No. 200 Content Visual Classification 0 SANDY LEAN CLAY (CL)- firm to hard, with SPT 18 silty, sandy lenses, brown SPT 42 1.2 m (4.0') El, 2161.3 m (7090.8') 1.5 m (5.0') FAT CLAY (CH)- hard, brown, dry El. 2161.0 m (7089.8') MC 30 SILTY SAND (SM)- fine grained, medium dense, slightly moist SPT 14 2.9 m (9.5') El. 2159.6 m (7085.3') 3.4 m (11.0') SANDY LEAN CLAY (CL)- hard, with fine MC 50 subrounded gravel, brown, moist WEATHERED CLAYSTONE - with clay layers, with thin sandstone lenses, brown SPT 39 with gray brown ferric staining, highly weathered to decomposed, tight calcite MC 54 infilling (calcite crystals to calcite staining), with fine to medium subrounded gravel, inclusions to 6.7m SPT 36 (22 ft) bgs MC 43 SPT 24 27 MC  $10^{7.8 \text{ m}} (25.5')$  Moist to wet in joints at 7.6m (25 ft) bgs, El. 2154.7 m (7069.3') possible perched water CORE 47 78 Practical auger refusal at 7.8m (25.5 ft) bgs SHALE - light yellow brown, slightly weathered, weak, very thinly bedded to CORE 92 67 laminated, aphanitic, slightly fractured, bedding joints horizontal, open to wide joints, ferric staining at some joints, CORE 100 93 mottled white zones CORE 100 80 11.0 m (38.0) El. 2150.9 m (7056.8') CORE 100 77 weak, intensely fractured, with carbonate material SHALE - light yellow brown, slightly weathered, weak, very thinly bedded to CORE 100 83 laminated, aphanitic, slightly fractured, bedding joints horizontal, open to wide joints, ferric staining at some joints, mottled white zones CORE 98 92 Fossiliferous at 15.2m (50 ft) bgs CORE 100 88 16.9 m (55.5') El. 2145.6 m (7039.3') Total Depth 16.9 m (55.5')

BORING METRIC (SOIL & ROCK) \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1.2.4.GPJ



Boring # BR-2

Sheet 1 of 1

	Started: 12/15/2009 Project Number Completed: 12/15/2009 105884									,		Revision: 0
ا ن												Project
$\triangle$		•					10	5884				N11(1Å)1,2,4
	Back	filled: 1	2/15/2	009	Rig	Тур	e: Cl	ME 75			Surf	nce Elevation: 2162.5 m (7094.8') Logged By: R. Stump
Lat	titude	:: 35°36.	7025'		Lor	ngitu	de: 1	08°18.	9351'		Loca	tion: N11(1A) Sta. 3+952 4.8m Rt
Groundwater Depth (m)	Depth (m)	Graphical Log	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Presing	AUGER - Auger Cuttings   Groundwater
	0		,									
	V -		SPT	28						1111		LEAN CLAY WITH SAND (CL)- fine to coarse sand, firm to hard, some sandstone fragments, brown, moist
	1 -		MC	58								Zones of silty sand lenses from 1.1m (3.5 ft)
	2 _		SPT	38						1111		bgs
			МС	38						5.5		2
	3 —		SPT	18					41	- 1	8	
			10000000				9139		0.0.0.0			****
	4 —		MC.	31						1111		4.1 m (13.5') El. 2158.4 m (7081.3')  WEATHERED CLAYSTONE - with thin
	5 —		SPT	40								sandstone lenses, with clay layers, yellow brown to gray brown, moist, highly weathered to decomposed, with ferric
		////	MC	36								staining and calcite infilling
	6 —		SPT	30								
$\bar{\Delta}$	7		мс	54								Wet in some joints at 6.9m (22.5 ft) bgs,
		///	SPT	53	82.0							possible perched water
	8	/, /, /, /, \ 1	CORE		75	33				111		7.8 m (25.5') El. 2154.7 m (7069.3')  SHALE - light yellow brown, slightly
	9 _		CORE		92	79						weathered, weak, very thinly bedded to laminated, aphanitic, slightly fractured, tight to open joints, very wide with spotty and filled calcite, slightly moist to dry
			erene							193		and fined carcite, stignity moist to dry
	10_		CORE		100	90				1111		
	11		12.10.10.2		1200000							111 (265)
			CORE		100	67				1000		11.1 m (36.5')  SANDSTONE - light gray, weak to extremely  11.7 m (38.5')  weak, intensely fractured, with carbonate.8 m (7056.3')  material
	12_									51×1 14×4 12×4		SHALE - light yellow brown, slightly weathered, weak, very thinly bedded to
	13_		CORE	101100	100	93						laminated, aphanitic, slightly fractured, tight to open joints, very wide with calcite infilling, slightly moist to dry
	14		rereces recession									
	15_		CORE		98	95						
	16_		CORE		100	92						
			0.00.00					*******	0.000	1401		
			000,00	mulurei	uien			n (55.5	000000			16.9 m (55.5') El. 2145.6 m (7039.3')

BORING METRIC (SOIL & ROCK) \ LIBRARY KLEINFELDER ALB PLOG GLB \ 105884 N11(1A)1.2,4 GPJ



Boring # BR-3

Sheet 1 of 1 Revision: 0

Started: 12/								- 1		
2	Started: 12/18/2009         Project Number           Completed: 12/18/2009         105884           Backfilled: 12/18/2009         Rig Type: CME 75									Project N11(1A)1,2,4
<u> </u>	Backfilled: 12/18/2009 Rig Type: CME 75 Situde: 35°36.7176' Longitude: 108°18.9314' L									
Backfilled:	12/18/200	09						_		Elevation: 2162.0 m (7093.2') Logged By: R. Stump
Latitude: 35°36	1 1		- 1	gitud	le: 10	)8°18.	9314'		1	1: N11(1A) Sta. 3+979 4.8m Lt  2: AUGER - Auger Cuttings Groundwater
Graphical Log	Sample Taken Sample Type Penetration	Resistance (Blows / 0.3 m)	% Receivery (Rock)	٥	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Pasticity Index	Percent Passing No. 200 Sieve	PAUGER - Auger Cuttings G - Grab Sample MC - 2.5° O.D. 2.46° I.D. Modified California Sample E SPT - 2° O.D. 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube  Groundwater Depth. m (ft.) Date 7.6 (25) 12/18/2009
588   5	Sar	25	3.5	2	انَ≅	문중	Liq	Pla	P P P	Visual Classification
Bod	SPT MC SPT MC SPT MC SPT MC SPT MC SPT	23 71 23 43 45 45 66 38 32 32 32/9"	100		17.9 loo	17.6	45	III	Per No.	SILTY TO SAND LEAN CLAY (CL)- firm to hard, light brown, moist  2.0 m (6.5')  2.3 m (7.5') SILTY SAND (SM)- fine grained, medisin2159.7 m (7086.7' dense, light brown, moist  SANDY SILT (ML)- hard, with fine to coarse, angular to subangular gravel, with coarse sand, brown and red brown, moist  SANDY SILT (ML)- firm, gray with ferric  4.4 m (12.5')  FAT CLAY (CH)- firm, gray with ferric  4.9 m (16.0') CLAYEY GRAVEL (GC)- fine to coarse, 2,157.1 m (7077.2' dense, angular to subangular, red brown, moist  WEATHERED CLAYSTONE - with clay layers, light yellow brown and gray, highly weathered to decomposed, iron staining and spotting in bedding joints, very tight joints  Very moist a 7.6m (25 ft) bgs, possible perched water  8.5 m (28.0')  SHALE - light gray, moderately weathered to slightly weathered, weak, very thinly bedded to laminated, alphanitic, laminated, slightly fractured to unfractured, fractures widely spaced, tight to moderately open joints, slightly rough, calcite infilling and staining  11.6 m (38.0')  El. 2150.4 m (7055.2')  SHALE - light gray, slightly weathered, weak, very thinly bedded to laminated, aphanitic, laminated, aphanitic, laminated, slightly fractured to unfractured, fractures widely spaced, tight to moderately open, slightly fractured to unfractured, fractures, widely spaced, tight to moderately open, slightly fractured to unfractured, fractures widely spaced, tight to moderately open, slightly fractured to unfractured, fractures widely spaced, tight to moderately open, slightly rough, calcite infilling and staining
1.9	I trees in	Tet	al Da-	nth 1	62-	n (53.6	J.		****	[16.3 m (53.6') El. 2145.7 m (7039.6')

BORING METRIC (SOIL & ROCK) \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ



Boring # BR-4 Sheet 1 of 1

D. W.

Section   Sect													Revision: 0
Backfilled: 12.17/2009   Rig Type: CNE 75   Surface Elevation: 216.3.0 m (1996.57)   Logged By: R. Stump   Latitude: 1367-4753   Longitude: 108718-9249   Longitude: 1087	<u></u>	Completed: 12/17/2009 105884							Num	ber			
Backfilled: 12.17/2009   Rig Type: CNE 75   Surface Elevation: 216.3.0 m (1996.57)   Logged By: R. Stump   Latitude: 1367-4753   Longitude: 108718-9249   Longitude: 1087	Tag [	Con	npleted:	12/17	/2009			105	5884				N11(1A)1,2,4
Designation		Bac	kfilled:	12/17	2009	Rig	у Тур	e: CN	ME 75			Surface	Elevation: 2163.0 m (7096.5') Logged By: R. Stump
Part	Lat	titud	le: 35°36	.7153	,	Lo	ngitu	de: 10	08°18.	9249'		Location	
SFT   60												-	AUGER - Auger Cuttings Groundwater
SFT   60	oundwater pth (m)	Pdh (m.)	aphical Log	nple Type	retration sistance lows / 0.3 n	Recuvery (Re	Q	oisture ntent (%)	y Density V/cu. m)	prid Limit	sticity Indo	cent Passir 200 Sieve	MC - 2.5" O.D. 2.46" I.D. Modified California Sample   Dcpth, m (ft.)   Data
SET   56   50   50   50   50   50   50   50	త్త	<u>ವ</u>	5	Sa S	a SE	*	≥	≱ರಿ	무중	تز	Pla	2 %	Visual Classification
1		0 _											
With sand lenses from 1.1m (2.5 ft) bgs				1									SILTY TO SANDY LEAN CLAY (CL)- hard, light brown, dry to moist
With occasional calcite stringers at 1.5m (5 ft) bgs		1 =		ML	30			1.3	15.0	NV	N		With sand lenses from 1 1m (2.5 ft) has
bgs    MC   47   3   3,7 m (12.0)   El. 2159.3 m (7084.5				Spr	77								1
3		2 _		31.		100140110	2327		288.888	********	41741		
SFT   18				МС	47								
3.7 m (12.0)   Section		3 -		SP	18					0.000.00	*****		
SPT   22   SPT   22   SPT   23   SPT   24   SPT   25   SPT   25   SPT   26   SPT   27   SPT   26   SPT   27   SPT   28   SPT   20   SPT   30		- 3		1		Alia.							
WEATHERED CLAYSTONE - with thin sandstone lenses, with clay layers		4 =		MC	16			12.8	13.9			. 90	(SP-SM)- fine grained, medium dense,
MC   S2   SPT   36   SPT   36   SPT   21   SPT   30   SPT   21   SPT   50/5"   SPT   30   SPT   3		5 _		SPT	22		5				in in		
SPT   36		3 =		МС	52								
Perched water at 9.3m (30.5) bgs		6 _	1/1/	1,5353.5					::::::::::		2000		
SPT   21   SPT   30   Perched water at 9.3m (30.5) bgs			1./.2	SP	36	X					11111		
SPT   21   SPT   30   Perched water at 9.3m (30.5) bgs		7 _	1///	MC	42								
Perched water at 9.3m (30.5) bgs  10 SPT 48 Perched water at 9.3m (30.5) bgs  10 SPT 50/5* SPT 5		· =		13,55		533115							
Perched water at 9.3m (30.5) bgs  10 SPT 48 Perched water at 9.3m (30.5) bgs  10 SPT 50/5* SPT 5			1/://	SPI	21			E 27 C.32			50505		
Perched water at 9.3m (30.5) bgs  10.		8 –	1///	4									
Perched water at 9.3m (30.5) bgs  10.1 m (33.0°)  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 98 82  OORE 98 82  Perched water at 9.3m (30.5) bgs  10.1 m (33.0°)  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured, with carbonate material  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  16 CORE 100 78  CORE 100 78  16.8 m (55.0°)  EL 2146.2 m (7041.5°)		•		SPI	30								
Perched water at 9.3m (30.5) bgs  10.1 m (33.0')  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 88 62  CORE 88 62  0.03m (1 in) of sandstone layer, white, moist, extremely weak at 12.2m (40 ft) bg. 2150.0 m (7054.0 m) (		9 _		1955				572.50			Series.		
SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 88 62 0.03m (1 in) of sandstone layer, white, moist, extremely weak at 12.2m (40 ft) bgs 12150.0 m (7054.0 m) (7053.3 extremely weak, intensely fractured, with carbonate material  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 100 91 16.8 m (55.0') El. 2146.2 m (7041.5 m) El. 2146.2 m	<del> </del>		1///	SP	48			11.533		5555555	100.00		Perched water at 9.3m (30.5) bgs
SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  12		10_		SP	50/5"						11111		10.1 m (33.0') El. 2152.9 m (7063.5"
laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 88 62  CORE 88 62  0.03m (1 in) of sandstone layer, white, moist, extremely weak at 12.2m (40 ft) best 2150.0 m (7054.0 ft) and (42.5) extremely weak at 12.2m (40 ft) best 2150.0 m (7053.3 ft) extremely weak, intensely fractured, with carbonate material  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  16 CORE 100 78  16.8 m (55.0')  El. 2146.2 m (7041.5)											1114		SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to
unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 88 62  0.03m (1 in) of sandstone layer, white, moist, extremely weak at 12.2m (40 ft) bgs. 2150.0 m (7054.0 stremely weak at 12.2m (40 ft) bgs. 2150.0 m (7054.0 stremely weak, intensely fractured, with carbonate material  CORE 98 82  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 100 91  CORE 100 78  CORE 72 55  16.8 m (55.0')  El. 2146.2 m (7041.5)		11_						0.07					laminated, aphanitic, bedding joints
moist to dry    CORE   88   62     0.03m (1 in) of sandstone layer, white, moist, extremely weak at 12.2m (40 ft) bgs   13.0 m (42.5')   extremely weak at 12.2m (40 ft) bgs   2150.0 m (7054.0 m)		•		COR	E X46XX	. 95	86	222	W.1186	1111111			unfractured, tight to moderately open
CORE 88 62  0.03m (1 in) of sandstone layer, white, moist, extremely weak at 12.2m (40 ft) bgs E1.2150.0 m (7054.0 m) (70		12			C. Minn								
14 CORE 98 82  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 100 78  CORE 72 55  16.8 m (55.0')  El. 2146.2 m (7041.5)				COR	E	88	62						0.03m (1 in) of conditions layer white moist
extremely weak, intensely fractured, with carbonate material  SHALE - gray with variated white, slightly weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 100 78  CORE 72 55 16.8 m (55.0') El. 2146.2 m (7041.5)		13_		27.22	1111111					1000200	15.550		13.0 m (42.5') E1. 2150.0 m (7054.0" L13.1 m (43.0°C A NDSTONE Light group grains area 1. E1. 2149.9 m (7053.5"
weathered, weak, very thinly bedded to laminated, aphanitic, bedding joints horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 100 78  CORE 72 55 16.8 m (55.0') El. 2146.2 m (7041.5													extremely weak, intensely fractured, with
horizontal, slightly fractured to unfractured, tight to moderately open joints, calcite infilling, fracture staining, moist to dry  CORE 100 78  CORE 72 55 16.8 m (55.0')  El. 2146.2 m (7041.5		14_		COR	E	98	82				*****		weathered, weak, very thinly bedded to
16 CORE 100 78 moist to dry  CORE 72 55 16.8 m (55.0') El. 2146.2 m (7041.5		15_		COR	E	100	91						horizontal, slightly fractured to unfractured, tight to moderately open
CORE 72 55 16.8 m (55.0') El. 2146.2 m (7041.5											57		
1 16.8 m (55.0') El. 2146.2 m (7041.5		16-		COR	E	100	78						
		-		COR	E 122 122	72	55	222	11545453		11 A 11		16.8 m (55.0') El. 2146.2 m (7041.5')
Total Depth 16.8 m (55.0')					To	tal D	epth 1	16.8 п	n (55.0	')			

BORING METRIC (SOIL & ROCK) \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ



Boring # EB-1 Sheet 1 of 1

`		<i>&gt;</i>		11 20121								_	Sheet 1 of 1
													Revision: 0
ا و	Star	ted: 12	/14	/200	9		Pro	oject	Num	ber			Project
Date	Con	npleted	: 12	2/14/	2009			105	5884				N11(1Å)1,2,4
	Bac	kfilled:	12	/14/2	2009	Rig	Тур	e: NA	<u> </u>		S	urface	Elevation: 2163.0 m (7096.5') Logged By: R. Stump
L	etitud	le: 35°3	6.72	249°		Lo	ngitu	de: 10	08°18.	9617'	L	ocatio	n: N11(1A) Sta. 3+972 48m Lt
undwater th (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified California Sample SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3 " O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube
5	2 2	E	Semi	Sam	Pen Se	% S	RQD	Ç.	S N	Ligi	Plas	No.	Visual Classification
		!			!								
	0 —				: 								LEAN CLAY (CL)- with silty and sandy lenses, brown, dry to slightly moist
	16										(4444.0)		
	1 —												
	-					AV 1 70 -			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				1.4 m (4.5') El. 2161.6 m (7092.0')
								Fe0.00		19 (0 (1))	(1))))))))))))))))))))))))))))))))))))		SILTY SAND (SM)- brown, dry to slightly moist
	2 _					T I		23	077	1000	13.67	06-400	
			11		Carantra	-01510				· · · · · · · · · · · · · · · · · · ·			
	3,6												
	•			7000		2335			900000	CHOCK CO.	0.000		
	3 —												
									1111111				
										no erre			3.3 (13.0)
		0000											3.7 m (12.0') El. 2159.3 m (7084.5')  SILTY LEAN CLAY (SL-ML)- firm, brown,
	4 _								SPECTO		100 CT 1 1 1 1 1		dry
		(XXXXX)								Delica, Tree		22	4.1 m (13.5') El. 2158.9 m (7083.0')  WEATHERED MANCOS SHALE AND
	- 4												CLAYSTONE - with thin sandstone
	-										400.00		lenses, with clay layers, highly weathered to decomposed, brown and gray brown, dry
	5 -						00000		iceres	ignom	44.00		E 3 (17.0)
		7./.	11.								22 55 55 55		5.2 m (17.0') El. 2157.8 m (7079.5')  WEATHERED CLAYSTONE - with clay
		1//						200					layers, brown to gray brown, slightly

Total Depth 5.8 m (19.0')

Note: Log created from observation of eroded arroyo bank west of BR-1. No drilling was performed at this location. Bank was approximately 5.8m (19 ft) high.

El. 2157.2 m (7077.5')

moist

5.8 m (19.0')







Boring # GR-01 Sheet 1 of 1

El. 2191.5 m (7189.9')

												Revision: 0	
0		ted: 12/7				Pro	oject	Num	ber			Project	
Date	Con	pleted: 1	12/7/2	009			105	884				N11(1A)1,2,4	
	Bacl	kfilled: 1	2/7/20	009	Rig	Тур	e: CN	<b>1E 75</b>			Surface	Elevation: 2195.0 m (7201.4') Logged By: R. Stump	
L	atitud	e: 35°34.	9153'		Lo	ngitu	de: 10	08°19.	9493'		Location	: N11(1A) Sta. 0+041 0.6m Lt	
١.		<u>≈</u> 0		Ê	(ya					Š	.ab .≘ ::	AUGER - Auger Cuttings Groundwater G- Grab Sample MC - 2.5 * Q.D. 2.46* I.D. Modified California Sample Depth, m (ft.) Date	$\neg$
valer	= =	2	S S	5 20	ry (R		8	sity m)		<u> </u>	Passi	MC - 2.5 O.D 2.46 1.D. Modified California Sample  Book of the Sample of	$\dashv$
9	 	Graphical Log	Sample Type	stan istan iws /	% Recovery (Rock)	_	Sture tent	Den /cu. i	Liquid Limit	Plasticity Index	200 J	C AC - 2.5" O.D 2.46" I.D. Modified California Sample SPT - 2" O.D 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube	
Sec	Depth (m)	G S	Sam	Penetration Resistance (Blows / 0.3 r	**	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liqu	Plas	Percent Passing No. 200 Sieve	Visual Classification	
	0 _												
		///	SPT	18	J. 100 T.				47	23		WEATHERED CLAYSTONE - with clay layers, light brown, moist	
	-	Y///\	V 2.									tayers, right brown, moist	
	· ·	1990	-44.671				55.50			12000	944001111		
	- 6	///	МС	69	577.555	6572.M	15.2	S13911	1444.44	25	66		
l	1		MIC	. 09	Average.	224	15.2			hilitai	00		
					a a de fr	incom	2.5472		10000	100000			
		///_	W-10							£1000.00			
		///	SPT	50			12.0						
	-	////	1	1000000			3.565				.00		
		1././		***************************************									
		///	МС	50/5"	ereti i	riori.		1000000	T-1200000		11000000	White sulfate in partings and joints at 2.3m	
		1///	*****					anan i		31111		(7.5 ft) bgs	
	10												
	3 _		25357			22,223					4	Dark brown and gray at 2.9m (9.5 ft) bgs	
		1./:/		0.00		1000	507.0		00000000	25,2985	10 1000000		

3.5 m (11.5')

Total Depth 3.5 m (11.5')







Boring # GR-02 Sheet 1 of 1

													Revision: 0
Date		ted: 12 ipleted					Pro	•	Num 5884	ber			Project N11(1A)1,2,4
	Bac	kfilled:	12	/7/2(	009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2202.0 m (7224.4') Logged By: R. Stump
Lı	atitud	e: 35°3	5.0	07'		Lo	ngitu	de: 1	08°19.	93871		Locatio	n: N11(1A) Sta. 0+200 1.2m Rt
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	۵	Moisture Content (%)	Dry Density (&N/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	# AUGER - Auger Cuttings   G - Grab Sample   Depth, m (ft.)   Date
ğ	{ Z	Ü	Sam	Sar	Res (B)	1	RQD	20	문종	Ę	=	5.5	Visual Classification
	0												
	8	X	M	SPT	. 59		1144						WEATHERED SILTSTONE - with silt layers, light brown, moist
	1 _	X	X	MC	50/5"								
	9	* * * * * * * * * * * * * * * * * * *	V.	SPT	29	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0.00	green.			10000		Gray with ferric staining, gypsum in partings and joints at 1.4m (4.5 ft) bgs
	2	X						11.1.4					
		x x x x x x x x x x x x	X	МС	40		e e const						
	3 _	X		1000 1200			0.00						
	¥	* * * * * * * * * * * * * * * * * * *	X.	SPT	40	inin.	iiiim	min.				A DATE	

Total Depth 3.5 m (11.5')







Boring # GR-03

	rted: 1: nplete			nn9		Pro	-	Num 884	ber			Project N11(1A)1,2,4
⊨—	kfilled				Rig	Тур		ME 75			Surface	Elevation: 2214.5 m (7265.4') Logged By: R. Stump
atitud	le: 35°3	35.1	077'		Loi	ngitu	de: 10	08°19.	9263'		Location	n: N11(1A) Sta. 0+401 0.9m Rt
	20	$\exists$		Ē	xck)		İ			- 5	B	AUGER - Auger Cuttings G - Grab Sample C - 2.5 ' O.D. 2.46" I.D. Modified California Sample SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3 ' O.D. 2.42" I.D. Ring Sample U - 3 ' O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube
	P	_	уре	m 0.3 t	y (Re		<u>@</u>	ii.	m i	重	assi	MC = 2.5° O.D. 2.46° I.D. Modified California Sample Dcpth, m (ft.) Date
Ē	ical	Taker	T of	ratic tanc	over		E E	Jens tt. 11	d Li	city	118	SPT - 2" O.D. 1.38" I.D. Tube Sample  U - 3 " O.D. 2-42" I.D. Ring Sample  ST - 3" O.D. 2-42" I.D. Ring Sample
Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
		0:	9.2				20					
0 -	* * * * * * * * * * * * * * * * * * *	111	SPT	40 .	ecceri.	1500	9.1	111110				WEATHERED SILTSTONE - with silt layers, gray with ferric staining, moist
	X	H		ineon.					11500000	000000		
1 _	x x x x x x x x x x	V	MC	51			14.6		54	24		
	X X X										i Principio	
5	X X X X X X X X X X X X X X X X X X X	Н										
2 _	X X X X X X X X X X X X X X X X X X X	Μ	SPT	61			17.8		1.000.000		98	With yellow mineral deposits in partings and
-	x x x				Maraga.	1000			Transa	******		joints at 1.8m (6 ft) bgs
	X	M	мс	50/5"					101031			
	X X X X X X X X X X X X X X X X X X X	П		er e nome		2000			0.000			
3 _	X X X		taren e				******			22333		
	× × ×	M	SPT	82/11"			Asim	annay		22.22		
	x x x	W										3.5 m (11.5') El. 2211.0 m (725

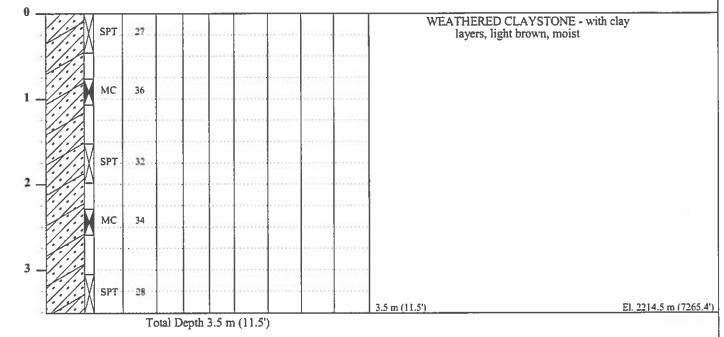






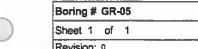
Boring # GR-04 Sheet 1 of 1

water
Date
)
1









												Revision: 0
얼님		ted: 12/7/ pleted: 1				Pro	_	Num 5884	ber			Project N11(1A)1,2,4
	Back	filled: 12	2/7/20	)09	Rig	Тур	e: Cl	ME 75			Surface	Elevation: 2218.5 m (7278.5') Logged By: R. Stump
La	titude	e: 35°35.2	941'		Loi	ıgitu	de: 1	08°19.	7913'	3	Location	n: N11(1A) Sta. 0+800 0.9m Lt
Groundwater Depth (m)	(m) t	Graphical Log	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified California Sample SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample U ST - 3" O.D. Thin-Walled Shelby Tube
Grou	Dcpt	Grap	Samp	Penel Resis (Blov	% Rex	RQD	Mois	(k)	Liqui	Plast	Perce No. 2	Visual Classification
	0 -		SPT	15	eco)	ionoi tron				(100)		WEATHERED CLAYSTONE - with clay layers, brown and gray with white, moist
	1 —		МС	15			20.7	14.4			84	
	2		SPT	9			18.9		(0)000			
	3 —		мс	27								
	3		SPT	23				rester	11274121			3.5 m (11.5') E1, 2215.0 m (7267.0'



Boring # GR-06 Sheet 1 of 1

El. 2213.0 m (7260.5')

									_	Sheet 1 di ;
								,		Revision: 0
Started: 12/7/				Pro	_	Num 5884	ber			Project N11(1A)1,2,4
Backfilled: 12	2/7/20	009	Rig	Тур	e: CN	<b>1E 75</b>			Surface	Elevation: 2216.5 m (7272.0') Logged By: R. Stump
Latitude: 35°35.3	890'		Lo	igitu	de: 10	08°19.	7310'		Location	:: N11(1A) Sta. 1+000 2.7m Lt
Depth (m) Depth (m) Graphical Log	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5° O.D 2.46° LD. Modified California Sample S SPT - 2° O.D 1.38° LD. Tube Sample U - 3° O.D. 2.42° LD. Ring Sample S ST - 3° O.D. Thin-Walled Shelby Tube
Smith Carl	Sam	Resi (Blo	% Re	RQD	Con	S D	Liqi	Plas	Pere No.	Visual Classification
0							•			
	SPT	20	iani i	in a co	Cioni			ignis		WEATHERED CLAYSTONE - with clay layers, brown and gray, moist
1-	мс	53						*****		With ferric staining at 0.9m (3 ft) bgs
2	SPT	29								
<u> </u>	МС	50/5*								
3	SPT	39								





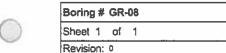


Boring # GR-07
Sheet 1 of 1

	/											<u> </u>
												Revision: 0
Star	ted: 12	2/7/	2009			Pro	oject	Num	ber			Project
Con	pleted	: 1	2/7/2	009			105	5884				N11(1A)1,2,4
Bacl	kfilled:	12	/7/20	009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2216.0 m (7270.3') Logged By: R. Stump
atitud	e: 35°3	5.4	906'		Loi	ngitu	de: 1	08°19.	7550'			n: N11(IA) Sta. 1+220 1.2m Lt
				Ē	-					ik	1	
	Log		7		%		(÷	ے ج	语	Inde	ssin	AUGER - Auger Cuttings G - Grab Sample U - 3.2 O.D. 2.46* I.D. Modified California Sample U - 3.2 O.D. 2.42* I.D. Ring Sample U - 3.2 O.D. 2.42* I.D. Ring Sample S 5T - 3* O.D. Thin-Walled Shelby Tube
E	ical		c T	atio ance	wers		1 E E	ensi J. m	l Cit	ji.	11 Pa	Ta. SPT - 2" O.D. 1.38" I.D. Tube Sample U+3" O.D. 2.42" I.D. Ring Sample (Not encountered)
텙	victor	믵		netr sist	Reco	8	vist	N C	hini .	astic	10 cc	
i A	Ğ	ž	స్ట	550	%	\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	20	25	تِ:	Ē	2 Z	Visual Classification
0												
• –	XXX	M	CDT	42			,,,,					WEATHERED SILTSTONE - medium strong,
•	XXX	M	SEL	100 T 4 1 1 1			10.2		,,,,,,,,,,	-11-0		with silt layers, brown and dark gray,
	xxx	Н		errorre	· · · · ·	155155			innee			moist
_	$\times \times \times$											
	xxx	$\mathbf{\Lambda}$	МС	71		111111111	13.7	227	49	18		
1 -	xxx	A	er er	- LTILLTY					. 1 . 1		5 4555	
-	xxx				Children.			iiiiiiiii			d min	
	x x x					1.777	200000	100000 Mg	s emerce c	1.7000		
•	X X X	M					976.55		211,1014.5			
•	XXX	IXI	SPT	35			15.9	overno-	100000		94	
2		Н							7.535.73.757.75			
V-100	XXX					70000					2 (1 20.00.000)	
•	xxx	V	MC				16.1	107				
32	XXX	Δ	MC	00			10.1	18.3		****		
1500	xxx								nomm re			
2	xxx											
<i>3</i> —	x x x	H			eutra.		******	10000				
	X X X	X	SPT	-41				N.,				
	Con Bac	### Completed  Backfilled:  #### atitude: 35°3    (iii)   (iii	Completed: 1  Backfilled: 12  atitude: 35°35.4  (iii) Ilpidod  O  O  O  O  O  O  O  O  O  O  O  O  O	Completed: 12/7/20   Backfilled: 12/7/20   atitude: 35°35.4906'   Oddition   Oddition	1	Completed: 12/7/2009  Backfilled: 12/7/2009  Rigument of the property of the p	Completed: 12/7/2009  Backfilled: 12/7/2009  Rig Typ  Atitude: 35°35.4906'  Cabhlical Logarity  Rig Typ  Atitude: 35°35.4906'  Cabhlical Logarity   Completed: 12/7/2009   Rig Type: Chatitude: 35°35.4906'   Longitude: 10	Completed: 12/7/2009   Rig Type: CME 75     Stitude: 35°35.4906'   Longitude: 108°19.     Completed: 12/7/2009   Rig Type: CME 75     Completed: 12/7/20	Completed: 12/7/2009   Rig Type: CME 75	Completed: 12/7/2009   Rig Type: CME 75     Stitude: 35°35.4906'   Longitude: 108°19.7550'     Completed: 12/7/2009   Rig Type: CME 75     Completed: 12/7/2009   Rig Type: CME 75     Completed: 35°35.4906'   Longitude: 108°19.7550'     Completed: 12/7/2009   Rig Type: CME 75     Completed: 108°19.7550'     Completed: 12/7/2009   Rig Type: CME 75     Completed: 108°19.7550'     Completed: 1	Completed: 12/7/2009   Rig Type: CME 75   Surface attitude: 35°35,4906'   Longitude: 108°19.7550'   Location   Location	







`		*										Revision: 0					
Date		ted: 12/ pleted:				Pro		Num 5884	ber		Project N11(1A)1,2,4						
	Back	dilled:	12/7/2	009	Rig	; Тур	e: CN	ME 75			Surface Elevation: 2229.5 m (7314.6') Logged By: R. Stump						
L٤	atitude: 35°35.5945 Longitude: 108°19.7719'										Location: N11(1A) Sta. 1+400 CL						
ndwater h (m)	Depth (m)	Graphical Log	Sample Taken Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified California Sample SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample V: ST - 3" O.D. Thin-Walled Shelby Tube					
Grou	Dep	Grap	Samp	Pene Resir (Bloy	% Re	RQD	Mois	Day I	Liqu	Plast	Perco No. 3	Visual Classification					
	0 _			,		,						<u> </u>					
			SPT	32 .			*****			****		WEATHERED SANDSTONE AND WEATHERED SILTSTONE - moderately hard, with silt layers, tan and red brown, moist El. 2228.9 m (7312.6')					
	1 _		МС	30						21111		WEATHERED CLAYSTONE - moderately hard, with clay layers, brown and gray and ferric staining, moist					
	2 —		SPT	. 19						44411							
			МС	41													
	3 _		SPT	33						*****		3.5 m (11.5') El. 2226.0 m (7303.1')					
	C+ E	1. 7. 5 7. 81	•	To	tal D	epth .	3.5 m	(11.5'	)			20. 22200 H 1 3 0001					







Boring # GR-09 Sheet 1 of 1

ગ ——	Started: 12/7/2009 Project Number Completed: 12/7/2009 105884									Project N11(1A)1,2,4						
Bac	ckfilled: 1	2/7/20	009	Rig	Rig Type: CME 75						Elevation: 2234.5 m (7331.0') Logged By: R. Stump					
Latitude: 35°35.6944' Longitude: 108°19.7241'										Location: N11(1A) Sta. 1+600 0.9m Lt						
Depth (m) Depth (m)	Graphical Log	pe n .3 m)		% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5° O.D. 2 45° I.D. Modified California Sample C - 2.5° O.D. 138° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample S ST - 3° O.D. Thin-Walled Shelby Tube  Visual Classification					
		W	1==-	•	<u> </u>	20				-2	Visual Classification					
0 -	* * * * * * * * * * * * * * * * * * *	SPT	21			15.2		+00010			WEATHERED SILTSTONE AND WEATHERED CLAYSTONE - with silt and clay layers, brown and tan, moist					
1 -	* * * * * * * * * * * * * * * * * * *	мс	40			9.1	18.5			60	1.1 m (3.5') El. 2233.4 m (7327. WEATHERED SANDSTONE AND					
		SPT	50			13.9		50	20		WEATHERED SILTSTONE - fine, medium strong, with silt layers, brown and red brown, moist					
2 -		01190		******		Million Consecution			100000		2.3 m (7.5) El. 2232.2 m (7323.					
		мс	50/4"								SANDY CLAYSTONE - medium strong, brown and gray, moist					
3 -		SPT	63							-1000	3.5 m (11.5') EL 2231.0 m (7319					







Boring # GR-10 Sheet 1 of 1

El. 2222.5 m (7291.6')

`			·											Devision	0		
Date	-	Started: 12/7/2009 Project Number Completed: 12/7/2009 105884										Project N11(1A)1,2,4					
Ã	Backfilled: 12/7/2009 Rig Type: CME 75										$\dashv$	Surface	Elevation: 2226.0 m (7303.1')	Logged	By: R. Stump		
L	Latitude: 35°35.7975' Longitude: 108°19.7491'												Location: N11(1A) Sta. 1+799 3.7m Rt				
oundwater	Depth (m)	Graphical Log	Sample Taken		Penetration Resistance (Blows / 0.3 m)	% Recuvery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5° O.D. 2.46° I.D. Modified Califo SPT - 2° O.D. 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube		Groundwater  Depth. m (ft.)  (Not encountered)		
٤٥	3 3	ō	J.	Sa	5%5	*	×	ΣŬ	Δ¥	12	Ε	2 ž	Visual Classific	cation			
	0 -	X X X X X X X X X X X X X X X X X X X	X	SPT	33				alatari renen		*****	1 ( 1 ( 1 ( 1 ( 1 ( 1 ( 1 ( 1 ( 1 ( 1 (	WEATHERED SILT with thin sand brown, moist	ISTONE - stone, with	medium strong, n silt layers, light		
	1 =	X X X X X X X X X X X X X X X X X X X	₩ A	МС	76				4								
	-	× × ×			. same		i sarini	Commo			1000		1.4 m (4.5')		El. 2224.6 m (7298.6		
	2 _		M	SPT	26				******		*****		WEATHERED CLA SILTSTONE I with clay layer staining	LENSES -	medium strong,		
	-		V	SPT	30				x		din						
	3 —		M M	CDT	36												

3.5 m (11.5')





Boring # GR-11 Sheet 1 of 1

_													Revision: 0			
Date		ted: 12.					Pro	_	Num 5884	ber		Project N11(1A)1,2,4				
3	_	Backfilled: 12/7/2009							ME 75			Surface Elevation: 2223.0 m (7293.3') Logged By: R. Stump				
Lı	atitude: 35°35.9085' Longitude: 108°19.7368'											Location	: N11(IA) Sta. 2+000 12.8m Lt			
Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	· Recovery (Rock)	Q	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample G - Carb Sample MC - 2.5" O.D 1.246" I.D. Modified California Sample SFT - 2" O.D. 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walked Shelby Tube  Groundwater Depth. m (ft.) Date (Not encountered)			
ć	3 2	Gr	S	Sai	255	100	RQD	Žΰ	짇종		Pla	Per	Visual Classification			
	0 -	X X X X X X X X X X X X X X X X X X X	X	МС	38	0004 6904		0200			*****		WEATHERED SILTSTONE WITH CLAYSTONE LENSES - medium strong, with silt and clay layers, tan and brown, moist			
	1 -	X X X X X X X X X X X X X X X X X X X		SPT	<u>22</u>			5.4		29	8		1.2 m (4.0°) El. 2221.8 m (7289.  WEATHERED CLAYSTONE - medium			
	2 _		M	SPT	39								strong, with clay layers, gray and dark brown with ferric staining and gypsum in partings and joints, highly weathered to decomposed No recovery in split spoon sample at 1.5m (5 ft) bgs			
			M	SPT	34			15.5				89	it) ogs			
	3 _		X	SPT	38								3.5 m (11.5') El. 2219.5 m (7281.			
					Tr	tal D	enth	3.5 m	(11.5)	)	-	.1	M3 M6 27 (4) T (47)			







Boring # GR-12 Sheet 1 of 1

												Revision: 0				
	Started: 12/11/2009 Project Number  Completed: 12/11/2009 105884											Project				
Date	Con	Completed: 12/11/2009 105884									N11(1Å)1,2,4					
	Bacl	Backfilled: 12/11/2009 Rig Type: CME 75									Surface	Elevation: 2217.0 m (7273.6') Logged By: R. Stump				
La	atitude: 35°35.9998' Longitude: 108°19.6653'										Location: N11(1A) Sta. 2+202 1.5m Rt					
		ಜು		Ê	ock)					5	a n	AUGER - Auger Cuttings Groundwater				
'atc	. =	C	) <u>y</u>	E 20	, y		· 8	ajty (	imi	필	'assi Sicv	MC - 25" O.D. 2.46" I.D. Modified California Sample  MC - 25" O.D. 2.46" I.D. Modified California Sample  SPT - 2" O.D. 1.38" I.D. Tube Sample  (Not encountered)				
A 5	5 5	Graphical Log	Sample Type	stane ws/	% Recovery (Rock)		Sture lent (	Cu. 1	Liquid Limit	Plasticity Index	200 cart	AUGER - Auger Cuttings G - Grab Sample C - 2.5° O D 2.46° LD Modified California Sample SPT - 2° O D 1.38° I.D Tube Sample U - 3° O.D 2.42° I.D. Ring Sample ST - 3° O.D. Thirr-Walled Shelby Tube				
Groundwater Denth (m)	Dep	Sil Gail	Sam	Penetration Resistance (Blows / 0.3 r	%   %	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Ŀiġ	Plas	Percent Passing No. 200 Sieve	Visual Classification				
	0_															
	<b>v</b> —	W/////V	SPT	15		17.00.007.5						LEAN CLAY WITH SAND (CL)- hard, brown,				
		//////////////////////////////////////	31.1		reckes	11111111	(-2-2					0.3 m (1.0') moist El 2216.7 m (7272.6')				
		///	******		-	60000	174744					WEATHERED CLAYSTONE - soft to hard, with clay layers, brown to gray, moist,				
	25	///							100200			with sandy zones (fine sand)				
	1 _	///	МС	36												
		1././	1000				20000			-580						
			1-14311													
		1//				44,000	1									
	1.7	////	SPT	37					90000		00-20000					
	2 _	///	51/55/2				SH TO		13.13.1333							
	100				90.11	Bille		F-1200		Sin						
		1///	CDT	25	99,542 [1]				5-06-68-600	-						
		////	SPT	25	110 9.45		14.13.134									
		1:/:/	9-000	000000			recent		*******	****						
	3 —	////	SPT	10/5"			00.00					12 - (10 fb				
		7. /. /.	21.1		1.7		1	(10.5	<u> </u>	1		3.2 m (10.5') E1. 2213.8 m (7263.1')				





Boring # GR-13
Sheet 1 of 1

												Revision: 0
	Start	ted: 12/8	/2009	•		Pro	oject	Num	ber			Project
Date	Com	ompleted: 12/8/2009 105884 ackfilled: 12/8/2009 Rig Type: CME 75 ude: 35°36.0971' Longitude: 108°19.6033'										N11(1Å)1,2,4
	Back	filled: 1	2/8/20	009	Rig	Typ	e: Cl	ME 75			Surface	Elevation: 2203.5 m (7229.3') Logged By: R. Stump
	atitude	de: 35°36.0971,   Tougitude: 108°19'6033,   Taken nation nance   S (0.3 m)   Tougitude: 108°19'6033,   Taken nation nance   S (0.3 m)   Taken nation nance   S (0.3 m)   Taken nation na									·	:: N11(1A) Sta. 2+400 CL
	atiltuu (	. 33 30.				igitu	ue. I		0033			
5		왕	2	_ E	(Rec		=	>	E	nde	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample Depth. m (ft.) Date C - S** O.D. 1.38** I.D. Tube Sample U - 3 ** O.D. 2.42** I.D. Ring Sample ST - 3** O.D. Thin-Walled Shelby Tube  Groundwater Depth. m (ft.) Date (Not encountered)
Groundwater Denth (m)	Depth (m)	cal L	7	nce nce	refry		20	HSH (II	Ein	ty li	P. C	E SPT - 2" O.D. 1.38" I.D. Tube Sample (Not encountered)
Groundwa Denth (m)		ple la		ettra sista oves	lecon	ا ۾ ا	iste	Q 2	nid	stici	20 ccm	ST - 3" O.D. Thin-Walled Shelby Tube
5	2 2	5 3	Sar	25.5	100	RQD	월ౖ5	문종	글	<u> </u>	25	Visual Classification
	_						1					
			SPT	40			9.6			*****	73	FAT CLAY WITH SAND (CH)- medium to coarse sand, some fine gravel, hard, light brown, moist
	œ			TREEFE				(September		5-1-5		
	25	////		2000	orner:						en Lecouse	
	1		SPT	22		8337	14.1.		51	. 23		1.1 m (3.5') El. 2202.4 m (7225.8')
	12											WEATHERED CLAYSTONE - medium strong, with clay layers, brown and gray with yellow and ferric staining, moist
		/•/·\	SPT	26								
	2					9770	111111					
		/:/:			296777		20.00			2.64		
		///\	SPT	41			11.3					
		1./	۸	''								
		1./.	00000	13171111	SERVICE.	errice.	reces	e e e e e e e e	187717-1	*****		
	3		SPT	23					,,,,,,,,			With gypsum crystals in partings and joints at 3m (10 ft) bgs
		1.11	<u> </u>	<u> </u>	<u></u>	ļ	<u> </u>	<u> </u>				3.5 m (11.5') El. 2200.0 m (7217.8')







Boring # GR-14
Sheet 1 of 1

El. 2198.5 m (7212.9')

	/											011000		
Backfilled: 12/9/2009   Rig Type: CME 75   Surface Elevation: 2202.0 m (722						Revisio	n; 0							
Sta	mpleted: 12/9/2009 105884 ckfilled: 12/9/2009 Rig Type: CME 75 de: 35°36.1873' Longitude: 108°19.5325'											oject		
E Coi	mpleted: 1	12/9/2	009	1		10:	5884				N11(	1Å)1,2,4		
Bac				Rig	, Typ	e: Cl	ME 75		$\overline{}$	Surface	Flevetion: 2702 0 m (7224 4')	Loggad	By: R. Stump	
		-		_				E225!	$\overline{}$				Dy. 1c Stump	
Latitue	ne: 35 30.	10/3	_	_	ngitu	ue: r	00-13.	3323					Groundwa	ater
5	50	皇	<u>E</u>	12 Oct		_		, <u>.</u>	g	Sing VC	☑ G · Grab Sample	omia Samola	Depth, m (fl.)	Date
\$ E E		7	E 2 0	ery (		ى ئ	asity (iii	-Ë	<u>=</u>	Pas Sic	SPT - 2" O.D. 1.38" I.D. Tube Sample	anna Sampre	(Not encountered)	
Groundwat Depth (m) Depth (m)	Graphical Sample Taken	Sample Type	ctra istar	Ama	ا ا	istur	<u>0</u> 3	Liquid Limit	isi	Scut 200	MC * 2.5" O.D. 2.46" I.D. Modified Califo E. SPT - 2" O.D. 1.38" I.D. Tube Sample U = 3 " O.D. 2.42" I.D. Ring Sample Z ST - 3" O.D. Thin-Walled Shelby Tube			
Groundwater Depth (m) Depth (m)	Gra	San	Penetration Resistance (Blows / 0.3 o	* ×	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Ľģ.	Plas	No.	Visual Classifie	cation		
	· · · · · · · · · · · · · · · · · · ·				,									
0 -	V/////	/			Π				1		SANDY LEAN CLA	AY (CI )- I	hard light hrown	
5	- <i>/////</i> ///	SPT	29	io		0.00		01160			moist	11 (02)	illu, iigin biovii,	
		4												
10	111111	2,777.17		10000	101011		- traine	12.12.12.1	20000		0.6 m (2.0°)			m (7222,4)
		1227.00		22.00	27	-	255	155555	1000		WEATHERED CLA layers, brown	YSIONE	: - With clay	
1 -	<i>-///</i>	МС	40		,,	-5.55	100000		l leest		staining and ye	ellow mine	eral deposits	
	1/1/			F-000	10 5 3300		222210		m togoso					
	////				1-1-1-1-1-1									
)	1/1/			6550T	1111111									
,	1//	SPT	23				0.0007700							
				200-70			2000000	100000000000000000000000000000000000000						
2 -	1///	1455	044503	200	2002	3552	678667	597.55	37.08					
-	1//	23.72			inia		maria.	i i i i i i						
	1//	SPT	36	377.57	2015.07		100017		5 225.53	***				
	1///	SFT	30											
5	1//				100000			0.000						
3 -	1//	02210	errunar.	erren.				1 100 31 101						
10000	1//	7			10.000				0 35		With fine sandy zon	es at 3m (1	10 ft) bgs	

3.5 m (11.5')







Boring # GR-15 Sheet 1 of 1

ــــا با			/2009   2/9/2			Pro	-	Num 5884	ber			Project N11(1A)1,2,4
Bac	kfille	d: 1	2/9/20	009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2199.0 m (7214.6') Logged By: R. Stump
Latitud	le: 35	°36.	2507'		Lo	igitu	de: 1	08°19.	4275'			n: N11(1A) Sta. 2+800 4.0m Rt
	30			Ê	tock)				_	lcx	ing o	AUGER - Auger Cuttings     G - Grab Sample     MC - 25 ° O D 2 46 ° I D. Modified California Sample     Depth, m (ft.)     Date
Depth (m) Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 r	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5° O.D 2.46° I.D. Modified California Sample SPT - 2° O.D 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube  Groundwater Dcpth, m (ft.)  (Not encountered)
PG PG	<u> </u>	Samp	Sam	Resi (Blo	₩.	RQD	Con	D S	Liqu	Plas	Per So.	Visual Classification
0 _												
			SPT	22	20			i de escrito de				SANDY LEAN CLAY (CL)- hard, light brown, dry to moist 0.5 m (1.5') El. 2198.5 m (721)
(3	XX	X					-95-1-5-		******			WEATHERED SILTSTONE - medium strong,
1	X X X X	×××	МС	39			16.6	15.6			90	with silt layers, brown and gray with ferric staining
	* * * * * * * * * * * * * * * * * * *	×××								2000		
	x x x x x x	××										
,	X X X X	ž N	SPT	30	· · · · ·		13.5	A	47	18		
-	× × × × × ×	××××										
-	X X X X	××	SPT	30			,,					
	X X X X	×	0.00			inni		·			nim	
3 _	X X	ž V	SPT	26								
	X X	* \	311	20						2223		3.5 m (11.5') El. 2195.5 m (720)







`		>						,				Revision: 0
Date	Star Con	ted: 12/ ipleted:				Pro	_	Num 5884	ber			Project N11(1A)1,2,4
	Bac	kfilled:	12/9/2	009	Rig	Тур	e: CN	1E 75		S	urface	Elevation: 2193.0 m (7194.9') Logged By: R. Stump
La	atitud	e: 35°36	.3133'		Lo	ngitu	de: 10	08°19.	3027'	L		: N11(1A) Sta. 3+020 5.5m Rt
undwater	Depth (m)	Graphical Log	Sample Taken Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	٥	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D 2.46" I.D Modified California Sample SPT - 2" O.D 1.38" I.D. Tube Sample U - 3 " O.D 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube
5		5	Sall	돌종필	%	RQD	\$5	25	Lř.	를	2 Z	Visual Classification
	0 _						-					
			SPT	18								SANDY LEAN CLAY (CL)- stiff, light brown, 0.3 m (1.0') moist El. 2192.7 m (7193.9')
	25									50000		WEATHERED CLAYSTONE - medium strong, with clay layers, brown with calcite deposits, moist
	1 _		МС	45								
						,,,,,,						
	2 _		SPT	26	Lervin							
	100							forms			S. C. L.	
	- 13		SPT	21			111111			*******		
	3 —					1.01.003			1			
			SPT	29							TO TOUR DE	3.5 m (11.5') E1. 2189.5 m (7183.4')
				To	otal D	epth.	3.5 m	(11.5)	)			







Boring # GR-17 Sheet 1 of 1

Separate   129/2009   Project Number   105884   105884   105884   105884   105884   105884   105884   105884   105884   105886   105884   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886   105886												Revision: 0
Backfilled: 12/9/2009   Rig Type: CME 75   Surface Elevation: 2191.5 m (719.04)   Logged By: R. Stump	_ Si	tarted: 12	/9/2009			Pro	oject	Num	ber			
Backfilled: 12/9/2009   Rig Type: CME 75   Surface Elevation: 2191.5 m (719.04)   Logged By: R. Stump	E C	ompleted	: 12/9/2	2009	1		105	5884				N11(1A)1,2,4
SPT   26   SPT   32   SPT   37   SPT   24   SPT   24	B	ackfilled:	12/9/2	009	Rig	Тур	e: CN	ME 75		S	urface	Elevation: 2191.5 m (7190.0') Logged By: R. Stump
Part	Latit	ude: 35°3	6.3641'		Lor	ngitu	de: 10	08°19.	2182'	L	ocatio	
SPT   26   SPT   27   SPT   27   SPT   26   SPT   27   SPT   26   SPT   26   SPT   26   SPT   26   SPT   26   SPT   26   SPT   27   SPT   28   SPT   27   SPT   27				2			ì			K	±0.7	# AUGER - Auger Cuttings Groundwater
SPT   26   SPT   27   SPT   27   SPT   26   SPT   27   SPT   26   SPT   26   SPT   26   SPT   26   SPT   26   SPT   26   SPT   27   SPT   28   SPT   27   SPT   27	undwater th (m)	phical Log	e Taken ple Type	etration istance ws / 0.3 n	scovery (Re	_	sture fent (%)	Density /cu. m)	aid Limit	ticity Inde	cent Passis 200 Sieve	MC - 2.5" O.D. 2.46" I.D. Modified California Sample  S SPT - 2" O.D. 1.38" I.D. Tube Sample  U - 3" O.D. 2.42" I.D. Ring Sample  S T - 3" O.D. Thin-Walled Shelby Tube
MC   37     11.6   13.9   65   SANDY LEAN CLAY (CL)- firm, with calcite, light brown, moist   El. 2190.9 m (7188.0)	Dep d		Sam	Ses Blog	% K	\ \overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\overline{\ove	Con	EN C	<u>F</u>	Plas	Per No.	
MC   37   11.6   13.9   65   SANDY LEAN CLAY (CL)- firm, with calcite, light brown, moist   El. 2190.9 m (7188.0')				1							1	,
WEATHERED CLAYSTONE - with clay layers, highly weathered to decomposed	"	-	МС	37			11.6	13.9	more.	111441	65	SANDY LEAN CLAY (CL)- firm, with calcite, light brown, moist
SPT   13   12.6		- /////			-151111					10000		
2.1 m (7.0)  SPT 13 12.6  2.1 m (7.0)  WEATHERED CLAYSTONE - medium strong, with clay layers, brown, moist  SPT 26  With thin fine sand layers at 3m (10ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 24  6 -			) 			******				*****		WEATHERED CLAYSTONE - with clay layers, highly weathered to decomposed
2 - 2.1 m (7.0)  SPT 26  SPT 32  With thin fine sand layers at 3m (10ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 24  SPT 46  SPT 46  SPT 46  6.6 m (21.5)  El. 2184.9 m (7168.5)	1	7///	M 2b1	-13			11111					
2 - 2.1 m (7.0)  SPT 26  SPT 32  With thin fine sand layers at 3m (10ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 24  SPT 46  SPT 46  SPT 46  6.6 m (21.5)  El. 2184.9 m (7168.5)		1///	1		111111	1.17811						
2 - 2.1 m (7.0)  SPT 26  SPT 32  With thin fine sand layers at 3m (10ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 24  SPT 46  SPT 46  SPT 46  6.6 m (21.5)  El. 2184.9 m (7168.5)		1/1/	-						441000			
SPT 26  SPT 26  WEATHERED CLAYSTONE - medium strong, with clay layers, brown, moist  With thin fine sand layers at 3m (10ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 24  SPT 24  SPT 24  SPT 26  SPT 26  SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs		1././	SPT	13		0.00	12.6	- 5000.000				
WEATHERED CLAYSTONE - medium strong, with clay layers, brown, moist  SPT 26  With thin fine sand layers at 3m (10ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 46  SPT 46  SPT 46	2	-1//	<b>H</b>		23.55.23.	20.000	32005		1011111111			21 m /7 0"\ Fil 2189 4 m (7183 0")
3 -		1/-/-	111111		name.							WEATHERED CLAYSTONE - medium
3 -		1//	M spr	76		H-0201				TERRE		strong, with clay layers, brown, moist
With thin fine sand layers at 3m (10ft) bgs  SPT 32  SPT 21 15.6 47 19  SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 46  SPT 46  G.6 m (21.5')  El. 2184.9 m (7168.5')		1././	W 3F1	20								
With thin fine sand layers at 3m (10ft) bgs  SPT 32  SPT 21 15.6 47 19  SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24  SPT 46  SPT 46  G.6 m (21.5')  El. 2184.9 m (7168.5')		1/:/.	7		4	******		SUSSES.		100000	10000000	
4 - SPT 21 15.6 47 19  SPT 37 With thin sandstone layers at 4.9m (16 ft) bgs  SPT 24 6 6.6 m (21.5') E1. 2184.9 m (7168.5)	3	-////		· merce	111111		13377	Million	1377153	100000		With thin fine sand layers at 3m (10ft) has
SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1:/:/	SPT	32			-1111					
SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1/://	<u> </u>		alline							
SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1//		-0.005	199717							
SPT 37  With thin sandstone layers at 4.9m (16 ft) bgs  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')	4	1././	M _{-SPT}	21	FF Lack L	0.000	15.6		47	19		
5 — With thin sandstone layers at 4.9m (16 ft) bgs  6 — SPT 46  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1//	1									
5 — With thin sandstone layers at 4.9m (16 ft) bgs  6 — SPT 46  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1/://			-00.0000	00000	100000	EUGUSS.		1771178	2004	
5 — With thin sandstone layers at 4.9m (16 ft) bgs  6 — SPT 46  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1://	7									
6 - SPT 24  SPT 46  6.6 m (21.5')  El. 2184.9 m (7168.5')		1./1	SPT	37						PERCENT	**********	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 - SPT 46 6.6 m (21.5') El. 2184.9 m (7168.5')	5	7///	H			er serv				min o		With thin sandstone layers at 4.9m (16 π) bgs
6 - SPT 46 6.6 m (21.5') El. 2184.9 m (7168.5')		////	1 12 22	n agains	10000				377772			
6 - SPT 46 6.6 m (21.5') El. 2184.9 m (7168.5')		1/1	M:SPT	24						*****		
SPT 46 6.6 m (21.5') E1. 2184.9 m (7168.5')		1/://	1/									
SPT 46 6.6 m (21.5') E1. 2184.9 m (7168.5')	6	· _///.			100.00			194 540				
6.6 m (21.5') El. 2184.9 m (7168.5')		(:/:)	4		/ 15/54							
		1/:/	SPT	46	115/00/	10 12 13	11-9270	0.000				66 m (21 51) E1 2104 0 m (7160 51)
		1.1.1	4	Т	otal D	)enth	6.6 m	2 (21.5	')		1	1 0.0 III (21.2) E1. 2164.9 III (7100.3)







Boring # GR-18
Sheet 1 of 1

El. 2175.5 m (7137.5')

-		/											Onest	
	_												Revision	1: 0
اد	Star	ted: 12/9	/2009			Pro	oject	Num	ber				oject	
Date	Con	npleted:	12/9/2	009			105	5884				N11(1	lÅ)1,2,4	
	Bacl	kfilled: 1	2/9/20	009	Rig	у Тур	e: CN	ME 75			Surface	Elevation: 2179.0 m (7149.0')	Logged 1	By: R. Stump
La	titud	Creptiled: 12/9/2009  Geraphical Log Sample Taken Sample Type Penetration Penetration Description			Lo	ngitu	de: 1	08°19.	1098'		Location	:: N11(1A) Sta. 3+398 3.7m Lt		
		an l	Ê	ick)					5	±0°.	AUGÉR - Auger Cuttings		Groundwater	
ater (		6	yrc	E 20	¥.		(%)	<u> </u>	Ţ.	를	assi	MC - 2.5" O.D. 2.46" I.D. Modified Califo	omia Sample	Depth, m (ft.) Date
whul	٤	hical	T of	tratic stanc	% Recuvery (Ruck)		cnt (	Dens	Liquid Limit	Plasticity Index	2002	AUGER - Auger Cuttings G - Grab Sample U MC - 2.5" O.D. 2 45" I.D. Modified Califit ST - 2" O.D. 1.38" I.D. Tube Sample U - 3" O.D. 2 42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube		(Not encountered)
Groundwater Depth (m)		Grap	Sam	Pene Resis (Blor	% Re	RÕD	Moisture Content (%)	Dry Density (kN/cu. m)	Liqu	Plast	Percent Passing No. 200 Sieve	Visual Classifie	cation	
			1				-	l	1	1		<u> </u>		
	0 —	<i>///////</i>	/						1		1	LEAN CLAY (CL)-	brown, mo	pist
		//////////////////////////////////////	SPT	11			entr.					0.3 m (1.0°)		El. 2178.7 m (7148.0')
		1///		477777	11211							WEATHERED CLA layers, with cla		
		<b>//</b> //_										inyers, with the	ay layers, t	nown, moist
	1		МС	38	10.	0.52								
	1 —	1//												
		///	1111111111	3	. 15.150	111111111	There exist							
		1/:/	12000	ececus.	Greek (			en i i i i i i i i i i i i i i i i i i i	******					
		////	SPT	38	seren	10000					er emme			
	2 _	///		1221010	000500		*17:00							
		////	36.000		2000			50777622		50000				
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	-	1/-//	SPT	29			111111							
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	3 _	1.//	155115	111 THE LAND		1,000		111111111111111111111111111111111111111						
		Y///\	SPT	31			Lun.							

Total Depth 3.5 m (11.5')







`														Revision: 0
Date					2009 2/9/2			Pro	-	Num 5884	ber			Project N11(1A)1,2,4
					/9/20		Rig	Тур		ME 75		$\top$	Surface	Elevation: 2178.5 m (7147.3') Logged By: R. Stump
L٤	titud	le: 3	5°3(	6.5	232'		Lo	ngitu	de: 1	08°19.	0455'			n: N11(1A) Sta. 3+582 1.8m Lt
nindwaler offi (m)	Depth (m)		Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)		Moisture Content (%)		Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings  G - Grab Sample C - 2.5 ° O D. 2.46 ° I.D. Modified California Sample S SPT - 2" O D. 1.38 ° I.D. Tube Sample U - 3 ° O.D. 2.42 ° I.D. Ring Sample S ST - 3" O.D. Thin-Walled Shelby Tube
غَ ذَ	2 2	t	5_	Sam	Sal	555	*	RQD	کیق	5	Liq	Z	P. So.	Visual Classification
	0 _													
	7.2	X X X X X X	X	$\bigvee$	SPT	22		.,	.,,,,,,		54	21		WEATHERED SILTSTONE - with silt layers, light brown
	85	X X X X	C X	Н								10.00		
	-	XX	( X	H			ururu.		111111	2511122	72551750	100		
	1 -	× × × ×	( X	X	SPT	27	12.000	A	14.8			11117	96	
	-	X X X X	K X	H		description.	ă î red	.)				11.443	an anana	
	-	X X X X	X	H			14-9-0				ii muse			
	3.5	X X	C X	X	SPT	37	CHICAGO.				and a	929	0.100.000	
	2 _	× × ×	X	H		ninia)	177876							
	100	X X X X	X	H	er er er e	refracti	er terici	ann	11/000	5511740			ni como	With ferric staining at 2.3m (7.5 ft) bgs
	1.0	X X X X	X X	X	SPT	- 50			14.2				83 amam	with ferric stanning at 2.5th (7.5 ft) ogs
	133	X X X X	X	H		22723	111111	******						
	3 —	X X	( X	H	9000	22/12/25	V3774.				NO. NO.	223		
	10	× × ×	X	X	SPT	38	10.7000			Minni	MINNE	Min	11 - 11 - 11 - 11 - 11 - 11 - 11 - 11	
	1/2	ž	* ×	VV		<u> </u>	1.7	1	2.5	(11.5	<u>.                                    </u>		1	3.5 m (11.5') El. 2175.0 m (7135.8
						10	IBI D	ери)	a.ə m	(11.5'	)			







Boring # GR-20 Sheet 1 of 1

1													
	-	1 451	D / D O D T			-						Revision: 0	
اوا		ed: 12/				Pro	•	Num	ber			Project	
Date	Com	pleted:	12/9/	2009			10:	5884				N11(1Å)1,2,4	
	Back	filled:	12/9/2	009	Rig	у Тур	e: Cl	ME 75			Surface	Elevation: 2169.0 m (7116.1') Logged By: R. Stump	
Lat	titude	e: 35°36	.6293	ı	Lo	ngitu	de: 1	08°18.	9802'		Locatio	n: N11(1A) Sta. 3+801 1.8m Rt	
		ab.		Ê	<u>ķ</u>		Π			×	20	AUGER - Auger Cuttings Groundwater	
ıter	_	Fog	<u>چ</u>	=	, K		3	<u>.</u>	Ē	1 3	icve		ate
A E	<b>E</b>	ica	다 다	atic mc s/(	)ve.		2 1	CIIS	<u>                                   </u>	<del>,</del>	1 P 0	MC - 2.5° O.D. 2.46° I.D. Modified California Sample SPT - 2° O.D. 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube	
Groundwater Depth (m)	chtl	Graphical Log	Sample Taken Sample Type	Penetration Resistance (Blows / 0.3	& Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve		
0		5	y n	1555	100	~	Σΰ	ರಿಕ		_ =		Visual Classification	
l	0 —												
			V SPT	14								0.2 m (0.5') LEAN CLAY (CL)- brown, moist El. 2168 8 m (7	115.6
	- 1	(-/:/	V 2.7	17	*****				CONTRACTOR	. Freeze		WEATHERED CLAYSTONE - with calcite,	
			00.50			0.000				2.23	rej some	with clay layers, brown and tan, moist, highly weathered to decomposed	
		1/1/	000000		000000	conne	0.01.00	73.000			0.114 (8.11.2-0.00.0		
	1	/./.	SPT	10	0.0000	4000						No split spoon sample recovery at 0.8m (2.5 ft)	
	• –		VI.2.1	1.0				11				bgs	
		///	14000										
	-	///							0.00				
		////	MC	24									
			22.565				111111111111111111111111111111111111111	2111112	10.	Mana sa			
1	2	///	(275)		2570	1687	7/2			3377			
	-	///	14444				11.11						
		1.//	SPT	59	12 (2.12)	1000.000						With thin sandstone layers at 2.3m (7.5 ft) bgs	
			1	33									
	27	1:/2	22,00					2111112					
	3	/:/:/	-		****	1996-8							
		/://	V CET	40	5.55	3005.0				1096			
		1././	X SPT	49		1	1						





Boring # GR-21 Sheet 1 of 1

													Revision: 0
او	Start						Pro		Num	ber			Project N11(1A)1,2,4
Date	Com	<u>.                                      </u>							5884		$\perp$		1111(121/1)497
	Back	cfilled	d: 12	2/9/20	309	Rig	Typ	e: CN	<b>ME 75</b>			Surface	Elevation: 2164.5 m (7101.4') Logged By: R. Stump
Ļa	titud	e: 35°	36.8	231'		Lo	ngitu	de: 1	D8°18.	8641'		Location	: N11(1A) Sta. 4+198 1.8m Lt
		20			[ E	ock)					č	.≊° ე	AUGER - Auger Cuttings G - Grab Sample MC - 2 5 O.D. 2 46 LD. Modified California Sample Depth, m (ft.) Date
į (		2	E	ypc	on 0.3	, Y		90	sity E	iii.	三	Sicv	MC - 25 O D . 2 46" I.D. Modified California Sample  MC - 25 O D . 2 46" I.D. Modified California Sample  SPT - 2" O D . 1.38" I.D. Tube Sample  (Not encountered)
E	Depth (m)	Graphical Log	Sample Taken	Sample Type	stant ws/	* Recovery (Rock)		sture tent (	Den:	Liquid Limit	Plasticity Index	cut 1	C - 2.5" O.D. 2.45" I.D. Modified California Sample  SPT - 2" O.D. 1.38" I.D. Tube Sample  U - 3" O.D. 2.42" I.D. Ring Sample  ST - 3" O.D. Thin-Walled Shelby Tube
Depth (m)	Dept	Grap	Sempl	Sam	Penetration Resistance (Blows / 0.3 r	% Re	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liqu	Plas	Percent Passing No. 200 Sieve	Visual Classification
_			, , ,										
	0 -		X	МС	13					i di di di		,	POORLY GRADED SAND (SP)- fine grained, loose, light brown, dry
	14				00000000			(3.000)					0.6 m (2.0°) E1. 2163.9 m (7099.4
													0.6 m (2.0°) E1. 2163.9 m (7099.4 SILTY SAND (SM)- fine, medium dense,
	. 7		Ϋ́	MC	24			4.4	13.7		123120	46	brown, dry
	1 -		:	4.2.1 - 4.2									1.2 m (4.0') El. 2163.3 m (7097.4
	1-			rerere	Breener	e11 61 6							LEAN CLAY WITH SAND (CL)- firm, brown,
	:3						1.0000	4111111		1-1-1-1-1			dry
	12.			MC	42			12.8	15.1	49	23		
	2								amin.				
		/////		220									2.1 m (7.0') El. 2162.4 m (7094.4 SILTY SAND (SM)- fine, loose, brown, dry,
			17										porous
	-		: ·  X	SPT	13	eco.gct		See of the	00000	174711149			
						es (Table)		energ		0.000			2.9 m (9.5') El. 2161.6 m (7091.5
	3 —			мc	37		1130	2015					SILTY LEAN CLAY (CL-ML)- hard, brown, dry
	1	000		MC	31	11,144							3.4 m (11.0') El. 2161.1 m (7090.4





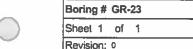


Boring # GR-22 Sheet 1 of 1

`		•										Revision: 0
Date		ted: 12/9				Pro	-	Num 5884	ber			Project N11(1A)1,2,4
	Back	dilled: 1	2/9/2	009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2167.0 m (7109.6') Logged By: R. Stump
La	titud	e: 35°36.	9281'		Lo	ngitu	de: 1	08°18.	82871		Locatio	n: N11(1A) Str. 4+400 4.6m Rt
Groundwater Depth (m)	Depth (m)	Graphical Log	Sample Type	Penetration Resistance (Blows / 0.3 m)	M. Recovery (Rock)	Đ	Moisture Content (%)	Dry Density (kN/cu, m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5° O.D. 2.46° I.D. Modified California Sample E SPT - 2° O.D. 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample S ST - 3° O.D. Thin-Walled Sheiby Tube
50	ũ	_ <u>5</u> }	Sai	돌종표	*	RQD	≱ಾ	문종	Lin	튑	2 %	Visual Classification
	0 _		SPT	15						441471		SILTY SAND (SM)- fine grained, loose to medium dense, brown, dry
	1 -		мс	16		i i neri	8.5	*******	74.001.001	10.10.10		
	. 2 _		МС	25								
			SPT	12								2.7 m (9.0') El. 2164.3 m (7100.6')  LEAN CLAY (CL)- firm, brown, moist
	3 _		SPT	20	00.00				innere			3.5 m (11.5') El. 2163.5 m (7098.1')







													Revision: 0
9	Start	ted: 1	2/9/	2009			Pro	oject	Num	ber			Project
Date	Com	plete	d: 1	2/9/2	009			105	5884		-		N11(1Ā)1,2,4
	Back	kfilled	l: 12	/9/20	009	Rig	Тур	e: CN	<b>ME 75</b>			Surfac	Elevation: 2171.0 m (7122.7') Logged By: R. Stump
L	atitude	e: 35°	37.0	350'		Lo	rgitu	de: 10	08°18.	8161'	$\neg$	Locati	n: N11(1A) Sta. 4+600 2.4m Lt
Groundwater Death (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recuvery (Ruck)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - Grab Sample C - SPT - 2° O.D . 2 46° LD. Modified California Sample C - SPT - 2° O.D 1.38° I.D. Tube Sample U - 3° O.D 2.42° I.D. Ring Sample S - ST - 3° O.D. Thin-Walled Shelby Tube
ے ق	<u> </u>	ర్	Se	Sa	556	*	≥ ≥	žū	호포	Ĕ	Ē	22	Visual Classification
	0												
			M	SPT	8			4.7					SILT WITH SAND (ML)- fine grained, loose, brown, dry
	1 -		V A	МС	19			3.6					
			X	SPT	13			7.5				71	
				SPT	21								2.6 m (8.5') E1. 2168.4 m (7114.2') CLAYEY SAND (SC)- fine grained, medium
	3 —			SPT	8								2.9 m (9.5') dense, brown, dry El. 2168.1 m (7113.2')  SILTY SAND (SM)- fine grained, loose, brown, dry
			11		L						L	l	3.5 m (11.5') El. 2167.5 m (7111.2')







3.4 m (11.0') El. 2172.6 m (7128.1')
3.5 m (11.5')SANDY LEAN CLAY (CL)- hard, browfil, 2179.5 m (7127.6')

Boring # GR-24
Sheet 1 of 1
Revision: 0

													Revision: 0
	Star	ted: 12	/9/2	2009			Pro	ject	Num	ber			Project
Date	Con	pleted	: 12	2/9/2	009			105	5884				N11(1Å)1,2,4
	Bacl	kfilled:	12	/9/20	09	Rig	Тур	e: CN	4E 75			Surface	Elevation: 2176.0 m (7139.1') Logged By: R. Stump
La	titud	e: 35°3	7.14	411'		Lo	igitu	de: 10	08°18.'	7913'		Location	: N11(1A) Sta. 4+800 2.4m Lt
			П		_	8					*	20	AUGER - Auger Cuttings Groundwater
5		80		된	3 m)	훈		اچ ا	۸.	⋅ <u>=</u>	5	ssin	AUGER - Auger Cuttings G - Grab Sample Depth, m (ft.) Date SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3 " O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube  Groundwater Depth, m (ft.) (Not encountered) (Not encountered)
lew Ca	Ê	=	Ę	Ţ	tion ncc / 0.	1		2	] <u>Si</u>	=	Š	Pag S	SPT - 2" O.D. 1.38" I.D. Tube Sample (Not encountered)
P =	=	: [ ]	<u></u>	임	etra istas ws	) À			G.E.	<u>\$</u>	<u>:</u>	15 Š	Z ST - 3" O.D. Thin-Walled Shelby Tube
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 r	% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0												
	v —		M	SPT.	.6	2251	173677	iiikaa .		wa.o.	24664		SILTY SAND (SM)- fine grained, loose, brown, dry
			://										orown, ary
			П				emene.		20,000,00				
			Н		Z		100,000	****		5745555	****		
	1 _		M	SPT.	9				38600.0		37.71		
			₩						77				
			Ī		577,1371		ernne	+++++	CERCISI I				
		: :[:	Ц			11040			en on		111111		
	Ca.		M	SPT	8					4917334111			
			M				2.000	-	0.00000	0.00	-1	1 2 2 2 2 1	
	2 —			50000			11.500		12.2,7		various.		
				SH					1	5	2.3.5		
	-								2000		100.00		
			:										
	196	1:1:4:	: 1		12000		.,	5500	3,000	1007004	(0.00		







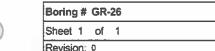
Boring # GR-25 Sheet 1 of 1

El. 2175.5 m (7137.5')

														Revision: 0
Date	Star							Pro	-	Num 5884	ber			Project N11(1A)1,2,4
	Bacl	kfili	ed:	12	/9/20	09	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2179.0 m (7149.0') Logged By: R. Stump
La	titud	e: 3	5°3	7.2	547'		Lo	ngitu	de: 1	08°18.	7589'			n: N11(1A) Sta. 5+004 0.9m Rt
Groundwater Depth (m)	ath (m)	alitant t an	urapnicai Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	۵	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	# AUGER - Auger Cuttings G - Grab Sample U - 2.5" O.D 2.46" I.D. Modified California Sample SPT - 2" O.D 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample U - 3" O.D. 7 Inin-Walled Shelby Tube
<u>0</u>	Del	d		Sam	San	555	15	RQD	٥ٍڮؖ	문중	Liq	먑	2 S	Visual Classification
	0 _					-								
				M	SPT	9			5.2					SANDY SILT (ML)- loose to medium dense, light brown, dry
	15			П					11110	3920	ereneri			
	1 _			V A	МС	22								
	13		Н			*******	77.45			alahari				
				V A	МС	18			7.8	14.3		****	64	
	2 _												,,,	2.1 m (7.0') EL 2176.9 m (7142.0')
				V	МС	27								POORLY GRADED SAND WITH SILT (SP-SM)- loose, light brown, dry
	3 _				9800 9800	37.77						555 Y		

3.5 m (11.5°)





`													Revision: 0
ان	Star	ted: 1	2/9/	2009			Pro	oject	Num	ber			Project
Date	Com	plete	d: 1	2/9/2	009			105	5884				N11(1Ā)1,2,4
	Back	kfilled	: 12	/9/20	009	Rig	Тур	e: CN	<b>ME 75</b>			Surface	Elevation: 2172.5 m (7127.6') Logged By: R. Stump
La	titud	e: 35°3	37.3	497'		Lo	ngitu	de: 1	08°18.	7127'		Locatio	n: N11(1A) Sta. 5+201 2.7m Lt
		20		P)	Ê	(uck)					<u>5</u>	9 5 9 5	AUGER - Auger Cuttings Groundwater
valer n)	· 📻	<u> </u>	Ę	Турс	0.3 0.3	ابر (ج		3	sity m)	jii j	y Ind	Passi	MC - 2.5° O D 2.46° I.D. Modified California Sample  SPT - 2° O.D. 1.38° I.D. Tube Sample  (Not encountered)
Groundwater Depth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 r	* Recovery (Rock)	۵	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample G - 2.5" O D 2.46" I.D. Modified California Sample SPT - 2" O D, 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube
Gro	Dep	Gra	Samp	San	E S S	25	RQD	₩ Cor	R D D	Liq	ᆵ	Pen No.	Visual Classification
ł	0 _												
	=		X	МС	11	Sec. 100		THIEF	n cerego	(1414343	14411		SILTY SAND (SM)- fine grained, loose, light brown, dry
					1,000	99.00	1200	10.11.13	(() - () - ()		4.40111		0.6 m (2.0') El. 2171.9 m (7125.6')
	1		X	SPT	19								SILTY CLAYEY SAND (SC-SM)- fine grained, loose to medium dense, light brown, dry
				e de la constante de la consta	50.000	arto.		Conti	derion.	i i i i i i i i i i i i i i i i i i i	00000		
	10		X	SPT	8			******					
	2 _		Н								Lissa		2.1 m (7.0') El. 2170.4 m (7120.6')
	T4		V	SPT	8								POORLY GRADED SAND (SP)- fine grained, loose, light brown, dry
	85		Δ	SF1	0			19111-01			3.0.11		
	3 _			W2250									
	34		:M	SPT	10	na.		Maria.	arrani.				
			: [[										3.5 m (11.5') El. 2169.0 m (7116.1')
					To	tal D	epth .	3.5 m	(11.5"	)			



Started: 12/9/2009   Project Number   105884   Surface Elevation: 2186.0 m (7171.9)   Logged By: R. Stump													Revision: 0
Backfilled: 12/9/2009   Rig Type: CME 75   Surface Elevation: 2186.0 m (7171.9')   Logged By: R. Stump	Jate						Pro	-		ber			
A   Company   Company	_	Bac	kfilled: 1	12/9/2	009	Rig	Тур	e: Cl	ME 75			Surface	Elevation: 2186.0 m (7171.9') Logged By: R. Stump
SPT 26 11.4 39 16 SANDY LEAN CLAY (CL)- fine grained, hard to firm, light brown and brown, dry  SPT 10 7.1 60  SPT 9 2.1 m (7.0) El. 2183.9 m (716-17)  SPT 9 POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11 3.5 m (11.5) El. 2182.5 m (7166-17)	L	atitud	le: 35°37	.4393'		Lo	ngitu	de: 1	08°18.	6409'	]		
SPT 26 11.4 39 16 SANDY LEAN CLAY (CL)- fine grained, hard to firm, light brown and brown, dry  SPT 10 7.1 60  2.1 m (7.0) El. 2183.9 m (716- POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11 3.5 m (11.5) El. 2182.5 m (7166-	oundwater	7th (m.)	phical Log	nple Type	ictration sistance ows / 0.3 m)	ecovery (Rock)	D	isture ntent (%)	/ Density //cu. m)	uid Limit	sticity Index	cent Passing 200 Sieve	AUGER - Auger Cuttings G - Grab Sample G - Crab Sample C - 2.5° O.D. 2.46° I.D. Modified California Sample S SPT - 2° O.D. 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample S ST - 3° O.D. Thin-Walled Shelby Tube
SPT 26 11.4 39 16 SANDY LEAN CLAY (CL)- fine grained, hard to firm, light brown and brown, dry  SPT 10 7.1 60  SPT 9 2.1 m (7.0') El. 2183.9 m (7164 POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11 3.5 m (11.5') El. 2182.5 m (7166 POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry	Ğ	2 2	Ë,	Sal	25.5	37	8	žů	문중	Ę	를	P S	Visual Classification
SPT 26 11.4 39 16 SANDY LEAN CLAY (CL)- fine grained, hard to firm, light brown and brown, dry  SPT 10 7.1 60  SPT 9 2.1 m (7.0') El. 2183.9 m (7164 POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11 3.5 m (11.5') El. 2182.5 m (7166 POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry		n											
2 — 2.1 m (7.0')  El. 2183.9 m (716- POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11  3.5 m (11.5')  El. 2182.5 m (7160)				SPT	26			11,4		39	16		SANDY LEAN CLAY (CL)- fine grained, hard to firm, light brown and brown, dry
2 — 2.1 m (7.0°)  E1. 2183.9 m (7164)  POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11  3.5 m (11.5°)  E1. 2182.5 m (7164)		1 -		SPT	10			7.1				60	
POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, dry  SPT 11  3.5 m (11.5')  El. 2182.5 m (7160)		2 -		SPT	9								
SPT 11 3.5 m (11.5') E1. 2182.5 m (7160		SV 		SPT	9		ini.	144141			20.44		POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light
		3 _		SPT	11								2.5 m (11.5)
				1	To	tal D	enth	1 5 m	(11.5)	,	1		[ 3.5 m (11.5 ) El. 2182.5 m (7160.4





Boring # GR-28
Sheet 1 of 1

											Revision: 0
<u>ا د ا</u>	arted: 12/9				Pro	_	Num 5884	ber			Project N11(1A)1,2,4
Ba	ckfilled: 12			Rig	Tvp		ME 75			Surface	Elevation: 2190.0 m (7185.0') Logged By: R. Stump
Latiti	ıde: 35°37.5	189°		<del>-</del>			08°18.				n: N11(1A) Sta. 5+600 1.2m Lt
Groundwater Depth (m) Depth (m)	go.	ъс	Penetration Resistance (Blows / 0,3 m)	Se Recuvery (Ruck)		Moisture Content (%)		Liquid Limit	Masticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings  G - Grab Sample  MC - 2.5" O.D. 2 45" I.D. Modified California Sample  SPT - 2" O.D. 1 38" I.D. Tube Sample  U - 3" O.D. 2 42" I.D. Ring Sample  U - 3" O.D. 2 42" I.D. Ring Sample  ST - 3" O.D. Thin-Walled Shelby Tube
2 2 3	Gra	San	돌중	**	RQD	₹5	문종	Ę.	E	No. of	Visual Classification
1 2		SPT	15								SANDY LEAN CLAY (CL)- fine grained, firm, brown, dry  1.4 m (4.5')  El. 2188.6 m (7180.5')  SILTY SAND (SM)- fine grained, loose, light brown, dry
3		SPT	5			120000			111111		2.9 m (9.5')  POORLY GRADED SAND WITH SILT (SP-SM)- fine grained, loose, light brown, moist  3.5 m (11.5')  El. 2187.1 m (7175.5')  El. 2186.5 m (7173.5')







Boring # GR-29 Sheet 1 of 1

El. 2191.0 m (7188.3')

													Revision: 0	
9	Star	ted: 12	2/9/	2009	)		Pro	oject	Num	ber			Project	
Date	Con	pleted	l: 1	2/9/2	009			105	5884				N11(1Å)1,2,4	
	Bacl	kfilled	: 12	2/9/20	009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2194.5 m (7199.8') Logged By: R. Stump	
L	ititud	e: 35°3	37.5	635'		Lo	ngitu	de: 1	08°18.	4907'		Locatio	n: N11(1A) Sta. 5+722 3.7m Lt	
			11		2	8	1		1	l i	ĸ	<u></u>	AUGER - Auger Cuttings Groundwater	
ic		یّق	Ш	7	E	8		(°	2	擅	퓔	Ssir	MC - 2.5" O.D. 2.46" I.D. Modified California Sample Depth, m (ft.) Date	
<u> </u>	Depth (m)	Graphical Log	Sample Taken	Sample Type	nice /	% Recuvery (Ruck)		Moisture Content (%)	ensi III	Liquid Limit	Plasticity Index	E S	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O D. 2 46" LD. Modified California Sample SPT - 2" O.D. 1.38" I D. Tube Sample U - 3 " O.D. 2.42" D. Ring Sample ST - 3" O.D. Thin-Walked Shelby Tube	
	뒫	를.	I 의	Ě	sista	leco.	۾ ا	Moisture Content (*	Q 3	E I	stic	5.2	ST - 3° O.D. Thin-Walled Shelby Tube	
Groundwater Death (m)	N N	5	Sam	Sar	Penetration Resistance (Blows / 0.3 m)	15	RQD	₹5	Dry Density (kN/cu. m)	Liq	<u>=</u>	Percent Passing No. 200 Sieve	Visual Classification	
	0 _													
			X	МС	23		- (111)						SANDY SILT (ML)- fine grained, hard to soft, light brown, dry	
	1 -		X	МС	12			6.2	12.7			57		
	2 _		X	SPT	7			7.2		NV	NI	P		
			X	SPT	6			0.000						
	3 _				5505505		0.55	10000						
			M	SPT	7			5.1				12 111111		

3.5 m (11.5°)



Boring # GR-30
Sheet 1 of 1
Revision: 0

Started: 12/9/2009													
ا ا	Start	ted: 12	/9/:	2009			Pro	ject	Num	ber			
at	Com	pleted	: 12	2/9/2	009			105	5884				N11(1A)1,2,4
"	Back	cfilled:	12	/9/20	09	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2197.0 m (7208.0') Logged By: R. Stump
L	titud	e: 35°31	7.5	886'		Lor	ngitu	de: 10	08°18.	45091	$\neg$	Locatio	n: N11(1A) Sta. 5+800 CL
			П		ê	_							
ate ~		Log		урс	nn e 0,3 n	y (Rc		2	ا قِيْ	酒	Jinde	assir	MC - 2.5" O.D. 2.46" I.D. Modified California Sample Depth. m (ft.) Date
Sp I	ا ي	hical	Take	le T	Iratic stanc vs/(	Over		ture (	Dens	E E	city	200 S	U - 3 * O.D. 2.42* I.D. Ring Sample (Not encountered)
Sign of the	<u> </u>	Gen	ample	Sam	enel esis Blov	Rec	G o	Mois Cont	KN.	inbir	last	Perce	
-			0.							<u> </u>			
	0 —		М		100							1	SILTY SAND (SM)- fine grained, loose to
	-		M	SPT.	15			200.00			1111111		medium dense, light brown, dry
	-		H			::::55	er een i				1.44-07		
			Ц				11.01.04				343233		
	1		N	MC	14		124.7						
	22		П		25 TOO 6-5		75 05-00	120.000	F 3000 N 100 N	nasaro.na			
			1										
	-		H	******	***********	*****		*****					
	85		XI:	SPT	8	101///	955	and i	rations	urgani.	10000	h karren	
	2		Η.		44				******				
	12		Ш				a contra	11555	in min			Simula.	
	-		M	SPT-	8	54101	- 4 7 - 6 1	- 35 - 35			21,020		
			M		-								
-	,		П		2000000	3251111					JAMES CO		
	3 –		H	V	27444	10.000	2500.40		10000	2200			3.2 m (10.5') El. 2193.8 m (7197.5'
	3.0		X	SPT	20								WEATHERED SANDSTONE - weak, with
	3.1	********	¥.¥.			4-1 F			(11.5)	<u> </u>	l	<u>.l</u>	
					10	nai D	eptn .	o.5 m	(11.5)	)			\ uy



Boring # GR-31
Sheet 1 of 1

													Revision; 0
ان	Star	ted: 12	/10	<b>/20</b> 09	9		Pro	oject	Num	ber			Project
Date	Con	pleted	: 12	/10/:	2009			10:	5884				N11(1A)1,2,4
	Bacl	kfilled:	12/	10/2	009	Rig	Тур	e: Cl	ME 75			Surface	Elevation: 2200.0 m (7217.8') Logged By: R. Stump
La	ititud	e: 35°3′	7.65	575'		Lo	ngitu	de: 1	08°18.:	35091		Location	:: N11(1A) Sta. 6+000 CL
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Ruck)	D	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample Depth. m (ft.) Date SPT - 2° O.D. 2.46° LD. Modified California Sample U - 3° O.D. 2.48° LD. Tube Sample U - 3° O.D. 2.42° LD. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube  Groundwater Depth. m (ft.) (Not encountered)
حَ ق	2	G	Samy	Sall	15 % E	**	RQD	≅§	E.S.	3	를	P S	Visual Classification
	0 —		М	SPT	9			8.2					SILTY SAND (SM)- fine grained, loose,
			M	SEI.				0,2			i i i i i i		brown, moist
	- 1		1			78555		*****		(marg)	0.00		0.6 m (2.0°) E1. 2199.4 m (7215.8°)
	1 —		X	MC	18			13.0	15.9			74	LEAN CLAY WITH SAND (CL)- fine grained, soft, brown, moist
	- 5		į.				ium		1111111	6,630	The second		
	- 10		V.	SPT	13						o eres		1.7 m (5.5') EL 2198.3 m (7212.3')
	2		Δ.					1711/4		101010	(Victor)		WEATHERED SANDSTONE - with sand layers, red brown, highly weathered to 2.1 m (7.0') decomposed El. 2197.9 m (7210.8')
	5					in her	1111111	mille		fami			CLAYEY SAND (SC)- fine grained, very loose
	9			SPT	5			16.1		29	30H		to loose, with silt, brown, moist to very moist
	3		П	8111113	CEPTURE TO			mue	050.55	100000			
	3 —		M		31 113	WW.	10000	1000	1010000	Little Carl	\$2,51.55 55.55.55	Tereror	
			X	SPT	7712-17		. radi						3.5 m (11.5') El. 2196.5 m (7206.3')



Boring # GR-32
Sheet 1 of 1
Revision: 0

											De Miles de
Stort	orl: 17/1	0/20	10		Dro	riect	Num	bar			Revision: 0 Project
					110			nei			N11(1A)1,2,4
				Dia	Т						
			2009	-							Elevation: 2200.5 m (7219.5') Logged By: R. Stump
itude	:: 35°37.	6960'			ngitu	de: 10	08°18	3043'			: N11(1A) Sta. 6+100 11.6m Lt  PAUGER - Auger Cuttings Groundwater
	go,	2	3 m)	Rock			_	æ	rdex	sing	AUGER - Auger Cuttings  G - Grab Sample  MC - 2.5" O.D. 2.46" I.D. Modified California Sample  SPT - 2" O.D 1.38" I.D. Tube Sample  U - 3" O.D 2.42" I.D. Ring Sample  ST - 3" O.D. Thin-Walled Shelby Tube
3	ical I	L J	ation ince	very		216	ensit . m)	Liii	ity	O Sic	SPT - 2" O.D 1.38" I.D Tube Sample  U - 3 " O.D 2.42" I.D Ring Sample  (Not encountered)
lpd:	aphi		enctra ssiste	Reco	a	oistu	Z/2 Z/2 Z/2	quid	astic	n. 20	
Ā	5	S	5%8	*	×	ΣŬ	ē	5	=	22	Visual Classification
0											
		MC	31		vs terms.		-0-110000	New Months of Co.			SILTY SAND (SM)- fine grained, medium dense, brown, moist
								2.000.000.0			dense, orown, moist
1				erra.ne-		SHEE		********			
17		146	20	:::::::::::::::::::::::::::::::::::::::	5.0165			22322			
1 —		MC	20	iiviii.				1.21111			
14		once	i in and a	aria e							1.2 m (4.0°) El. 2199.3 m (7215.5°)
				20000000				500000000			WEATHERED SANDSTONE - with sand 1.5 m (5.0') layers, red brown, highly weather £2.12199.0 m (7214.5')_
		7		90.30.00	3.50005			1111111111			decomposed
		SPI	1000	our.							CLAYEY SAND (SC)- fine grained, very loose
2 -								MINES			to loose, dark brown, very moist
		100000		and.							
		МС	8								
								11.5555	-		
3 —				2004	2225					20402	
- 2		MC	19	inin.			130000			A ACM	3.4 m (11.0') E1. 2197.1 m (7208.5')
	Com Back titude	Completed: Backfilled: 1 titude: 35°37.	Completed: 12/10 Backfilled: 12/10/ titude: 35°37.6960'  Cuablical Logo Sample Tyle Sample Tyle  MC  MC	O Depth (m)  O Caphical Log  O Sample Take  Sample Type  O Sharm of the contration  Resistance  O Sharm of the contration  O Shar	Completed: 12/10/2009  Backfilled: 12/10/2009  Riggitude: 35°37.6960'  Cultiful and	Completed: 12/10/2009  Backfilled: 12/10/2009  Rig Typ  Ritude: 35°37.6960'  Longitu  Samble Type  Resigned  (Blows / 0.3 m)  MC 31  MC 31  A MC 20  A MC 20  A MC 88  A MC 88	Completed: 12/10/2009 Rig Type: C. Situde: 35°37.6960' Longitude: 16 Cubhical Completed: 12/10/2009 Rig Type: C. Samble Type Type Completed: 16 Completed: 17 Completed: 1	Completed: 12/10/2009  Backfilled: 12/10/2009  Rig Type: CME 75  Longitude: 108°18.  Sample Type  Righows / 0.3 m)  Rog Moisture Content (%)  MC 31  MC 20  MC 31  MC 8  MC 20  MC 8  MC 8  MC 8  MC 8	Completed: 12/10/2009   Rig Type: CME 75	Dockleted: 12/10/2009   Rig Type: CME 75	Completed: 12/10/2009 Rig Type: CME 75 Surface I stitude: 35°37.6960' Longitude: 108°18.3043' Location  (a) Sumble Laten  (b) Day Density  (control (a) Surface I (a) Moisture  (control (a) Surface I (a) Surface I (a) Moisture  (control (a) Surface I (a) Surface I (a) Moisture  (control (a) Surface I (a) Surface I (a) Moisture  (control (a) Surface I



Boring # GR-33 Sheet 1 of 1

Project N11(1A)1,2,4  201.5 m (7222.8') Logged By: R. Stump  ta. 6+200 9.1 m Lt  er Cuttings ple 2.48'   D. Modified California Sample 1.38'   D. Tube Sample 42'   D. Ring Sample hin-Walled Shelby Tube  Visual Classification  ANDY LEAN CLAY (CL)- fine to medium grained, hard to firm, brown, moist	Date
ta. 6+200 9.1m Lt  er Cuttings ple 1.38°   D. Modified California Sample 1.38°   D. Tube Sample hin-Walled Shelby Tube  Visual Classification  ANDY LEAN CLAY (CL)- fine to medium	Date
ta. 6+200 9.1m Lt  ct cuttings ple 12.45°   D. Modified California Sample 1.38°   D. Tube Sample 24.7'   D. Ring Sample hin-Walled Shelby Tube  Visual Classification  ANDY LEAN CLAY (CL)- fine to medium	Date
er Cuttings ple 1.2.48"   D. Modified California Sample 1.38"   D. Tube Sample 42"   D. Ring Sample hin-Walled Shatby Tube  Visual Classification  ANDY LEAN CLAY (CL)- fine to medium	Date
2.48"   D. Modified California Sample 1.38"   D. Tube Sample 42"   D. Ring Sample hin-Walled Shelby Tube  Visual Classification  ANDY LEAN CLAY (CL)- fine to medium	
Visual Classification  ANDY LEAN CLAY (CL)- fine to medium	
ANDY LEAN CLAY (CL)- fine to medium grained, hard to firm, brown, moist	
ANDY LEAN CLAY (CL)- fine to medium grained, hard to firm, brown, moist	
El. 2199 VEATHERED SANDSTONE - fine grained,	9.7 m (7216.8)
with sand layers, light brown, moist,	
• •	9.1 m (7214.8'
VEATHERED CLAYSTONE - medium	5.1 III (7214.0
strong, with clay layers, gray	
El. 2198	8.5 m (7212.8'
	h 8.0 m (7211.3)
	highly weathered to decomposed  El. 219 /EATHERED CLAYSTONE - medium strong, with clay layers, gray  El. 219 /EATHERED CLAYSTONE - medium strong, with clay layers, light brown with





Boring # GR-34 Sheet 1 of 1

												Revision: 0	
9	Start	ted: 12/1	0/200	9		Pro	ject	Num	ber			Project	
Date	Com	pleted: 1	2/10/	2009			105	5884				N11(1Å)1,2,4	
	Back	dilled: 1	2/10/2	2009	Rig	Тур	e: CN	<b>ME 75</b>			Surface	Elevation: 2206.0 m (7237.5')   Logged By: F	l. Stump
L	atitude	e: 35°37.1	7672'		Loi	ngitu	de: 1	08°18.	1248'			: N11(1A) Sta. 6+400 4.9m Lt	
Groundwater Doub (m)	Depth (m)	Graphical Log	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	۵	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	L NO-ES O.D.E. TO I.D. INDUNING COMMOTTIC CEMPIN	oth. m (ft.) Date encountered)
5	[ <u>5</u> ]	5 1	Sam	255	% ∞	RQD	ξŪ	문중	Ę	E	1 4 S	Visual Classification	
	0_	•		•		:							
		$\mathbb{N}$	SPT	. 13								SILTY SAND (SM)- fine to medium medium dense, light brown, d	n grained, ry to moist
	1 —		SPT	9									
	2 _		SPT	10			711313 21222 20122			.0021 .0021		With rootlets from 1.5m (5 ft) bgs	
	-		SPT	27		1000				0.00			
	3		SPT	22								3.5 m (11.5')	El. 2202.5 m (7226.0')







`													Revision: 0
te	Starte						Pro	-	Num	ber			Project N11(1A)1,2,4
Date	Comp Backf					Rig	Тур		5884 ME 75		$\dashv$	Surface	Elevation: 2214.5 m (7265.4') Logged By: R. Stump
L	ıtitude:	: 35°3	7.7	888'		Loi	ngitu	de: 1	08°17.	9940'			n: N11(1A) Sta. 6+600 1.2m Rt
			П		Ē	<del>}</del>			ĺ		×	- 1	
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0,3 m)	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5" O.D. 2.46" I.D. Modified California Sample C SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3" O.D. 2 42" I.D. Ring Sample S ST - 3" O.D. Thin-Walled Shelby Tube
irou Jene	gbd 2	jrapi	ample	aling	enet tesis Blow	6 Rec	RQD	Moisture Content (	KN KN	iqui	lasti	erce do. 2	Visual Classification
	1 in		V.			• *		20			_		Visual Classification
	0 -		M	, SPT .	24					merce			SILT WITH SAND (ML)- fine to medium grained, soft to firm, light brown, moist
	-												
	1 -		À	МС	13	i i i i i i i i i i i i i i i i i i i		13.6	12.6			80	With rootlets from 0.9m (3 ft) to 1.8m (6 ft) bgs
			V A	МС	19								
	2												
	35		A	SPT	8			15.8				84	
	3		X	SPT	5			16.3		145551			
	3.4		<u> </u>		Т.	tol D	anth	2 5	(11.5°	1		1	3.5 m (11.5') E1. 2211.0 m (7253.
					10	nai D	epui	111 د.ډ	(11.2	,			





				1								Revisi	on: 0	
	ted: 12/1 npleted:				Pro	-	Num 5884	ber				Project N11(1A)1,2,4	į.	
Baci	kfilled: 1	2/10/2	2009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2224.5 m (7	298.2') Logged	l By: R. Stump	
atitud	e: 35°37.	.8081'		Lo	ngitu	de: 1	08°17.	8639'		Location	n: N11(1A) Sta. 6+800	1.2m Lt		
Depth (m)	Graphical Log	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	E AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O D. 2.46" I.D. Mr SPT - 2" O D. 1.38" I.D. Tut U - 3" O.D. 2.42" I.D. Ring ST - 3" O.D. Thin-Walled St		Depth, m (ft.) (Not encountered)	Date Date
3 2	5  j	Sar	555	*	8	žŝ	2,8	3	£	2 Z	Visual	Classification		
1 —		SPT	26								SILT:	RED SANDY CLASTONE - with clastorown and yellow tred sandstone laying,	y and silt layers, brown, highly	
2 —		SPT	48											
3 _		SPT	50/4"								3.4 m (11.0°)			.1 m (7287







Started: 12/ Completed: Backfilled:		9		70						Revision: 0
Completed: Backfilled:	12/10/			Pro	iect :	Num	ber			Project
Backfilled:	4	2009			-	884				N11(1Å)1,2,4
	12/10/2	2009	Rig	Туре	: CM	1E 75		Sı	urface	Elevation: 2236.5 m (7337.6') Logged By: R. Stump
Latitude: 35°37	.8356'		Lon	egitud	le: 10	8°17.	7368'		ocation	n: N11(1A) Sta. 7+000 2.4m Rt
Groundwater Depth (m) Depth (m) Graphical Log	Sample Taken Sample Type	Penetration Resistance (Bluws / 0.3 m)	Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	nt Passing 00 Sieve	## AUGER - Auger Cuttings ## G - Grab Sample ## MC - 2.5" O.D. 2.46" I.D. Modified California Sample ## Dopth, m (ft.) ## Dopth, m (ft.)    Date
Srour Depth Depth Graph	iample Samp	enct Resis Blow	% Rec	₹QD	Moisture Content (	KN/c	Ciqui	Jasti	Percent   No. 200	Visual Classification
0 1	w 53				291					Y 13441 CIMSSIIICAGOII
0 -	SPT	19			10.3	*******	000 000		87	SILT (ML)- fine grained, firm, some sand, brown, dry
1 -	мс	14								U.1 m (3.5')  El. 2235.4 m (7334.1')  WEATHERED SILTSTONE AND  CLAYSTONE - with silt and clay layers,  gray brown and light brown with iron
2 — x x x x x x x x x x x x x x x x x x	SPT	37			13.4		- 42	17		staining, moist  2.1 m (7.0')  El. 2234.4 m (7330.6')
	SPT	50/5"								SANDSTONE - fine grained, with iron staining, weakly cemented, light tan, dry
3 —	SPT	50/5"								
			ender Fr	rossi				******		3.7 m (12.0') El. 2232.8 m (7325,6') SHALE - gray and brown with iron staining,
4 -	SPT	50/4"		0000	10.6		33	12		moist
	SPT	50/5"				(16.0')				4.9 m (16.0') E1. 2231.6 m (7321.6')







Boring # GR-38 Sheet 1 of 1

	_												Revision:	0	
63	Star	ted: 12/	10/200	19		Pro	oject	Num	ber			Pro			
Date	Com	pleted:	12/10/	2009	1		105	5884				N11(12	A)1,2,4		
	Back	cfilled:	12/10/	2009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2235.5 m (7334.3')	Logged B	y: R. Stump	
Ls	ititud	e: 35°37	.9147'		Lo	ngitu	de: 10	08°17.	6461'		Location	n: N11(1A) Sta. 7+203 CL			
				=	çk)					*				Ground	water
ic.		Graphical Log	= =	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)		( G	2	擅	Plasticity Index	Passing ) Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5° C.D. 2.46° I.D. Modified Caliform SPT - 2° C.D. 1.38° I.D. Tube Sample U - 3° C.D. 2.42° I.D. Ring Sample ST - 3° C.D. Thin-Walled Shelby Tube		Depth. m (ft.)	Date
43		ical	e T	atio s/0	very		= ±	ensi	Ľ	<u>\$</u>	1 Pa	Tal SPT - 2" O.D. 1.38" I.D. Tube Sample □ U - 3 " O.D. 2.42" I.D. Ring Sample		Not encountered	)
Groundwater Denth (m)	Depth (m)	nde l	Sample Taken Sample Type	netr sista low	Keco	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	stic	Percent P				
غ ق	2 2	Ğr	Sa	5%8	¥.	ĭ≚	≱೮	\$\frac{1}{2}	Li	=	22	Visual Classifica	tion		
	0 _														
	v —		VI									SILTY SAND (SM)-:	fine to med	dium grained,	
	0.7		X SPT	30	en ein	overer.	erro	2000	(corner	0.000		dense to mediun	n dense, lig	ght brown,	
	100				o.ero.		rento.	arrea.	09.0000	100.00		moist			
			Market Control					00000		5.7					
			1							141.00		2			
	1 _		SPT	. 12	ma		alan.			2000		J.			
	54						30557		Kanada I	.0116.6		1.2 m (4.0')			4.3 m (7330.3")
												WEATHERED SAND		fine grained,	
	10.2		52000	2000	Services:		*****	genera	(10.00.00)			with sand layers	s, dry		
			SPT	25				CECKERIA.							
	2		/	to a District	COURT	1000	16,1536	1000000							
												2.1 m (7.0') Thin lignite layer at 2:	m (6.5 ft) l	bgs El 223	3.4 m (7327.3')
	174	X	▼ SPT	50/1"								SANDY SILTSTONE			
		xxx	SPI	30/1		139910	7000					SANDSTONE -			
		X										shale layers, light staining, yellow			ic
	32	X X X X X X X X X X X X X X X X X X X	000,000	1391135	o can-	5000	200.0	company.	0703030	ECEC		Statining, yenow.	ian achosu	13	
	3 _	X X X X X X X X X X X X X X X X X X X	30250			45	.,,,,,,	inner			L				
		x x x	SPT	50/5"								3.2 m (10.5')			2.3 m (7323.8°)
				To	otal D	epth :	3.2 m	(10.5)	)			Gray shale layer at 3.2	2m (10.5 ft	i) bgs	



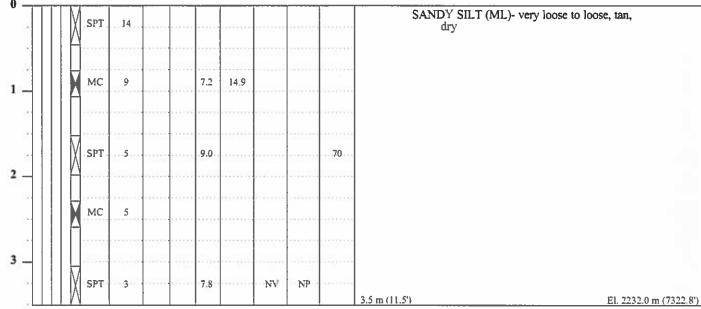
0

#### **Boring Log**

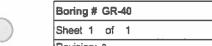


Sheet 1 of 1
Revision: 0

														TI VE VISIO	11. 0	
2	Started: 12/10/2009 Project Number													oject		
Ĭ	Com	pleted		105	884			N11(1A)1,2,4								
	Bacl	kfilled:	12/10	/2009	Rig '	Туре	: CN	1E 75			Surface	e E	Elevation: 2235.5 m (7334.3')	Logged	By: R. Stump	
L	atitud	e: 35°3	8.0068	1	Lon	gitud	le: 16	)8°17.	5801'		Locatio	n:	: N11(1A) Sta. 7+400 12.2m R	t		
				1 =	( <del>k</del> )				ĺ	×	20	1	AUGER - Auger Cuttings		Groundwa	ater
5		2	g	3 =	<u>&amp;</u>	i	ာ	>-	4	월	Passing   Sieve	1	G - Grab Sample MC - 2.5° O.D. 2.46° I.D. Modified Califo	omia Sample	Depth, m (ft.)	Date
W.	ÎÊ	=		tior 70.	ery		20	IS (H	15	2	E S		₹ SPT • 2" O.D. 1.38" I.D. Tube Samole	•	(Not encountered)	
	<u> </u>	를	Sample Taken Sample Ty	ctra ista	eco.	أحا	탏	2 <u>2</u>	温	astici	cent 200	3	U · 3 ° O.D. 2.42° I.D. Ring Sample ST · 3° O.D. Thin-Walled Shelby Tube			
		<u>E</u>		P 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	25	8	홍칭	골	<u>-</u> <u>ş</u>	1 2	1 5 S	Γ	Visual Classific	cation		







El. 2243.5 m (7360.5')

													Revision: 0
Date		ted: 1					Pro	-	Num	ber			Project N11(1A)1,2,4
Da		plete		_		T):	7.		5884		$\dashv$		
		kfilled			009				ME 75				Elevation: 2247.0 m (7372.0') Logged By: R. Stump
L	titud	ie: 35°	38.1	060'			ngitu	de: 1	08°17.:	5272'			1: N11(1A) Sta. 7+600 1.8m Lt  2 AUGER - Auger Cuttings Groundwater
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	۵	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5" O.D. 2.46" I.D. Modified California Sample E SPT - 2" O.D. 1.38" I.D. Tube Sample E U + 3" O.D. 2.42" I.D. Ring Sample S ST - 3" O.D. Thin-Walled Shelby Tube
200	2 2	Gra	Sam	San	Pes 35	20	RQD	₽ō	무슨 도움	Liq	Plas	No.	Visual Classification
	0_			-					:				
	0 —		$\mathbb{V}$	SPT	14	(8) (10)		******					SILTY SAND (SM)- fine grained, loose to dense, tan, dry
	1 -		V	МС	9						27.19.5	*1	
	94			a.1-901		ilino -					1,		
		× × ×		SPT	31	2.1121							1.8 m (6.0') E1. 2245.2 m (7366.0')  SILTSTONE - with fine sand, moderately
	2 _	X X X X X X X X X X X X X X X X X X X											cemented, tan and light brown, with
		X X X X X X X X X X X X X X X X X X X	X	SPT	50/6"	e:::::::::::::::::::::::::::::::::::::					*****		
	3 _	xxx								AXX			

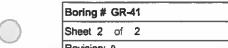
Total Depth 3.5 m (11.5')



Boring # GR-41 Sheet 1 of 2

Revision: 0 Started: 12/10/2009 **Project Number** Project N11(1A)1,2,4 Completed: 12/10/2009 105884 Backfilled: 12/10/2009 Rig Type: CME 75 Surface Elevation: 2256.0 m (7401.6') Logged By: R. Stump Latitude: 35°38.2002' Longitude: 108°17.4664' Location: N11(1A) Sta. 7+800 0.6m Lt AUGER - Auger Cuttings
G - Grab Sample
MC - 2.5° O.D 2.46° I.D. Modified California Sample
SPT - 2° O.D 1.38° I.D. Tube Sample
U - 3° O.D 2.42° I.D. Ring Sample
ST - 3° O.D. Thin-Walled Shelby Tube Groundwater % Recovery (Rock Plasticity Index Graphical Log Depth, m (ft.) Groundwater Depth (m) Depth (m) Sample Type Penetration Resistance (Blows / 0.3 r Dry Density (kN/cu. m) Content (%) Liquid Limi (Not encountered) Percent I No. 200 RQD Visual Classification 0 SANDY SILT (ML)- fine grained, soft, light SPT 7. brown, moist MC 12 9.6 12.5 65 1 SPT .5 2 2.4 m (8.0') El. 2253.6 m (7393.6') MÇ 27 CLAYSTONE - with clayey zones, well cemented, light gray brown, moist, highly weathered to decomposed SPT 53 12.4 43 19 4.0 m (13.0') El. 2252.0 m (7388.6') SPT 68 SILTSTONE/CLAYSTONE - fine grained, poorly to moderately cemented, dry SPT 50/3" 5 SPT 50/3" 8.5 54 6 SPT .50/5" SPT 50/3" SPT 50/6" 8 SPT 50/4" 7.0 24 5 BORING METRIC (SOIL & ROCK) \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1.2.4.GPJ





														Revisio	n; 0				
Γ	ی	Star	ted: 12	/10	/200	9		Pro	oject	Num	ber		Project						
'		10.0004											N11(1A)1,2,4						
ľ,	_	Bacl	kfilled:	12/	10/2	2009	Rig	Тур	e: CN	1E 75			Surface	Elevation: 2256.0 m (7401.6') Logged	By: R. Stump				
	La	titud	e: 35°38	3.20	02'		Lo	ngitu	de: 10	)8°17.4	1664'	1	Location	: N11(1A) Sta. 7+800 0.6m Lt					
Г				П			ck)					×	20	★ AUGER - Auger Cuttings     G - Grab Sample	Groundwa	ater			
	į.		207		2	3 11	\$		(%)	>> _	- <u>-</u>	월			Depth, m (fl.)	Date			
		Ē	<u> </u>	E E	<u> </u>	hior 70.	reny.		25	i <u>s</u>	i.E	2	P. O. S.	C MC・2.5* O.D. 2 46* I.D. Modified California Sample E SF1・2* O.D. 1.38* I.D. Tube Sample E U・3* O.D. 2 42* I.D. Ring Sample S ST・3* O.D. Thin-Walled Shelby Tube	(Not encountered)				
		Depth (	raphical	Sample Taken	Sample	Penetration Resistance (Blows / 0.3	Reco	ے ا	Moisture Content (	<u>2</u> <u>5</u>	quid	Plasticity	cent 1	ທີ່ ST - 3" O.D. Thin-Walled Shelby Tube					
	Graphical Esample Taken Sample Taken Sample Typ Penetration Resistance (Blows / 0.) % Recovery RQD Moisture Content (% Dry Densit (kN/cu. m)							RQD	\$5	Dry Density (kN/cu. m)	<u>-</u> Ξ	_ =	Perc No.	Visual Classification					
Г																			

Total Depth 9.2 m (30.3')

BORING METRIC (SOIL & ROCK) \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ



Boring # GR-42 Sheet 1 of 2

									,		Revision; 0	
E Sta	rted: 12/	10/20	09	J	Pro	oject	Num	ber			Project	
Coi	npleted:	12/1	0/2009			10:	5884				N11(1Å)1,2,4	
Bac	kfilled:	12/10	/2009	Rig	Тур	e: C!	ME 75			Surface	Elevation: 2254.0 m (7395.0') Logged By: R. Stump	
Latitue	le: 35°38	3.2916	,•	Lo	ngitu	de: I	08°17.	3985'			n: N11(1A) Sta. 8+000 7.3m Rt	
				1							2 AUGER - Auger Cuttings Groundwal	ter
<u>15</u>	Log	2	- C	1 \$		_ 	_خ	ıΞ	nde	ssin	G - Grab Sample C MC - 2.5" O.D. 2.46" LD. Modified California Sample Depth. m (ft.)	Date
Groundwater Depth (m) Depth (m)	Graphical Log	Sample Taken Sample Type	Penetration Resistance (Blovs / 0.3 m)	% Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu, m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O D 2.46" LD. Modified California Sample SPT - 2" O.D. 1.38" LD. Tube Sample U - 3" O.D 2.42" LD. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube	
मून मून	l de	뒑廬	neth siste fowe	55	RQD	oiste et et	200	lig.	stic	Cen . 20		]
<u>ಕ್ರದಿ</u>	Ö	San	555	₩.	2	žű	호종	ڐ	Ē	22	Visual Classification	
0 -												
"-	223	M				Ì					SILTY SAND (SM)- fine grained, loose to medium dense, light brown to tan, dry	
- 3		X SP	Γ 10	11)(1)11	(1=44)		1000			0-1000	medium dense, light brown to tan, dry	
		1,000		guille.	10000	-0.00	20000		0.00	9 00000		
		77							S			
		М	12			1077		3333333				
1 -		A street		200000	1.0000	Jeres.			Teres			
73		1000	i de const	over.	11000	0.00	00000	inani	receive		1.4 m (4.5') E1, 2252.6 r	m (7390 5')
		17.767		(****	-10000		0.0000				SANDSTONE - fine grained, poorly to moderately cemented, tan to light brown,	
		SP	T 59								moderately cemented, tan to light brown,	
¥		N-3F	39			11311	= 111500	*******			dry, silty	
2 _	-	1222				155.55	200000					
6		5.77			52.00		13.77					
8		X SP	Γ 50/6"				7.556633					
		4										
2		41.00			1,5500							
3 -	-	7577		10.000.0		00000	2.000.000	73777047	100000			
24		X SP	Γ 50/4"		and a	7170			14.50			
		T										
- 0		P. P. T. T.		0.000		100000	50000	i i i i i i i i i i i i i i i i i i i	10000			
		6555		0000	0.00					1000		
4 -	:::::::::	X SP	Γ 50/4"			*****			000000		991 1 1 1 1 4 (12.6)	
5					12.538.3	2000			19796		Thin shale layers at 4m (13 ft) bgs	
8			7		71							
15		income.		or neon				noncini	1.6 ( )			
39		X SP	50/6"				11-11-16	((1441)				
5 -				arevar.								
		3000		200000		2007000			1000			
		V				75552	18.80	2211324		3 - 40 40		
Ε.		X SP	T 85/8"				V.A.	AWAIN.	77.77			
		100.1				200	10000	Timber.				
6 -			ALCO GEOGRAPHIC		.,							
"-		C.E.	E 60/45	000000		103300		sectable.	Miles			
8		SP	Γ   50/4"	2000		1755	1000					
- 5		1111		117.000					*****			
		14.00										
4		∑ SP	Γ 50/5"									
7 -		A		********		-			(DEPTERMENT			
- 0	-	1100			Interd	17170	1111111			e ionio		
		1.755		553838	-12.2	11,1000,000	11111111	1250000				
V					20.00	96860		0000000	1000000			
		X SP	Γ 60									
8 -		V										
79		Keek				11140	10000	i deserves				
5.0	***********	<b>H</b>			m ir kon nair	13111			Teres			
		X SP	Г 72					T0 - T1	al desired			
		Δ										
9 -	]::::::::	1.0	.1									
BOR	ING METRIC	(SOIL	& ROCK) \	LIBRAR	Y KLEII	NFELD	ER ALB P	LOG GLE	3 \ 1058	84 N11(1A	1.2.4.GPJ	



Boring # GR-42
Sheet 2 of 2
Revision: 0

													Revision	n; 0	
د	Star	rted: 12/	10/20	09		Pro	oject	Num	ber				ject		
Date	Соп	npleted:	12/10	/2009			10:	5884				N11(1.	Å)1,2,4		
	Bac	kfilled:	12/10/	2009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2254.0 m (7395.0')	Logged	By: R. Stump	
L	atitud	ie: 35°38	3.2916		Lo	ngitu	de: 1	08°17.	3985'		Location	: N11(1A) Sta. 8+000 7.3m Rt			
Groundwater	Depth (m)	Gmphical Log	Sample Taken Sample Type	Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	PAUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified Califorr SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3 " O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube  Visual Classifica		Depth, m (fl.) (Not encountered)	Date
	9 <b>–</b>		SPT	1200000	******		1000		03.000			SANDSTONE - fine g moderately cem dry, silty	grained, pented, tar	poorly to n to light brown,	
			1 2223	1000000	0.00	1000	90000	cere ce	100000	00000		9.6 m (31.5')		El. 2244.4 s	n (7363.5

Total Depth 9.6 m (31.5')



Boring # GR-43
Sheet 1 of 1

													Revision: 0
ē	_	rted: 12					Pro	-	Num	ber			Project
Date	$\vdash$	npleted:							5884				N11(1A)1,2,4
匚	Bac	kfilled:	12	/10/2	009	Rig	Тур	e: Cl	ME 75			Surface	Elevation: 2246.5 m (7370.4') Logged By: R. Stump
L	atitud	le: 35°38	706'		Lo	ngitu	de: 1	08°17	3071'		Location	: N11(1A) Sta. 8+200 1.2m Lt	
		20			Œ	nck)					cx	50 5	∠ AUGER - Auger Cuttings     ☐ G - Grab Sample     ☐ G - Grab Sample
alcr		2	E	, N		y (R		(%)	े हें ह	ŢĪ.	<u> </u>	assi	MC - 2.5 O.D 2 46* I.D. Modified California Sample Depth. m (ft.) Date SPT - 2" O.D 1.38" I.D. Tube Sample (Not encountered)
Groundwater	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3	* Recovery (Rock)		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	## AUGER - Auger Cuttings ## G - Grab Sample ## MC - 2.5" O.D. 2.46" I.D. Modified California Sample ## E SPT - 2" O.D. 1.38" I.D. Tube Sample ## U - 3" O.D. 2.42" I.D. Ring Sample ## ST - 3" O.D. Thin-Walled Shelby Tube
Ö	D Co	C _m	Samp	Sarr	Pen Resi (Blo	25 R	RQD	Com Com	S S	Liqu	Plas	Perc No.	Visual Classification
	0 _												
	-		×	SPI	50/4"								SANDSTONE - fine grained, light brown
		XXX						*****	- PETECT		*****		0.3 m (1.0') El. 2246.2 m (7369.4')  SILTSTONE - with sandstone layers, light
		X X X X X X X X X X X X X X X X X X X							eram m	011125			brown, dry to moist, some ferric staining
	1.5	XXX	Н		945346	553355	100000	70.0755	COMMIN.	1304 1904			-
	1 -	x	M.	SPT	37			13.2			Will.	89	
		X X X	Λ	0.00.00	000000 to 2.55 m						10.58-8		
		X X X			00000000		11.10	69000	THE CHELL	0000000		10.00.100.000	
		X	H						erent e			manner.	
	17	XXX	XI.	SPT	54			13.3	225,500				
	2 _	X X X	Ц	,			.,,	3676	4.7,3,4				
		XXX			00 00	100 100 (100 (100 (100 (100 (100 (100 (1	100 AUG	10.75		100,000,000	10000		
		x	M								20,100		
		X X X X X X X X X X X X X X X X X X X	X	SPT	78/11"		2000						

3.2 m (10.5°)



Boring # GR-44 Sheet 1 of 1

Revision: 0 Started: 12/11/2009 **Project Number** Project Date N11(1A)1,2,4 Completed: 12/11/2009 105884 Backfilled: 12/11/2009 Rig Type: CME 75 Surface Elevation: 2250.5 m (7383.5') Logged By: R. Stump Latitude: 35°38.4326' Longitude: 108°17.1975' Location: N11(1A) Sta. 8+400 4.6m Lt AUGER - Auger Cuttings
G - Grab Sample
W C - 2.5" O.D 2.46" L.D. Modified California Sample
SPT - 2" O.D. 1.38" I.D. Tube Sample
U - 3 " O.D. 2.42" I.D. Ring Sample
ST - 3" O.D. Thin-Walled Shelby Tube Groundwater Recuvery (Ruck) Passing Sieve Plasticity Index Graphical Log Groundwater Depth (m) Depth (m) Depth, m (ft.) Date Sample Type Penetration Resistance (Blows / 0.3 1 Dry Density (kN/cu. m) Moisture Content (%) Liquid Limit (Not encountered) Percent I No. 2003 RQD Visual Classification SILTY SAND (SM)- fine grained, loose to very SPT 6 loose, light brown, moist MC 11 SPT 2 2 SPT 2 3 MC 8 3.7 m (12.0') El. 2246.8 m (7371.5') WEATHERED CLAYSTONE - with clay layers, gray brown, moist SPT 30 4.6 m (15.0°) El. 2245.9 m (7368.5') SILTSTONE - light brown, with sandstone SPT 73/11" layers 5 SPT 77/10" 6 SPT 50/4" SPT 50/6" Gray shale with calcite layers from 6.9m (22.5 ft) to 7.3m (24 ft) bgs SPT 50/5" 7.9 m (26.0') El. 2242.6 m (7357.5') Total Depth 7.9 m (26.0')

BORING METRIC (SOIL & ROCK) LIBRARY KLEINFELDER ALB PLOG.GLB 105884 N11(1A)1,2,4.GPJ



Boring # GR-45
Sheet 1 of 3

Revision: 0 Started: 12/11/2009 **Project Number Project** N11(1A)1,2,4 Completed: 12/11/2009 105884 Backfilled: 12/11/2009 Rig Type: CME 75 Surface Elevation: 2263.5 m (7426.2') Logged By: R. Stump Latitude: 35°38.4591' Longitude: 108°17.0690' Location: N11(1A) Sta. 8+600 1.2m Rt AUGER - Auger Cuttings

G - Grab Sample

MC - 2.5" O.D. 2.46" I.D. Modified California Sample

SPT - 2" O.D. 1.38" I.D. Tube Sample

E U - 3 " O.D. 2.42" I.D. Ring Sample

ST - 3" O.D. Thin-Walled Shelby Tube Groundwater % Recovery (Rock Plasticity Index Graphical Log Groundwater Depth (m) Depth (m) Depth, m (fl.) Sample Type Penetration Resistance (Blows / 0.3 r Dry Density (kN/cu. m) Liquid Limit Content (%) (Not encountered) Percent F No. 200 ₩ 1 Visual Classification 0 CLAYSTONE - olive brown SPT 48 El. 2263.0 m (7424.7') 0.5 m (1.5') SANDSTONE - light brown 0.9 m (3.0°) El. 2262,6 m (7423.2') SPT CLAYSTONE - gray 1.2 m (4.0°) El. 2262.3 m (7422.2') SANDSTONE - light gray 1.5 m (5.0°) El. 2262.0 m (7421.2') SILTSTONE - light brown, slightly SPT 32 carboniferous 2.1 m (7.0°) El. 2261.4 m (7419.21) SANDSTONE - brown SPT 50/3" 2.4 m (8.0°) El. 2261.1 m (7418.2') SANDSTONE - gray 76 mm (3 in) shale/coal seam at 5.8 (19 ft) bgs SPT 50/6" 3.2 m (10.5') El. 2260.3 m (7415.7') Pratical auger refusal at 3m (10 ft) bgs SANDSTONE - light gray, fine grained, slightly weathered, weak to medium CORE .100 100 strong, slightly fractured, thinly bedded, bedding joints tight, moderately smooth, no infilling With thin shaly coal seams from 4.4m (14.5 ft) CORE 100 100 6 CORE 98 87 Reduced coal seams from 7m (23 ft) bgs CORE 100 100 100 100 BORING METRIC (SOIL & ROCK) LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ



Boring # GR-45 Sheet 2 of 3

												Revision: 0
T	Star	ted: 12	/11/2009			Pro	iect	Num	ber			Project
Date	Con	pleted	12/11/20	009			-	884				N11(1Ā)1,2,4
		<u> </u>	12/11/20	_	Rio	Type		<b>4E 75</b>		$\dashv$	Suefo	e Elevation: 2263.5 m (7426.2') Logged By: R. Stump
_				07					0.6001	$\dashv$		· · · · · · · · · · · · · · · · · · ·
La	titua	e: 35°31	T   3	_		igitud	de: 10	08°17.(	Dean.			on: N11(1A) Sta. 8+600 1.2m Rt
Froundwater Jenth (m)	Depth (m)	Graphical Log	Sample Taken Sample Type	Resistance (Blows / 0.3 m)	% Recovery (Rock)	RQD	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified California Sample MC - 2.5" O.D. 1.38" I.D. Tube Sample U - 3 " O.D. 2.42" I.D. Ring Sample S - 3" O.D. Thin-Walled Shelby Tube  Visual Classification
			w   w   =		•~	-	20		-			V AJAM (CINJAIAMICA)
	9 _	 		i						i		CANDCTONE Lists and England
	10		CORE		100	100						SANDSTONE - light gray, fine grained, slightly weathered, weak to medium strong, slightly fractured, thinly bedded, bedding joints tight, moderately smooth, no infilling
			100000000000000000000000000000000000000		98	98						
	12_				100	100						
	13								1111111	223		
			CORE		100	100	******					
	15_											Increasing coal seams from 14.8m (48.5 ft) bgs
	16_		CORE		95	92						
	18_		CORE		100	100						1A)1,2,4.GPJ



Boring # GR-45
Sheet 3 of 3

El. 2241.6 m (7354.2')

		/												
													Revision: 0	
٠,	Star	ted: 12	/11/2	:00	9		Pro	oject	Num	ber			Project	
Date	Con	npleted:	12/	11/2	2009	1		105	5884				N11(1Å)1,2,4	
		kfilled:				Die	Turn		ME 75					
	Dac	кишеи:	14/1	1/2	007	Rug	тур	e: Cr	VIE /3			Surfac	Elevation: 2263.5 m (7426.2') Logged By: R. Stump	
L	titud	le: 35°38	3.459	11		_	ngitu	de: 1	08°17.	0690'		Locati	: NI1(1A) Sta. 8+600 1.2m Rt	
				İ	=	% Recovery (Rock)				1	*	_ 20.	PAUGER - Auger Cuttings Go - Grab Sample MC - 2.5° O.D. 2.46° I.D. Modified California Sample SPT - 2° O.D. 1.38° I.D. Tube Sample U - 3° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube	er
Groundwater Denth (m)		Graphical Log		된	Penetration Resistance (Blows / 0,3 m)	1 🐔		130	<u> </u>	揰	Plasticity Index	Percent Passing No. 200 Sieve	MC - 2.5° O.D. 2.46° I.D. Modified California Sample Dcpth, m (ft.)	Date
85	Depth (m)	ical	Sample Taken	5	atio anc	Wen		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	ję.	200	E. SPT - 2" O.D. 1,38" I.D. Tube Sample  E. U - 3 " O.D. 2.42" I.D. Ring Sample  (Not encountered)	
	튄	l dr	뒽	Ē	netr sist low	Şec.	RQD	oist onde	2×2		stic	155	ST - 3" O.D. Thin-Walled Shelby Tube	
ے ق	18				5%E	*	2	žů	호본	ے	=======================================	2 2	Visual Classification	
	10													
	18—		Ш	1		100	100			T		1	SANDSTONE - light gray, fine grained,	
				erere.		Section 1	10.00	0.000	Sept.	55 i osai	slightly weathered, weak to medium			
										1			strong, slightly fractured, thinly bedded,	
	15		1					CHAPTE	********		07.65		bedding joints tight, moderately smooth,	
	2.5		CO	RE		100	100	STREET	uman	1500000	71555		no infilling	
	19_			-	Section 1	100/1000		3.353	35100.555	-255,355	Janear			
	17—									1				
					100000	*****	11.111				eres e			
					STEATURE.		. 1001010							
			92		10,000	2000	20.00	22.13		100000	222			
	20_		233				Sec.	ASS	SMILL		Lett.			
								100000						
			C0	RE		98	92	innin.			*****			
			122						ineidi.	100000	(Helico			
			Ш											
			10%	22		egira)	111111	oren.u	0.00000	100000		en en en		
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			111	RE	555367	.100.	.100			Lorderso				

21.9 m (72.0°)



Boring # GR-46 Sheet 1 of 1

													Revision	n: 0	
ę		ted: 12				Pro	-	Num	ber				oject lA)1,2,4		
Date		pleted:			F.	<b>T</b>		5884		$\perp$					
		kfilled:						ME 75		$\dashv$		Elevation: 2249.5 m (7380.2')	Logged	By: R. Stump	
L٤	titud	e: 35°38	8.4828 	_	•	igitu	de: 1	08°16.	9390'		1	n: N11(1A) Sta. 8+800 CL		Groundy	vater
er.		80	ျ <u>ှ</u>	Penetration Resistance (Blows / 0.3 m)	% Recuvery (Ruck)		3	۸.	_'	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample MC - 2.5" O.D. 2.46" I.D. Modified Califo SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3 " O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube	mia Sample	Depth, m (ft.)	Date
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken Sample Type	ation mcc s / 0.	very		Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	ity j	C Pas	E SPT - 2" O.D. 1.38" I.D. Tube Sample E U - 3 " O.D. 2.42" I.D. Ring Sample		(Not encountered)	
	th.	idqe	Sample Taken Sample Ty	Sistr	Recu	RQD	oiste	NG D	quid	astic	). 20	ST - 3" O.D. Thin-Walled Shelby Tube		<u> </u>	<u> </u>
ے ق		ō	ž Ž	535	*	3	ΣŬ	ڪ۵	ت	Ξ	22	Visual Classific	cation		
	0 _	17 2 X X 7	1 1		· · · · ·										
	(0)		M_SP1	25			inan.			,0000		CLAYEY SAND (S very loose, bro	C)- fine gr wn to ligh	ained, loose to	
			1/									1.00, 10000, 110			
	- 1			N 0.000000	387 (827)		140253	44444							
	101		М	7	33334	7.500	14.8	14.4	72.17		47				
	Ι —		A	of Talina	221111177		17414	7	.0210000						
	9				den in		11.00	e mei							
	8						E5 E53			÷::::					
			SP1	4		ernn:	mer.	******	AND THE						
	2 _		1												
	40						2000	500000	60						
			М												
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			SP	4	MANN!	SHW	13.5		30	8					
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	ė						2000	CLEASE .		Frein					
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	6									7					
	_		H		e2555555										
			X SP	6											
			H		*****										
	1						E0127								
	7 _	1.1.	МС	25			16.8	16.9	30	10	)	7.0 m (23.0') WEATHERED CLA	YSTONE		.5 m (7357.2')
		1///	2001		0.00		50 F F F F					lenses of fine s	sandstone a	and siltstone,	
		////	100000									with clay layer weathered	s, gray to	light brown,	
		17./	M		2							weathered			
	8 _		SP	37	30 30 30 30 30 30 30 30 30 30 30 30 30 3		20000	10000000000000000000000000000000000000	11 10 2 2 2 2	11100		9.1 (26.51)		794 AP	4 (80.50 50)
	J —	// / :	7	T	otal D	enth	8.1 m	(26.5)	)			8.1 m (26.5')		El. 2241	.4 m (7353.7')
						-press	J. 1 111	(2002)	,						

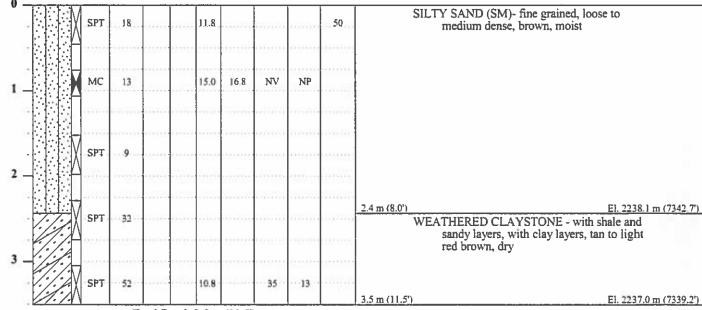
BORING MÉTRIC (SOIL & ROCK) \ LIBRARY KLÉINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ





Boring # GR-47 Sheet 1 of 1

													Revision: 0	
e.	Star	Started: 12/11/2009 Project Number											Project	
Date	Con	pleted	: 1	2/11/	2009			105	5884				N11(1A)1,2,4	
	Bacl	kfilled:	12	/11/2	2009	Rig	Тур	e: CN	<b>1E 75</b>			Surface	Elevation: 2240.5 m (7350.7') Logged By: R. Stump	
L	atitud	e: 35°3	8.5	062'		Lo	ngitu	de: 1	08°16.	80911		Location	n: N11(1A) Sta. 9+000 CL	
	_atitude: 35°38.5062'					ck)						50	AUGER - Auger Cuttings Groundwater	
cr	Log Log				3 11	Ro		(%)	ج.	·#	Inde	Passing Sieve	G - Grab Sample  MC - 2.5° O.D. 2.46° I.D. Modified California Sample  Depth. m (ft.)  Date  Not encountered	
Wa.	Depth (m) Depth (m) Depth (m) Graphical Log Sample Taken Sample Type Penetration Resistance (Blows, 7.0.3 m				Pice /	ery			insi (m.	Ę.	)	Pa	E SPT - 2" O.D. 1.38" I.D. Tube Sample (Not encountered)	
Į,	Depth (m) Depth (m) Depth (m) Graphical L Sample Taken Penetration Penetration Resistance					Recor	ے ا	isture ntent (	Dry De (kN/cu.	· 를	Plasticity	Percent I No. 200	U-3" O.D. 2.42" I.D. Ring Sample ST -3" O.D. Thin-Walled Shelby Tube	
5	Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti Depti					**	RQD	βŪ	문 공	1.5	=	2 S	Visual Classification	



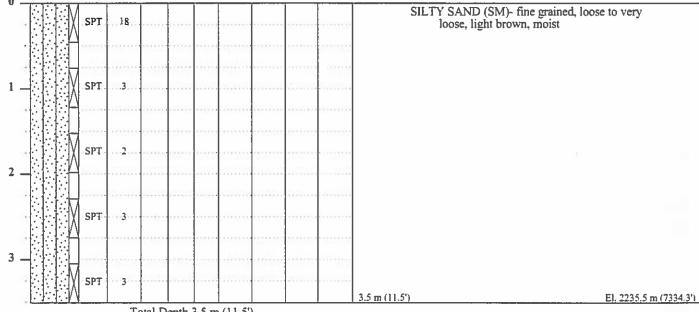
Total Depth 3.5 m (11.5')



Boring # GR-48 Sheet 1 of 1

Revision: 0

	Start	ed: 12/	/11/	/200	9		Pro	ject	Numi	ber		·	Project
) II	Com	pleted:	12	/11/	2009			105	884				N11(1Å)1,2,4
	Back	filled:	12/	11/2	2009	Rig	Тур	e: CN	<b>1E 75</b>			urface	Elevation: 2239.0 m (7345.8') Logged By: R. Stump
L	atitude	: 35°38	3.52	.79'		Lor	gitu	de: 1(	)8°16.6	58071	<u>  1</u>	_ocation	n: N11(1A) Sta. 9+200 CL
		Ē	( <del>k</del> )					IK.	de	AUGER - Auger Cuttings G - Grab Sample G - Grab Sample			
5	1 2 2					多		اء ا	>-	Æ	Si	Passing Sieve	
E A	(m) (m) (m) (m) (m) (m) (m) (m) (m) (m)					ci.		g(%)	iisi III (III	اً∴ا	=	Sis	F SPT • 2" O.D. 1.38" I.D. Tube Sample (Not encountered)
Pun		phic	ηre	ctra istan	1000	Ω	istin	<u>2</u>	quid	<u> </u>	cent 200	U · 3 ° O.D. 2.42° I.D. Ring Sample ST · 3° O.D. Thin-Walled Shelby Tube	
Groun	20 20	G	Sample Taken	San	Res (Bkc	25	RQD	Moistu	Α Ņ	Liq	l las	Per No.	Visual Classification





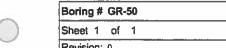
Boring # GR-49 Sheet 1 of 1

`		-										Revision: 0
و		ted: 12/1				Pro	_	Num	ber			Project
Date	Com	ipleted: 1	12/11/	2009			105	5884				N11(1Å)1,2,4
-	Back	kfilled: 1	<b>2/11/</b> 2	2009	Rig	Тур	e: CN	ME 75			Surface	Elevation: 2239.0 m (7345.8') Logged By: R. Stump
La	titud	e: 35°38.:	5619'		Lo	ngitu	de: 10	08°16.:	5569'		Location	ı: N11(1A) Sta. 9+400 10.7m Rt
	Depth (m)	Graphical Log	24	Penetration Resistance (Blows / 0.3 m)	% Recovery (Ruck)		%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index		AUGER - Auger Cuttings G - Grab Sample MC - 2.5 O.D. 2.46 I.D. Modified California Sample MC - 2.5 O.D. 1.38 I.D. Tube Sample U - 3 O.D. 2.42 I.D. Ring Sample ST - 3 O.D. Thin-Walled Shelby Tube  Visual Classification
Coul	)chi	Grap	, iii	central Series	- X-	RQD	Moisture Content (	EŽŽ	ig.	last	Perce No. 2	Visual Classification
0-		0 8	02		97		20				-2	Visual Classification
	0 -		SPT	7		()-100 ()-1111	16.1				. 40	SILTY SAND (SM)- fine grained, loose, light brown, moist
	1 –	////	20			7.2	14.7				1.1 m (3.5') El. 2237.9 m (7342.3')  WEATHERED CLAYSTONE - with thin shale	
							12.5		- 28	8		and clayey lenses, with clay layers, brown to dark brown, moist, highly weathered to decomposed
	2 — SPT 36						12.6				61	
	3 _		SPT	33						201111		3.5 m (11.5') E1. 2235.5 m (7334.3')

Total Depth 3.5 m (11.5')

Note: Survey stake location inacessible behind fence line. Boring offset 10.7 m Rt of centerline.





													Revision: 0
Date	⊨	ted: 12 apleted					Pro	_	Num 5884	ber			Project N11(1A)1,2,4
	$\vdash$	kfilled:				Rig	Тур		ME 75			Surface	Elevation: 2239.5 m (7347.4') Logged By: R. Stump
La	atitud	le: 35°3	8.6	248'		Lor	ngitu	de: 1	08°16.	4450'		Location	n: N11(1A) Sta. 9+600 12.2m Rt
Groundwater Denth (m)	Depth (m)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows / 0.3 m)	& Recuvery (Ruck)	Q	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5 ' O.D 2.46" I.D. Modified Cattfornia Sample E U - 3" O.D 2.46" I.D. Tube Sample U - 3" O.D 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube  Groundwater  Dcpth. m (ft.)  Not encountered)  Not encountered)
G	Graphi Sample Sample Penetri				Pen Res (Bk	2	RQD	Com	R D S	Ę	Plas	P. P. S. O.	Visual Classification
	0	X X X X X X X X X X X X X X X X X X X		SPT	. 20	70.000 70.000 70.000 70.000				10000	 		SILTY SAND WITH FINE GRAVEL (SM)- loose, brown, moist El. 2239.2 m (7346.4')  WEATHERED SILTSTONE - with thin sandstone and shale layers, with silt layers, weakly cemented, brown
	1 — * * * * *   SPT   .5										11111		

3.5 m (11.5')

Total Depth 3.5 m (11.5')

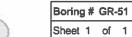
SPT

55

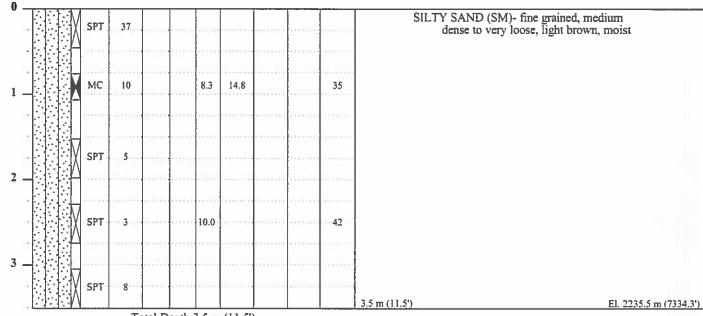
Note: Survey stake location inacessible behind fence line. Boring offset 12.2 m Rt of centerline.

El, 2236.0 m (7335.9')

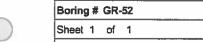




														Revisio	n: 0	
2	Star	ted: 12	/11/20	09		Pro	ject	Num	ber					oject		
Jat	Com	pleted	: 12/1	1/2009			105	5884					N11(1	(A)1,2,4		
	Back	cfilled:	/2009	Rig	Тур	e: CN	4E 75		S	urface	E	Elevation: 2239.0 m (7345.8')	Logged	By: R. Stump		
L	atitud	11	Lon	gitu	de: 1	08°16.	3427'	1	ocatio	n:	N11(1A) Sta. 9+800 0.9m Lt					
		-	ck)					K	50	12	AUGER - Auger Cuttings G - Grab Sample		Groundw	ater 📉		
5	Log Pro				훈			>-	<u>=</u>	Inde	Passing Sieve	Į.	G - Grab Sample MC - 2.5° O.D. 2.46° I.D. Modified Califo SPT - 2° O.D. 1.38° I.D. Tube Sample	mia Sample	Depth, m (ft.)	Date
lva.	그 그 그 그리는 등 1를 사업			Je Sign	(ca)		<u>. S</u>	nsity (III)	<u>:</u>	city I	Pa Si	1	SPT - 2" O.D. 1.38"   D. Tube Sample		(Not encountered)	
1					600	۵	istu	De la	層	<u> </u>	200	3	U - 3 ° O.D. 2.42° I.D. Ring Sample ST - 3° O.D. Thin-Walled Shelby Tube			
Įį.	Graphi Graphi Sample T				×	RQD	웃증	2.Z	1.5		Perc.	Г	Visual Classific	ation		







El. 2237.5 m (7340.9')

Revision: 0 Started: 12/11/2009 **Project Number** Project Date N11(1A)1,2,4 Completed: 12/11/2009 105884 Backfilled: 12/11/2009 Rig Type: CME 75 Surface Elevation: 2241.0 m (7352.4') Logged By: R. Stump Latitude: 35°38.7699' Longitude: 108°16.2423' Location: N11(1A) Sta. 10+010 4.6m Lt AUGER - Auger Cuttings
G - Grab Sample
MC - 2.5" O.D. 2.46" I.D. Modified California Sample
SPT - 2" O.D. 1.36" I.D. Tube Sample
U - 3 "O.D. 2.42" I.D. Ring Sample
ST - 3" O.D. Thin-Walled Shelby Tube Groundwater * Recovery (Rock) Penetration Resistance (Blows / 0.3 m) Passing Sieve Index Graphical Log Groundwater Depth (m) Depth (m) Depth, m (fl.) Sample Type Moisture Content (%) Dry Density (kN/cu. m) Liquid Limit (Not encountered) Plasticity Percent I No. 200 RQD Visual Classification 0 SILTY SAND WITH FINE GRAVEL (SM)-SPT 19 fine to coarse grained, medium dense, brown, dry MC 11 1.4 m (4.5') El. 2239.6 m (7347.9') SILTY SAND (SM)- fine grained, loose to medium dense, with some fine gravel, SPT 10 brown, dry SPT 17

3.5 m (11.5')

SPT



Boring # GR-53
Sheet 1 of 1

,		/										_	Silder I of I
													Revision: 0
ا ا	Star	ted: 12	/11/	200!	9		Pro	oject	Num	ber			Project
Date	Con	npleted:	: 12	/11/:	2009			105	5884				N11(1Å)1,2,4
	├──	kfilled:				Rio	Tvn	e· Cl	ME 75			Sueface	Elevation: 2243.0 m (7358.9') Logged By: R. Stump
H	Į.				007	_							
L	atitud	ie: 35°38	3.85	56'		<del>!                                    </del>	ngitu	de: 1	08°16.	1721'			: N11(1A) Sta. 10+200 9.1m Lt
Groundwater Denth (m)	Graphical Log Sample Taken Sample Type Penetration					% Recovery (Rock)	0	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	# AUGER - Auger Cuttings G - Grab Sample Depth. m (ft.) Depth. m (ft.) Date SPT - 2" O.D. 1.38" I.D. Tube Sample U - 3" O.D. 2.42" I.D. Ring Sample ST - 3" O.D. Thin-Walled Shelby Tube  Groundwater Depth. m (ft.)  (Not encountered)  (Not encountered)
55	-					%	RQD	Ž Ç	S. C. C.	Lig	Plas	No. 2	Visual Classification
								1				· ·	
				SPT	20	30000		7.8			****	34	SILTY SAND WITH FINE GRAVEL (SM)- fine to medium grained, medium dense, brown, moist
	1 -	* * * * * * *	SPT	. 18								1.1 m (3.5') El. 2241.9 m (7355.4')  SILTSTONE - with thin claystone and	
		* * * * * * * * * * * * * * * * * * *	M.										sandstone layers, weakly to moderately cemented, olive brown to light brown, dry
	2	X X X X X X X X X	SPT	60			10.3		35	11			
		X	SPT	82/9"		0000 0000	9,9		1444	11111	36		
	3 —	X	X	SPT	50/5*					1111	****		3.2 m (10.5') E1. 2239.8 m (7348.4')

Total Depth 3.2 m (10.5')

Note: Survey stake location inacessible behind fence line. Boring offset 9.1 m Lt of centerline.



Boring # GR-54 Sheet 1 of 1

													Revision: 0
	Star	ted: 12/	11	/200	9		Pro	- oject	Num	ber			Project
Date	Con	pleted:	12	2/11/2	2009			105	5884				N11(1Å)1,2,4
_	Bacl	kfilled:	12	/11/2	2009	Rig	Тур	e: CN	<b>1E</b> 75			Surface	Elevation: 2249.5 m (7380.2') Logged By: R. Stump
La	ititud	e: 35°38	3.94	181'		Lo	ıgitu	de: 1(	08°16.1	E0481			ı: N11(1A) Sta. 10+400 6.4m Lt
	Depth (m)	Log	Sample Taken		Penetration Resistance (Blows / 0.3 m)	% Recovery (Rock)	D	Moisture Content (%)	Dry Density (kN/cu. m)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	AUGER - Auger Cuttings G - Grab Sample C - 2.5 O.D 2.45° i.D. Modified California Sample E U - 3 ° O.D 2.42° i.D. Ring Sample E U - 3 ° O.D 1.38° i.D Tube Sample ST - 3° O.D Thin-Walled Shelby Tube  Visual Classification
55	2 2	- E	Sam	Sar	Per Res (B)	*	RQD	ΣŪ	EN EN	Ę	Fla	Per	Visual Classification
	0 _												
			X	SPT.	20								POORLY GRADED SAND WITH SILT AND FINE TO COARSE GRAVEL (SP-SM)- fine to medium grained, medium dense, brown and red brown, dry
	1 <u>-</u>			SPT	10								
	. 2 _		X .	SPT	10								
			X	SPT	17								2.7 m (9.0°) El. 2246.8 m (7371.2°)  SANDSTONE - fine grained, weakly to
	3 —		$\nabla$	SPT	50/4"			2017.1		213421			moderately cemented, tan to red brown, dry
	4		\\ \ \ \	SPT	50/2.5**								
			X	SPT	50/5*								4.7 m (15.5') E1. 2244.8 m (7364.7')

Total Depth 4.7 m (15.5')

Note: Survey stake location inacessible behind fence line. Boring offset 6.4 m Lt of centerline.

### **APPENDIX C**

## **Geotechnical Laboratory Test Results**

Summary of Laboratory Test Results
Particle Size Distribution Results
Atterberg Limits Test Results
Direct Shear Test Results

# SUMMARY OF LABORATORY ANALYSIS

Project: N11(1A)1,2,4 Project Number: 105884

Location: Near Crownpoint, New Mexico

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T			•				-(0)										)							
	Dry Density	(kg/m³)	ı	ŀ	1713.1	1459.5	1353.4	ı	1	-	1	ı	l	1396.1	ı	1	-		1779.0	•	1798.4	1	ı	
:	Dry Density	(bcl)	ı	:	6.901	91.1	84.5	1	-	1	-	1	ı	87.2	1	ţ	1	1	11111	1	112.3	ı	ı	
	Moisture Content	(%)	1	;	17.9	7.3	12.8	1	15.2	12.0	9.1	14.6	17.8	20.7	18.9	10.2	13.7	15.9	16.1	15.2	9.1	13.9	5.4	
		38.1 mm (1 1/2 in)	1	1	1	ı	ŀ	1	1	1	ŀ	1	ı	1	1	ı	l	1	-	1	100	-	ı	
		25.4 nm (1 in)	ı	1	ļ	1	ı	ı	1	ł	1	ı	1	1	1		1	1	-	1	80	-	1	
	_	19.05 nun (3/4 in)	ı	ı	ı	1	1	ı	1	1	ı	1	1	ı	ŀ	ı	1	1	1	1	80	-	1	
	% Passing	12.7 mm (1/2 in)	ŀ	ı	ŀ	ŀ	1	ı	1	1	-	ı	1	-	ı	1	1	-	1	1	80	-	1	
	mulative	9.525 mm (3/8 m)	:	ŀ	ı	ŀ	1	ŀ	100	1	1	1	ı	100	ŀ	1	-	1	1	1	80	-		
	sis - Accu	4.750 nm (No. 4)	1	ı	:	1	ŀ	1	66	1	1	ı	ı	001	ı	1	-	ı	1	1	77	1	1	
	Sieve Analysis - Accumulative % Passing	2.000 mm (No. 10)	1	ı	1	ı	ŀ	1	93	1	1	ı	ı	001	1	1		1	1	1	75	1	1	
	Sic	0.425 mm (No. 40)	1	-1	-1	ь	100	1	73		8	:	1	96	4	1	1	1	***	: 1	29	1	1:	
		0.150 mm (No. 100)	1	1	1	ſ	97	1	67	1	100	1	1	06	1	П	1	-1	1	1	62	1	1	
		0.075 nan (No. 200)	92	1	1	1	06	ı	99	ŀ	1	10	86	84	1	1	ı	94	1	1	09	1	1	
	Limits	TI	1	41	45	NV	É	47	ı	ı	F	54	1	ī	1	ı	49	1	ı	î	1	50	29	
	Atterberg Limits	Ы	1	18	16	å	£	23	1	1	E	24	1	1	74		18	1	1	ä	-	20	∞	
		AASHTO																						
100001	Soil Classification	OSCS A																						
100000		E (E)	1.5 - 2.0 (5.0 - 6.5)	3.0 - 3.5 (10.0 - 11.5)	3.8 - 4.1 (12.5 - 13.5)	(2.5 - 3.5)	3.8 - 4.1 (12.5 - 13.5)	(0.0 - 0.5	(2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	0.0 - 0.5 (0.0 - 1.5)	0.8 - 1.1 (2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	(2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	(0.0 - 0.5	(2.5 - 3.5)	(5.0 - 6.5)	2.3 - 2.6 (7.5 - 8.5)	0.0 - 0.5 (0.0 - 1.5)	(2.5 - 3.5)	(5.0 - 6.5)	0.8 - 1.2 (2.5 - 4.0)	
- 1			BR-2 (5.	BR-2 (10.	3. BR-3 (12.	BR-4 0.	3. BR-4 (12.				GR-03 (0.	GR-03 (2.	GR-03 (5.	GR-05 (2.	GR-05 (5.	GR-07 0.	GR-07 (2.	GR-07 (5.	GR-07 2.	GR-09 (0.	GR-09 0.	GR 09   (5		
	Bor ;	Numpci Numpci	BR	BR	BR	BR	BR	GR-01	GR-01	GR-01	g	g	GR	GR	GR	GR	GR	GR	GR	GR	GR	GR	GR-11	

KLEINFELDER BIRDI Prope, Right Schilbers.

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Project: N11(1A)1,2,4 Project Number: 105884

Location: Near Crownpoint, New Mexico

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	Dry Density	(kg/m³)	ı	ı	1	ı	1516.4	ŀ	1352.1		ı		1	ŀ	1327.5	1468.5	,	1	1	1	ı	1394.8	î	
	Dry Density	(bcl)	ı	ŀ	1	ı	94.7	ı	84.4	1	ŀ	1	1	!	82.9	91.7	ı	1	ţ	1	ì	87.1	ı	
	Moisture	(%)	15.5	9.6	14.1	11.3	16.6	13.5	11.6	12.6	15.6	1	14.8	14.2	4.4	12.8	8.5	4.7	3.6	7.5	5.2	7.8	11.4	
		38.1 mm (1 1/2 in)	ŀ	ı	1	,	ļ	ı	1	,		1	1	1	ı	ı	ı	1	1	1	l	ı	1	
		25.4 mm (1 in)	ı	ı	ı	ı	1	ı	1	ŀ	ı	ı	1	1	ı	ŀ	ı	1	1	1	1	ŀ	1	
		19.05 nm (3/4 in)		ı	1	1	l	ı	1	ŀ	ì	ı	1	1	ı	ı	ı	1	1	1	1	1	1	
	% Passing	12.7 mm (1/2 in)	ı	100	1	ı	100	1	1	ŀ	ì	ı	1	ı	1	ì	ı	1	1	ı	1	1	1	
	amulative	9.525 mm (3/8 m)	1	100	1	1	100	1	901	1	1	ı	1	1	8	ı	l	1	1	ı	1	1	1	
	Sieve Analysis - Accumulative % Passing	4.750 nan (No. 4)	ı	96	1	ı	66	ı	86	1	ı	ı	1	1	66	ŀ	ı	1	:	ı	ı	ı	-	
	eve Analy	2.000 mm (No. 10)		92	1	ı	86	ı	93	1	1	ı	ı	ı	76	ŀ	1	ı	:	ı	ı	1		
	Si	0.425 mm (No. 40)	1	87	i	1	93	ı	79	1	ŀ	ı	1	ı	94	1	1	ı	1	100	ı	100	1	
		0.150 mm (No. 100)	ı	<u>8</u>	1	ı	16	ı	71	1	ŀ	ı	1	ł	72	1	ı	ı	1	06	ı	91	ı	
		0.075 mm (No. 200)	68	73	ı	1	8		65	1	t	1	96	-	46	1	ı	1	ı	7.1	ı	£	ı	
	g Limits	LL	1	1	51	ı	1	47	1	1	47	54	1	ı	3	49	ı	ı	1	1	ı	ı	39	
	Atterberg	F	1	1	23	ı	1	<u>sc</u>	1	1	61	21	1	ı	1	23	1	ı	t	1	ı	t	16	
	Soil Classification Atterberg Limits	AASHTO																						
	Soil Clas	nscs																						
	Depth	E (£)	2.3 - 2.7 (7.5 - 9.0)	0.0 - 0.5 (0.0 - 1.5)	(2.5 - 4.0)	2.3 - 2.7 (7.5 - 9.0)	0.8 - 1.1 (2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	0.0 - 0.3 (0.0 - 1.0)	1.5 - 2.0 (5.0 - 6.5)	3.8 - 4.2 (12.5 - 14.0)	0.0 - 0.5 (0.0 - 1.5)	0.8 - 1.2 (2.5 - 4.0)	2.3 - 2.7 (7.5 - 9.0)	0.8 - 1.1 (2.5 - 3.5)	1.5 - 1.8 (5.0 - 6.0)	0.8 - 1.1 (2.5 - 3.5)	0.0 - 0.5 (0.0 - 1.5)	0.8 - 1.1 (2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	0.0 - 0.5 (0.0 - 1.5)	1.5 - 1.8 (5.0 - 6.0)	0.0 - 0.5 (0.0 - 1.5)	
3	Boring	Number	GR-11	GR-13	GR-13	GR-13	GR-15	GR-15	GR-17	GR-17	GR-17	GR-19	GR-19	GR-19	GR-21	GR-21	GR-22	GR-23	GR-23	GR-23	GR-25	GR-25	GR-27	

KLEINFELDER
Bright Proph. Night Solutions.

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# SUMMARY OF LABORATORY ANALYSIS

Project: N11(1A)1,2,4 Project Number: 105884

Location: Near Crownpoint, New Mexico

Depth         Soli Classification         Attention Library         Depth         Soli Classification         Attention Library         Attention Library         Soli Classification         Attention Library         Attention L		_	_	_	_	_						_	-	-	_		-(	)-	_		_				
Depth   Soil Classification   Atterborg Limits   Technology Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   Soil Classification   Atterborg Limits   A	2	Density	(kg/m³)	1	1239.5	1	t	1	1548.7	1	ı	ı	1225.3	1	ä	1	1	ı	1446.5	ı	1	1212.3	1	ı	
Depth   Soil Classification   Microberg Limits   Microberg Limits   Soil Classification   Microberg Limits   II .		(bcl)	1	77.4	1	1	3	7.96	1	1	1	76.5	1	1	1	1	ŀ	90.3	1	ţ	75.7	ı	1		
Depth   Soil Classification   Microberg Limits   Microberg Limits   Soil Classification   Microberg Limits   Moisture	Content	(%)	7.1	6.2	7,2	5.1	8.2	13.0	16.1	9.4	11.2	13.6	15.8	16.3	10.3	13.4	9'01	7.2	9.0	7.8	9.6	12.4	8.5	(	
Depth   Soil Classification   Atterberg Limits			38.1 mm (1 1/2 in)	1	1	1	1	. 1	1	:	1	1	١	ij	1	1	1	1	1	!	1	ŀ	ı	1	`
Depth   Soil Classification   Alterberg Limits   Alterberg Limits   Depth   Soil Classification   Alterberg Limits   Alterber			25.4 mm (1 in)	1	1	1	1	1	Ä	ı	1	ı	ŀ	1	1	1	ı	į	1	1	1	ŀ	1	1	
Depth   Soil Classification   Atterberg Limits   (ft.)   USCS   AASITO   P1   LL   (Rac 200)   (Rac 100)   (Rac		• 6	19.05 mm (3/4 in)	ì	ŀ	1	1	t	ï	ı	ı	ı	ŀ	1	:}	1	-	1	-	ł	-	1	1	1	
Depth   Soil Classification   Atterberg Limits   (ft.)   USCS   AASITO   P1   LL   (Rac 200)   (Rac 100)   (Rac	% Paccine	Times 1 n/	(1.2 in)	ı	901	1	1	1 3	100	ŀ	ı	1	t	001	1	1	l	1	1	1	ı	1	1	1	
Depth   Soil Classification   Atterberg Limits   (ft.)   USCS   AASITO   P1   LL   (Rac 200)   (Rac 100)   (Rac	nulative		9.525 mm (3/R in)	:	100	- 1	1	1	66	ţ	100	ł	100	001	1	1	ı	1	1	100	1	100	ı	ı	
Depth   Soil Classification   Atterberg Limits   (ft.)   USCS   AASITO   P1   LL   (Rac 200)   (Rac 100)   (Rac	Acis - Acri	nav - ele	4.750 mm (No. 4)	100	100	1	- 1	1	66	1	86	t	100	100	1	001	ŀ	!	ı	100	1	100	1	ł	
Depth   Soil Classification   Atterberg Limits   (ft.)   USCS   AASITO   P1   LL   (Rac 200)   (Rac 100)   (Rac	slenc Analy		2,000 mm (No. 10)	100	66	1	Ĭ	1	86	1	96	1	66	100	1	66	1	ı	ı	100	1	66	1	1	
Depth   Soil Classification   Atterberg Limits   (ft.)   USCS   AASHTO   P1   LL   (No. 200)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.8 - 1.4)   (0.	37	5	0.425 mm (No. 40)	66	96	ı	ŀ	-	96	1	92	1	86	66	1	86	1	-1	1	99	1	96	1	1	
Depth   Soil Classification   Atterberg Limits   0.8 - 1.2   0.25 - 3.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.0 - 0.5   0.			0.150 um (No. 100)	83	08	ı	ŀ	L	16	1	82	1	94	76	ı	76	<b>L</b> I	ı	1	76	1	90	1	1	
Depth   Soil Classification   (ft.)		0.075 mm (No. 200)	09	57	1	1	:	74	1	19	1	- 08	84	ŀ	87	1	1	1	70	1	65	1	54		
Depth   Soil Classification   (ft.)    Limite		LL	ı		N	1	t	= ,	29	1	32	ŀ	1	ŀ	1	42	33	1	-	N	1	43	-1		
m (ft.)  (ft.)  (gs. 1.1)  (2.5 - 3.0)  (3.0 - 0.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)	Atterben	ing range	PJ	_		ź	1	t	1	=	ı	14	1	1	ļ	ŀ	17	12	-1	ŀ	Ŝ	:	61	1	
m (ft.)  (ft.)  (gs. 1.1)  (2.5 - 3.0)  (3.0 - 0.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)  (10.0 - 11.5)	iffcation	Nation 1	AASIFTO																						
	Soil Class	Con Cias																							
	Donth	md or	(R.)	0.8 - 1.2 (2.5 - 4.0)	0.8 - 1.1 (2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	3.0 - 3.5 (10.0 - 11.5)	0.0 - 0.5 (0.0 - 1.5)	0.8 - 1.1 (2.5 - 3.5)	2.3 - 2.7 (7.5 - 9.0)	(0.0 - 0.5	0.8 - 1.2 (2.5 - 4.0)	0.8 - 1.1 (2.5 - 3.5)	(7.5 - 9.0)	3.0 - 3.5 (10.0 - 11.5)	0.0 - 0.5 (0.0 - 1.5)	1.5 - 2.0 (5.0 - 6.5)	3.8 - 4.0 (12.5 - 13.3)	0.8 - 1.1 (2.5 - 3.5)	1.5 - 2.0 (5.0 - 6.5)	3.0 - 3.5 (10.0 - 11.5)	0.8 - 1.1 (2.5 - 3.5)	3.0 - 3.5 (10.0 - 11.5)	5.3 - 5.5 (17.5 - 18.3)	
	Boring		Jagitina	GR-27	GR-29			GR-31	GR-31	GR-31	GR-33	GR-33	GR-35			GR-37			GR-39						

KLEINFELDER Bight People, Right Solutions.

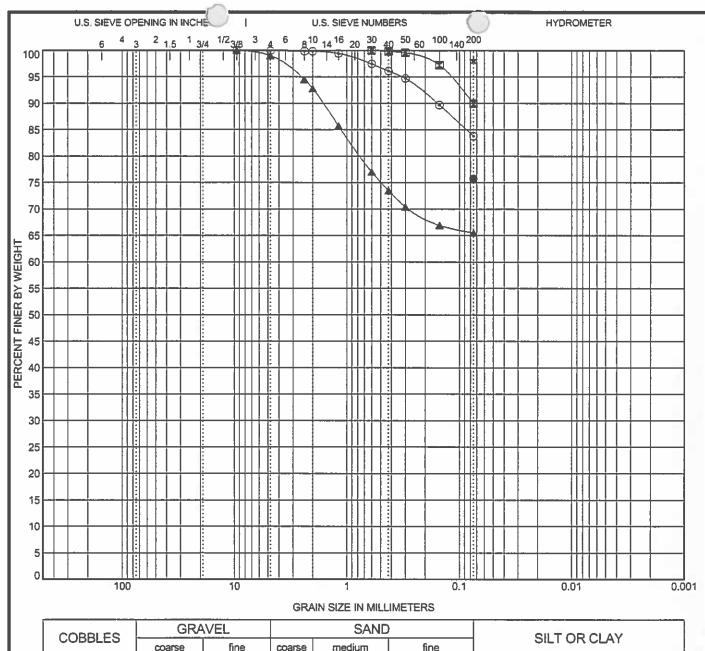
# SUMMARY OF LABORATORY ANALYSIS

Project: N11(1A)1,2,4 Project Number: 105884

Location: Near Crownpoint, New Mexico

7				-	_		-	-			_			_	-	-(	)				
	Dry Density	(kg/m³)	1	ı	1	1403.8		1	1647.1	1	1636.7	1	1	1430.3	***	ı	1441.3	1	ı	1	1
	Dry Density	(bcl)	}	ł	1	87.6	1	ŀ	102.8	a	102.2	1	1	89.3	1	ı	90.0	t	1	. 1	1
	Moisture Content	(%)	7.0	13.2	13.3	14.8	13.5	10.7	16.8	11.8	15.0	10.8	16.1	7.2	12.5	12.6	8.3	10.0	7.8	10.3	6.6
		38.1 mm (1 1/2 in)		1	1	ŀ	1	ı	1	31	1	1	1	1	1	ı	1	1	1	1	1
		25.4 mm (1 in)	ŀ	1	ı	1	1	1	1	1	ı	1	-	-	1	ì	1	ì	1	1	ı
		19.05 nam (3/4 in)	1	1	1	l	1	1	1	34	1	1	-	1	1	1	ı	ì	1	1	ı
	% Passing	12.7 irm (1/2 in)	ŀ	1	t	ı	J	1	1	81	1	6	1	1	1	1	001	ŀ	1	1	1
	ımulative	9.525 nun (3/8 in)	1	1	ı	100	1	1	1	100	ı	1	001	1	1	1	66	100	100	1	ı
	Sieve Analysis - Accumulative % Passing	4.750 mm (No. 4)	1	1	ł	100	1	100	1	100	ı	1	100	1	1	ł	66	66	100	1	ı
	cvc Analy	2.000 mm (No. 10)	:	1	t	100	ı	100	1	66	ı	1	66	1	3	ı	86	86	66	1	1
	is.	0.425 mm (No. 40)	1	001	ŀ	86	1	97	1	86	-	1	76	ŀ	1	ı	95	96	86		1
		0.150 nm (No. 100)	1	66	1	06	ı	80	1	87	-	1	68	ı	ı	1	77	88	09	1	1
		0.075 mm (No. 200)	-	68	1	47	ı	33	ı	50		ŀ	40	ŀ	1	19	35	42	34	1	36
	Limits	77	24	ı	ı	1	30	1	30	1	N	35	ı	ı	28	:	ŀ	ı	1	35	ı
	Atterberg Limits	ы	5	1	1	ı	6	1	10		NP	13	1	-	8	1	ŀ	1	1	11	ı
	Soil Classification	AASHTO																			
	Soil Class	nscs																			
	Depth	E (E)	8.3 - 8.4 (27.5 - 27.8)	0.8 - 1.2 (2.5 - 4.0)	1.5 - 2.0 (5.0 - 6.5)	0.8 - 1.1 (2.5 - 3.5)	3.0 - 3.5 (10.0 - 11.5)	4.5 - 5.0 (15.0 - 16.5)	(22.5 - 23.5)	0.0 - 0.5 (0.0 - 1.5)	(2.5 - 3.5)	3.0 - 3.5 (10.0 - 11.5)	(0.0 - 0.5)	$\begin{bmatrix} 0.8 - 1.1 \\ (2.5 - 3.5) \end{bmatrix}$	(5.0 - 6.5)	2.3 - 2.7 (7.5 - 9.0)	0.8 - 1.1 (2.5 - 3.5)	2.3 - 2.7 (7.5 - 9.0)	0.0 - 0.5 (0.0 - 1.5)	(5.0 - 6.5)	2.3 - 2.6 (7.5 - 8.8)
·	Boring	Number	GR-41	GR-43	GR-43	GR-46	GR-46	GR-46	GR-46	GR-47	GR-47	GR-47	GR-49	GR-49	GR-49	GR-49	GR-51	GR-51	GR-53	GR-53	GR-53
1												_	_	_							





CORRIES	GRA	VEL		SAND	)	SUTORCIAV
COBBLES	coarse	fine	coarse	medium	fine	SILT OR CLAT

	Sp	ecimen	dentification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
	• B	R-2	1.5 m (5.0')	0.075				0.0	0.0	75	.7
	X B	R-4	3.8 m (12.5')	0.6				0.0	10.1	89	.9
	▲ G	R-01	0.8 m (2.5')	9.525				1.0	33.5	65	.5
Ŀ	* G	SR-03	1.5 m (5.0')	0.075				0.0	0.0	98	.2
	ອ G	SR-05	0.8 m (2.5')	9.525				0.1	16.1	83	.8

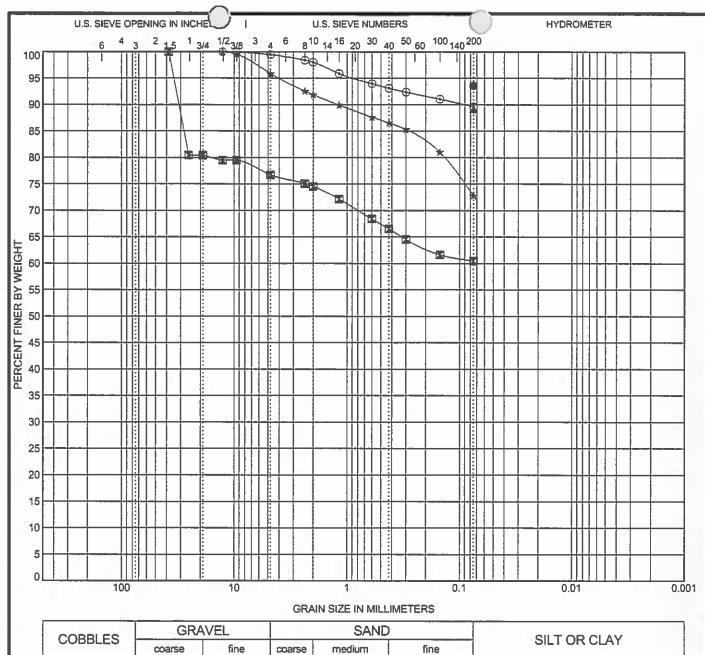


### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

KLI GRAIN SIZE METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2.4 GP Project Number: 105884



COPPLES	GRA	VEL		SAND	)	SILT OR CLAY
COBBLES	coarse	fine	coarse	medium	fine	SILT OR CLAY

_											
		Specimen I	dentification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
	•	GR-07	1.5 m (5.0')	0.075				0.0	0.0	93	.6
	M	GR-09	0.8 m (2.5')	38.1				23.2	16.3	60	.5
	A	GR-11	2.3 m (7.5')	0.075				0.0	0.0	89	).1
	*	GR-13	0.0 m (0.0')	12.7				4.1	23.1	72	.8
	⊚	GR-15	0.8 m (2.5')	12.7				0.5	9.9	89	.6

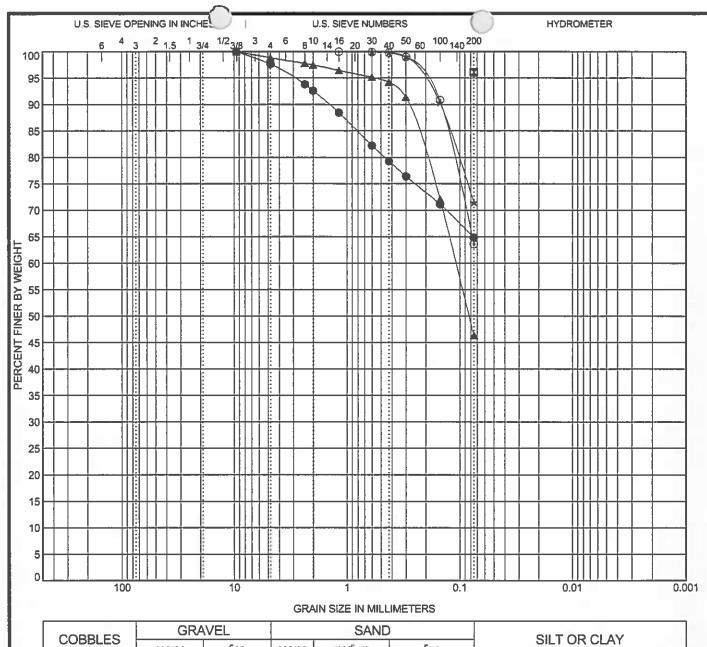


### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

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CORRIEC	GRA	VEL		SAND	)	SILT OR CLAY
COBBLES	coarse	fine	coarse	medium	fine	SILI OR CLAT

		Specimen I	dentification	D100	D60	D30	D10	%Gravei	%Sand	%Silt	%Clay
	•	GR-17	0.0 m (0.0')	9.525				2.4	32.8	64	.9
1	M	GR-19	0.8 m (2.5')	0.075				0.0	0.0	96	.1
I	A	GR-21	0.8 m (2.5')	9.525	0.108			1.2	52.5	46	.3
Ŀ	*	GR-23	1.5 m (5.0')	0.6				0.0	28.5	71	.5
	⊚	GR-25	1.5 m (5.0')	1.18				0.0	36.4	63	.6

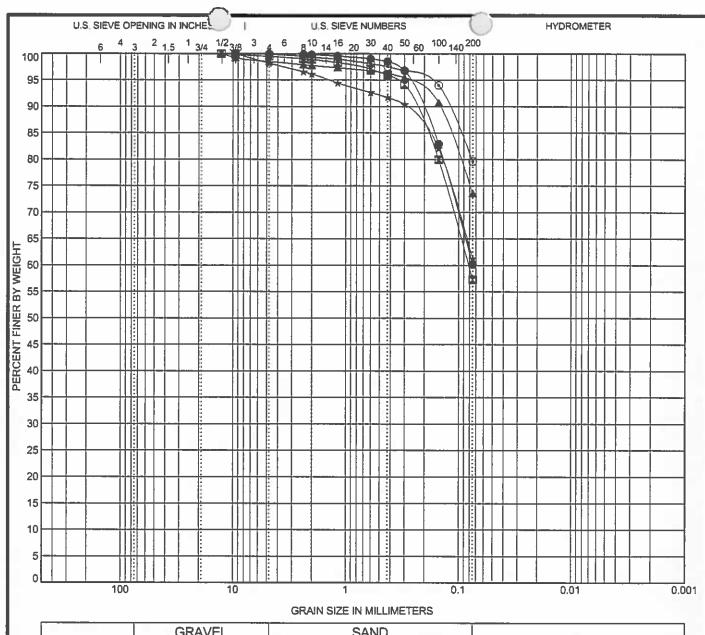


### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

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CORRIES	GRA	VEL		SAND		011 7 00 01 41/
COBBLES	coarse	fine	coarse	medium	fine	SILT OR CLAY

- 10											
ŀ		Specimen I	dentification	D100	D60	D30	D10	%Gravel	%Sand	%Siit	%Clay
	•	GR-27	0.8 m (2.5')	4.75				0.0	39.8	60	).2
ı		GR-29	0.8 m (2.5')	12.7	0.081			0.5	42.2	57	7.3
		GR-31	0.8 m (2.5')	12.7				1.5	25.0	73	3.6
	*	GR-33	0.0 m (0.0')	9.525				1.8	36.9	61	.3
ı	⊚	GR-35	0.8 m (2.5')	9.525				0.2	20.2	79	).6

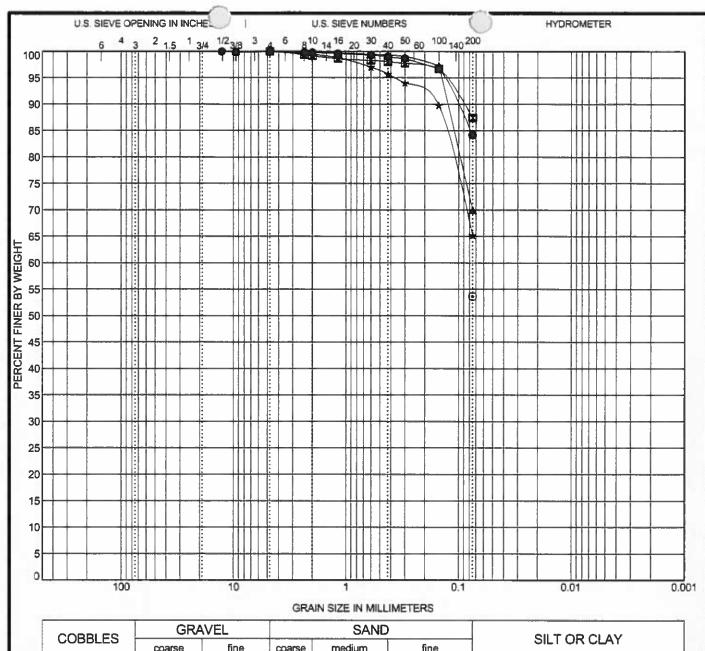


### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

KLI GRAIN SIZE METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4,GP Project Number: 105884



Γ	CORRIES	GRA	VEL		SAND	)	SUTORCLAY
L	COBBLES	coarse	fine	coarse	medium	fine	SILT OR CLAT

						16	100			
	Specimen	Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
•	GR-35	2.3 m (7.5')	12.7				0.1	15.7	84	.2
×	GR-37	0.0 m (0.0°)	4.75				0.0	12.5	87	'.5
A	GR-39	1.5 m (5.0')	9.525				0.1	30.0	70	0.0
*	GR-41	0.8 m (2.5')	9.525				0.1	34.7	65	5.2
⊚	GR-41	5.3 m (17.5')	0.075				0.0	0.0	53	3.7

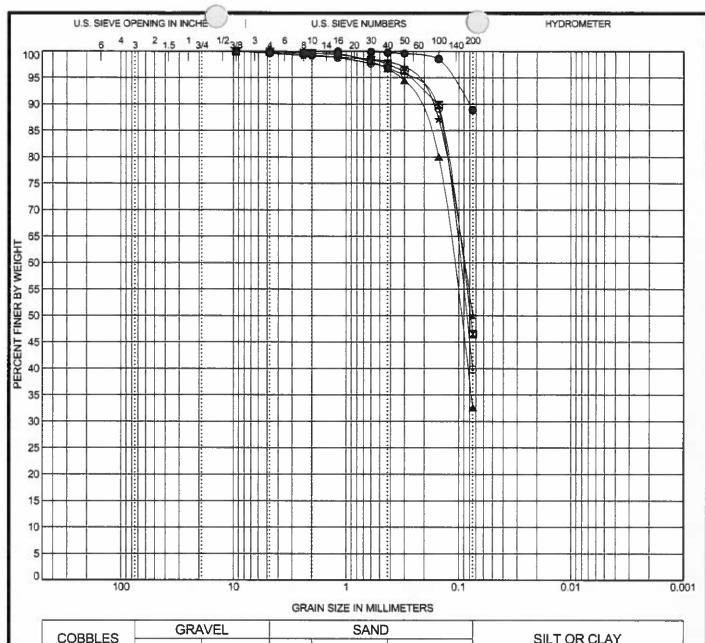


### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

KLI GRAIN SIZE METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GP Project Number: 105884



COBBLES	GRA	VEL		SAND		SILTOPOLAV
COBBLES	coarse	fine	coarse	medium	fine	SILT OR CLAY

- 1							25	- 22			
	Specimen Identification		D100	D60	D30	D10	%Gravei	%Sand	%Silt	%Clay	
	•	GR-43	0.8 m (2.5')	1.18				0.0	11.1	88	3.9
	X	GR-46	0.8 m (2.5')	9.525	0.093			0.1	53.4	46	5.5
	lack	GR-46	4.5 m (15.0')	4.75	0.112			0.0	67.4	32	2.6
	*	GR-47	0.0 m (0.0')	9.525	0.09			0.4	49.6	50	0.0
	0	GR-49	0.0 m (0.0')	9.525	0.1			0.3	59.9	39	0.8

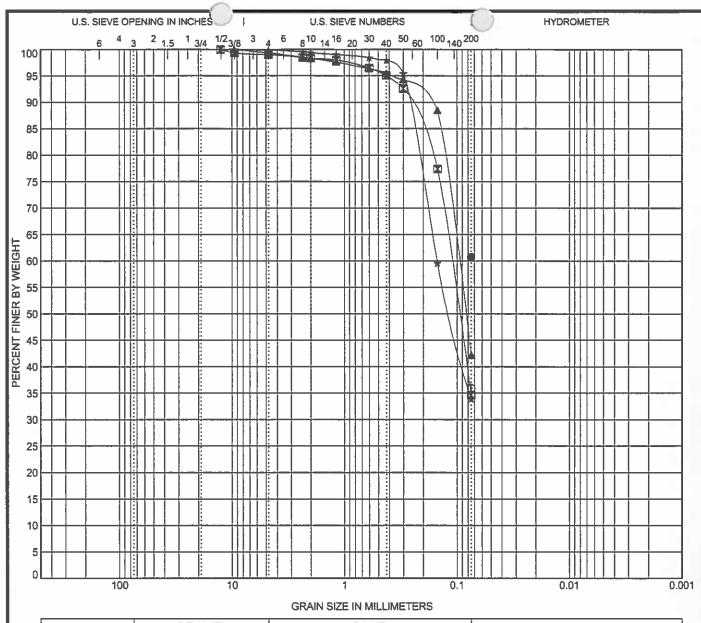


### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

KLI GRAIN SIZE METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4,GP Project Number: 105884



COBBLES	GRAVEL		SAND			SILT OR CLAY
COBBLES	coarse	fine	coarse	medium	fine	SILT OR CLAT

ľ	Specimen Identification		dentification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
I	•	GR-49	2.3 m (7.5')	0.075				0.0	0.0	60	.7
		GR-51	0.8 m (2.5')	12.7	0.113			1.0	64.4	34	.6
	A	GR-51	2.3 m (7.5')	9.525	0.098			0.6	57.1	42	.2
	*	GR-53	0.0 m (0.0')	9.525	0.151			0.1	66.0	33	.9
	0	GR-53	2.3 m (7.5')	0.075				0.0	0.0	35	i.9



0

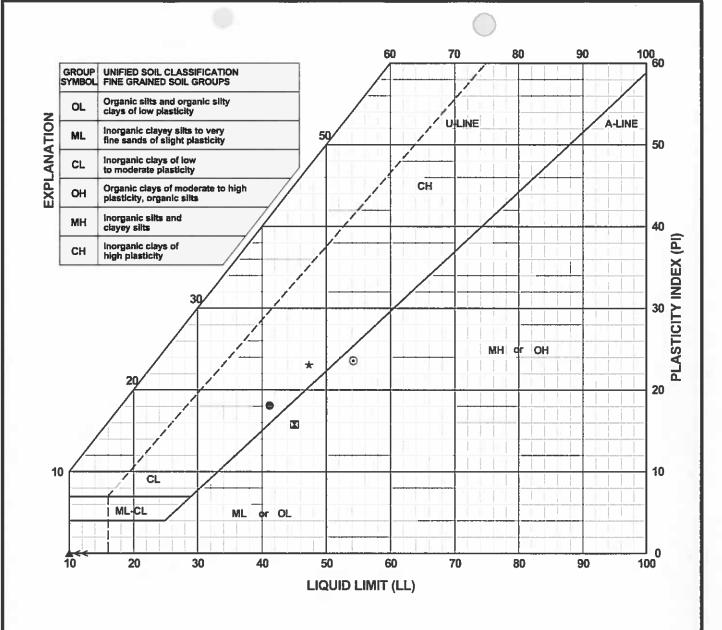
8300 Jefferson NE, Suite B Albuquerque, NM 87113

### **GRAIN SIZE DISTRIBUTION**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico

KLI GRAIN SIZE METRIC \ LIBRARY KLEINFELDER ALB PLOG GLB \ 105884 N11(1A)1,2.4 GPProject Number: 105884



	Specimen	Identification	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
	BR-2	3.0 m (10.0')	41	23	18
×	BR-3	3.8 m (12.5')	45	29	16
A	BR-4	0.8 m (2.5')	NV	NV	NP
*	GR-01	0.0 m (0.0')	47	24	23
0	GR-03	0.8 m (2.5')	54	31	23

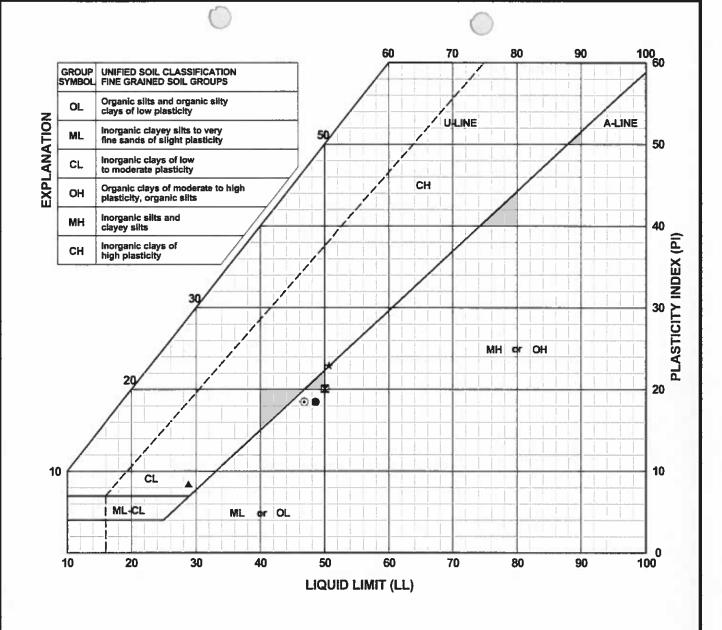


KLI ATTER METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ

### ATTERBERG LIMITS

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico



	Specimen	Identification	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
•	GR-07	0.8 m (2.5')	49	30	19
×	GR-09	1.5 m (5.0')	50	30	20
	GR-11	0.8 m (2.5')	29	20	9
*	GR-13	0.8 m (2.5')	51	28	23
0	GR-15	1.5 m (5.0')	47	28	19

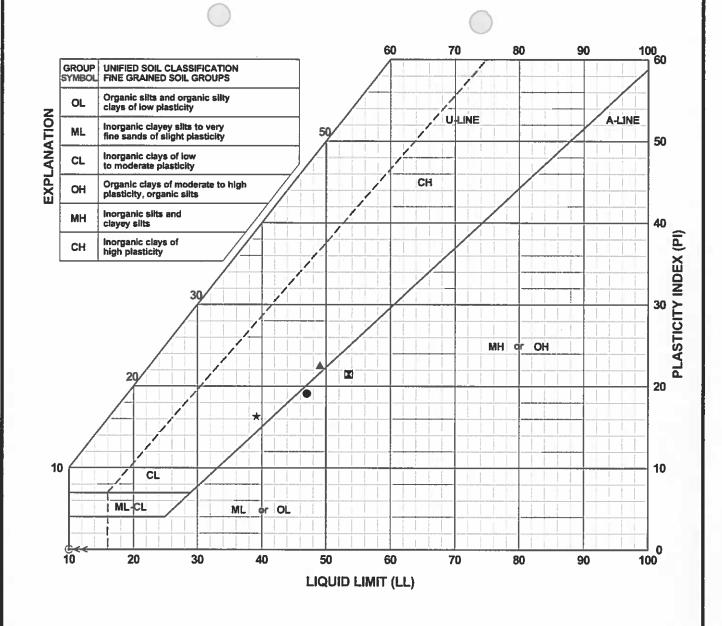


KLI ATTER METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1.2.4.GPJ

### ATTERBERG LIMITS

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico



	Specimen	Identification	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
	GR-17	3.8 m (12.5')	47	28	19
×	GR-19	0.0 m (0.0')	54	32	22
	GR-21	1.5 m (5.0')	49	27	22
*	GR-27	0.0 m (0.0')	39	23	16
0	GR-29	1.5 m (5.0')	NV	NV	NP



0

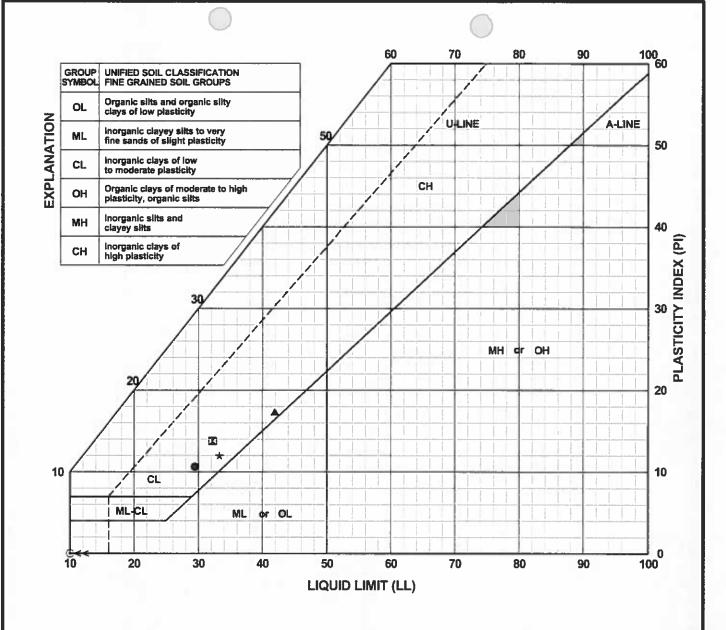
8300 Jefferson NE, Suite B Albuquerque, NM 87113

KLI ATTER METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4.GPJ

### ATTERBERG LIMITS

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico



	Specimen	Identification	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
	GR-31	2.3 m (7.5')	29	19	10
X	GR-33	0.8 m (2.5')	32	18	14
A	GR-37	1.5 m (5.0')	42	25	17
*	GR-37	3.8 m (12.5')	33	21	12
0	GR-39	3.0 m (10.0')	NV	NV	NP

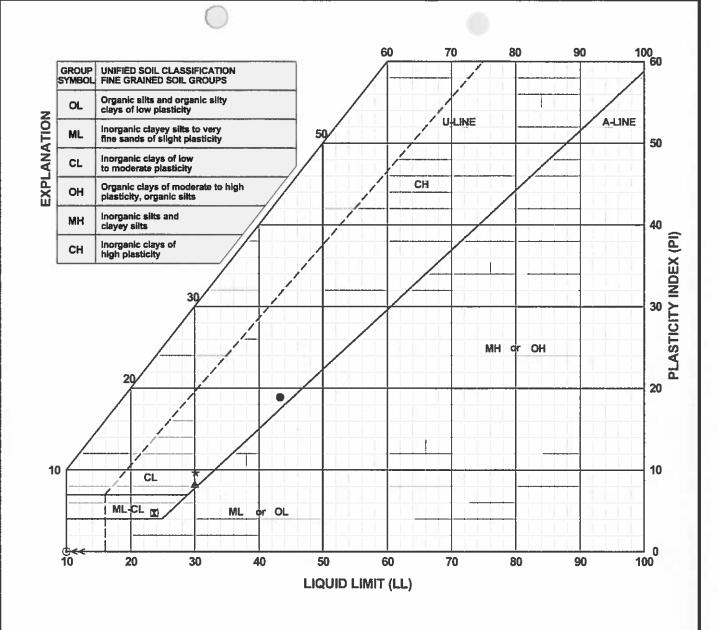


KLI ATTER METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2,4 GPJ

### **ATTERBERG LIMITS**

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico



	Specimen	Identification	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
	GR-41	3.0 m (10.0')	43	24	19
M	GR-41	8.3 m (27.5')	24	19	5
	GR-46	3.0 m (10.0')	30	22	8
*	GR-46	6.8 m (22.5')	30	20	10
0	GR-47	0.8 m (2.5')	NV	NV	NP

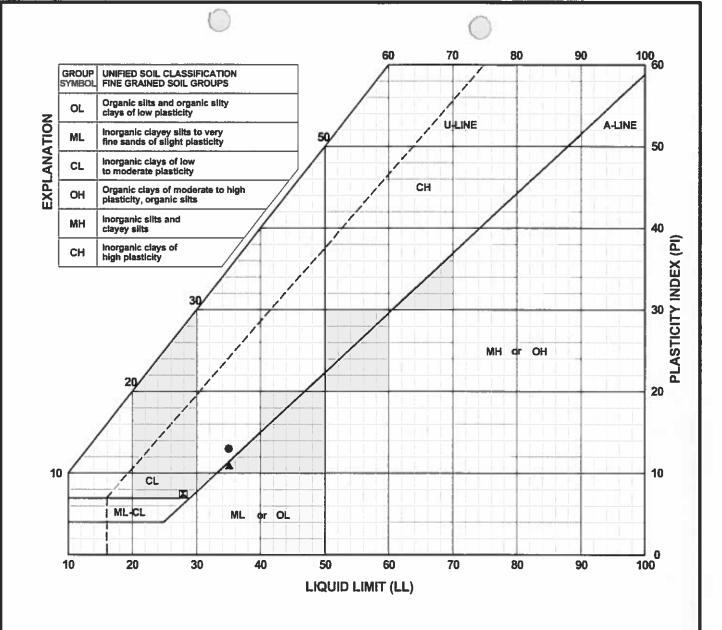


KLI ATTER METRIC \ LIBRARY KLEINFELDER ALB PLOG GLB \ 105884 N11(1A)1.2,4.GPJ

### ATTERBERG LIMITS

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico



Specimen	Identification	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	
GR-47	3.0 m (10.0')	35	22	13	
GR-49	1.5 m (5.0')	28	20	8	
GR-53	1.5 m (5.0')	35	24	11	



KLI ATTER METRIC \ LIBRARY KLEINFELDER ALB PLOG.GLB \ 105884 N11(1A)1,2.4.GPJ

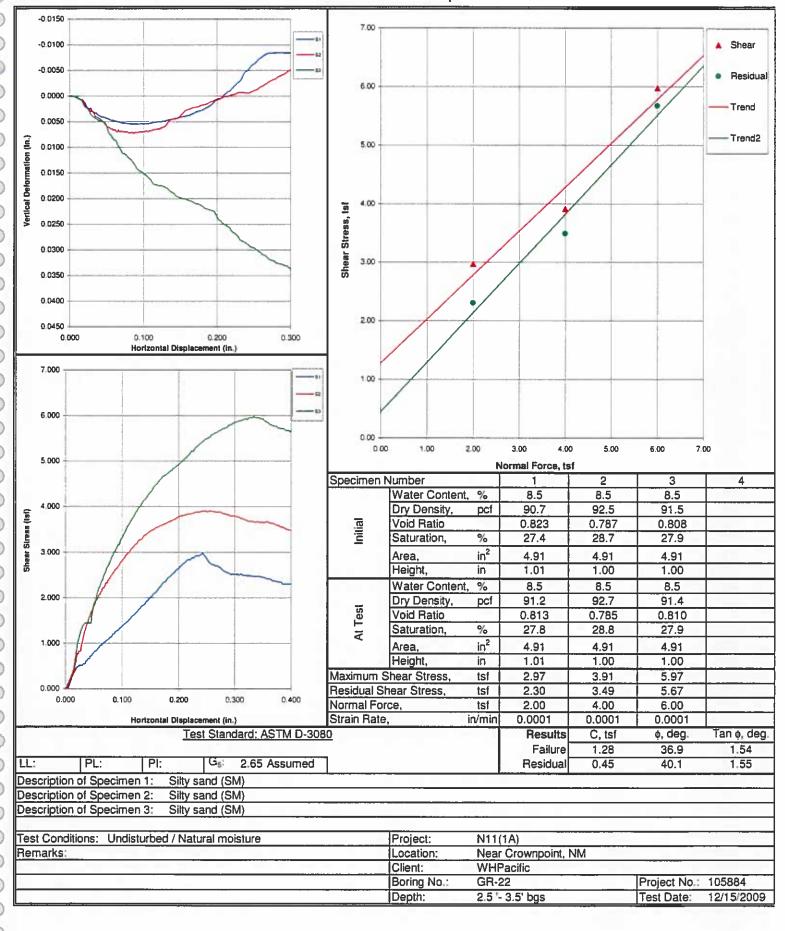
### ATTERBERG LIMITS

Project: N11(1A)1,2,4

Location: Near Crownpoint, New Mexico



### **Direct Shear Test Report**



### **APPENDIX D**

0

### **Road Condition Photographs**



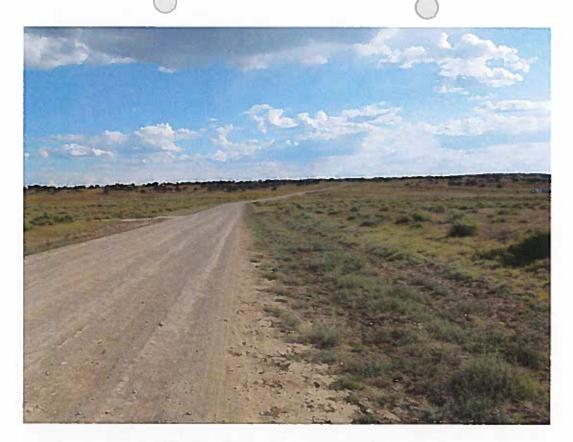


Photo 1: General Condition of N11(1A) Roadway

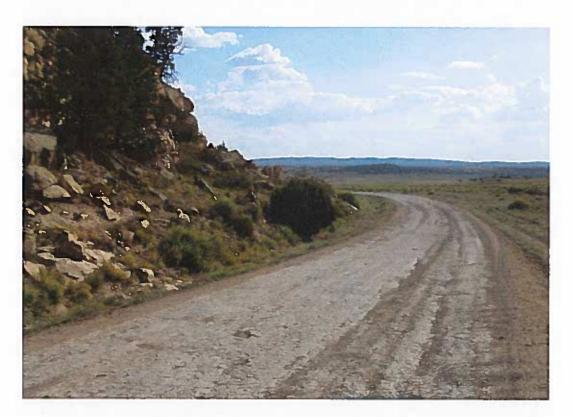


Photo 2: Sandstone Outcrop with Boulders





Photos 3 and 4: Drainage Culvert Located approximately 65 m (213 ft) south of station 3+965 (note standing water)

### **APPENDIX E**

Lateral Capacity of Piles for Bridge Foundations

TABLE E.1 – Pile Foundation Reactions (provided by WHPacific) (reactions for single HP360X152 pile)

Loading	Maximum Axial Load		Shear Force about x-x axis		Shear Force about y-y axis		Moment about y-y axis	
Case	(kN)	(kips)	(kN)	(kips)	(kN)	(kips)	(kN-m)	(kip-ft)
Case 1, Str la	1233.0	277.2	0.0	0.0	32.9	7.4	22.4	16.5
Case 2, Str V	1159.7	260.7	11.6	2.6	27.1	6.1	17.4	12.8
Case 3, Ext Event	926.6	208.3	48.0	10.8	13.3	3.0	8.4	6.2
Case 4, Str lb	970.2	218.1	0.0	0.0	33.4	7.5	15.9	11.7

### **Results for No Scour:**

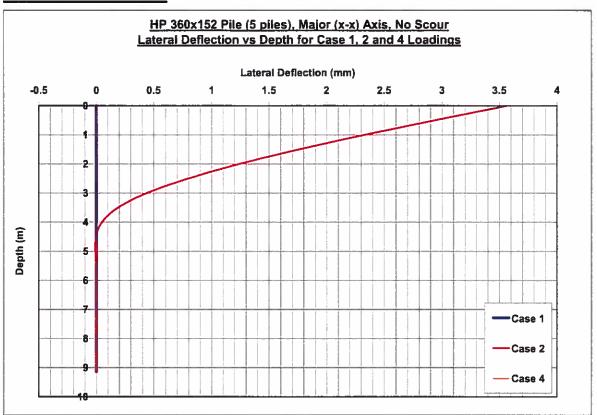


Figure E.1 - Lateral Deflection vs. Depth (x-x axis, no scour)

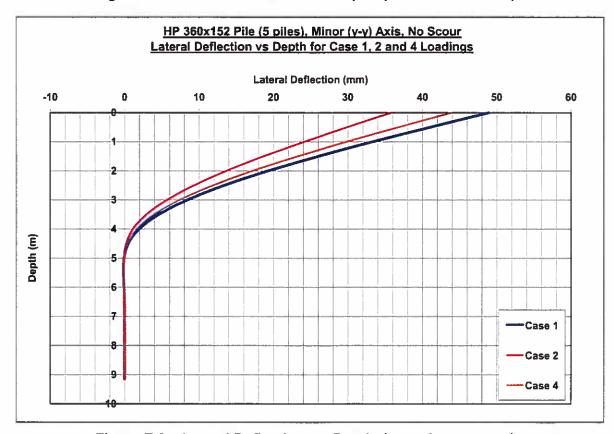


Figure E.2 – Lateral Deflection vs. Depth (y-y axis, no scour)

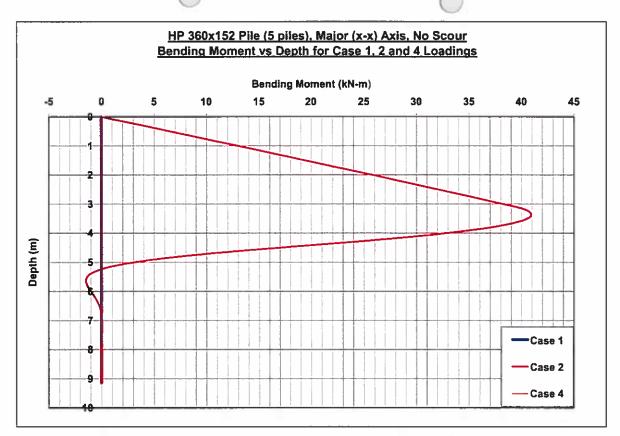


Figure E.3 - Bending Moment vs. Depth (x-x axis, no scour)

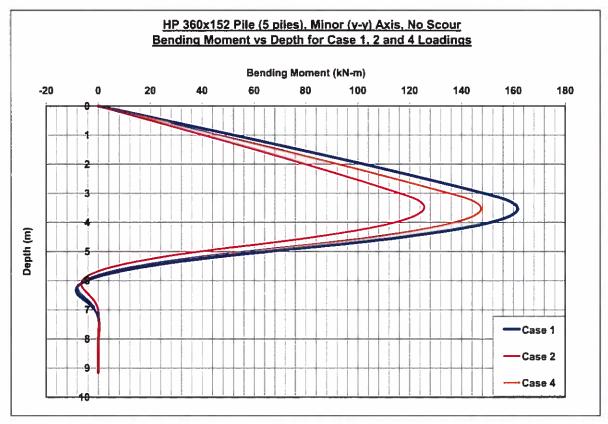


Figure E.4 – Bending Moment vs. Depth (y-y axis, no scour)

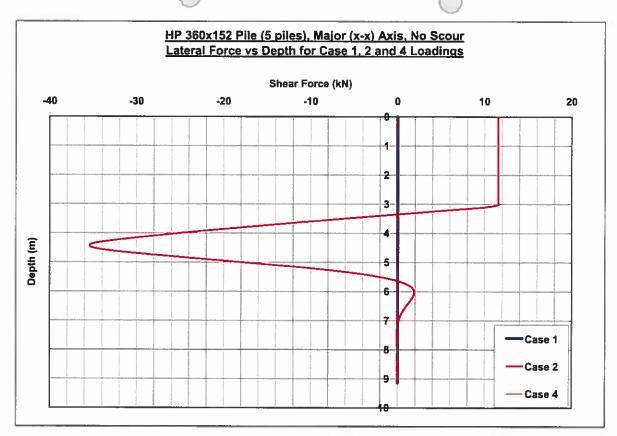


Figure E.5 – Lateral Force vs. Depth (x-x axis, no scour)

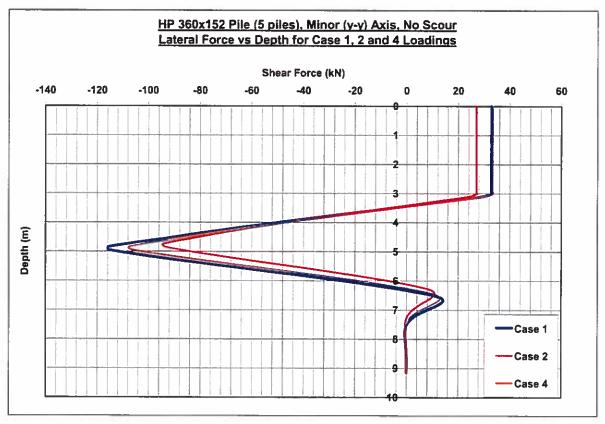


Figure E.6 – Lateral Force vs. Depth (y-y axis, no scour)

### Results for 4.2 m (13.8 ft) Scour:



Figure E.7 – Lateral Deflection vs. Depth (x-x axis, 4.2m scour)



Figure E.8 – Lateral Deflection vs. Depth (y-y axis, 4.2m scour)

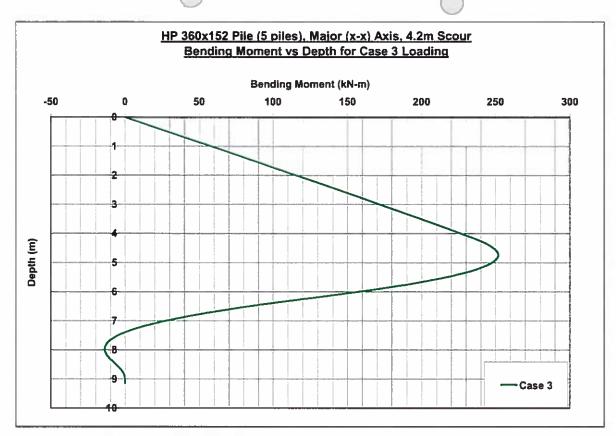


Figure E.9 – Bending Moment vs. Depth (x-x axis, 4.2m scour)

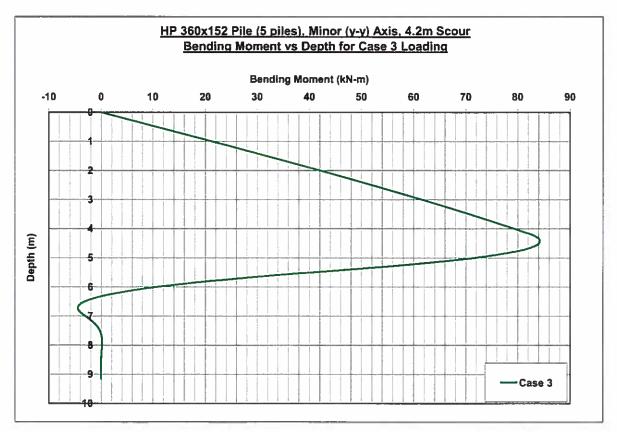


Figure E.10 – Bending Moment vs. Depth (y-y axis, 4.2m scour)

### HP 360x152 Pile (5 piles), Major (x-x) Axis, 4.2m Scour Lateral Force vs Depth for Case 3 Loading

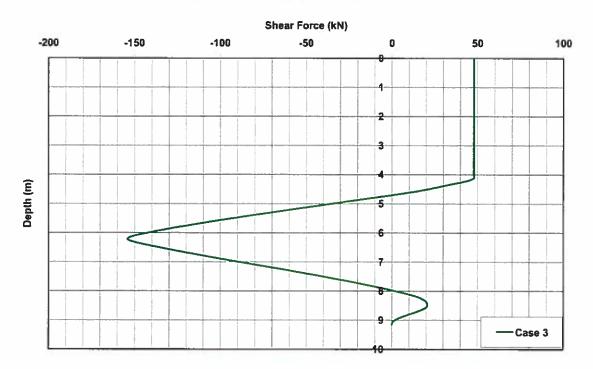


Figure E.11 - Lateral Force vs. Depth (x-x axis, 4.2m scour)

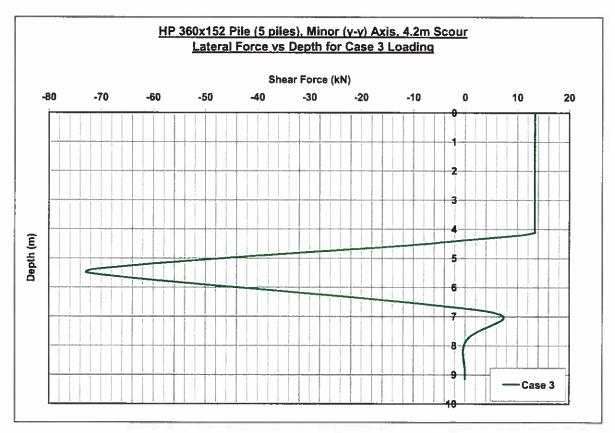


Figure E.12 – Lateral Force vs. Depth (y-y axis, 4.2m scour)

### **APPENDIX F**

## **Pavement Design Calculations**

105884 N11(1A)
Pavement Design Calculation
01/21/10

Originated By: Cとび チフ3/ Reviewed By: 4 コフェフ

Date: 2/12/10

### Objective

Calculate pavement design sections for the southern portion of Route N11 on the Navajo Nation in Crownpoint, NM.

### References

- 1. Department of the Interior, Bureau of Indian Affairs, Navajo Region Office, Division of Transportation, Highway design Unit, "Design Analysis Report for Project: N11(1)1,2&4", June 27,2005, revised October 11, 2005.
- 2. Email from Ms. Rachel LeVee of WHPacific, subject "Re: N11 Traffic Counts," August 31, 2009.
- 3. New Mexico Department of Transportation, "Infrastructure Design Directive IDD-2008-05 (Pavement Design Guideline)", July 21, 2008.

### <u>Given</u>

- 1. Borehole Logs from the Kleinfelder geotechnical and investigation of the site.
- 2. Traffic count data provided in Reference 1.
- 3. Anticipated percentage of heavy vehicles provided by Ms. Rachel LeVee of WHPacific (Reference 2).

### **Assumptions**

- Variable subgrade support is anticipated based on the range of geologic materials encountered in our geotechnical investigation and variable N values from Standard Penetration Tests (SPT). Therefore, a conservative composite CBR estimate of 8 was utilized in the calculations to account for weaker materials.
- Drainage coefficients of 1.0 for the asphalt and crushed base course were assumed for the calculations. These values assume that positive drainage controls will be designed and constructed.
- 3. The total Average Daily Traffic (ADT) values for light duty and medium duty vehicles were subdivided based on anticipated vehicle type.
- 4. The following parameters were assumed for the pavement design calculations:
  - Direction factor = 1
  - Lane distribution factor = 0.5
  - Initial serviceability index = 4.2 (Reference 3)
  - Terminal Serviceability Index = 2.0 (Reference 3)

105884 N11(1A) **Pavement Design Calculation** 01/21/10

Date: 02/11 Originated By: CLT 7731 Reviewed By: 41777 Date:

5. A design period of 20 years was assumed for calculations.

### Calculations

### **Resilient Modulus**

The resilient modulus (M_R) for the subgrade was calculated utilizing the composite CBR value for the roadway (based on AASHTO T193, "The California Bearing Ratio"):

$$M_R = (2555) * CBR^{0.64} = (2555) * (8^{0.64}) \approx 9.500$$

### Growth Rate and 2009 ADT

The growth rate and 2009 ADT value was calculated utilizing the ADT estimates for a 20-year time period (n) from 2002 and 2022 provided in Reference 1:

ADT ₂₀₀₂ = 371 vehicles per day (vpd), Reference 1 ADT  $_{2022}$  = 453 vpd, Reference 1

Growth rate (g) =  $(ADT_{2022} / ADT_{2002})^{1/n} = (453 \text{ vpd/ } 371 \text{ vpd})^{1/20} = 1\%$ 

 $ADT_{2009} = (ADT_{2002})^*(1+g)^n = (371 \text{ vpd})^*(1+0.01)^7 = 398 \text{ vpd}$ 

### **ESAL Applications**

The 18 kip equivalent single axle load (ESAL) applications were calculated as shown below:

18 KIP EQUIVLENT SINGLE AXLE LOAD (ESAL) APPLICATIONS - AASHTO

Project Name:

WHP N11 (1A) Reconstruction

Job Number:

105884

Date:

01/21/10

Location: Pavement Type: Crownpoint, NM Mainline - Flexible Design Period: Growth Factor: 20 Years

1.00%

Monthly Traffic:

Avg. ADT:

398

Number of Lanes in Each Direction:

4.2

Present Serviceability Index (pt): Estimated Structural Number:

Vehicle Types	Axle	Percent	ADT	ADT x 365	Load Equivalent	ESAL
	Load	ADT		x Design Period	Factor	
Light Duty		93.00%	370	2,974,792	0.00002	59
Medium Duty		5.00%	20	159,935	0.617	98,680
Heavy Duty		2.00%	В	63,974	1.693	108,308
TOTAL			398			207,047

ESAL	Direction	Lane Distribution	DESIGN
	Factor	Factor	ESAL
207,047	1	0.50	103.524

20 YEAR DESIGN ESAL =

103,524

DESIGN EDI	LA=	14

105884 N11(1A)
Pavement Design Calculation
01/21/10

Originated By: (22773) Date: 02/11/10
Reviewed By: 9/14/57 Date: 2/2/10

The pavement design sections were calculated utilizing the information above in the PAS pavement analysis software, version 5.0, which utilizes the 1993 AASHTO method (AASHTO Guide for Design of Pavement Structures).

### Results

The following pavement design section was calculated for the N11 (1A) Roadway:

76 mm (3 in) asphalt over 150 mm (6 in) aggregate base:

		02-11-2010
State: NM	Job Number: 105884	
Agency: WHPacific Company: Kleinfelder	Location: Crownpoint, N	М
Contractor: N/A Engineer: C. Vallejo		
****** F	lexible Analysis =========	
Structural Number	= 1.94	
Design E 18's	= 103,524	
Design E 18's Reliability Overall Deviation	= 75.00 percent = 0.45	
Resilient Modulus	= 0.45 = 9,500.0 psi	
Initial Serviceability	= 4.20	
Terminal Serviceablity	= 2.00	
Layer Layer Number Coefficient	Drainage Layer Coefficient Thickness a(i)	a sa.
Number Coerricient	Cd t	*Cd*t
		. 26
2 0.12	1.00 6.00 0	.72
3		
1 0.42 2 0.12 3 4 5		
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	_ ====	=====
	Total SN = 1	. 98
		ļ

105884 N11(1A) **Pavement Design Calculation** 01/21/10 Conclusions

Originated By: CLV 7731 Reviewed By: 457 4757

Date: oaliko

Date: 2/12/10

Based on our calculations a pavement section consisting of 76 mm (3 inches) of asphalt over 150 mm (6 inches) of aggregate base course would be sufficient for the anticipated traffic loads. This pavement section corresponds to the minimum required section based on Reference 1. We therefore recommend the minimum BIA pavement section for Route N11 presented in the following table.

**Table 1-- Design Pavement Section** 

Traffic Loading	Asphaltic Concrete Pavement (ACP) (inches)	Aggregate Base (inches)
103,524 18-kip ESAL	76 mm (3 in) ACP	150 mm (6 in) Base