GEOTECHNICAL ENGINEERING REPORT NATIONAL CHEROKEE NATION PARK **SEQUOYAH COUNTY** SALLISAW, OKLAHOMA

Prepared for:

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PROJECT NUMBER: 256748 Rev. 1

July 1, 2019



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July 1, 2019

Cherokee Nation Entertainment, LLC 777 West Cherokee Street Catoosa, Oklahoma 74015

Attn: Mr. James Thornton, Director of National Park

Email: James.Thornton@cn-bus.com

RE: Revised Geotechnical Engineering Report

National Cherokee Nation Park

Sequoyah County Sallisaw, Oklahoma

PPI Project Number: 256748 Rev. 1

Project Service Agreement No.:15E0644.14

Dear Mr. Thornton:

Attached, please find the report summarizing the results of the geotechnical investigation conducted for the proposed National Cherokee Nation Park in Sallisaw, Oklahoma. We appreciate this opportunity to be of service. If you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC.

By:

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EXECUTIVE SUMMARY

A Geotechnical Investigation was performed for the National Cherokee Nation Park located in Sequoyah County near Sallisaw, Oklahoma. It is understood that a new park including camping sites for tents and RVs, cabins, general store, residences, pool, stables, arena, restaurant, marina, and meeting centers will be constructed at the approximate 160-acre subject site bordering the Robert S. Kerr Reservoir. Traffic loading was not provided but is assumed to be light. Cut and fill depths are anticipated to be highly variable due to the size of the site and topographic relief of the site.

Based upon the information obtained from the borings drilled and subsequent laboratory testing, the site is suitable for the proposed National Cherokee Nation Park. Important geotechnical considerations for the project are summarized below. However, users of the information contained in the report must review the entire report for specific details pertinent to geotechnical design considerations.

- Due to the size of the subject site, location specific geotechnical considerations have been provided in this report. These location specific considerations have been summarized in a table in <u>Section 8.8</u>;
- Portions of the subject site were heavily wooded with highly variable amounts of topsoil and organic materials. The existing access area and pavilion areas are partially grass covered. Surface material on the south side of the site was generally noted to have exposed bedrock and/or exposed boulder fields;
- Soils across the site are primarily residual from the weathering of shale and sandstone. Soil depths and depth to bedrock are highly variable due to varying degrees of weathering. Mixes of sands, lean clays, and fat clays should be anticipated in excavations;
- Shallow bedrock is anticipated within portions of the subject site. Varying depths
 of weathered bedrock over more competent bedrock were noted in the subsurface
 exploration. Generally, weathered bedrock should be excavatable with heavy duty



EXECUTIVE SUMMARY - CONTINUED

equipment. Pneumatic rock breaking equipment may be needed to excavate more competent bedrock areas;

- Moisture sensitive lean clays were noted near the surface of the subgrade exploration. This material is generally stable in moderately dry conditions but is sensitive to the addition of moisture and repeated traffic. Some over excavation and replacement or stabilization may be required of these soils;
- Some undocumented fill should be anticipated near existing structures;
- Medium volume change/expansive material was noted in the subsurface exploration. Areas noted with medium volume change material will require removal and replacement with a Low Volume Change (LVC) material as indicated within this report;
- Foundations for the proposed light structures are anticipated to bear on native soils, LVC fill material, or bedrock. Foundations bearing on native soils or controlled fill can be designed for allowable bearing capacities of 2,500 psf for column footings and 2,000 psf for continuous footings. Foundations bearing on competent bedrock can be designed for allowable bearing capacities of 5,000 psf for column footings and 4,500 psf for continuous footings;
- Foundations for the proposed moderate to heavily loaded structures, i.e. connector bridge structure, are anticipated to be supported upon drilled piers bearing on competent bedrock. Refer to <u>Section 10.4</u> for additional details;
- Due to the number of different structure types and differing soil conditions encountered across the large site, we recommend foundation plans be reviewed by PPI once final site grading, structure loads, and foundation types are selected;
- The project site classifies as a Site Class C in accordance with Section 1613 of the 2012 International Building Code (IBC);



EXECUTIVE SUMMARY - CONTINUED

 Palmerton & Parrish, Inc. should be retained for construction observation and construction materials testing. Close monitoring of subgrade preparation work is considered critical to achieve adequate pavement and subgrade performance.



REVISED GEOTECHNICAL ENGINEERING REPORT NATIONAL CHEROKEE NATION PARK SEQUOYAH COUNTY SALLISAW, OKLAHOMA

1.0 INTRODUCTION

This is the report of the Geotechnical Investigations performed for the proposed National Cherokee Nation Park located in Sequoyah County near Sallisaw, Oklahoma. This investigation was authorized by a Project Service Agreement number 15E0644.14 issued by Cherokee Nation Entertainment, LLC to Palmerton & Parrish, Inc. (PPI). In addition to the original geotechnical investigation performed between February 19 through March 1, 2019, a second investigation was performed between June 10 through June 12, 2019 for the newly proposed central premium cabins and for the additional cabins on the east bank of the subject site that were not originally explored in the February through May exploration. This revised report reflects the conditions of both explorations. The approximate site location is shown below:





The purpose of the Geotechnical Investigation was to provide information for foundation design, pavement design, construction planning, and to aid in site development. PPI's scope of services included field and laboratory investigation of the subsurface conditions in the vicinity of the proposed project site, engineering analysis of the collected data, development of recommendations for foundation design and construction planning, and preparation of this engineering report.

2.0 PROJECT DESCRIPTION

Item	Description
Site Layout	See Figure 1: Boring Location Plan
Buildings and Structures	Barn, Park Operations Buildings, Community Center, Welcome and Cultural Center, Amphitheater, Pavilions, Cabins, Stables, Arena, Residence, General Store, pool, splash pad, pool house, mini-golf, kiosk, helipad, Docks, Marina Building, Restaurant, Storm Shelter, Bridge, and Paved Areas for Parking and Drive Lanes.
Foundation Loadings	Loading information for the structures/buildings was not provided. All structures and buildings are anticipated to have light foundation loads, i.e. less than 250-kip column loads.
Existing Structure	Existing pavilions/sheds, parking and drive area pavements, and restrooms associated with the existing Sallisaw Public Use Area.
Grading	Grading at the subject site will be specific to the individual structures. It is anticipated that structures in steeply sloped areas will require large amounts of cut/fill. Flatter sections of the site are anticipated to have approximately equal cut and fill depths.

3.0 SITE DESCRIPTION

Item	Description
Physical Location	Sequoyah County in Sallisaw, Oklahoma. Bordering the Robert S. Kerr Reservoir.
Latitude:	35.396552°
Longitude:	-94.870230°
(± Center of Project Site)	
Available Historic Aerial Photography	The existing structures located on the northeast side of the site were constructed between the years 2003 and 2005, and the existing structures located near the center of the site were constructed between the years 2016 and 2017. The Public Use Area and roads pre-date photography from 1995.
Current Ground Cover	The subject site is generally densely wooded with some open areas.
Existing Topography	The subject site is generally a peninsula that extends into the existing Robert S. Kerr Reservoir. Accordingly, steeply sloped banks are present at the subject site.
Drainage Characteristics	Generally good with some areas of poor drainage within lower lying areas.



4.0 SITE PHOTOGRAPHS

Site photographs were obtained during the investigation of the landscapes at the site. Refer to the photographs presented below for typical land cover and topography present over the project site.







Heavily Wooded Areas









Community and Cultural Center Areas





Southeast Bank Premium Lake Cabin Areas/Top of Bluffs





Southeast Bank Premium Lake Cabin Areas/Top of Bluffs



Southeast Bank Premium Lake Cabin Areas/Bottom of Bluffs







Northeast Premium Lake Cabin Areas









5.0 SUBSURFACE INVESTIGATION

Two (2) subsurface investigations were performed at the subject site. The original investigation was performed between February and May, 2019 for the original site layout and an additional subsurface investigation was requested by the client and was performed in June, 2019 for the newly added central cabins and east bank cabins not previously explored. The subsurface exploration performed between February and May consisted of one-hundred, ten (110) subsurface borings and subsequent laboratory testing. The additional exploration performed in June contained an addition thirty-eight (38) borings.

5.1 Subsurface Borings

Boring locations were staked in the field by PPI using a site plan provided by the Client. Approximate boring locations are shown on <u>Figure 1</u>, Boring Location Plan. The Oklahoma One-Call System was notified prior to the investigation to assist in locating buried public utilities.

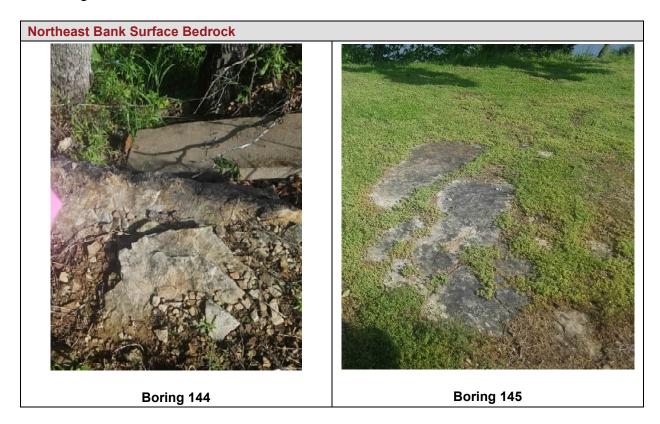
Logs of the borings showing descriptions of soil and rock units encountered, as well as results of field tests, laboratory tests and a "Key to Symbols" are presented in Appendix II.

Borings were drilled using 4.5-inch O.D. continuous flight augers powered by ATV-mounted drill-rigs. Soil samples were collected at 2.5 to 5-foot centers during drilling. Soil sample types included split spoon samples collected while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586 and thin walled Shelby tubes pushed hydraulically in advance of drilling in accordance with ASTM D1587. Please refer to <u>Appendix III</u> for general notes regarding boring logs and additional soil sampling information.

Due to the terrain, boulders, and rock bluffs at the project site, borings 76 and 77 were not accessible with drill rigs and were not explored. Additional areas not accessible with drill rigs were explored by hand sampling procedures and manual equipment as noted in the boring logs in Appendix II. Borings 143 through 145 contained bedrock



at the ground surface, as noted in the below images, and were not explored with soil borings.



5.2 Laboratory Testing

Collected samples were sealed and transported to the laboratory for further evaluation and visual examination. Laboratory soil testing included the following:

- Moisture Content (ASTM D2216);
- Unconfined Compressive Strength (ASTM D2166);
- Atterberg Limits (ASTM D4318);
- Grain Size Analysis (ASTM D6913);
- Swell Tests (ASTM D4546); and
- Pocket Penetrometers.

Laboratory test results are shown on each boring log in <u>Appendix II</u> and are summarized in <u>Appendix IV</u>.



6.0 SITE GEOLOGY

The subject site is located over the McAlester and Hartshorne Formations. The primary bedrock types within this formation are shale and sandstone. Some coal is also known to be found within this formation. Based on the results of the subsurface exploration, sandstone, shale, and trace amounts of coal were noted in the subsurface borings. Some alluvial deposits of clay and sands were also encountered; however, the subsurface soils primarily consisted of residual clays and sands from the weathering of sandstone and shale.

7.0 GENERAL SITE SUBSURFACE CONDITIONS

Based upon subsurface conditions encountered within the borings drilled at the project site, generalized subsurface conditions are summarized in the table below. Soil stratification lines on the boring logs indicate approximate boundary lines between different types of soil units based upon observations made during drilling. In-situ transitions between soil and some rock types are typically gradual.

7.1 Soils

Generalized subsurface conditions are summarized in the list below:

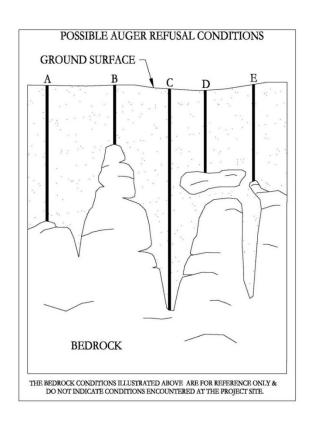
- Surface soils generally consisted of a dark brown, lean clay, topsoil with varying amounts of sand and gravel. Portions of this material may not be suitable for reuse as topsoil due to the amount of sand and gravel present. Additionally, organic roots and compost from leaves are present within this material;
- Native soils at the subject site were highly variable. Native soils generally consisted of lean clay, fat clay, and clayey sand with highly varying amounts of clay, sand, and gravel. The native soils appear to be residual soils from the weathering of the shale and sandstone bedrock present at the subject site. Soils with liquid limits over 40 percent were noted to have medium volume change potential; and
- Bedrock was encountered as auger or split-spoon refusal across most of the site.
 Generally, the south side and higher elevation areas of the site contained shallow



bedrock conditions. Areas of weathered bedrock that were penetrable with auger drilling techniques were also encountered and are noted on the logs as weathered shale or weathered sandstone. Auger refusal and weathered bedrock depths are noted in the below table;

7.2 Auger Refusal

Auger refusal is defined as the depth below the ground surface at which a boring can no longer be advanced with the soil drilling technique being used. Auger refusal is subjective and is based upon the type of drilling equipment and types of augers being used, as well as the effort exerted by the driller. Several different auger refusal conditions are possible in the general site area. These conditions are represented graphically in the adjacent figure: (A) on the upper surface of continuous bedrock, (B) on



rock "pinnacles", (C) in widened joints that may extend well below the surrounding bedrock surface, (D) slabs of unweathered rock suspended in the residual soil matrix, or "floaters", or (E) on the upper surface of discontinuous bedrock.

Due to possibility that some or all of these features exist at this project site, estimating the exact quantity of rock excavation is difficult. Linear interpolation of apparent bedrock elevations based upon the boring data is often used but can misrepresent actual rock removal quantities where such anomalies exist.

7.3 Bedrock

Bedrock in the location of the future bridge was explored with rock coring techniques utilizing a diamond impregnated core barrel of NQ size. Based on the samples of bedrock recovered, the bedrock in the location of the future bridge (southwest



abutment) is anticipated to be shale. Some minor amounts of sandstone may also be encountered. Rock Quality Designation (RQD) and percentage recovery of the rock core performed are included on the boring log located in <u>Appendix II</u>. Photographs of the rock core are included in <u>Appendix VII</u>.

Weathered bedrock units were encountered within the subsurface exploration at varying depths. These materials were generally able to be penetrated with augers and split-spoon samplers. Generally, the weathered bedrock units consisted of sandy shale or sandstone. Highly variable depths of weathering were noted across the subject site.

7.4 Groundwater

Shallow groundwater was observed within the borings at depths ranging from 0.5 to 13 feet below the existing ground surface on the date drilled. Groundwater levels should be expected to fluctuate with changes in site grading, precipitation, and regional groundwater levels. Groundwater may be encountered at shallower depths during wetter periods. Refer to <u>Section 8.7</u> for additional details.

8.0 GEOTECHNICAL CONSIDERATIONS

Due to the size and scope of the proposed National Cherokee Nation Park, geotechnical considerations for the individual structures will vary based on the structure's location on the project site. Geotechnical considerations for the project site have been listed below:

8.1 Topsoil

Topsoil was noted in the subsurface exploration to depths between 0.1 to 1.5 feet below the ground surface. Due to the influence of vegetation and trees, this material should be stripped from construction areas and stockpiled for use in non-pavement or structure areas or removed from the site. Large root systems, such as root balls from trees or any root over 6 inches in diameter should be included in the removal of topsoil from beneath structures and pavements. Root systems may extend to depths deeper than those noted in the subsurface exploration. It should be noted that the use of the term topsoil within this report is for site construction and does <u>not</u> imply that the



material is suitable for sale as topsoil. Due to the increased gravel and sand contents and the plasticity of some of the topsoil, some of this material may not be suitable for re-use as a surficial landscaping material.

8.2 Surface Boulders

Boulders were noted on the ground surface at the project site. Boulders were especially noted on the south side of the project site below the exposed rock bluffs. Foundations and floor slabs for structures should not bear directly on large surface boulders. Additionally, boulders should be removed from areas to receive fill materials. Some boulder features may be too large to remove intact and may require special equipment, pneumatic breakers, or explosives to be reduced in size and removed.

8.3 Soft Surficial Soils

Areas of lean clay were noted near the surface in some of the borings. Generally, these materials may be stable during dry weather; however, these materials are anticipated to be sensitive to the addition of moisture. **During wet seasons or rain events or when exposed to repeated traffic, the near surface lean clay soils may become unstable and require over excavation and replacement or stabilization.** The amount of over excavation will be dependent upon conditions encountered during construction.

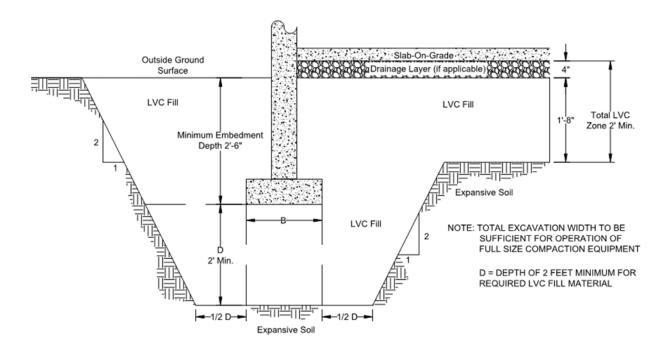
8.4 Undocumented Fill Near Existing Structures

Undocumented fill was not encountered in the subsurface exploration but is anticipated near existing structures. If undocumented fill is encountered during construction, foundations and slabs-on-grade should not bear over undocumented fill material. Foundations should either be extended through undocumented fill or be removed and replaced with controlled, engineered fill as described in Section 9. If undocumented fill is encountered in slab-on-grade areas, it should be removed and replaced as described in Section 9.



8.5 Moderate Volume Change Material

Based on laboratory testing of samples from the project site, soils with moderate swell potential were noted. These materials can excessively swell and sometimes shrink with the addition or evaporation of moisture. The excessive swelling can cause cracks in foundations, concrete slabs, and pavements to form. The material prone to swell at the project site includes materials noted as Lean to Fat Clay (CL-CH), Fat Clay (CH), and materials designated as shaley. Where these materials are present within 2 feet below the bottom of foundations or slabs-on-grade, a minimum of 2 feet of Low Volume Change (LVC) material should be established beneath foundations and slabs-on-grade. The LVC material should also extend a minimum of 12 inches beyond the footing width and be sloped up at a 1H:2V angle as shown in the below image. Material suitable as LVC material is described in Section 9.4 and includes treated soils as described in Section 9.2.



Moderate swell potential materials may also be encountered in pavement areas. Where moderate swell potential material is encountered in proposed road areas, moisture contents of the subgrade soils should be adjusted and **maintained** above

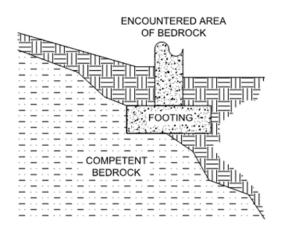


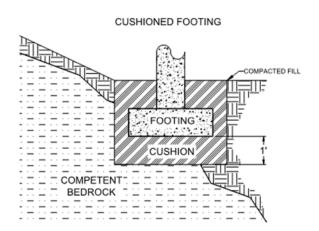
optimum to limit the potential for shrink/swell and a minimum of 1-foot of expansive material should be removed and replaced with LVC material.

8.6 Shallow Bedrock Considerations

The subsurface exploration program encountered areas of shallow bedrock and shallow auger refusal at the project site. Bedrock at the project site consists of variable units of shale and sandstone with highly variable degrees of weathering. Because of the variable degrees of weathering there is the potential for structures to encounter a condition where areas of intact, competent bedrock are mixed with relatively soft soils. In view of the increased potential for differential settlement between foundation units installed upon bearing strata with widely varying compressibility characteristics (incompressible bedrock versus firm clay), one of the following corrective measures should be implemented if bedrock is exposed in footing excavations or immediately below footing bottom elevation:

The bedrock be over-excavated sufficient to allow placement of a minimum 12-inch "cushion" below footing bottoms as shown below. This "cushion" material may consist of a well-compacted low plasticity earth fill (if no groundwater is present), shot rock fill or compacted baserock. Bedrock heaved by blasting is not considered acceptable as cushion material. Caution should be exercised to limit over-shot of bedrock.





 Sufficient reinforcing steel added to the footing/foundation wall system in order to allow the footing/foundation wall to span at least 20 feet each side of the



edge of rock. Further, use of building components sensitive to differential settlement (plastic, masonry veneer, glass, etc.) should be prohibited at the edge of rock where there is an abrupt change in support characteristics.

8.7 Shallow Groundwater Considerations

Groundwater was encountered during the subsurface exploration at depths between 0.5 and 13 feet below the ground surface. As previously mentioned, water levels at the subject site should be anticipated to fluctuate with seasonal changes in moisture. Contractors should be prepared to encounter areas of shallow groundwater at the subject site. Generally, the shallow groundwater should be able to be removed with conventional pumping equipment; however, construction below the lake water table, if required, may require additional drainage systems to be implemented. PPI can provide these recommendations if needed.

8.8 Summary of Anticipated Geotechnical Considerations Per Structure

A table has been provided below based on the subsurface exploration and laboratory testing summarizing the geotechnical considerations noted within <u>Section 8</u>. Due to the relatively widely spaced borings at the subject site, some conditions may exist at the structures that were not present with the borings performed. If such conditions are encountered during construction, PPI should be contacted to provide additional recommendations.

Location	Surface Boulders	Moisture Sensitive Lean Clay	Moderate Swell Potential	Possible Area Undocumented Fill	Shallow Bedrock	Shallow Groundwater
Entry Areas	X	X	-	X	-	×
Community Center	Х	Х	Х	-	Х	-
Cultural Center	Х	Х	Х	-	Х	-
Amphitheater	Х	Х	Х	-	-	-
Southeast Bank Premium Lake Cabins	Х	Х	Х	-	Х	Х



Location	Surface Boulders	Moisture Sensitive Lean Clay	Moderate Swell Potential	Possible Area Undocumented Fill	Shallow Bedrock	Shallow Groundwater
Central Inland Premium Lake Cabins	Х	Х	Х	-	Х	-
Northeast Bank Premium Lake Cabins	Х	Х	-	Х	Х	-
Executive Cabins	Х	Х	-	-	Х	-
Stables	Х	Х	-	-	-	-
Rodeo Area	Х	Х	Х	-	Х	Х
Manager's Residence	Х	Х	-	-	-	-
General Store	Х	Х	Х	-	Х	-
Pool Area	Х	Х	-	Parking/Drive Area	Х	-
Group Pavilions	Х	Х	Х	Х	Х	-
Payment Kiosk	Х	Х	-	-	-	-
Flag Poles	Х	Х	Х	-	-	-
Helipad	Х	-	Х	-	Х	-
Marina Building and Restaurant	Х	Х	Х	-	-	х
Storm Shelter West	Х	-	Х	-	Х	Х
Storm Shelter East	Х	Х	-	-	Х	-
Picnic Pavilions	Х	Х	Х	Nearby Loop Area	Х	-

9.0 EARTHWORK

Earthwork for the proposed National Cherokee Nation Park will be dependent on the structure and location of the structure within the project site. A summary of anticipated geotechnical considerations per structure has been included in <u>Section 8.8</u> to assist in identifying these conditions during construction.

9.1 Site Preparation

Grading plans for the National Cherokee Nation Park were not provided. Grading for the project site is anticipated to be highly variable across the project site and per structure. Large cuts or fills are anticipated on along the southeast bluff in the location



of the proposed cabins. Moderate cut and fills of 5 feet or less are anticipated for all other locations. The initial phase of site preparation should include the steps listed below;

- It is recommended that a representative from PPI be present during site preparation to help identify the conditions described below;
- Stripping and removal of all topsoil and vegetation as Describe in Section 8.1;
- Any loose boulders in building areas, fill areas, or pavement areas should be removed from the construction area as noted in Section 8.2;
- Areas of lean clay may be sensitive to moisture and require over excavation and replacement or stabilization if exposed to rain, excessive moisture, or repeated traffic as described in <u>Section 8.3</u>;
- Areas containing undocumented fill, if encountered, should be stripped and replaced, or measures taken as described in <u>Section 8.4</u>;
- Fat clay, moderate plasticity clay, and all shaley clay within 2 feet of at grade slabs and foundations should be removed and replaced or treated as described in Section 8.5;
- Structure areas that encounter a combination of partial rock and soil bearing should be treated as noted in Section 8.6;
- All areas scheduled to receive new fill should be proof-rolled as described below.
 Fill should not be placed on a frozen subgrade.

Proof-rolling consists essentially of rolling the ground surface with a loaded tandem axle dump truck or similar heavy rubber-tired construction equipment and noting any areas which rut or deflect during rolling. All soft subgrade areas identified during proof-rolling should be undercut and replaced with compacted fill as outlined below. Proof-rolling, undercutting, and replacement should be monitored by a qualified representative of the Geotechnical Engineer. The depth and areal extent of undercutting will be largely dependent upon the time of year and related soil moisture



conditions. If construction is initiated during wetter spring or winter months, the requirement for undercutting soft surficial soils below normal topsoil stripping should be anticipated and reflected in contract documents. However, even during summer months it is possible to encounter soft and saturated subgrade conditions. As previously mentioned, lean clays at the project site are moisture sensitive and may pose difficulties regarding subgrade stability and proper compaction.

9.2 Treated Soils

Chemical stabilization is an alternate for utilizing the on-site moderate to high plasticity clay and shaley clay generated from undercutting procedures. It is recommended that chemically stabilized clays be placed in 6 to 9-inch lifts and compacted to specified densities. Use of approximately 6 percent hydrated lime or 15 percent Type C Flyash, by weight, should be anticipated. With CH or CL clays chemically stabilized, it is considered applicable to place this material at all locations and elevations within the proposed pavement areas. Treated soils can be used in place of LVC material in all locations.

9.3 Scarifying and Recompacting

All subgrade areas approved after proof-rolling should be scarified to a depth of at least 8 inches and soil moisture adjusted and compacted to comply with project specifications.



9.4 Fill Material Types

Fill Type ¹	USCS Classification	Acceptable Location for Placement
Low Volume Change (LVC) Engineered Fill ²	Non-shaley CL, GC, or SC (LL < 45) And treated soils as described in <u>Section 9.2</u>	All locations and elevations
On-Site Natural Soils	CL, SC, GC	All locations and elevations
On-Site Natural Solis	CL-CH ³ , CH ³	See Note 3
Rock Fill ⁴	GW	All locations and elevations

- 1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris and contain maximum rock size of 4 to 6 in. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to its use.
- 2. Low plasticity cohesive soil or granular soil having at least 15% low plasticity fines.
- 3. CL-CH or CH clays with a Liquid Limit equal to or above 45 are considered suitable for use as controlled fill, only if the percentage of rock fragments exceeds 35% or if placed 2 feet below shallow foundations, pavements, or slab areas.
- 4. If rock is to be used as the primary filling medium, embankments should be constructed using rock having maximum dimensions in excess of 4 inches, but no greater than 8 inches. Rock material should be placed in horizontal layers having a thickness of approximately the maximum size of the larger rock comprising the lift, but not greater than 12 inches. Rocks or boulders too large to permit placing in a 12-inch thick lift should be reduced in size as necessary to permit placement or be bladed over the edge of the fill and not used in the compacted fill. Rock fill should not be dumped into place but should be distributed in horizontal lifts by blading and dozing in such a manner as to ensure proper placement into final position in the embankment. Finer material including rock fines and limited soil fines should be worked into the rock voids during this blading operation. Excessive soil and rock fine particles preventing interlock of cobble and boulder sized rock should be prohibited. Rock fill should be consolidated by a minimum of three (3) passes of a large diameter self-propelled vibratory compactor. Terminal fill slopes using rock may be constructed 1.5 horizontal to 1 vertical for fill height of 15 feet or less. The testing of rock fill quality should include the requirements that a representative of the Geotechnical Engineer be present daily, but not necessarily continuously during the placement of the fill to observe the placement of rock fill in order to determine fill quality and to observe that the contractors work sequence is in compliance with this specification. Progress reports indicative of the quality of the fill should be made at regular intervals to the Owner. If improper placement procedures are observed during the placement of the fill the Geotechnical Engineer should inform the Contractor. and no additional fill should be permitted on the affected area until the condition causing the low densities has been corrected and the fill has been reworked to obtain sufficient density.



9.5 Compaction Requirements

Item	Description
Subgrade Scarification Depth	At least 8 inches
Fill Lift Thickness	8-inch (loose)
Compaction Requirements ¹	 <u>Coarse Grained Material with little or no fines:</u> 70% Relative Density, or compacted by a minimum of three (3) passes of a self-propelled smooth drum vibratory compactor. <u>Fine Grained Material:</u> 95% Standard Proctor Density (ASTM D-698)
Moisture Content	 ± 2% optimum moisture for CL, SC, or GC soil types; or 0 to 4% above optimum for CL-CH or CH soil types
Recommended Testing Frequency	 One (1) Field Density (compaction) test for each 2,500 sq. ft. of fill within building areas; One (1) Field Density (compaction) test for each 5,000 sq. ft. of fill within paving areas; and A minimum of three (3) tests per lift.

We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

9.6 Landscaping & Site Drainage

Discharge from roof downspouts should be collected and diverted well away from building perimeters and incorporated into the design plans. Rapid, efficient runoff away from buildings should also be provided. In addition, landscaping requiring frequent watering should be prohibited adjacent to building foundations.

In addition, provisions should be implemented to reduce the potential for large fluctuations in moisture within the subgrade soils adjacent to the structure. Ponding of surface water immediately adjacent to the structures and pavements can significantly increase subgrade moisture and may result in undesirable subgrade movement. As previously mentioned, careful consideration should be given to the landscaping and drainage elements to be installed at the project site adjacent to building and pavement areas. **Trees and some large bushes can draw significant**



moisture from the subgrade soils, resulting in shrinkage and subsequent foundation/pavement movement.

9.7 Earthwork Construction Considerations

Once grading and filling operations have been completed, the moisture within subgrades should be maintained and soils not be allowed to dry and desiccate prior to construction of floor slabs and footings. Grading of the site should be performed in such a manner so that ponding of surface water on prepared subgrade or in excavations is avoided. During construction, if the prepared subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be scarified or removed, moisture conditioned and recompacted prior to floor slab construction.

9.8 Excavations

Based upon the subsurface conditions encountered during this investigation, the onsite soils typically classify as Type C in accordance with OSHA regulations. Temporary excavations in soils classifying as Type C with a total height of less than 20 feet should be cut no steeper than 1.5H:1V in accordance with OSHA guidelines. If stable sandstone/shale bedrock is encountered in excavations, the bedrock may be cut to near vertical sidewalls. Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), is the responsibility of the contractor.

9.9 Inclement Weather

If construction is initiated during wetter months, the requirement for undercutting soft surficial soils below normal site stripping should be anticipated and reflected in contract documents. Undercut depths on the order of 2 or more feet are considered possible within structure footprints. Based upon past experience of this firm, the shallow lean clay subgrade at the site is known to significantly lose strength when saturated and disturbed by construction equipment. Further, material removed from undercuts may not be suitable for use as compacted fill due to high soil moisture if poor drying conditions (cool



temperatures and/or frequent precipitation) occur during site grading. If the construction schedule will not permit delay for better drying conditions, the project budget should include an allowance for subgrade undercut and replacement with soil material containing appreciable quantities of rock fragments, treated soils as described in Section 9.2, or sand and gravel from an off-site borrow area that meet the requirements above. As an alternate to select fill, rock fill subbase (4 to 8-inch top size stone) may be placed to improve subgrade stability.

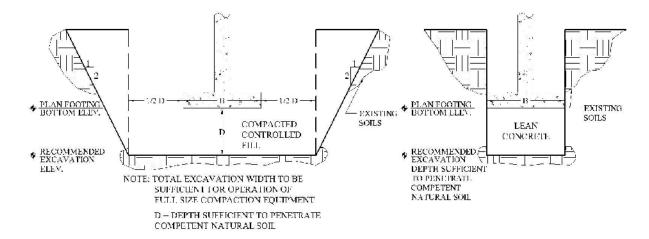
10.0 FOUNDATIONS

As previously noted, foundations for the proposed structures will be dependent on the structure's location on the project site. Refer to Section 8.8 for a summary of anticipated geotechnical conditions that may affect building foundations. Structures at the project site are anticipated to bear on native soils, controlled fill, bedrock, and combinations of those three materials. Foundations for the structures at the project site are anticipated to be primarily shallow, spread foundations or turned-down slabs with primarily light foundation loads. Drilled pier recommendations have been included for the proposed bridge located at the northeast corner of the project site. Drilled pier recommendations are meant only for the proposed bridge. Drilled pier recommendations can be provided for other structures, if necessary, upon request.

10.1 Shallow Building Foundations

As previously noted, footings for the proposed structures are anticipated to bear in stiff natural soils, controlled fill, bedrock, or a combination of those three materials. If isolated shallow rock is encountered, the shallow rock should be over excavated and replaced to provide a cushion as described in <u>Section 8.6.</u> Foundations for the proposed buildings should be extended through soft soils and through undocumented fill, if encountered, to bear on native soils. Alternatively, soft soils or undocumented fill should be removed and replaced with compacted, controlled fill or lean concrete as noted in the figure below. If expansive soils are encountered, they should be treated as noted in Section 8.5.





Please refer to the section below for recommendations regarding shallow foundations.

10.2 Shallow Foundation Design Recommendations

Description	Column (Spread Footing)	Wall (Continuous Footing)
Net allowable bearing pressure ¹	Soil: 2500 psf Bedrock: 5,000 psf	Soil: 2000 psf Bedrock: 5,000 psf
Minimum dimensions	2.5 feet	1.5 feet
Minimum embedment below finished grade for frost protection and variation in soil moisture ² (footings on soil)	2.0 feet	2.0 feet
Estimated total settlement ³	Soil: 1 inch or less Bedrock: Less than ½ inch	Soil: 1 inch or less Bedrock: Less than ½ inch
Allowable passive pressure ⁴	600 psf	600 psf
Coefficient of sliding friction ⁵	0.4 (natural soils/fill)	0.4 (natural soils/fill)

- 1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed. A factor of safety value of 3 has been applied to these values.
- 2. For perimeter footings and footings beneath unheated areas.
- 3. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations.
- 4. Allowable passive pressure value considers a factor of safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2 feet of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell.
- 5. Coefficient of friction value is an ultimate value and does not contain a factor of safety.



10.3 Uplift

Resistance of shallow spread footings to uplift (U_p) may be based upon the dead weight of the concrete footing structure (W_c) and the weight of soil backfill contained in an inverted cone or pyramid directly above the footings (W_s) . The following parameters may be used in design:

Description	Weights
Weight of Concrete (Wc)	150 pcf
Weight of Soil Resistance (Ws)	100 pcf
Weight for on-site soils placed in ac	cordance with <u>Section 8</u>

The base of the cone or pyramid should be the top of the footing and the pyramid or cone sides should form an angle of 30 degrees with the vertical. Allowable uplift capacity (U_p) should be computed as the lesser of the two (2) equations listed below:

$$U_P = (W_S/2.0) + (W_C/1.25)$$
 or $U_P = (W_S + W_C)/1.5$

10.4 Drilled Pier Recommendations for Bridge Foundations

The below drilled pier recommendations have been provided for the proposed bridge location only. Drilled shafts for the proposed bridge are anticipated to bear in shale bedrock. Drilled pier shafts should be installed straight with <u>no</u> underreaming due to the competent shale encountered within the subsurface exploration. Drilled shafts may be designed using an allowable bearing pressure of 20 ksf. This allowable bearing pressure may be utilized for the entire width of the bottom of the drilled shaft. It is recommended that drilled shafts have a minimum shaft diameter of 18-inches. A minimum embedment into the weathered shale unit of 5 feet is recommended. However, deeper embedment depths may be required to resist uplift and/or lateral loads.

Drilled shafts should be free of all loose and/or soft soils at the time of concrete placement. Concrete placement below more than 2 to 3 inches of water should be placed using a tremie. It is recommended that drilled shafts be examined by a representative of the Geotechnical Engineer to assure a relatively flat pier bottom, a plumb pier shaft and competent shale consistent with the recommended bearing



pressures, as well as removal of essentially all groundwater prior to concrete placement. In case shallow groundwater or caving soils are encountered, use of temporary casing should be anticipated and should be on-site prior to commencement of drilling.

10.4.1 Uplift Resistance for Drilled Shafts

For resistance to the total uplift, <u>only</u> the side friction of the sidewalls of the drilled shaft that penetrates into the shale bedrock a minimum depth may be applied. To calculate resistance to the total uplift, an allowable side friction of 1,300 psf may be used for shale.

10.4.2 Lateral Loadings

It is anticipated that resistance of the foundations to lateral loading and the associated lateral deflection will be evaluated using finite difference computer models based on the horizontal modulus of subgrade reaction (Kh). The following values may be used in the analysis for this site.

Pier Depth	Unit Weight (pcf)	Static K _h (pci)	Cyclic K _h (pci)	Fiction Angle (°)	Cohesion S _u (psf)	Uniaxial Compressive Strength (psi)	e ₅₀	
*0-1 Pier Diameter	Ignore	-	-	-	-	-	-	
*1 Pier Diameter to 10 feet	125	680	280	-	2,000	-	0.006	
10 feet to 30 feet	140	2000	800	30	-	150	0.002	
*Lateral parameters for the upper 1 pier diameter, or 2.5 feet, whichever is shallower, should be ignored.								

The above values were measured or based upon published correlations with anticipated soil strength and classification tests.

11.0 BELOW GRADE POOL CONSIDERATIONS

Pool and aquatics features are greatly susceptible to settlement and movements due to the rigidity of the materials they are generally constructed of. Total allowable differential settlements of pool shell are often ½-inch for skimmer filtered systems and as little as ¼-inch for gutter skimmer systems. Additionally, because these features contain water often



chlorinated or salted, failures in the structures typically experience larger movements due to the introduction of water to the subgrade. Therefore, it is important that pool designs take into consideration site specific geotechnical considerations and that a proper pool design includes both the liner and the subgrade. Proper maintenance operations are also vital in the longevity of a pool/aquatics system and should not be overlooked.

It is anticipated that the proposed pool/aquatics area will be an outdoor feature with no controlled heating/cooling. Accordingly, it is anticipated that the pool will be closed and possibly drained during winter months. Due to the potential for frost induced movement, pool features not bearing on bedrock should be surrounded by a minimum of 2 feet of frost resistant material. Frost resistant material should consist of clean gravels having less than 10 percent fines. It is recommended that a filter fabric be utilized between soils and frost material to limit fine migration. A drainage system may also be required to limit water ponding within this material, especially when the base of the granular material is near bedrock elevation.

As noted in <u>Section 8</u>, the proposed pool and aquatics area at the project site was noted to contain shallow bedrock. Individual pool and aquatics features should bear on uniform bearing material and partial bearing on bedrock and partial on soil should be avoided due to the possibility of differential settlement and associated structure cracking. This may require over excavation of bedrock and replacement with a non-frost susceptible material with a proper drainage system as described above.

Below is a list of geotechnical items to be considered for pool and aquatic park systems:

• Groundwater Concerns: No indications of groundwater were noted in the soil exploration near the pool area; however, due to the presence of shallow shale and sandstone bedrock, ground water may perch temporarily over the bedrock. While the pool is filled this is not a concern; however, when the pool is drained this ponding of water may create enough buoyant force to lift the pool shell out of the ground. It is recommended that pools not placed directly on bedrock contain a proper under-pool drainage system to capture possible ground water and remove it from below the pool system;



- Isolated Pool Shells: Due to a pool's increased sensitivity to settlement, the pool shell should be isolated from any structure that may increase the possibility of settlement. Foundations from building and other structures should be kept a minimum of 2 foundation widths away from the edge of the pool shell. Additionally, it is not recommended that pool decks be tied into the pool shell;
- Expansion Joints: Expansion joints within a pool system should be avoided if possible. Due to the degradation of expansion joints with time, expansion joints are prone to leaking and are often the first areas of failure of pool systems. Leaking in these areas can cause increased swelling or erosion of subsurface soils. If expansion joints are utilized, they should be evaluated and maintained on a regular schedule.
- Design for At-Rest Wall Conditions: Pool side walls should be designed for At
 Rest wall conditions as backfill material will generally not be able to be placed
 properly behind pool walls. Design recommendations for at rest wall conditions
 are provided below;
- Pool Construction: Care should be taken during construction and once the pool system has been installed to not introduce surcharge loads on the pool shell with heavy machinery or by other means; and
- Expansive Soils: Due to the possibility of shrink and swell potential of the native shaley soils, it is considered essential that moisture content be adjusted and maintained above optimum for all exposed shaley clay and clays with a liquid limit of 45 percent or more to limit the potential for shrink/swell. Additionally, shaley clays and clays with liquid limits of 45 percent or more should be removed from beneath the pool and from the walls of the pool a minimum of 30 inches and replaced with an LVC material; however, this is anticipated to be accomplished with the installation of non-frost susceptible material.



11.1 Pool Lateral Earth Pressure Design

The below table should be used for pool wall design parameters only:

Soil Material	Level Backfill					
3011 Waterial	Equivalent Fluid Pressure	K _o				
Lean Clay	85 pcf	0.7				
Fat Clay	75 pcf	0.6				
Clean Crushed Stone*	50 pcf	0.4				
*For pool walls of 3 feet or less						

12.0 LATERAL EARTH PRESSURE FOR BELOW GRADE WALLS

Retaining wall backfill should consist of free-draining crushed stone or alternatively, may consist of lean clay with appreciable chert fragments. Depending upon the type of backfill selected and degree of wall restraint, the following table of lateral earth pressures are considered appropriate for wall design.

For backfill sloped other than 2H:1V, interpolate between values given in the table below for level and sloped backfill.

NOTE: Structural design of unrestrained walls should permit wall rotation at top of wall equal to 1/240th of wall height.

Type of Backfill	Drained Level Backfill			Drained Sloped Backfill (2H:1V)*				
	Restrained Walls		Unrestrained Walls		Restrained Walls		Unrestrained Walls	
	Equivalent Fluid Pressure	K	Equivalent Fluid Pressure	K	Equivalent Fluid Pressure	K	Equivalent Fluid Pressure	K
Compacted Lean Clay (CL) or Cherty Clay >35% + No. 4 Sieve	70 pcf	0.6	45 pcf	0.4	80 pcf	0.7	55 pcf	0.5
Clean Crushed Stone	50 pcf	0.4	35 pcf	0.25	60 pcf	0.5	45 pcf	0.35
Rock Fill (Free Draining)	50 pcf	0.4	35 pcf	0.25	60 pcf	0.5	45 pcf	0.35

If crushed stone backfill is selected and wall design in accordance with the above equivalent fluid pressures, the crushed stone backfill should be placed within a boundary



projecting 30 degrees from the vertical commencing at a point 1 foot out from the base of wall. Regardless of the backfill type selected, an impervious moisture barrier should be applied to the basement wall. In addition, if lean clay backfill is selected, a geosynthetic drainage mat should be applied to the wall to assure removal of subsurface water. A perforated pipe should be laid at the base of wall to collect and remove subsurface water either from free-draining crushed stone or drainage mats. Flow line of the perforated pipe should be laid below basement finished floor.

13.0 SEISMIC CONSIDERATIONS

Code Used	Site Classification
2012 International Building Code (IBC) ¹	С
1. In general accordance with the 2012 International	Building Code, Section 1613

14.0 FLOOR SLABS

Details of floor slab and slab-on-grade construction will be dependent on the structure's location at the project site as noted above. For geotechnical consideration affecting the proposed floor slabs and slabs-on-grade refer to <u>Section 8</u>. Slab-on-grade or slab-on-fill floor systems are considered appropriate at the site based upon subsurface conditions encountered and future site grading. Listed below are key considerations for design purposes of floor slabs.

- Subgrades containing fat clays (CH) or shaley clays in floor slab areas should be over excavated and replaced as described in Section 8.5;
- Subgrade materials containing undocumented fills, if encountered, in the areas of floor slabs should be proof-rolled prior to the construction of floor slabs. Areas not passing the proof rolled should be treated as noted in <u>Section 8.4</u>;
- Prior to placement of controlled fill, if any, natural soils should be scarified, moisture content adjusted and re-compacted in accordance with <u>Section 9</u> of this report; and
- Prior to slab placement, soil moisture should be adjusted and maintained within the parameters specified in <u>Section 9</u> of this report.



Placement of 4 or more inches of compacted free-draining granular base course below slabs that are <u>not</u> below grade is recommended to limit moisture rise through slabs and to improve slab support, particularly at joints. An impervious moisture barrier consisting of 6-mil plastic sheeting or equivalent should be provided in accordance with the 2012 IBC. Use of a 10-mil vapor barrier is recommended below all slab areas with an intended use sensitive to slab moisture.

15.0 PAVEMENT

Pavement subgrades should be prepared in accordance with <u>Sections 8 and 9</u> of this report. If fat clays are exposed during road construction, a minimum of 12 inches of soil beneath the pavements should be removed and replaced with LVC material as described in <u>Section 8.5</u>. It is considered essential that moisture content be adjusted and <u>maintained</u> above optimum for all exposed CH clays to limit the potential for <u>shrink/swell</u>. It is anticipated that any new pavements associated with this project will be constructed of either an asphaltic concrete wearing surface placed over a base or a rigid Portland Cement Concrete pavement over a granular base.

15.1 Flexible Pavement

If asphaltic paving is selected, the aggregate base may be a granular compacted crushed limestone with a gradation and quality conforming to the requirements of the Oklahoma Department of Transportation (ODOT), Standard Specification 703.01 for Type A aggregate. The maximum lift thickness for the granular base is 4 in. Granular base thicknesses in excess of 4 in. should be placed in multiple lifts with each lift being of approximately equal thickness. The granular base should be compacted to at least 100% of Standard Proctor Compaction (ASTM D-698).

Asphaltic concrete, both base and surface, should conform to the applicable requirements of ODOT Standard Specification 708. Asphaltic concrete should be compacted to 92 to 96% of Maximum Theoretical Gravity (ASTM D-2041). Substitution of an appropriate Superpave Mix Design, SP 190C or SP 250C, can be used in place of the bituminous base. SP 190C or SP 125C may be used for the surface. All



bituminous mix designs should have been prepared or verified within 6 months of the date of placement on the project.

15.2 Rigid Pavement

If rigid concrete paving is selected, a minimum 4-in. thickness granular base compacted to 100% of Standard Proctor should be placed on the prepared subgrade. The Portland Cement Concrete (PCC) mix should have a minimum 28-day compressive strength of 4000 pounds per square inch (psi). Concrete should be placed at a low slump (1 to 3 inch) and have an entrained air content of 5 to 7%. If an increased slump is desired, use of Super Plasticizer is recommended.

15.3 Pavement Thickness

A pavement thickness would best be computed if traffic frequencies and wheel loadings were provided to us, but a typical pavement design for this type of facility would generally generate a Structural Number of 3.0 to 3.5 within heavy duty areas and 2.4 to 2.6 within light duty areas, depending on the subgrade conditions. The following table presents corresponding typical flexible and rigid pavement thicknesses using the general Structural Numbers. The pavement thicknesses provided below are conservative and can be re-evaluated if a final grading plan, traffic frequencies and wheel loadings are provided, if desired.

Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)
	Heavy Duty 3.0 4.0 - Heavy Duty w/ Tensar TX5 Geogrid* 3.0 3.0 - Light Duty 2.0 2.0 -	6.0			
Flexible Tel		3.0	3.0	-	6.0
Pavement	Light Duty	2.0	2.0	-	6.0
	Light Duty w/ Tensar TX5 Geogrid*	3.0	3.0 - 6.0		
Rigid	Heavy Duty	-	-	7.0	4.0
Pavement	Light Duty	Surface ency Aspnattic Base (in.) Concrete Thickness (in.) Duty 3.0 4.0 - Outy w/ Geogrid* 3.0 3.0 - Duty 2.0 2.0 - W/ Tensar ogrid* 3.0 - - Duty - - 7.0	4.0		

^{*}Geogrid to consist of Tensar TX5, installed below aggregate baserock section per manufacturer's recommendations.



As mentioned above, a more accurate pavement thickness can be computed if anticipated traffic frequencies and wheel loadings are provided to PPI. The above thicknesses are considered approximate since actual pavement loading has not been provided.

16.0 CONSTRUCTION OBSERVATION & TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Since geotechnical engineering is influenced by variable depositional and weathering processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the Geotechnical Engineer the opportunity to evaluate assumptions made during the design process. Therefore, we recommend that PPI be kept apprised of design modifications and construction schedule of the proposed project to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study. We recommend that during construction all earthwork be monitored by a representative of PPI, including site preparation, placement of all engineered fill and trench backfill, and all foundation excavations as outlined below.

- An experienced Geotechnical Engineer or Engineering Technician of PPI should observe the subgrade throughout the proposed project site immediately following stripping to evaluate the native clay, identify areas requiring undercutting, and evaluate the suitability of the exposed surface for fill placement;
- An experienced Engineering Technician of PPI should monitor and test all fill placed within building and pavement areas to determine whether the type of material, moisture content, and degree of compaction are within recommended limits;



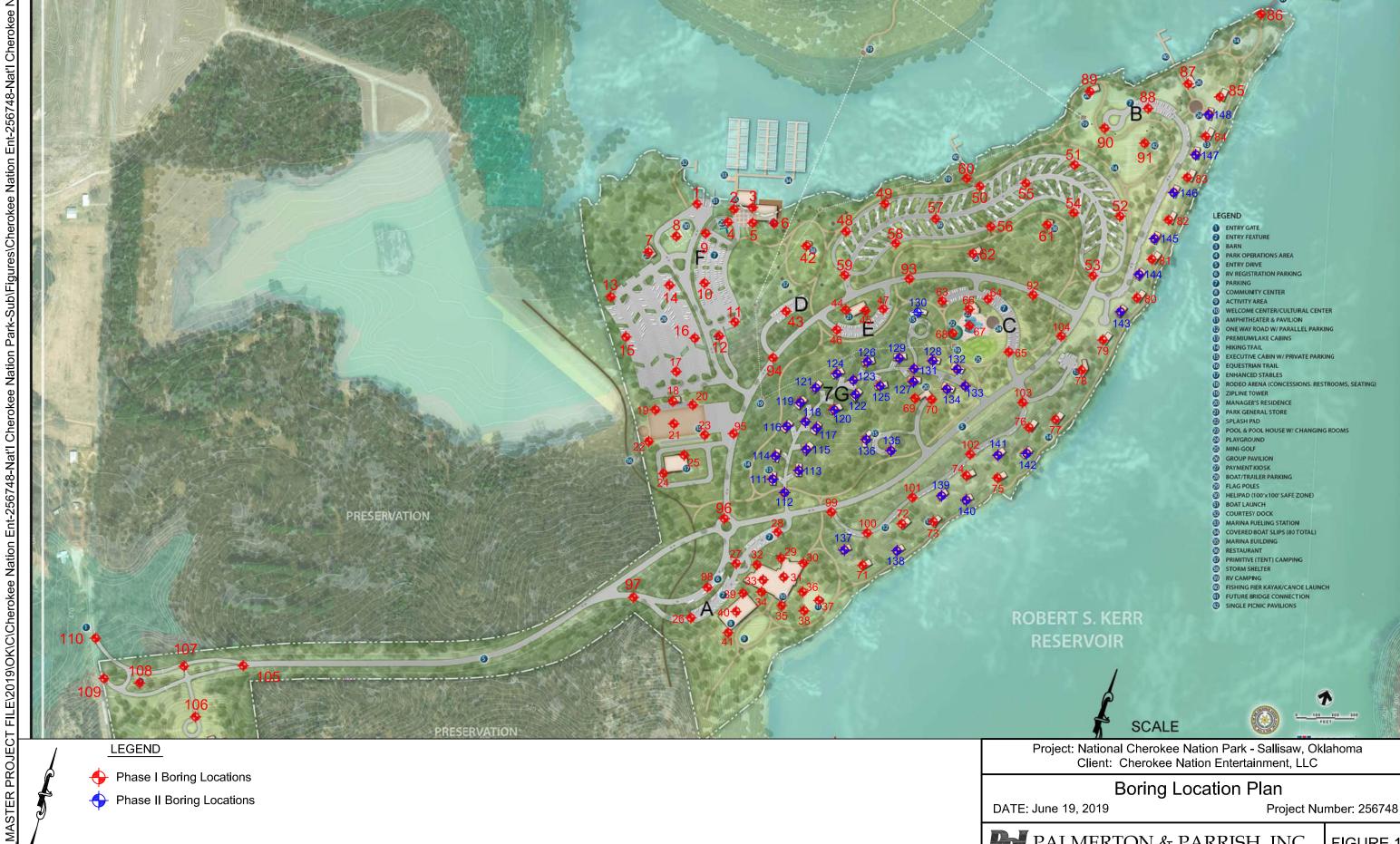
- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays; and
- The condition of the subgrade should be evaluated immediately prior to construction of building floor slabs to determine whether the moisture content and relative density of the subgrade soils are as recommended.

17.0 REPORT LIMITATIONS

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Palmerton & Parrish's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.



APPENDIX I - FIGURES



Phase I Boring Locations Phase II Boring Locations

SCALE: 1"=450'

Boring Location Plan

Project Number: 256748 DATE: June 19, 2019



FIGURE 1



APPENDIX II - BORING LOGS & KEY TO SYMBOLS

GEOTECHNICAL BORING LOG

BORING NUMBER

PAGE 1 OF 1

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	DRIL	LER CW	1		DRILL RIG 2015 CME 55	GROU	ND WAT	ER L	EVELS						
	HAM	MER TYPE	E Auto				AT TIME	OF D	RILLING	1 ft					
	LOG	GED BY _	CJ		CHECKED BY BP		AT END	OF DI	RILLING	1 ft					
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ROJ					Bottom of borehole at 11.2	feet.									
ERF															
MAS															
-S:\															
9:07															
/19 0															
./2 - 1															
:GD															
LATI															
TEM															
STD															
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:07 - S._MASTER PROJECT FILE\(\crite{100}\) FILE\(\crite{100}\) OK\(\crite{100}\) CHEROKEE INTION ENT-256748-NAT\(\crite{100}\) CHEROKEE NATION PARK-SUBBORING LOGS\(\text{BORING LOGS\(\crite{100}\)}\) GRING LOGS\(\crite{100}\)															
PPI															
LOG															
SING															
BOR															

GEOTECHNICAL BORING LOG

BORING NUMBER

GE 1 OF 1

### Rev. 1 ### COMPLETED _2/20/19 ### DRILL RIG _2015 CME 55 ### CHECKED BY _BP	PROJE SURFA GROUI	CT LOC CE ELE ND WAT AT TIME	EVATION TER LI		aw, Ok 0.5 ft	B	ENCH	MARK E			
DRILL RIG 2015 CME 55 CHECKED BY BP	SURFA GROUI	CE ELE ND WAT AT TIME	EVATION OF D	ON EVELS RILLING	0.5 ft	B					
DRILL RIG _2015 CME 55 CHECKED BY _BP	GROU!	ND WAT	ER LI	EVELS RILLING	0.5 ft						
CHECKED BY BP	A	T TIME	OF D	RILLING							
CHECKED BY BP											
		AT END	OF DI	rilling _	0.5 ft						
						•			T (pcf)	•	
		Ъ	%	D S	j	20) 60 N VALU			_
MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2			0 80		ELEVATION (ft)
		ole JMB	불용	A SE	(tsf)		PL	МС	LL		₹€
Unified Soil Classification System		AMF	S S S	à S S	OC	2	20	40 6	80		Щ
		Ś		В	Д.	□ SI	HEAR	STREN	GTH (ksf		
	0.3 #						<u>1</u>	2 3	3 4		
		SPT		0-1-1	0.5	▲ ⊢	: 				
SANDY LEAN CLAY, w/ Gravel, Trace Roots,	Tan,	1		(2)	0.0			:			
Soft, Moist (CL)		-	1								
	3 O ft						:				
SANDY FAT CLAY Tan Stiff to Very Stiff Moi											
orang river object, run, cun to very cum, men	101 (011)	CDT									
		2		5-5-7 (12)	1.75		0				
Increasing Intermittent Layers of Weathered Sha With Depth Below 4-5'	ale		-				: : :				
Will Bopti Bolow 1.0								•			
	6.5 ft			40.0.40							
SHALE, Highly Weathered, Gray to Tan, Soft to	0	SPI 3			2.25		(2)				
Medium Hard			1								
							:				
		SPT		27-56-	2.75						
		4		65/2"	2.75		<u>(</u>			Ť	
								•			
							:				
	13.0 ft										
SHALE, Gray, Medium Hard	13.7 ft					0					
Refusal at 13.7 feet.		SPT 5		65/2"	4.5	<u> </u>		•			
Bottom of borehole at 13.7 feet.			l								
Bottom of borehole at 13.7 feet.			,								
	Soft, Moist SANDY LEAN CLAY, w/ Gravel, Trace Roots, Soft, Moist (CL) SANDY FAT CLAY, Tan, Stiff to Very Stiff, Mo Increasing Intermittent Layers of Weathered Shawith Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard SHALE, Gray, Medium Hard Refusal at 13.7 feet.	Soft, Moist SANDY LEAN CLAY, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' 6.5 ft SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SHALE, Gray, Medium Hard 13.7 ft Refusal at 13.7 feet.	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SHALE, Gray, Medium Hard 13.7 ft Refusal at 13.7 feet.	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SPT 4	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SHALE, Gray, Medium Hard 13.0 ft Refusal at 13.7 feet.	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, W/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SHALE, Gray, Medium Hard 13.7 ft Refusal at 13.7 feet.	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, W/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SPT 2 SPT 3 SPT 4 SPT 4 SPT 2 27-56-65/2" A.5 SPT 4 SPT 5	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist (Noist Sandy Lean Clay, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SPT 4 SPT 4 SPT 65/2" 4.5	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist Soft, Moist SANDY LEAN CLAY, w/ Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SPT 4 SPT 4 SPT 65/2" 4.5	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, W/ Gravel, Trace Roots, Tan, Soft, Moist (CL) SANDY LEAN CLAY, W/ Gravel, Trace Roots, Tan, Soft, Moist (CL) SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5' SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard SPT 27-56-65/2" SPT 4 3 3 4 4 4 4 5 5 4 4 5 5 6 6 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TOPSOIL - SANDY LEAN CLAY, Dark Brown, Soft, Moist SANDY LEAN CLAY, W Gravel, Trace Roots, Tan, Soft, Moist (CL) 3.0 ft SANDY FAT CLAY, Tan, Stiff to Very Stiff, Moist (CH) Increasing Intermittent Layers of Weathered Shale With Depth Below 4.5 SHALE, Highly Weathered, Gray to Tan, Soft to Medium Hard 13.0 ft SHALE, Gray, Medium Hard 13.7 ft SHALE, Gray, Medium Hard 13.7 ft SPT G5/2* 4.5

GEOTECHNICAL BORING LOG

BORING NUMBER

			ation Entertainment				ational C			on Park				
DATE DRIL HAMI	E STARTI LER <u>CV</u> MER TYP	ED <u>2/20</u> V PE Auto	18 Rev. 1	SURFAC 5 GROUN	E ELE D WAT TIME	VATION LER LE		0.5 ft	B					
DEPTH (#)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification Sys	N stem	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 ▲ N 20 4 PL 20 4 HEAR 3	60 N VALUE 40 60 MC 40 60	LL D 80 GTH (ksf)	0 VOI-4 VOI-	(ft)
0 -			TOPSOIL - SANDY LEAN CLAY, Dark Soft, Wet SANDY LEAN CLAY, Brown, Soft to S		SPT 1		1-1-3 (4)	0.75	^	0				
5			SANDY FAT CLAY, Tan Gray, Stiff, Mo	3.7 ft oist (CH)	SPT 2	-	4-4-5 (9)		A	0				
	4.5" O.D.		Increasing Intermittent Layers of Weath With Depth Below 8'	ered Shale	SPT 3	-	7-4-5 (9)	0.75	A	0				
10	CFA -		- Very Stiff Below 8.5' SHALE, Highly Weathered, Tan Gray,	11.0 ft Soft	SPT 4	_	5-8-12 (20)	2.25		0				
			SANDY SHALE, Gray, Soft	13.0 ft	SPT 5	Ī	65/1"		0					
15				17.2 ft										
			Refusal at 17.2 feet. Bottom of borehole at 17.2	feet.										

GEOTECHNICAL BORING LOG

BORING NUMBER

CLIE	NT Che	rokee Na	ation Entertainn	nent	PROJE	CT NAM	/IE _N	lational C	heroke	e Natio	on Par	k			
PRO.	JECT NO	25674	8 Rev. 1		PROJE	CT LOC	ATIC	N Sallisa	aw, Oł	(
DATE	START	ED 2/20)/19	COMPLETED 2/20/19	SURFA	CE ELE	VATI	ON		B	ENCH	MARK E	EL		
DRIL	LER _CV	V		DRILL RIG 2015 CME 55	GROU	ND WAT	ER L	EVELS							
HAM	MER TYP	PE Auto			A	T TIME	OF D	RILLING	None)					
LOG	GED BY	CJ		CHECKED BY BP		T END	OF D	RILLING							
NOTE	ES				-										
											DRY	UNIT W	/T (pcf)	•	
		30L				ᆺ	%	D TS	z	20) 60 N VALL		100	
王	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2				30	ELEVATION (ft)
DEPTH (ft)	를 표	8	l Ir	nified Soil Classification System		PLE JME	SOVE	V CC	Est (PL	MC	LL		
	₽≥	₹	O.	inica con ciacomoanon cyclom		MA N	ZEC (F	ROJS ROJS	ပ္စ		20	40 (50 8	30	
		ST				0)	Ľ	В	"	■ S	HEAR	STREN		sf) 🗖	
0		71 18 71	TOPSOIL -	SANDY LEAN CLAY, Dark Brown,							<u>1 </u>	<u>2</u> :	<u>3 </u>	<u>4</u> :	
		1, 11,	Soft, Wet		U.6 IL	SPT 1		0-1-1 (2)	1	A	0		:	:	
			SANDY LE	AN CLAY, Brown, Soft to Stiff, Mois	st (CL)	A '		(2)			:		:	:	
 											:		:	:	
					3.0 ft						:		:	:	
				T CLAY, Brown, Stiff to Very Hard,	Moist						:		:	:	
 			(CH)			SPT		4-5-5	2	A (:)		:	:	
						2		(10)	2	_ `	<i>ب</i> :	:	:	:	
5											:	• • • • • • • • • •	÷······	:	
 											:	:	:	:	
	O.D.					SPT		8-5-7	3.75	A C	:)				
	ŗċ.		-Brownish	Gray Below 7'		3		(12)							
	4 - 4										:				
	CFA					ST				_	:		:		
						4	79		4.5		: 0 -	-	:	• •	
10	Ì										: :		<u>:</u>	<u>.</u>	.
											:	:	:	:	
	9				11.5 ft						:		:	:	
			SHALE, Hiệ Hard	ghly Weathered, Gray, Soft to Medi	um						:	:	:	:	
			i iai u										:	:	
													:		
-						SPT 5		56-65/3"	3.5	0			:	4	
					15.0 ft		1								
15				Refusal at 14.3 feet.					-						
				Bottom of borehole at 15.0 feet.											
1															I

GEOTECHNICAL BORING LOG

BORING NUMBER

CLIE	NT Cher	okee Na	ation Entertainment	PROJE	CT NAM	NE N	lational Cl	heroke	e Natio	on Par	k			
			8 Rev. 1				N Sallisa							
			1/19 COMPLETED 2/21/19						В	ENCH	MARK E	L		
			DRILL RIG 2015 CME 55											
			<u> </u>				RILLING							
_			CHECKED BY BP		T END	OF DI	rilling _							
NOIE	:S								_			-		
		占					. ග) 40	60	T (pcf) 4 80 10	00	
	50	STRATA SYMBOL	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	% } }	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2		N VALU 40 6	E ▲ 80 80)	ELEVATION (ft)
DEPTH (ft)	DRILLING METHOD	A S)	MATERIAL DESCRIPTION		LE.	RECOVERY (RQD %)	REC SO ALL	(ET		PL	МС	LL		(#)
	RA	ZAT,	Unified Soil Classification System		AMP N	EC R	Š Š Š Š Š Š Š Š	OC N		-	$\overline{}$,	
		STI			S	<u> </u>	В		■ SI	HEAR	STREN	GTH (ksf		
0		7 <u>1 1</u> N . 7 <u>1</u>	TOPSOIL - SANDY LEAN CLAY, Dark Brow	wn 0.5 ft						<u>1</u> :	2	<u>34</u> : :		
<u> </u>			Soft, Wet		SPT 1		0-1-3 (4)	0.75	A	0				
			SANDY FAT CLAY, Brown Tan, Soft, Very	Moist (CH)			. ,			:				
	•													
 - -			LEAN TO FAT OLAY or Orand Tor Oran	3.0 ft						:	:			
5	B		LEAN TO FAT CLAY, w/ Sand, Tan Gray, S Hard, Moist (CL-CH)	Stiff to Very	V									
					SPT 2		7-7-5 (12)	2	_	0	:			
5 5														
S .										:	:			
	1			7.0 ft	СТ									
= -	•		FAT CLAY, Shaley, Tan Gray, Very Hard to		ST 3	67		3.75	⊢				•	
			Moist (CH)											
	·				V									
	O.D				SPT 4		5-5-5 (10)	1.25	_	0				
10	.4.5"									 :				
	CFA.			11.0 ft						:				
			SHALE, Slightly Weathered, Tan Gray, Soft Medium Hard	t to										
			Wedam Hard							:	:			
	9													
	•				SPT		65/1"		0	:	:		4	\
	4				5									
15	.									<u>:</u>	· ! · · · · · · ·	::		
										:				
										:				
										:				
	P				SPT		65/1"		0	:	:		4	
					6					:				
20			Refusal at 18.6 feet.	20.0 ft						:	<u>:</u>	<u>: </u>		
<u> </u>			Refusal at 18.6 leet. Bottom of borehole at 20.0 feet.											

GEOTECHNICAL BORING LOG

BORING NUMBER

6

CLIE	NT Chero	kee Na	ation Entertainn	nent	PROJE	CT NAI	ME N	lational C	heroke	ee Natio	n Par	k		
PRO.	IECT NO.	25674	18 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, Oł	(
DATE	STARTE	2/2	1/19	COMPLETED 2/21/19	SURFA	CE ELE	VATI	ON		В	ENCH	MARK EL.		
DRIL	LER CW			DRILL RIG _2015 CME 55	GROU	ND WAT	ER LI	EVELS						
HAMI	MER TYPE	Auto)		_	AT TIME	OF D	RILLING	3 ft					
				CHECKED BY BP		AT END	OF DI	RILLING	6 ft					
.1			Due to Standing		_			-						
<u> </u>			•							_	DRV	UNIT WT (p	ocf) 📤	
		占				111		_ ഗ	١.	20	40	0 60 80	100	
	<u></u> 0	MB(Z Z	% (o		ا ا	2		N VALUE ▲ 40 60	80	NO
DEPTH (ft)	득운	\S\		MATERIAL DESCRIPTION		1 1 1 1 1 1 1	VEF	ALOGE:	ET F					TE)
	DRILLING METHOD	STRATA SYMBOL	Ur	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL	MC CO	LL H	ELEVATION (ft)
	_	TR.				SA	R	SC BLO	<u>P</u>			40 60 STRENGTI	80 -l (ksf) □	Ш
		0,									11	2 3	4	
0		7/1/		SANDY LEAN CLAY, Dark Brown	o.8 ft	SPT		1-1-3						
}			Soft, Wet	Y, Trace Sand, Tanish Gray, Stiff to) Verv	1		(4)	0.5	A	0			
			Stiff, Moist		o very		1							
	7												:	
-			$\bar{\Delta}$:		:	
	Ь				4.0 ft	ST					:			
╬┤			FAT CLAY,	Trace Sand, Brownish Tan, Soft to	o Very	2	71		4.5	0	:		•	
			Stiff, Moist	(CH)	,						<u>;</u>			
5	o.		_								:		:	
╟╶┤	o		Ā				1			<u> </u>				
	- 4.5"					SPT 3		4-5-8 (13)	2.75	_	0			
	CFA -							(10)						
	5										:		•	
							1 1				:			
						SPT 4		5-8-9 (17)	2.75	_	0			
10								(**)			: }	. į į		.
					11.0 ft									
			SANDY SH	IALE, Highly Weathered, Gray, So	ft to									
		77	Medium Ha											
													:	
╟╶┤					13.5 ft									
 			Auger Refu	sal on Shale Bedrock		SPT	-	65/0"				- 1 1 1		
				Refusal at 13.5 feet. Bottom of borehole at 13.5 feet.		5								
:														
1														

GEOTECHNICAL BORING LOG

BORING NUMBER

			ion Entertain	nent					lational C			on Park	(
DATI DRIL HAM LOG	JECT NO. E STARTE LER CW MER TYP GED BY ES	ED 2/20/ / E Auto	19	DRILL RIG 20	2/20/19 15 CME 55 BP	SURFA GROU	ND WAT	EVATION LICENSE		8.5 ft	В	ENCH	MARK E	EL		
B/BORING LOGS/BORING LOGS.C DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 2	PL 20 4 PL 20 4	60 N VALU 40 6 MC 40 6 STREN	/T (pcf) 80 10)	ELEVATION (ft)
VIT CHEROKEE NATION PARK-SI	.5" O.D.		Stiff, Wet SANDY FA	T CLAY, Brown, HALE, Highly Wea	Stiff, Moist (CH)	1.0/ft	SPT 1		3-4-7 (11) 16-40-59	1.75	•	Ο				
EROKEE NATION EN 1-256748-NA	CFA-4		SANDY SH	HALE, Brown & Gr	ray, Soft to Mediur		SPT 3	<i>)</i>	(99) 65/5"	4.5	0					
BORING LOG - PPI - PPI SID I EMPLAIE GOI - 7/1/19 09:08 - 5.7 MASI ER PROJECT PILEZO 19/OKNECIO PERONEE DA IL CHERONEE DA IL C				Refusal at Bottom of boreh			SPT 4		65/3"				;			

GEOTECHNICAL BORING LOG

BORING NUMBER

_ . __

8

01:5:						DD 0 :-					.			FAGL	. I OF
			tion Entertainı	ment					lational C			on Parl	(
	JECT NO.			COMPLETED 2/2	20/10				N <u>Sallis</u>			ENCLI	MADK	=	
				COMPLETED							P	LINCHI	VIAKK E		
					OIVIL 33				RILLING	None					
				- CHECKED BY BI	D				RILLING						
1															
											•	DRY		/T (pcf) •	•
		BOL					ᆔ	%	O L	ż	20		60 N VALL	8010 JE ▲	
E_	DRILLING METHOD	SYMBOL		MATERIAL DESCR	RIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2			80 80	ELEVATION
DEPTH (ft)	플		U	nified Soil Classificat	ion System		IPLE UME	S S	RR V ∨ C	Ä 📆		PL	MC	LL ———	EVA
	≥ ۵	STRATA			•		SAN	REC (S S S	P00			40 (80	
		S									🖪 SI		_	lGTH (ksf 3 4	7) 🗖
0		71 14 77		- SANDY LEAN CLA	Y, Dark Brown,	0.5 ft	SPT		3-3-13				:		
O DEPTH (1)			Very Stiff,	<u>vveτ</u> \Τ CLAY, Tan Gray, '	Very Stiff, Moist	1.3 ft			(16)	1	_	0	:		
			(CH)												
		77	SANDY SI	HALE, Highly Weathe	ered, Tan Gray,	Soft						:	:		
	<u>i</u>														
- -	5" 0					4.5 ft	SPT 2	-	27-62- 65/2"	3.75	0	:	:		
	4	7 / /	SANDY SI	HALE, Tan, Soft to M	edium Hard			1	03/2						
5	CFA											:	:		
-							X SPT	-	5/4"		0				
	B						3	1		1		:			
												:			
						8.7 ft									
				Refusal at 8.7			SPT 4		3/2"	(4.5)					
				Bottom of borehole	at 8.7 feet.										
1															
1															

GEOTECHNICAL BORING LOG

BORING NUMBER

9

PAGE 1 OF 1

CLIENT Cherokee I	Nation Entertainment	PROJEC	T NAM	IE Na	tional Ch	erokee	e Nation P	ark		
PROJECT NO. 256	748 Rev. 1	PROJEC	T LOC	ATION	I Sallisa	w, OK				
DATE STARTED 2/	20/19 COMPLETED 2/20/19	SURFAC	E ELEV	VATIO	N		BENC	HMARK E	L	
DRILLER CW	DRILL RIG 2015 CME 55	GROUNI) WATE	ER LE	VELS					
HAMMER TYPE Au	to	AT	TIME	OF DR	ILLING _	None				
LOGGED BY CJ	CHECKED BY BP	AT	END C	OF DRI	ILLING _					
NOTES										
t) LING HOD SYMBOL			YPE R	% (s	TED JNTS E)	PEN.	20 4	Y UNIT W 40 60 ▲ N VALUE 40 6	<u>8Ö ´100</u> E ▲	NO NO
DEPTH (ft) (ft) DRILLING METHOD STRATA SYME	MATERIAL DESCRIPTION Unified Soil Classification Syste	em	SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTEE BLOW COUNT (N VALUE)	POCKET F (tsf)	PL 		LL ——I	ELEVATION (ft)
			σ I	Ľ.	Ŭ <u>B</u>	ш	SHEA 1	R STRENG 2 3	GTH (ksf) 🗖 3 4	
	TOPSOIL - SANDY LEAN CLAY, Dark I Stiff, Wet SANDY LEAN TO FAT CLAY, Tannish I	1.2/ft	SPT 1		3-3-8 (11)	1	A 0			
- 4.5" O	Moist (CL) SANDY SHALE, Highly Weathered, Tar	n Gray, Soft								
CFA	SANDY SHALE, Highly Weathered, Gra	4.2 ft	SPT 2	2	23-47-65 (112)	4.5	0			
5	Refusal at 4.8 feet.		-		(/		<u> </u>	<u> </u>		

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\. MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

PRO DAT DRI	OJECT NO. TE STARTE	_25674 D _2/20	0/19		PROJE SURFA	CT LOC	EVATIO	N Sallis	aw, Ok			L	
LOG		CJ		CHECKED BY BP				RILLING RILLING					
DEPTH (#)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 20 PL 20	N VALUE 40 60 MC 40 60	80 100 E A 0 80 LL 0 80 GTH (ksf)	ELEVATION (ft)
8-NATIC CHEROKEE NATION PARK-SUE	CFA - 4.5" O.D.	77.7	Soft, Moist	SANDY LEAN CLAY, Dark Brown, AN CLAY, w/ Gravel, Tannish Gray, Moist (CL)	0.8 11	SPT 1	-	1-1-1 (2) 5-7-9 (16)	1.25	•		7	
5		10/////		Bottom of borehole at 5.0 feet.					•			•	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\. MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-

GEOTECHNICAL BORING LOG

BORING NUMBER

11

			ation Entertain	ment				lational C			on Park	(
	JECT NO. E STARTE			COMPLETED 2/20/19				ON <u>Sallis</u> ON			BENCH	MARK E	L	
	LER CW			DRILL RIG 2015 CME 55		ND WAT								
ı								RILLING						
		<u>CJ</u>		CHECKED BY RTH		AT END	OF DI	RILLING	0.5 ft					
S. NOI	ES								_		DDV	INUT VAC	T (===5) 🛕	
UB\BORING LOGS\BORING LOG DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION Inified Soil Classification System	0.24	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2	0 40 20 2 PL 20 4 HEAR	60 N VALUI 10 6 MC 10 6	0 80 LL 0 80 GTH (ksf)	ELEVATION (ft)
ION PARK-SU	q.		Soft, Wet	- LEAN CLAY, With Sand, Dark E EAN CLAY, Tan & Gray, Soft to S		SPT 1		1-1-1 (2)	0.5	<u> </u>	0			
ROKEE NATI	A - 4.5" O		(OL)											
18-NAT'L CHE	CFA				5.0 ft	SPT 2		3-4-7 (11)	0.75	A	 O			
5 2567				Bottom of borehole at 5.0 feet.										
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\(\circ{2}{2}\) 1000\(\circ{1}{2}\) 1000\(\circ{1}\) 1000\(\circ{1}\) 1000\(\circ{1}\)														

GEOTECHNICAL BORING LOG

BORING NUMBER

12

CL	IENT Che	erokee Na	ition Entertaii	nment	PROJE	CT NAI	ME N	lational C	heroke	e Nati	on Par	k		
	OJECT NO							N Sallis						
- 1				COMPLETED _2/19/19						E	ENCH	MARK E	L	
- 1				DRILL RIG _2015 CME 55										
						AT TIME	OF D	RILLING	_1 ft					
- 1				CHECKED BY RTH		AT END	OF DI	RILLING	1 ft					
₽ NC	TES													
LOGS											DRY 0 40		T (pcf) ◆ 80 100	
SING	(0.0	SYMBOL				SAMPLE TYPE NUMBER	%	CORRECTED BLOW COUNTS (N VALUE)	z		A	N VALU	E▲	z
		X X X		MATERIAL DESCRIPTION		EF.	ER)		E E E	- :	20	40 6	0 80	ELEVATION (ft)
LOGS/BOI DEPTH	DRILLING METHOD	I A	1	Unified Soil Classification Syste	m	IPLE IOM	RECOVERY (RQD %)	W C	POCKET PEN. (tsf)		PL	MC	LL ——	EV#
SING		STRATA				SAN	REC (850	PQ				80	
BOR		l io								S	HEAR 1	_	GTH (ksf) 🗖 3 4	'
-Sul		11 18. 14	¬ TOPSOIL	L - LEAN CLAY, Trace Sand, Da	ark Brown, 0.3 ft	· Vent		0-0-0			:	:		
PAR			Very Soft		Set (CLI)	SPT 1		(0)	4		0			
NOI	1			.Y, w/ Sand, Tan, Very Soft, Moi g Sand with Depth	St (CH)		1							
N N											:			
S H					3.0 ft							:		
띩			SANDY L (CL)	LEAN CLAY, Gray & Tan, Mediu	ım Stiff, Moist		-							
TH-	O.D		,			SPT 2		3-3-3 (6)	0.5	A	O	:		
48-N-	4.5"							(0)			<u>.</u>	. .	: :	
5 2567	1				6.0 ft						:	:		
	CFA (SANDY S	SHALE, Highly Weathered, Tan	to Brown,	Vanz		10 11 10				:		
	_		Very Soft			SPT 3		13-14-10 (24)						
≱							-							
8	-				8.5 ft									
焸	_		SANDY S	SHALE, Gray, Soft to Medium H	ard	SPT]	31-40-	3.25):			
OK/O	4				10.0 ft	4		65/2"	0.20				: : : :	T
<u>§</u> 10)			Bottom of borehole at 10.0 fe						<u> </u>		·····		
ECT														
2 2 3														
ER														
MAST														
- Si-														
80.6														
/19 0														
- 7/1														
[G]														
LATE														
LEMP														
PPI														
PPI-														
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(2019\) OKIC\(CHEROKEE NATION ENT-256748-NAT\). CHEROKEE NATION PARK-SUB\(BORING LOGS\) BORING LOGS\(GACOREGO SOR) AND STAND														
NGL														
BORI														

GEOTECHNICAL BORING LOG

BORING NUMBER

13

PAGE 1 OF 1

CLIENT Chero	okee N	ation Entertainn	nent		PROJE	CT NAM	/IE _N	lational C	heroke	e Nation Park	
PROJECT NO.	2567	48 Rev. 1			PROJE	CT LOC	CITA	N Sallisa	aw, Ok		
DATE STARTE	D <u>2/2</u>	0/19	COMPLETED	2/20/19	SURFA	CE ELE	VATI	ON		BENCHMARK EL.	
DRILLER LB			DRILL RIG _	050	GROU	ND WAT	ER L	EVELS			
HAMMER TYPE	E Auto)				AT TIME	OF D	RILLING	_1 ft		
LOGGED BY _	JH		CHECKED BY	RTH	_ /	AT END	OF DI	RILLING	0.5 ft		
NOTES					_						
DEPTH (ft) DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DE	SCRIPTION ification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) ◆ 20 40 60 80 100 A N VALUE A 20 40 60 80 PL MC LL 20 40 60 80 ■ SHEAR STRENGTH (ksf) ■ 1 2 3 4	ELEVATION (ft)
0		TOPSOIL -	LEAN CLAY, T	race Sand, Dark Bı	rown, 2 #						
CFA - 4.5" O.D.		1	AN CLAY, Gray	Tan, Stiff to Very S	Stiff,	SPT 1		0-5-10 (15)	1	4-0-1	
		SANDY SH	IALE, Highly We	eathered, Gray Bro	4.5 ft _{vn,} 5.0 ft	SPT 2		5-8-13 (21)	2.5	A 0	
5		Soft	Bottom of bore	hole at 5.0 feet.							

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S3_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION

GEOTECHNICAL BORING LOG

BORING NUMBER

14

CLIE	NT Chero	kee Na	ation Entertai	nment			PROJE	CT NAM	ME N	lational C	heroke	ee Natio	on Park			
PRO	JECT NO.	25674	18 Rev. 1				PROJE	CT LO	CATIO	N Sallisa	aw, Oł	<				
DATI	E STARTE	D 2/20	0/19	COMPLET	ED <u>2/20/19</u>		SURFA	CE ELE	EVATI	ON		В	ENCH	/IARK E	L	
DRIL	LER CW			DRILL RIG	2015 CME	55	GROU	ND WAT	TER LI	EVELS						
HAM	MER TYPE	_ Auto)	_			A	T TIME	OF D	RILLING	None)				
				CHECKED	BY RTH											
JB/BORING LOGS/BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		Unified Soil Cl		system	0.5.6		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 ▲ N 20 4 PL 1 20 4 HEAR S	60 N VALU 10 6 MC 10 6		ELEVATION (ft)
TION PARK-SU	0.D.		\ Medium	L - LEAN CLAY Stiff, Moist FAT CLAY, Sh			/	SPT 1	-	1-3-3 (6)	1.75	A	0			
HEROKEE NA:	CFA - 4.5" C		SANDY	SHALE, Highly	Weathered,	Trace Roots	3.0 ft s, Tan									
#8-NAT'L CF			to Brown	, Soft			5.0 ft	SPT 2		40-52-60 (112)	4.5	0				
5 5				Bottom of b	orehole at 5.	0 feet.										
BORING LOG - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\(2019\)(OK\C\C\HEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\)BORING LOGS\(BORING LOGS\(

GEOTECHNICAL BORING LOG

BORING NUMBER

15

CL	ENT Chero	okee N	ation Enterta	ainment		PROJE	ECT NAI	ME N	lational C	heroke	e Nat	ion Par	k		
PR	OJECT NO.	2567	48 Rev. 1			PROJE	ECT LO	CATIO	N Sallis	aw, Oł	(
DA	TE STARTE	D 2/1	9/19	COMPLETE	ED 2/19/19	SURFA	ACE ELE	EVATION	ON		6	BENCH	MARK E	EL	
DR	ILLER CW			DRILL RIG	2015 CME 55	GROU	ND WAT	ΓER LI	EVELS						
НА	MMER TYPE	E Auto	0				AT TIME	OF D	RILLING	None)				
					BY RTH										
- 1															
SUB/BORING LOGS/BORING LOGS.	DRILLING METHOD	STRATA SYMBOL	TOPSO	Unified Soil Clas	DESCRIPTION ssification System	Brow P.3 ft		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2	20 40 20 PL 20	0 60 N VALU 40 0 MC 40 0 STREN	VT (pcf) 80 100 JE	ELEVATION (ft)
NAT'L CHEROKEE NATION PARK-S	CFA - 4.5" O.D.		\ Soft, Mo	oist	Trace Sand, Dark		SPT 1		0-1-1 (2) 3-3-3 (6)	1.25		0			
6748-		<i>\////</i>	1	Bottom of bo	rehole at 5.0 feet.	5.0 11							_i	<u>:</u>	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(2019\)OK\(C\)\C\\C\\C\\C\\C\\C\\C\\C\\C\\C\\C\\C\\															

GEOTECHNICAL BORING LOG

BORING NUMBER

16

CLIE	NT Chero	kee Na	ation Entertai	nment			PROJE	CT NAI	ME N	lational C	heroke	ee Nation I	Park		
PRO	JECT NO.	25674	18 Rev. 1				PROJE	CT LO	CATIO	N Sallis	aw, Oł	<			
DAT	E STARTE	D 2/19	9/19	COMPLE	TED 2/19/1	19	SURFA	CE ELE	EVATION	ON		BEN	CHMARK	EL	
DRIL	LER CW			DRILL RI	G 2015 CM	ME 55	GROUI	ND WAT	TER LI	EVELS					
HAN	IMER TYPE	_ Auto)	_			ļ	T TIME	OF D	RILLING	3 ft				
				CHECKE	D BY RTH		A	T END	OF DI	RILLING	3 ft				
	ES														
SUB\BORING LOGS\BORING LOGS\ ODEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAI Unified Soil C		System	owr0.5 ft	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 Pl H 20	40 60 ▲ N VAL 40 MC 40	UE <u>^</u> 60 80	ELEVATION (ft)
ARK.			∖ Soft, Moi	st			JVVII,	SPT 1		1-1-3 (4)	0.5	A 0			
NO P	ا ب		LEAN CI	₋AY, Tan Brov	vn, Soft, We	et (CL)		A .		(4)		!			
CHEROKEE NATION -	CFA - 4.5" O.		▼ With Sar	nd, Moist, Very	v Stiff Below	v 3 5'									
IAT'L			Will out	14, 1410101, 1101	y Ct, Bolov	. 0.0		SPT 2		9-9-9 (18)	3.25	(2)			
2 5748-1				D.#f	borehole at	F.O.f 1	5.0 ft			(- /		<u> </u>	<u>:</u>		
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\(\rangle O19\)\OKIC\CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\(\rangle BORING LOGS\(\rangle BORING\(\rangle BORING\															

GEOTECHNICAL BORING LOG

BORING NUMBER

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	CLIE	NT Cher	okee Na	tion Entertainm	ient		PROJE	CT NAI	ME N	lational C	heroke	e Natio	n Park			
	PRO.	JECT NO.	25674	8 Rev. 1			PROJE	CT LO	CATIO	N Sallis	aw, Ok	(
	DATE	STARTE	D 2/19	/19	COMPLETED 2	/19/19	SURFA	CE ELE	EVATI	ON		BE	NCHM	IARK EL.	·	
	DRIL	LER CW	1		DRILL RIG 2015	5 CME 55	GROU	ND WAT	TER LI	EVELS						
	HAMI	MER TYPE	E Auto				A	T TIME	OF D	RILLING	None)				
	LOG	GED BY _	CJ		CHECKED BY _F	RTH		T END	OF DI	RILLING						
GPJ	NOTE	ES														
B/BORING LOGS/BORING LOGS	DEPTH (ft)	STR						SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	40 ▲ N 0 4 PL 1 4	MC 0 60	80 100 80	ELEVATION (ft)
748-NAT'L CHEROKEE NATION PARK-SUB\BORING	0	ST S					2.0 ft	1		3-3-3 (6) 4-4-7 (11)	3.75)			
NENT-2567	5			OI IALL, III	ghly Weathered, Gr Bottom of borehole	•										

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION

GEOTECHNICAL BORING LOG

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CI	LIENT Ch	erokee Na	ation Entertainn	nent	PROJE	CT NAN	/E _N	lational C	heroke	e Nation P	ark		_
PI	ROJECT NO	O . 25674	48 Rev. 1		PROJE	CT LOC	CATIO	N Sallis	aw, Ok	(
D	ATE STAR	TED 2/19	9/19	COMPLETED 2/19/19	SURFA	CE ELE	VATI	ON		BENC	HMARK E	EL	
DI	RILLER _C	W		DRILL RIG 2015 CME 55	GROUN	ND WAT	ER L	EVELS					
H	AMMER TY	PE Auto)		Δ	T TIME	OF D	RILLING	None				
LO	OGGED BY	CJ_		CHECKED BY RTH		T END	OF DI	RILLING					
ਤੂ No	OTES												
DRING LUGS		SYMBOL				Y PE	الله (ه و)	red JNTS E)	PEN.	20 4	<u>40 60</u> ▲ N VALU	/T (pcf) ◆ 80 100 JE ▲ 50 80)
NG LUGS/BC DEPTF	(ft) DRILLING METHOD	STRATA SY	Ur	MATERIAL DESCRIPTION nified Soil Classification System	1	SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET F (tsf)	PL 	MC 40	LL 60 80	ELEVATION (ft)
JB/BCR		S			0.2.4			<u> </u>		SHEA 1	_	IGTH (ksf) 3 4	0
N PAKK-SI			\ Very Stiff, N CLAYEY S	AND, Reddish Brown, Medium		SPT 1		8-9-9 (18)	1.25	04			
OKEE NATIC	- 4.5" 0		Moist (SC)		3.0 ft								
-NAI'L CHER	CFA		SANDY SH Soft to med	IALE, Highly Weathered, Tan to dium Hard	o Brown,	SPT 2		62-51- 65/2"	4.5	0			
256748	5		1	Refusal at 5.0 feet.						<u> </u>		<u>:</u>	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-

GEOTECHNICAL BORING LOG

BORING NUMBER

19

CLIE	NT Cher	okee Na	ation Entertainı	ment	PRO	JECT NAI	ME _N	National C	heroke	e Natio	on Park			
PRO	JECT NO.	25674	8 Rev. 1		PRO	JECT LO	CATIC	N Sallis	aw, Oł	<				
DAT	E STARTE	D 2/19	9/19	COMPLETED 2/19/1	9 SUR	FACE ELI	EVATI	ON		В	ENCH	/IARK E	iL	
				DRILL RIG _D50										
	IMER TYP								10 ft					
1				CHECKED BY RTH										
GS.G							1		1	•	DRYI	INIT W	'T (pcf) ◆	
O C C		ᅵᅥ				Ш	%	ွတ		20	40	60	80 100	
	90	SYMBOL		MATERIAL DECORIO	-101	SAMPLE TYPE NUMBER	\ } (?	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2		N VALU 10 6		ELEVATION (ft)
LOGS/BOF DEPTH (ft)	DRILLING			MATERIAL DESCRIPT		LE I	RECOVERY (RQD %)	A S S S S S S S S S S S S S S S S S S S	ET		PL	МС	LL	(#)
	NE:	AT/	U	nified Soil Classification	System	MP	100 %	ROON Y	S S S	,	-	$\overline{}$		LE)
N N		STRATA				S A	2	2,9	A				<u>60 80</u> GTH (ksf) ⊑	
JB/BC		0,											3 4	
FILEZO19)OKICCHEROKEE NATION ENT-256748-NATL CHEROKEE NATION PARK-SUBIBORING LOGS/BORING LOGS.GPJ		7. 7.	TOPSOIL Soft, Moist	- LEAN CLAY, Trace Sa	nd, Dark Brown, 1.0	ft						:		
A -	1			AT CLAY, Red, Hard, Mo		1	-			<u>.</u>	:	:		
VOIT N			OANDITA	AT OLAT, Rod, Hard, Mo	2.0	ft SPT	Г	5-13-20 (33)	3.5	С)	:		
Ž[·			SANDY SI	HALE, Highly Weathered	, Tan to Brown,			(33)				:		
% - 1 ₩	- 1		Soft to Me	dium Hard		SPT	-		-					
뿡	 					2		27-53/3"		0		:		↑
JŢŢ .												:		
3748-N	1										<u>.</u>	<u>.</u>	: :	
2567												:		
						X SPT	F	50/4"	4.5	0		:		A
	o					_3_	4				:	:		
Ψ.	4.5"		_								:	:		
Š	CFA -		Ā								:	:		
삙	5					SPT	r)	50/4"	4.5	0				A
SKC SKC						4	1							
10			$\bar{\Delta}$										<u>.</u>	
ILEY2											:	:		
딩	1 1										:	:		
- 1 S 	▎											:		
ER P.					13.0	ft					:	:		
AAST T		7 7 7	SANDY SI	HALE, Gray, Soft to Med							:	:		
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\						SPT 5	7)	50/5"	4.5	0		:		†
- 80:					14.8		1				:	:		
BORING LOG - PPI - PPI STD TEMPLATE,GDT - 7/1/19 09:08 - S.\. MASTER PROJE				Refusal at 14.8 fe										•
- 7/1/				Bottom of borehole at 1	4.8 feet.									
GDT														
ATE.														
MPL														
SIdo														
7-I														
9-P														
O LC														
ORIN														
ωı														

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Na	ation Entertainm	nent	PROJE	CT NAM	/E N	lational C	heroke	e Nation P	ark			
PRO	JECT NO.	25674	l8 Rev. 1		PROJE	CT LO	CATIO	N Sallisa	aw, Ok	(
DAT	E STARTEI	D <u>2/18</u>	3/19	COMPLETED 2/18/19	SURFA	CE ELE	VATI	ON		BENO	CHMARK	(EL		
DRIL	LER CW			DRILL RIG 2015 CME 55	GROU	ND WAT	ER L	EVELS						
HAM	IMER TYPE	Auto	1		A	AT TIME	OF D	RILLING	2 ft					
LOG	GED BY _	CJ		CHECKED BY RTH		AT END	OF DI	RILLING	2 ft					
NOT	ES Offset	10' S [Due to Overhea	ad Trees	-									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	40	0 80 -UE 60 -60	100	ELEVATION (ft)
	CFA - 4.5" O.D.		Stiff, Moist SANDY LE	LEAN CLAY, Trace Sand, Dark Br AN CLAY, Brown, Stiff, Moist (CL) IALE, Highly Weathered, Tan to Bro lium Hard	1.3 ft	SPT 1		4-4-5 (9)	1.25	•			4	
5				Refusal at 5.0 feet.							•		•	

Bottom of borehole at 5.0 feet.

4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

GEOTECHNICAL BORING LOG

BORING NUMBER

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			Fax: (417) 864	-6004										PAGE 1	OF 1
CLIE	NT Che	rokee Na	ation Entertainm	nent		PROJE	CT NAM	/E _N	lational Cl	heroke	e Natio	n Park			
PRO.	JECT NO	. 25674	48 Rev. 1			PROJE	CT LOC	CATIC	N Sallisa	aw, OK					
DATE	E START	ED 2/19	9/19	COMPLETED	2/19/19						BE	ENCHI	IARK EL		
				DRILL RIG D	50	GROUN	ND WAT	ER L	EVELS						
1)				T TIME	OF D	RILLING	None					
1				CHECKED BY	RTH	^	T END	OF D	rilling _						
NOTI	ES		T												
		٦							"		20	DRY U	TNIT WT 60	Γ (pcf) ♦ 80 100	
	<u>0</u> 0	STRATA SYMBOL					SAMPLE TYPE NUMBER	% (3 (3 (3)	CORRECTED BLOW COUNTS (N VALUE)	PEN.	20		VALUE 0 60		NO NO
DEPTH (ft)	DRILLING METHOD	\S\		MATERIAL DES	CRIPTION		LE T MBE	VER 2D %	ALU ALU	ET F		PL	MC	LL	⊢Ė∉
	NE.	\ YAT⁄	Ur	nified Soil Classifi	cation System		MP	RECOVERY (RQD %)	S S S	POCKET (tsf)	20	-	10 60		ELEVATION (ft)
		STF					'S	교	S H	lg				GTH (ksf)	
0		11 11 1/2	TODCOIL	LEANICLAY To	ace Sand, Dark Bro	Ω 5 ft					1		2 3	4	
ľ			Soft, Moist	LEAN CLAY, 118	ace Sand, Dark Br	OWIY, O					:			:	
-			SANDY FA	T CLAY, Reddish	n Brown, Stiff, Mois	st (CH) 2.0 ft	SPT		7-4-8	4.05				:	
			SANDY SH	HALF Highly Wea	athered, Reddish B		1		(12)	1.25	A O				
				t to Medium Hard							:			:	
							SPT		10-20-30	4.5	0				
- -	O.D						2		(50)	1.5	į			:	
5	1.5"														
	CFA - 4.														
-	5						SPT		19-43-					:	
-	-						3		50/5"	4.5	0 :			:	1
il															
			- Soft Belov	N 8'							:			:	
<u> </u>	-						SPT		13-23-37	4.5			A		
	\					10.0 ft	4		(60)		0				
10				Bottom of boreho	ole at 10.0 feet.										
II.															

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILI

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Che	rokee Na	ation Entertainn	nent	PROJE	CT NAM	/IE _N	National Cl	neroke	e Nation Pa	ırk		
PRO	JECT NO	. 25674	18 Rev. 1		PROJE	CT LOC	ATIC	N Sallisa	aw, OK				
DATI	E STARTI	ED 2/19	9/19	COMPLETED 2/19/19	SURFA	CE ELE	VATI	ON		BENC	HMARK E	L	
DRIL	LER LB			DRILL RIG D50	GROUI	ND WAT	ER L	EVELS					
НАМ	MER TYP	E Auto)		A	T TIME	OF D	RILLING	None				
LOG	GED BY	JH		CHECKED BY RTH		T END	OF D	RILLING _					
NOT	ES				_								
		٦								◆ DRY 20 4	/ UNIT W	T (pcf) ♦ 80 100	
	NG OD	YMBC		MATERIAL DESCRIPTION		TYPE ER	RY % (%)	CTED CUNTS UE)	PEN.		N VALU	E 🔺	NO.
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	PL —	MC	LL ——I	ELEVATION (ft)
		STR				SAI	R	BLO O	<u>8</u>	20 ■ SHEAF	RSTREN	<u>60 80</u> GTH (ksf) □	I
0		711/	TOPSOIL -	LEAN CLAY, Trace Sand, Dark Br	own.					1 :	<u>2</u> :	3 4 : :	
<u> </u>		11.111	Soft, Moist		1.0 ft					:	:		
			SANDY LE	AN CLAY, Tan & Gray, Stiff, Moist	(CL)	SPT 1		4-5-8 (13)		△I ⊕			
- - -	4									:	:		
 	O.D.					SPT 2		6-12-15 (27)	3.75	0 🛦			
5	- 4.5"												
<u> </u>	CFA				6.0 ft					:	:		
			SHALE, Hi	ghly Weathered, Tan to Brown, Soft	t	SPT 3		30-42-27 (69)	1.75	0		A	
	1					_					:		
			SHALE, Br	own & Gray, Soft to Medium Hard	9.0 ft 10.0 ft	SPT 4	-	25-26- 50/1"	4.5	0			†
10				Bottom of borehole at 10.0 feet.	10.011					<u>:</u>	<u>:</u>	<u>:</u>	
2				25.15 31 301011010 at 10.0 1001.									

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT

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CLIE	NT Chero		PROJECT NAME National Cherokee Nation Park															
PRO.	JECT NO.	25674	18 Rev. 1			PROJE	CT LOC	CATIO	N Sallisa	aw, Ok	<u> </u>							
DATE	STARTE	D 2/18	3/19	COMPLETED 2/1	8/19	SURFA	CE ELE	VATI	ON		BEN	ICHM/	ARK EL.					
DRIL	LER CW			DRILL RIG 2015	CME 55	GROU	ND WAT	ER LI	EVELS									
HAM	MER TYPE	E Auto	1				T TIME	OF D	RILLING	None								
LOG	GED BY _	CJ		CHECKED BY R	ГН		AT END	OF DE	RILLING									
NOT	ES																	
	ű O	SYMBOL					YPE 3	% \ (ED NTS	PEN.	20	40 ▲ N	VALUE .	8 <u>Ö ´100</u> ▲	Z			
DEPTH (ft)	DEPTH (ft) DRILLING METHOD		Ur	MATERIAL DESCRIPTION nified Soil Classification System			SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET P (tsf)	20	L 40	TRENGT	80 LL 80 TH (ksf) •	ELEVATION (ft)			
0	" O.D.		\ Medium Sti	LEAN CLAY, Trace ff, Moist / FAT CLAY, w/ Sand ff, Moist (CH)			SPT 1		3-3-4 (7)	2	A C	:						
	CFA - 4.5"		Very Soft	IALE, Highly Weathe		5.2 ft	SPT 2		4-10-14 (24)	4.5	0							
			─_ SHALE, Br	ownish Gray, Soft to Refusal at 5.5	feet.		l			l	:_	:	<u>:</u>	- :	1			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OKICKCHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Na	ation Entertainment											
PRO	JECT NO.	25674	48 Rev. 1	PROJE	CT LOC	OITA	N Sallisa	aw, Ok	(
DAT	E STARTE	D 2/18	8/19 COMPLETED 2/18/19	SURFA	CE ELE	VATI	ON		BENCH	IMARK EL				
			DRILL RIG D50	GROU	ND WAT	ER LI	EVELS							
HAM	IMER TYPE	_Auto)	A	T TIME	OF D	RILLING	None	•					
			CHECKED BY RTH	A	T END									
NOT	ES													
		ا پ							◆ DRY 20 4	' UNIT WT (pcf) 0 60 80	• 100			
	(7.0	STRATA SYMBOL			SAMPLE TYPE NUMBER	% ~	ED (I	Ä	_	N VALUE 🔺		z l		
DEPTH (ft)	DRILLING METHOD	SYI	MATERIAL DESCRIPTION		E T 18EF	ÆR, D%	L S S S	:T P	20	40 60 8		ELEVATION (ft)		
) SRIE MET	٩T٨	Unified Soil Classification System		MP NUN	RECOVERY (RQD %)	JW C	CKE (#	PL —	$\overline{}$		LEV.		
		TR/			SAI	RE	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	40 60 8 R STRENGTH (F	30	Ш		
N N N N N N N N N N N N N N N N N N N		0,							1	2 3	4			
AKK-SU		1/ /1/	TOPSOIL - LEAN CLAY, Trace Sand, Dark Brov Soft, Moist	vn, 1.0 ft					:					
			LEAN CLAY, Gray & Tan, Very Stiff to Hard, Mo (CL)	ist	SPT		3-7-10							
<u> </u>			(GL)		1		(17)		A :O		:			
											:			
Ę.					SPT		6-13-20	2.75	[:			
					2		(33)	2.73						
84 N	1													
5				6.0 ft					:		:			
<u>-</u> -	O.O.		SANDY SHALE, Highly Weathered, Brown, Very		Vanz						:			
<u> </u>	4.5				SPT 3		7-11-10 (21)	4.5	0 🏝		:			
Ž H	CFA -													
<u> </u>	ō	77		8.5 ft	¥ O		8-50/5"	4	0					
를 			SANDY SHALE, Gray, Soft to Medium Hard Increasing Sand With Depth		4		0-00/0	_						
S S	1		g cana cana - .,								:			
10											:			
립 -	-													
											:			
MASIEK PROJ											:			
- A	1			12 0 H					:		:			
≥ 			Refusal at 13.8 feet.	13.8 ft	SPT 5		50/3"]	<u> </u>	; ;	:			
00:			Bottom of borehole at 13.8 feet.		ت									
90:60 61/1/														
-														
5														
5														
AING LOG - PPI - PPI S I D I EMPLAI E.GD.														
<u>,</u>														
<u>, </u>														
201														
אוצ אוצ														

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Cher	okee Nat	tion Entertainment	PROJECT NAME National Cherokee Nation Park										
PRO	JECT NO.	256748	8 Rev. 1	PROJECT LOCATION Sallisaw, OK										
DAT	E STARTE	ED <u>2/18/</u>	/19 COMPLETED _2/18/19	SURFACE ELEVATION BENCHMARK EL										
DRIL	LER CW	/	DRILL RIG 2015 CME 55	GROU	ND WAT	ER L	EVELS							
HAM	MER TYP	E Auto		1	AT TIME	OF D	RILLING	None)					
LOG	GED BY _	CJ	CHECKED BY RTH		AT END	OF D	RILLING							
ਰੂ NOT	ES			-										
909									◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 10					
US NO	(D =	SYMBOL			퓝	%	CORRECTED BLOW COUNTS (N VALUE)	PEN.		▲ N V	ALUE 🔺	100	z	
	DRILLING METHOD	N K	MATERIAL DESCRIPTION		ET	ERY		E E E	2	20 40	60 8	30	ELEVATION (ft)	
LOGS/BOF DEPTH (ft)	RILI	STRATA (Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	W C	POCKET I		PL N	IC LL		EV EV	
SING NG		₹			SAN	REC (950	P _O		20 40		30	급	
B/BOF		S					_		SI	HEAR STF 1 2	RENGTH (k 3	(st) 🚨 4		
0	Б	7/1/V	TOPSOIL - LEAN CLAY, Trace Sand, Dark Br		SPT		1-3-3			: :	:	:		
- PAR		11/1//	Medium Stiff, Moist SANDY LEAN CLAY, Red Tan, Medium Stiff,	1.0 ft	1		(6)	0.75	_	0		:		
FILE/2019) OKIC/CHEROKEE NATION ENT-256748-NATI/ CHEROKEE NATION PARK-SUB/BORING LOGS/BORING LOGS/GFJ			(CL)	IVIUISL		1					:	:		
≱[2 O #							•	:		
- 18kg	•		LEAN CLAY, Shaley, Tan, Very Stiff, Moist (C	3.0 ft							:	:		
뽕			ELAN GLAT, Shaley, Tall, Very Still, Moist (G	L)	V _{CDT}		40.0.40				•	:		
I.T A T					SPT 2		10-8-13 (21)	4.5	15	1		:		
6748										: : :	· · · · · · · · · · · · · · · · · · ·			
- 17-25	.5" 0			6.0 ft							:	:		
Δ N	4		SANDY SHALE, Highly Weathered, Tan to Bro Soft	own,	SPT		9-26-42	4.5				:		
Ĕ	CFA		Cont		3		(68)	4.5				:		
쒸 -											:	:		
뙤	6			9.0 ft	SPT						:	:		
 - - -			SANDY SHALE, Gray, Soft to Medium Hard		4		21-65/5"	4.5	0		:		<u> </u>	
) 10			·							ļ		:		
10											:	:		
<u>-</u>	9										:	:		
& -				12.5 ft										
HR			Refusal at 12.5 feet.							<u>: : : : : : : : : : : : : : : : : : : </u>	<u> </u>	:		
MAST			Bottom of borehole at 12.5 feet.											
- S:														
80:60														
1/19 (
/- T														
GD GD														
PLAT														
TEM														
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT														
- P														
- PP														
SLOC														
NE NE														
ЖI														

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CLIE	NT Cherc	nent	PROJE	ECT NAM	ME N	lational C	heroke	e Nation Par	k								
PRO	JECT NO.	25674	18 Rev. 1		PROJECT LOCATION Sallisaw, OK												
DAT	E STARTE	D 2/27	7/19	COMPLETED 2/27/19	SURFA	CE ELE	VATI	ON		BENCH	BENCHMARK EL.						
DRIL	LER RD			DRILL RIG D50													
нам	IMER TYPE	Auto	<u> </u>			AT TIME	OF D	RILLING	None)							
LOG	GED BY _	JG		CHECKED BY RTH													
NOT	ES																
DEPTH (f)	O DEPTH (f) DRILLING METHOD O STRATA SYMBOL Stiff, Woist			MATERIAL DESCRIPTION iffied Soil Classification System LEAN CLAY, Dark Brown, Medium Y, Shaley, Red Tan, Medium Stiff to (CL)	X SPI 1-2-3 (5)					20 40 20 PL 20 SHEAR	N VALUE 40 60 MC 40 60	80 100 80 LL 80 TH (ksf)	ELEVATION (ft)				
5	CFA			Bottom of borehole at 5.0 feet.	5.0 ft	SPT 2		3-6-11 (17)	4.5	A							
				bottom of porenoie at 5.0 feet.													

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\(\)_MASTER PROJECT FILE\(\)2019\(\)OK\(\)CHEROKEE NATION ENT

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CLIE	CLIENT Cherokee Nation Entertainment							PROJECT NAME National Cherokee Nation Park											
PRO.	JECT NO.	25674	8 Rev. 1			PROJECT LOCATION Sallisaw, OK													
DATE	E STARTEI	2 /27	/19	COMPLETED	2/27/19	SURFA	CE ELE	VATIO	ON		BENO	HMARK	EL						
DRIL	DRILLER RD DRILL RIG D50							_ GROUND WATER LEVELS											
HAM	HAMMER TYPE Auto						AT TIME OF DRILLING None												
LOG	GED BY _	JG		CHECKED BY	RTH	AT END OF DRILLING													
NOTI	ES					_													
			Ur	MATERIAL DES	CRIPTION cation System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL I— 20	40 60 ▲ N VAL 40 MC 40	80 -UE • 60	60 80 OO (##) 60 80 GTH (ksf)					
0	TOPSOIL - LEAN CLAY, Trace Sand, Dark Brow Stiff, Moist				1.5 ft	SPT 1		2-1-8 (9)		A 0									
 	CFA - 4		Hard, Moist		sh Brown, Mediun		SPT		8-50/0"										
			SANDSTOM Medium Ha			Brown													

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-\$

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	CLIENT Cherokee Nation Entertainment						PROJECT NAME National Cherokee Nation Park										
	PRO.	JECT NO.	25674	18 Rev. 1		PROJE	PROJECT LOCATION Sallisaw, OK										
	DATE	STARTE	D 2/20	0/19	COMPLETED 2/20/19	SURFA	CE ELE	VATI	ON		BE	ENCHM	ARK EL				
	DRIL	LER LB			DRILL RIG _D50	_ GROUND WATER LEVELS											
	HAM	MER TYPE	_ Auto)		Δ	T TIME	OF D	RILLING	None	1						
	LOG	GED BY _	JH		CHECKED BY RTH		T END	OF DI	RILLING								
2	NOTE	ES				_											
G LUGO							111	٠,0	- W	◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100							
Ž,	_	50	SYMBOL		MATERIAL RECORDERION		YPE :R	۶۲ % %)		PEN.	20	▲ N 0 40	VALUE		ELEVATION (ft)		
e LOGS/B	DEPTH (ft)	DRILLING METHOD	STRATA SY	Ur	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYF NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET I (tsf)	20	PL 	$\overline{}$	MC LL 60 80			
N PC R IV			STR			<i>t</i> s	N N	_ - 으괵	Ĭ.				STH (ksf)				
AKK-VC	0			TOPSOIL - Soft, Moist	LEAN CLAY, Trace Sand, Dark B	rown, 3 ft						:	:	:			
AIION		O.D.		LEAN CLA	Y, With Very Fine Sand, Brown Gr d, Moist (CL)	ay, Very 2.0 ft	SPT 1		13-34-48 (82)	3.25	0		•	^			
OKEE N		4.5"		SHALE, Hiç Medium Ha	ghly Weathered, Tan to Brown, So ırd	ft to								:			
I CHER		CFA					SPT 2		50/1"	/	0		:		<u> </u>		
%-NA		1				5.0 ft						:	:	:			
256/4	5				Bottom of borehole at 5.0 feet.												

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT



4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

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01.151			ax: (417) 864-6004		OKIN					PAGE 1 OF 1
CLIE	NT Cher	okee Nati	on Entertainment	l	PROJ	ECT NA	ME N	lational C	l heroke	ee Nation Park
PROJ	ECT NO.	256748	Rev. 1		PROJ	ECT LO	CATIO	N Sallis	aw, Ok	<
DATE	STARTE	D 2/27/1	9 CON	IPLETED <u>2/27/19</u>	SURF	ACE EL	EVATI	ON		BENCHMARK EL.
DRILL	ER RD		DRII	L RIG D50	GRO	JND WA	TER L	EVELS		
HAMN	IER TYPI	E Auto				AT TIMI	OF D	RILLING	None)
LOGG	SED BY _	JG	CHE	CKED BY RTH		AT END	OF D	RILLING		
NOTE	:s									
DEPTH (ft)	DRILLING METHOD	STRATASYMBOL		ERIAL DESCRIPTION Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) ◆ 20 40 60 80 100 N VALUE ▲ 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) ■ 1 2 3 4
0	O.D.		TOPSOIL - LEAN Brown, Soft to Ha	CLAY, Trace Sand, Dark	8:3/	SP.	Г	3-23- 50/0"		
	4.5" (rd, мовt w/ Gravel, Brown, Very De	ense, 17f	1	+	30/0	1	
	_,		Moist (SC)		_ _	SP ⁻	Γ	50/0"		<u> </u>
	CFA			ne Grained, Poorly to Wel n, Soft to Medium Hard	'	2				



GEOTECHNICAL BORING LOG

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CLIE	NT Cherc	okee Na	ation Entertainment	PROJE	CT NAM	/E _N	lational Cl	neroke	e Natio	on Park		
			48 Rev. 1				N Sallisa					
			7/19 COMPLETED 2/27/19						В	ENCHMARK	EL	
			DRILL RIG 2015 CME									
			<u> </u>									
_			CHECKED BY RTH	,	AT END	OF D	RILLING _					
NOTE	=S						T					
									20	DRY UNIT V 40 60		
	<u>ت</u> 0	STRATA SYMBOL			SAMPLE TYPE NUMBER	% ★ (°	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2	▲ N VALU 20 40	JE 🔺	ELEVATION (ft)
DEPTH (ft)	DRILLING METHOD	S.	MATERIAL DESCRIPTION		E T	RECOVERY (RQD %)	PE023	ET F				#)
	MEI MEI	ATA	Unified Soil Classification System		MPI	(RC)	N V	S S	_	PL MC 20 40	LL 60 80	LEV (
	_	STR			SA	RE	S.H.	<u>8</u>	■ SI		NGTH (ksf)	⊣ "
ا				N 2 #						1 2	3 4	
0			TOPSOIL - SANDY LEAN CLAY, Dark Brown, Hard, Moist	0.3 ft_ 1.0 ft	▼ SPT		30-23-13					
<u> </u>			BOULDER/COBBLES, Sandstone, Brown		1		(36)					
<u> </u>			LEAN TO FAT CLAY, Shaley, w/ Sand, Reddis Brown, Hard, Moist to Slightly Moist (CL-CH)	sh								
			Brown, Franci, Moist to Olightiy Moist (OE-OH)									
					SPT		10-8-14	4.5				
	9				2		(22)	4.5				
5												
			- Very Stiff Below 6'									
	Ь		very earn 2010 ii e		SPT 3		17-21-22 (43)	4.5		A		
							(10)					
	1											
	a.				SPT		10-16-27					
	2" 0				4		(43)	4.5	0			
10	4.											
	CFA											
	Ь											
				13.0 ft								
			SANDY SHALE, Highly Weathered, Gray & Bro									
<u> </u>			Soft	,	SPT		23-38-44					
	1				5		(82)	4.5	0			
15										: :	· <u>······</u>	
		77										
	Ь											
	1	77										
5	ľ											
				00 0 f	SPT 6		36-40-48 (88)	4.5	0		A	
20			Bottom of borehole at 20.0 feet.	20.0 ft					l	<u> </u>	<u>:</u>	
			bottom of boreflore at 20.0 feet.									

GEOTECHNICAL BORING LOG

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			ion Entertainr					National C			on Par	'k			
		. 256748													
				COMPLETED 2/27/19						В	ENCH	MARK E	EL		
				DRILL RIG 2015 CME	GROU	ND WAT	ER L	EVELS							
HAM	MER TYP	E Auto		-		AT TIME	OF D	RILLING	None	!					
LOG	GED BY	CJ		CHECKED BY RTH		AT END	OF D	RILLING							
NOT	ES														
		7				111		Ø		20) 40	60	/T (pcf) • 80 1		
TH (ING 10D	SYMBOL		MATERIAL DESCRIPTION		TYPE 3ER	ERY %	CTED OUNT LUE)	T PEN	2		N VALU 40 6	IE ▲ 80 80)	NOIL
DEPTH (ft)	DRILLING METHOD	STRATA 8	U	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2	PL 	MC 40 €	LL 50 80)	ELEVATION
		STI					2	BI	۵		HEAR 1		GTH (ks 3 4		
0 -			Very Stiff,		8:3#	SPT 1		3-5-14 (19)		04	•				
	Y		LEAN CLA	/COBBLES, Sandstone, Brown Y, w/ Sand, Shaley, Reddish Brown Gray, Very Stiff, Slightly Moist (CL)	to		_		_						
						SPT 2		5-5-17 (22)	4.5	C	A				
5 															
	O.D.				8.0 ft	SPT 3		5-5-22 (27)	4.5	0	A				
	CFA - 4.5"		SANDY SI Soft	HALE, Highly Weathered, Gray & Bro		SPT	-	23-25-27							
10	<u>5</u>					4		(52)	4.5	0	: : : :			• • • • • • • • • • • • • • • • • • • •	
						SPT	-	40-49-60	4.5	0					
15						5		(109)	1.0			. <u></u>			
					16.3 ft						:				
				Refusal at 16.3 feet. Bottom of borehole at 16.3 feet.											



GEOTECHNICAL BORING LOG

BORING NUMBER

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(CLIEN	NT Chero	kee Na	ation Entertaiı	nment	·		PROJE	CT NAM	/IE N	lational C	heroke	e Nation Park		
F	PROJ	ECT NO.	25674	18 Rev. 1				PROJE	CT LOC	CATIO	N Sallis	aw, OK	(
[ATE	STARTE	2/2	7/19										(EL	
[RILL	ER RD			_ DRILL RI	I G _D50		GROU	ND WAT	ER LI	EVELS				
	IAMN	IER TYPE	Auto)	_			A	T TIME	OF D	RILLING	None			
						D BY RTH	I		T END	OF DE	RILLING				
- 1								_							
UB/BORING LOGS/BORING LOGS.	0 (#)	DRILLING METHOD	STRATA SYMBOL		Jnified Soil (n System	0.4 ft		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 PL MC 20 40 SHEAR STRE 1 2	0 80 100 LUE 60 80 C LL 60 80	ELEVATION (ft)
RK-S	0	Ο.Ο	<u> </u>	TOPSOIL Soft to Ha	AY, Trace S	and, Dark B	rown, T	X 1]	7-50/2"	2	0		†	
AP P		4.	:::::	SANDST	ONE, Fine G d, Tan, Soft t			1.2/ft	SPT		50/0"		<u> </u>	<u> </u>	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS.GPU		CFA				isal at 1.2 fe borehole at			2						
SORING LOG - PPI - PPI STD															

GEOTECHNICAL BORING LOG

BORING NUMBER

33

PAGE 1 OF 1

CLIE	NT Chero	kee Na	tion Entertainm	nent		PROJE	CT NAM	/IE N	lational C	neroke	e Nation F	ark			
PRO.	JECT NO.	25674	8 Rev. 1			PROJE	CT LO	CATIO	N Sallisa	aw, OK	(
DATE	STARTE	2/27	/19	COMPLETED	2/27/19	SURFA	CE ELE	VATIO	ON		BENG	CHMAR	K EL.		
DRIL	LER RD			DRILL RIG D	50	GROU	ND WAT	ER LI	EVELS						
HAMI	MER TYPE	Auto				A	T TIME	OF D	RILLING	None					
LOGG	GED BY _J	G		CHECKED BY	RTH	A	T END	OF DE	RILLING						
NOTE	ES														
DEPTH (ft)	NOTES H (#) NOTES WATERIAL DESCRIPTION Unified Soil Classification System						SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	40	0 80 LUE 4 60 C	100	ELEVATION (ft)
0	۸ - 4.5" O.D.	1,1 12. 1	Stiff to Hard	l, Moist NE, Fine Grained	ace Sand, Dark Bro d, Weakly to Well dium Hard	1.9 ft	SPT 1		7-40- 50/0"	2.25	0				
	CFA	. :		Refusal at Bottom of borel			SPT 2		50/0"						

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ

GEOTECHNICAL BORING LOG

BORING NUMBER

34

CLIE	NT Cher	okee Na	ation Entertainment	PROJEC	T NAM	NE N	ational Cl	neroke	e Natio	n Park		
PRO.	JECT NO.	25674	18 Rev. 1	PROJEC	T LOC	ATIO	N Sallisa	aw, OK				
DATE	STARTE	D 2/27	7/19 COMPLETED 2/27/19	SURFAC	E ELE	VATI	ON		BI	ENCHMARK	EL	
DRIL	LER RD		DRILL RIG _D50	GROUN	D WAT	ER LI	EVELS					
1	MER TYPI							None				
			CHECKED BY RTH									
_							_					
ź									•	DRY UNIT	NT (pcf) ♦	
ا ا ا		占			ш	%	S			40 60	8Ö 100	-
	920	₩	MATERIAL DESCRIPTION	N.	문		HE (H		2	▲ N VAL 0 40	60 80	NO
DEPTH (ft)	DRILLING METHOD	A S			MBF		₩8¥	(tsf)		PL MC	LL	(#)
	絽	STRATA SYMBOL	Unified Soil Classification Sys	stem	SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		\longrightarrow	60 80	ELEVATION (ft)
		STF			Ś	₩	оĦ	ا م			NGTH (ksf)	 "
		13 L 1		0.3#						1 2	3 4	
0			TOPSOIL - LEAN CLAY, Trace Sand, Stiff, Moist	Dark Brown, J	SPT		13-6-3	2.75	A O			
			CLAYEY SAND, Trace Gravel, Tan & I	Brown, Loose to	1		(9)					
<u>}</u>			Medium Dense, Wet to Slightly Moist (SC)								
	1											
					SPT 2		3-5-8 (13)	4.5				
- - -				5.0 ft	\ _		(10)					
5 5			SANDY SHALE, Highly Weathered, Ta									.
27-			OAND FORALL, Highly Weathered, Te	an a Gray, Gon								
	9				SPT		12-23-25					
					3		(48)	4.5	0	_		
)							
	<u>ن</u>				SPT		15-24-30					
	o				4		(54)	4.5	0	4		
	.4.5"				\							
10	CFA -							•	• • • • • • • •			
	Ö											
Š					SPT		15-27-38	4.5	0			
					5		(65)	4.5	J			
5										<u> </u>	<u>:</u>	
15												
}	•											
3				40.0 #								
		7	SANDY SHALE, Gray, Soft to Medium	18.0 ft								
2			SAND I SHALE, Glay, SOIL to Medium	19.0 ft	SPT		43-50/0"	4.5	0		<u>:</u> :	<u> </u>
			Refusal at 19.0 feet.	foot	6							
[Bottom of borehole at 19.0	ieet.								
3												

GEOTECHNICAL BORING LOG

BORING NUMBER

35

CLIE	NT Che	rokee Nati	on Entertainn	nent	_ PROJE	CT NAI	ME N	lational C	heroke	e Natio	on Par	k			
PRO	JECT NO	. 256748	Rev. 1		_ PROJE	CT LO	CATIC	N Sallis	aw, Ok	(
DATI	E STARTI	ED <u>2/27/</u>	19	COMPLETED 2/27/19	SURFA	CE ELE	VATI	ON		В	ENCH	MARK I	EL		
DRIL	LER CV	V		DRILL RIG 2015 CME	GROU	ND WAT	ER L	EVELS							
		E Auto						RILLING	None						
1				CHECKED BY RTH				RILLING							
					_			-							
ODE (1) DEPTH (1) DESCRIPTION OF THE EXPLOSION OF THE EXP													VT (pcf)		
<u> </u>		SYMBOL				SAMPLE TYPE NUMBER	%	CORRECTED BLOW COUNTS (N VALUE)	z	20		N VALL	80	100	z
	N. O	N.∀		MATERIAL DESCRIPTION		: TY 3ER	 } }	555	l PE	2	20	40	60 8	0	ELEVATION (ff)
DEPTH (ft)	DRILLING METHOD		Ur	nified Soil Classification System		PLE UME	RECOVERY (RQD %)	V CKE	POCKET PEN. (tsf)		PL	MC	ĻĻ		[X] EX
<u> </u>	≧≅	STRATA	.			NAX N) E	2002	၁၀၀	2	20		60 8	80	
		S				0)	_						NGTH (k	sf) 🗖	
0		17. 17. 12.	TOPSOIL -	SANDY LEAN CLAY, Dark Brown	0.3 ft						<u>1</u> :	<u>2</u> :	3 4	1 :	
<u> </u>			Stiff, Moist			SPT 1		4-4-5 (9)	2.75	_	0				
5			SANDY FA Moist (CH)	T CLAY, Reddish Tan, Stiff to Very	y Stiff,		-	(0)							
<u>-</u>											:		:	· · ·	
<u> </u>											:	:	:		
			- Shaley Be	Now 4!		SPT		8-9-13	4.25		<u>.</u>				
5			- Snaley be	HOW 4		2		(22)	4.25						
5										*******					
<u>-</u>			CANDY OF	IALE High NAVe of board Documents	6.0 ft		-				:	:	:	· ·	
	O.D		Gray, Soft	IALE, Highly Weathered, Brown to to Medium Hard	Brown &	SPT		20-33-52	4.5	0		:	:	A	
-	4.5"		•			3		(85)				:	:	:	
 - -												:	:	: :	
	CFA					SPT	1						:	: : :	
						4		40-65/4"	4.5	0	:	:	:	4	
											<u>.</u>		. <u>;</u>	: ;	
10											:		:		
<u>-</u>											:	:	:	· · ·	
											:	:	:	:	
Ž L											:	:	:	: : :	
- - -											:	:	:	: : :	
- I						SPT		33-65-			:	:	:	: : :	
9		47			14.8 ft	5		65/4"	4.5	0	:	:	:	4	
		<i>c. [.].</i>		Refusal at 14.8 feet.								•			
:				Bottom of borehole at 14.8 feet.											
<u>-</u>															
<u>}</u>															
<u>-</u>															
<u>-</u>															
-															
<u> </u>															
3															

GEOTECHNICAL BORING LOG

BORING NUMBER

36

CL	ENT Che	erokee Na	ation Entertainn	nent	PROJE	CT NAM	/IE _N	lational Cl	heroke	e Natio	on Parl	k		
PR	OJECT NO	D. 25674	l8 Rev. 1		PROJE	CT LO	CATIO	N Sallisa	aw, OK	(
DA	TE START	Γ ED 2/27	7/19	COMPLETED 2/27/19	SURFA	CE ELE	VATI	ON		В	ENCH	MARK E	L	
1				DRILL RIG 2015 CME										
1	MMER TY							RILLING	None					
		<u></u>		CHECKED BY RTH				RILLING						
_1					•	NI LIND	01 01	IXILLING _						
5 NO	TES													
3								40		20	DRY 40	UNIT W 60	T (pcf) 🔶 80 100	
	(1)	/BC				/ PE	% (ED (:	Ä.			N VALU	E 🔺]z
	J ŽŽ	l X l		MATERIAL DESCRIPTION		E T	ER 0	COU	T (£		20		08 0	뒱
DEPTH	DRILLING METHOD	Į ₹	Ur	nified Soil Classification System		1₽ N	ŠÄ	W C	쑮ᇵ		PL —	MC	LL ——i	ELEVATION (ft)
ב ב ב		STRATA SYMBOL				SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)			40 6	80 80	┤╗╶
		ν.						ш				_	GTH (ksf)	
3 0		74 1/2 1/4	→ TOPSOIL -	SANDY LEAN CLAY, Dark Brown,	0.3 ft						<u>1 </u>	<u>2</u> ;	3 4 : :	\dagger
Ž Ž			Medium Sti	ff, Moist		SPT 1		3-3-5 (8)	2	A	0			
2			SANDY FA	T CLAY, Trace Gravel, Reddish Bro ff, Moist (CH)	own,	A .		(0)			:			
<u> </u>	-		Mediairi Sti	ii, Woist (Ci i)										
Ä												:		
튜 S -	1		- Shaley &	Stiff Below 3'							:	:		
5	_					SPT		4-5-8				:		
Z-						2		(13)	2.75		0	:		
5							1						· · · · · · · · · · · · · · · · · · ·	1
C7-													:	
					6.5 ft	SPT		17-25-27						
<u></u> -	5" 0.		SANDY SH	ALE, Highly Weathered, Tan to Gra	ay, Soft	3		(52)	4.5	0		_	: :	
Z 	- 4.5						1				:	:		
Ž -	CFA -										:			
₽ -						SPT		27-36-40			:	:		
2						4		(76)	4.5	0		:	A	
10							1				 :	. i	: :	·
											:	:		
֚֚֚֓֡֝֟֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֓֓֓֡֓֓֓֓֡֓֡֓֓֡֡֡֡֡֡														
- S.Y. MASTER PROJE	-										:	:	: :	
ፓ														
- A	7										:	:		
- N						SPT		17-49-52				:	: :	
- 80:60	1				15.0 ft	5		17-49-52 (101)	4.5	0	:	:	: :	↑
<u>15</u>	1	77		Bottom of borehole at 15.0 feet.							·	•		
/1//														
3														
A E														
집														
<u> </u>														
<u> </u>														
-														
<u>.</u>														
NG EOG - PPI - PPI STD TEMPLATE.GD														
žΙ														

GEOTECHNICAL BORING LOG

BORING NUMBER

37

				nent				lational Cl			n Park				
				COMPLETED 2/27/19								IARK F	=1		
				DRILL RIG 2015 CME											
								RILLING	None						
LOG	GED BY	CJ		CHECKED BY RTH	. /	AT END	OF DI	RILLING _							
NOTI	ES				-										
i LOG		٦								20	DRY U	JNIT W 60	/T (pcf) 80	• 100	
	୍ଦ୍ର ପ୍ର	MBC				YPE R	% (o	E) TS	Ä.			I VALL	JE 🔺	30	NO
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL				ELEVATION (ft)
	RA	RAT,	Ur	ified Soil Classification System		AMP	ECC (R(NO S	l S		-	$\overline{}$		30	ELE
2 2 2 3		ST				σ	LE			SH		_	IGTH (k	sf) 🗖	
0		74 1 ^N - 74		SANDY LEAN CLAY, Dark Brown,	0.3 ft	SPT		5-5-5				<u>2</u> :	<u>3</u>	<u>4</u> : :	
			Stiff, Moist	T CLAY, Trace Gravel, Reddish Br	own.	1		(10)	2	A O			:	:	
<u> </u>	Ì		Stiff to Hard	I, Moist (CH)	,									:	
A L														:	
장			- Shaley Be	low 3'										:	
] - -						SPT 2		8-16-16 (32)	3.5		<u> </u>			:	
5			CANDA CH	ALE, Highly Weathered, Brown, Sc	5.0 ft			(02)					<u>.</u>	:	
3G7-17			SANDT SIT	ALL, Highly Weathered, Blown, 30	л					:			:	:	
	0.D.					SPT		21-27-31	4.5	0				:	
=	4.5" (3		(58)					:	:	
Ž – –	CFA - 4												:	:	
원 	5					SPT		23-31-39	4.5						
06 06		77				4		(70)	4.5	0					
10															
티 -	9	77												:	
<u> </u>														:	
MASTER PROJECT															
.∵ MAN							1								
0 - 00		77			15.0 ft	SPT 5		40-44-46 (90)	4.5	0				A	
15		<u> </u>		Bottom of borehole at 15.0 feet.	10.0 10								•	•	
E.GDI - //T															
ing LOG - PPI - PPI S ID TEMPLATE.GD															
<u> </u>															
2															
<u> </u>															
- 106															
2															

GEOTECHNICAL BORING LOG

BORING NUMBER

38

CLIE	NT Cher	okee Na	ation Entertainment	PROJE	CT NAN	/E _N	lational Cl	neroke	e Natio	n Park			
PRO.	JECT NO.	25674	48 Rev. 1	PROJE	CT LOC	CATIO	N Sallisa	aw, OK	(
DATE	STARTE	D 2/27	7/19 COMPLETED 2/27/19	SURFA	CE ELE	VATI	ON		BE	NCHMAR	K EL		
DRIL	LER CW		DRILL RIG _2015 CME	GROU	ND WAT	ER L	EVELS						
HAM	MER TYPE	E Auto)	,	AT TIME	OF D	RILLING	None	!				
LOG	GED BY _	CJ	CHECKED BY RTH	. /	AT END	OF DI	rilling _						
NOTI	ES												
									00	DRY UNIT	TWT (pcf)	100	
		BOL			씸	%	STS (z.	20	▲ N VA	80 80 €		z
TH (DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40	60 8	30	ELEVATION (ft)
DEPTH (ft)		Ĭ¥.	Unified Soil Classification System		IPLE UMI	SOV RQL	RRE W C	XE)			IC LL	-	EVA (#
2	△≥	<u>₹</u>			SAN	REC (S CO	POC	20	9 40	60	80	
		S							SH 1	IEAR STR 2	RENGTH (F 3	(st) 🚨 4	
0	-	711/	TOPSOIL - SANDY LEAN CLAY, Dark Brown,	0.7 ft	SPT		3-3-5		:		<u></u>	:	
<u> </u>			Medium Stiff, Moist SANDY LEAN CLAY, Shaley, Reddish Brown,		1		(8)		A :		:	:	
	L		Medium Stiff to Stiff, Moist (CL)						:				
<u> </u>	•										:	:	
5					Vont		5 7 40		:	:	:	:	
<u> </u>					SPT 2		5-7-10 (17)	4.25	<u> </u>	:	:	:	
5	L			5.5 ft			. ,						
7.75			SANDY SHALE, Highly Weathered, Brown, So						į			•	
	<u>.</u>				SPT		23-34-22						
	5" 0				3		(56)	4.5	0 :	:		•	
	4.								:		:	:	
1 2 2	CFA								:	:	:	•	
<u> </u>		77			SPT		27-31-33	4.5	0		A		
S					4		(64)						
10													
<u>-</u>									:	:	:	:	
		4							:	:	:	:	
										:	:		
	L												
					SPT		40-39-49						
- 00.7	9			15.0 ft	5		(88)	4.5	0	:	:		
15		<u> </u>	Bottom of borehole at 15.0 feet.				I		· ·	· · · · · ·	<u> </u>	<u>:</u>	
NG LOG- PYI- PYISID IEMPLAIE.GUI- 7													
2010													

GEOTECHNICAL BORING LOG

BORING NUMBER

39

PAGE 1 OF 1

CLIENT Cherokee Nation Entertain	ment F	PROJE	CT NAM	IE N	lational Ch	neroke	e Nation Pa	ark		
PROJECT NO. 256748 Rev. 1	F	PROJE	CT LOC	ATIO	N Sallisa	w, OK				
DATE STARTED 2/28/19	COMPLETED 2/28/19	SURFA	CE ELE	VATI	ON		BENC	HMARK	EL	
DRILLER CW	DRILL RIG 2015 CME	GROUN	D WAT	ER LI	EVELS					
HAMMER TYPE Auto	_	A.	T TIME	OF D	RILLING	None				
LOGGED BY CJ	CHECKED BY RTH	A.	T END (OF DI	RILLING _					
NOTES										
٦					"				WT (pcf) ♦ 80 100	
TH () HOD HOD SYMBOL	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	% ≿%	RECTED / COUNTS VALUE)	PEN.	20	N VAL 40	UE 🛕 60 80	ELEVATION (ft)
			LE .	ECOVERY (RQD %)	CORRECTE BLOW COUN (N VALUE)	POCKET (tsf)	PL	МС	LL	(#)
DRILL MET	Inified Soil Classification System		AMF	ZECC (R	% o ≤	100		40	60 80	
LS			S	œ		<u> </u>	■ SHEA	R STRE	NGTH (ksf) 🗖	
0	2412 / 2 1 2 1 1							2	3 4	
CLAYEY S Dense, Sli	SAND, w/ Gravel, Brown, Medium ghtly Moist (SC)	0.7 ft	SPT		10-10-12		0	Ė		
ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا	DNE, Fine Grained, Poorly to Well I, Tan, Soft to Medium Hard		1		(22)					
CFA 4										
		3.9 ft	SPT		65/2" /		0			<u> </u>
	Bottom of borehole at 3.9 feet.		2							

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT-2567484

GEOTECHNICAL BORING LOG

BORING NUMBER

40

CLIE	NT Cher	okee Na	ation Entertainment	PROJE	CT NAN	/E _N	National Cl	heroke	e Nation Pa	rk		
PRO	JECT NO.	25674	48 Rev. 1	PROJE	CT LOC	ATIO	N Sallisa	aw, OK				
DAT	E STARTE	D 2/28	8/19 COMPLETED 2/28/19	SURFA	CE ELE	VATI	ON		BENCH	IMARK EL.		
DRIL	LER CW	<i>l</i>	DRILL RIG _2015 CME	GROU	ND WAT	ER L	EVELS					
HAM	MER TYP	E Auto)	A	AT TIME	OF D	RILLING	None				
LOG	GED BY _	CJ	CHECKED BY RTH		AT END	OF D	RILLING _					
NOT	ES			_								
200									◆ DRY	UNIT WT (ocf) 🔷	
	(D	STRATA SYMBOL			SAMPLE TYPE NUMBER	%	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	_	0 60 80 N VALUE ⊿	<u> </u>	z
H (1)	DRILLING METHOD	SYN	MATERIAL DESCRIPTION		F.T.	RECOVERY (RQD %)		± €	20	40 60	80	ELEVATION (ft)
DEPTH (ft)	RILL	TA (Unified Soil Classification System		IP I	SS	W C	KE (\$	PL —	MC	LL ⊣	EVA (ft
킬		TRA			SAN	REC (log	20	40 60	80	┧╝
2000		S					_		SHEAR 1	STRENGTI	H (kst) ■ 4	
0	Ь		CLAYEY SAND, w/ Gravel, Dark Brown to B	rown,	SPT		4-8-9			<u> </u>	:	
<u> </u>			Medium Dense, Moist (SC)		1		(17)		^			
5				2.0 ft								
≥			SANDY LEAN CLAY, Shaley, Reddish Brow Brown, Very Stiff, Moist (CL)	n to					:		:	
<u> </u>	9		Brown, very Still, Moist (GL)									
					SPT		10-9-9				:	
- 4 2					2		(18)	4.5	40			
5				5.5 ft								.
67 - 			SANDY SHALE, Highly Weathered, Brown,	Very Soft					:		:	
	<u>.</u>		to Soft		SPT		10-14-13	4.5	0 🛦		:	
<u>-</u> -	5".0				3		(27)	4.5			:	
<u> </u>	4.											
H 된	CFA								:		:	
<u> </u>					SPT 4		13-16-23 (39)	4	: O	A	:	
					4		(39)					
10												
<u>-</u> -	9								:		: : :	
100			24457	12.0 ft					:		:	
T			SANDY SHALE, Gray, Soft									
NAV	L											
[- 					SPT		49-52-53	4.5	0		:	
00.80				15.0 ft	5		(105)	4.5		<u> </u>	<u> </u>	
15			Bottom of borehole at 15.0 feet.									
-												
<u> </u>												
NG COG - PPI - PPI S I D I EMPLAIE.GD												
<u>-</u>												
בֿן פֿל												

GEOTECHNICAL BORING LOG

BORING NUMBER

41

CLIE	NT Chero	okee Nat	ion Entertainm	nent	_ PROJE	CT NAI	ME _N	National C	heroke	e Natio	on Parl	<		
PRO.	JECT NO.	256748	Rev. 1		_ PROJE	CT LO	CATIC	N Sallisa	aw, Oł	(
DATE	STARTE	D 2/28/	19	COMPLETED 2/28/19	_ SURFA	CE ELE	VATI	ON		В	ENCHI	MARK E	L	
DRIL	LER RD			DRILL RIG D50	_ GROU	ND WAT	ER L	EVELS						
HAM	MER TYPE	E Auto				T TIME	OF D	RILLING	11 ft					
				CHECKED BY RTH										
)GS:(4	DRY	UNIT W	T (pcf) 🔷	
JG LC		ᇦ				Щ	%	ု က	 	20	40	60 N VALU	80 100	
H SORII	NG CO	SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2			0 80	ELEVATION (ft)
LOGS/BOF DEPTH (ft)	DRILLING METHOD					LE MB	28	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	(ET)		PL	МС	LL	(#)
DIG	RE	STRATA	Ur	nified Soil Classification System		AMF NU	5 S	805 805 805 805 805 805 805 805 805 805		2	—	$\overline{}$	80	
ORIN		STF				S)	8	оЯ	٩				GTH (ksf)	
SUB/B		11.7.7.	01.41/51/.0								1	2 3	3 4	
RK-S			Loose, Mois	AND, w/ Gravel, Dark Brown to Br st (SC)	rown,	SPT		14-3-3		A O	:	:		
Z				,		1		(6)				:		
ATIC	B				2.0 ft							:		
GE N			SANDY FA Stiff, Moist	T CLAY, Shaley, Tan & Gray, Me (CH)	dium							:		
			,	(-)								:		
						SPT	.]	3-3-5			:	:		
-NAT					5.0 ft	2		(8)	2.75	_	 0			
6748			SANDY SH	ALE, Highly Weathered, Brown, S							:			
T-25			Medium Ha	rd							:	:		
Z E	<u>.</u>					SPT		7-14-30			:			
ATIC -	5" 0					3		(44)	4.5	0		^		
(EE)	4.						1							
EROP	CFA													
팅						SPT		10-15-33	4.5					
OKIC		777				4		(48)	4.5	0	:	A		
10		77									: :	:	(:	
			<u>Z</u>								:	:	· · · · · · · · · · · · · · · · · · ·	
ECT											:	:		
- 기상 - 기상												:		
		77												
MAS	.	177				CDT		F0/0"	1.5	0				
S						SPT 5		50/0"	4.5					
80:60					15.0 ft						:	:		
15				Refusal at 15.0 feet.										
- 7/1				Bottom of borehole at 15.0 feet.										
-G9														
LATE														
EMP														
TDT														
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE/2019/OK/C/CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\(GF\) DEPTH 11.10 C1 C1 C1 C1 C1 C1 C1 C1 C1														
-id														
-90														
NGL														
BORI														

GEOTECHNICAL BORING LOG

BORING NUMBER

42

PAGE 1 OF 1

CLIE	NT Cherc	kee Na	ation Entertainn	nent	PROJE	CT NAM	ME N	National Cl	heroke	e Nati	on Pa	rk			
PRO.	JECT NO.	25674	l8 Rev. 1		PROJE	CT LO	CATIC	N Sallisa	aw, Oł	(
DATE	STARTE	D 2/2	1/19	COMPLETED 2/21/19	SURFA	CE ELE	VATI	ON		E	BENCH	MARK	EL		
DRIL	LER CW			DRILL RIG 2015 CME 55	GROUI	ND WAT	ER L	EVELS							
HAMI	MER TYPE	_ Auto			,	AT TIME	OF D	RILLING	2 ft						
LOG	GED BY _	CJ		CHECKED BY RTH		AT END	OF D	RILLING	2 ft						
NOTE	ES														
		٦										UNIT V	VT (pcf) 80	• 100	
ı	920	SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	:RY %	UNTS (E)	PEN.			N VAL	UE 🔺	30	ION
DEPTH (ft)	DRILLING METHOD		He	nified Soil Classification System		JMBE	ECOVER (RQD %	/ CO VALI	POCKET (tsf)		PL	MC	LL		ELEVATION (ft)
	유물	STRATA	Oi	illied Ooli Classification System		N N	ZEC (R	CORF BLOW (N V	၁၀		20	40	60 8	30	EE
		ST				(O)	<u> </u>	<u> </u>	"	B S	HEAR	STRE	NGTH (k	sf) 🗖	
0		711/	TOPSOIL -	LEAN CLAY, Trace Sand, Dark	0.7 ft						<u>1</u> :	:	3 4	<u>1</u>	
			Brown, Soft		0.7 IL	SPT 1		1-1-3 (4)	0	A	0	:	:	:	
	O.D.		FAT CLAY,	, With Coarse Sand, Tan, Soft, Mois	st (CH)	A .		(4)					:	:	
-	ָּטַ.		Ā								:		:		
	4 - 4				3.0 ft										
	CFA		SANDY SH	IALE, Highly Weathered, Brown, Sc	oft	VICDT.		05/5"	4.5					:	
}					4.5 ft	SPT 2		65/5"	4.5	0	:		:	. 4	
\vdash		7 6													

Refusal at 4.5 feet. Bottom of borehole at 4.5 feet.

GEOTECHNICAL BORING LOG

BORING NUMBER

43

PAGE 1 OF 1 PROJECT NAME National Cherokee Nation Park CLIENT Cherokee Nation Entertainment **PROJECT NO.** 256748 Rev. 1 PROJECT LOCATION Sallisaw, OK **DATE STARTED** <u>2/27/19</u> **COMPLETED** <u>2/27/19</u> SURFACE ELEVATION BENCHMARK EL. **DRILLER** RD **DRILL RIG** D50 **GROUND WATER LEVELS** HAMMER TYPE Auto AT TIME OF DRILLING 3.5 ft LOGGED BY JG CHECKED BY RTH AT END OF DRILLING 3.5 ft NOTES DRY UNIT WT (pcf) 20 40 60 80 CORRECTED BLOW COUNTS (N VALUE) STRATA SYMBOL SAMPLE TYPE NUMBER POCKET PEN. (tsf) ▲ N VALUE ▲ LEVATION (ft) DRILLING METHOD RECOVERY (RQD %) 60 40 80 DEPTH (ft) MATERIAL DESCRIPTION MC Unified Soil Classification System 80 40 60 ■ SHEAR STRENGTH (ksf) ■ TOPSOIL - LEAN CLAY, w/ Sand, Dark Brown, SPT 1-1-1 Soft. Moist 1.25 0 (2) SANDY LEAN CLAY, Shaley, Trace Gravel, Reddish \Box Ö Brown, Soft, Moist (CL) 5 4. CFA 4.0 ft SPT 1-43-3 0 SANDSTONE, Fine Grained, Poorly to Well 4.6 ft 2 50/1" Cemented, Tan, Soft to Medium Hard

Refusal at 4.6 feet. Bottom of borehole at 4.6 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\ MASTER PROJECT FILE\2019\00000KC\CHEROKEE NATION ENT-256748-NATL CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS.GPU

GEOTECHNICAL BORING LOG

BORING NUMBER

44

CLIE	NT Che	rokee Nat	ion Entertainr	ment	PROJE	CT NAI	ME N	lational C	heroke	e Nation I	Park		
PRO.	JECT NO	. 256748	Rev. 1		PROJE	CT LO	CATIC	N Sallis	aw, Ok	(
DATE	START	ED <u>2/27/</u>	19	COMPLETED 2/27/19	SURFA	CE ELE	VATI	ON		BEN	CHMARK	EL	
DRIL	LER CV	V		DRILL RIG 2015 CME	GROU	ND WAT	TER L	EVELS					
нам	MER TYP	PE Auto		_		AT TIME	OF D	RILLING	None				
LOG	GED BY	CJ		CHECKED BY RTH		AT END	OF D	RILLING					
NOTI	ES												
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DESCRIPTION Inified Soil Classification System	A 2 #		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 Pl F 20	40 60 N VALU 40 MC 40	VT (pcf) ◆ 80 100 JE ▲ 60 80 LL 60 80 NGTH (ksf) 3 4	ELEVATION (ft)
0			Very Moist	AT CLAY, Trace Gravel, Reddish		SPT 1	_	17-10-7 (17)	1.75	▲ C			
5	CFA - 4.5" O.D.		SANDY SI Brown, Sol	HALE, Highly Weathered, Brown ft	4.0 ft and Dark 6.0 ft	SPT 2	•	23-27-46 (73)	4.5	0		A	
			SANDY SH	HALE, Brown to Gray, Soft to Me	dium Hard	SPT 3	<i>J</i>	65/4"	4.5	0			
	,			Refusal at 8.8 feet.	0.0 11	SPT 4		65/3"	4.5	<u>O</u> :	•	<u>:</u> :	
NOTE (#) O DEPTH				Bottom of borehole at 8.8 feet.									

GEOTECHNICAL BORING LOG

BORING NUMBER

45

PAGE 1 OF 1

CLIE	NT Che	rokee Na	tion Entertainr	ment	PROJE	CT NAM	ME N	lational C	heroke	e Natio	n Park				
PRO.	JECT NO	. 25674	8 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, Ok	(
DATE	START	ED 2/27		COMPLETED 2/27/19							ENCH	/IARK E	L		
				DRILL RIG 2015 CME											
		PE Auto						RILLING	None	!					
				CHECKED BY RTH				RILLING							
								•							
OGS.(•	DRY I	JNIT W	/T (pcf)	•	
NG L(30L				Щ	%	D TS	z	20		60 VALU	<u>80 1</u> IF ▲	00	_
H H	NG OD	SYMBOL		MATERIAL DESCRIPTION		ΞÄ	% % %	STE OUN (E)	H (2			80 80	0	ē
DEPTH (ft)	DRILLING METHOD		11	nified Soil Classification System	,	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL	MC	ĻĻ		ELEVATION (ft)
NG L	ద	STRATA	O	Tillied Ooli Classification System	'	M N	REC.	S C C C	ပ္ပ	2	20 4	10 6	50 80	0	
CT FILE YOU OK CICHEROKEE NATION ENT-286748-NATI. CHEROKEE NATION PARK-SUBIBORING LOGS/BORING LOGS/GPJ O DEPTH (1) (1) LOS DEPTH (1) DEPTH DE		ST				(I)	<u> </u>) <u>a</u>	"				IGTH (ks		
-SUB		71 1/1	TOPSOIL	- LEAN CLAY, Trace Sand, Dar	k Brown0.5 ft						<u>1</u> :	<u>2</u> :	<u>3 4</u> : :	<u> </u>	
ARK-			\ Medium St	tiff, Moist		SPT 1		1-3-3 (6)	2.5	A	0				
NO NO			SANDY FA Moist (CH)	AT CLAY, Reddish Brown, Medi	um Stiff,			(-)			:	:			
			Molot (011)												
											:	•			
HEN EN			0.4410.7.01	1415 111 14 14 14 1	3.5 ft	SPT		65/2"	A 3 /		0	:			
) 	O.D		SANDY SE Soft to Med	HALE, Highly Weathered, Gray of dium Hard	& Brown,	2		03/2				:			
48-N/	4.5"											<u>.</u>	<u>.</u>		
525674											:	:			
<u> H</u>	CFA						1								
NOL _						SPT 3		27-48- 65/5"	4.5	0				4	
В М															
8 -		7. 7.7.7										:			
						SPT	.	40-56-				:			
OK/C/					9.8 ft	4		65/4"	4.5	0	:			4	
019/0				Refusal at 9.8 feet.		V						1	•		
ILE/2				Bottom of borehole at 9.8 feet											
NO.															
핅															
MAS															
\. \.															
80:6															
/19 0															
- 1/1															
.:GDT															
LATE															
EMP															
101															
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - SA_MASTER PROJE															
<u>-</u>															
1-90															
J Q L															
30RII															

GEOTECHNICAL BORING LOG

BORING NUMBER

46

	CLIE	NT Cherc	kee Na	ation Enterta	inment	·	PROJI	ECT NAI	ME N	National C	heroke	e Natio	on Park			
	PRO.	JECT NO.	25674	18 Rev. 1			PROJI	ECT LO	CATIC	N Sallis	aw, Oł	<				
	DATE	STARTE	D 2/2	7/19	COMPLET	ED 2/27/19	SURF	ACE ELE	VATI	ON		В	ENCH	/IARK EI	L	
	DRIL	LER CW			DRILL RIG	_2015 CME	GROU	ND WAT	ER L	EVELS						
	HAMI	MER TYPE	Auto)				AT TIME	OF D	RILLING	None)				
	LOG	GED BY	CJ		CHECKED	BY RTH		AT END	OF D	RILLING						
ЭРЈ																
JB\BORING LOGS\BORING LOGS.	DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		Unified Soil Cla	DESCRIPTION assification Syste	em	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 20 4 PL 20 4 HEAR S	60 N VALUE 10 60 MC 40 60	LL 0 80 GTH (ksf)	ELEVATION (ft)
N PARK-SI	0			Soft to F	Hard, Moist	/, Trace Sand, D an, Hard, Very N	1.0/ft	SPT 1		4-10-22 (32)	1		0 🛦			
CHEROKEE NATION	 	CFA - 4.5" O.D		SANDY (CH)	FAT CLAY, Sha	aley, Red & Gray Weathered, Gra	y, Hard, Moist 3.0 ft									
18-NAT'L (Below 4.5'		5.0 ft	SPT 2		27-33-43 (76)	4.5	0			A	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\\Q019\OK\C\CHEROKEE NATION ENT-256748-NAT\L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS. GPJ																
30RING L																

GEOTECHNICAL BORING LOG

BORING NUMBER

47

CL	IENT Cher	okee Na	ation Entertainment	PROJI	ECT NAI	ME N	lational C	heroke	kee Nation Park	
PR	OJECT NO.	25674	8 Rev. 1	PROJI	ECT LO	CATIO	N Sallis	aw, Oł	OK	
DA	TE STARTE	D 2/26	6/19 COMPLETED 2/26/19	SURF	ACE ELE	EVATI	ON		BENCHMARK EL.	
DR	ILLER CW		DRILL RIG 2015 CME	GROU	ND WAT	TER LI	EVELS			
НА	MMER TYPI	E Auto	<u> </u>		AT TIME	OF D	RILLING	None	ne	
LO	GGED BY	CJ	CHECKED BY RTH		AT END	OF DI	RILLING			
30RING LOGS.GPJ	MMER TYPI GGED BY _ OTES ON TES MELHOD ON TES	E _Auto CJ	CHECKED BY RTH	em Oark 0.7 ft /ery Moist (SC) 2.0 ft Gray, Very	SAMPLE TYPE NUMBER SEL	RECOVERY % 40 40 40	RILLING RILLING	o POCKET PEN.	DRY UNIT WT (pcf) 10 20 40 60 80 10 20 40 60 80 10 20 40 60 80 80 80 80 80 80 80 80 80 80 80 80 80	ELEVATION (ft)
3ORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S∆_MASTER PROJI										

GEOTECHNICAL BORING LOG

BORING NUMBER

48

	CLIE	NT Cherc	kee N	ation Entertai	inment	·	PROJI	ECT NAI	ME N	lational C	heroke	e Nati	on Parl	<		
	PRO.	JECT NO.	2567	48 Rev. 1			PROJI	ECT LO	CATIO	N Sallis	aw, Ok	(
	DATE	STARTE	D 2/2	1/19	COMPLETE	ED 2/21/19	SURF	ACE ELE	EVATI	ON		E	BENCH	MARK EI	L	
	DRIL	LER CW			DRILL RIG	2015 CME 55	GROU	ND WAT	ΓER LI	EVELS						
)							None	:				
						BY RTH										
G					_					-						
GS.G								1				4	DRY	I INIT W	T (pcf) 🔷	
G LO			7					ш	%	, so			0 40	60	80 100	
ORIN	_	<u> </u>	SYMBOL		MATERIAL	DECODIDATION		SAMPLE TYPE NUMBER	% (₀	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		20	N VALUE 40 60	E A 0 80	O
GS/B	DEPTH (ft)	클문				DESCRIPTION		LE	VEF SD %	SEC COL	ET tsf)		PL	МС	LL]¥£
3 LO	ᆸ	DRILLING METHOD	AT/		Unified Soil Cla	ssification System		MAD	RECOVERY (RQD %)	ANON V	OCK)		<u> </u>	40 60		ELEVATION (ft)
RIN			STRATA					δS	R	S B (M				GTH (ksf)	 "
JB/BC							0.0#						1	2 3		
R-SI	0			TOPSOI Soft, Moi	L - LEAN CLAY	, Trace Sand, Darl	k Brown, $\frac{0.3 \pi}{100}$	SPT	-	3-4-4	1				:	
N PA				1 —		.AY, Brown, Mediu	um Stiff.	1		(8)	'		0		:	
4TIO!		O.D		Moist (Cl	L-ML)	, ,	,		1 1						:	
) H		4.5					20#								:	
S Š				SANDY	SHALE Slightly	Weathered, Brow	3.0 ft	-							:	
뜅		CFA		Brown, S	Soft to Medium F	lard	II to Daik	SPT	1	65/5"	4.5	0			: : :	<u> </u>
NATI							5 O ft	2	1				:		:	
3748-	5	The state of the s	1-1-1		Bottom of ho	orehole at 5.0 feet.	5.0 ft						<u>:</u>	<u>: :</u>	· · · · · · · · · · · · · · · · · · ·	
IT-25					Bottom of Bo	7011010 at 0.0 100t.										
N E																
ATIC																
EE N																
ROK																
H N N																
OKIC																
2019																
FILE																
ECT																
ROJ																
ERF																
MAS																
.S:																
9:08																
/19 0																
- 7/1																
GDT																
ATE																
EMPL																
TD																
SIdo																
PH-F																
G-F																
IG LC																
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT\L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ																

GEOTECHNICAL BORING LOG

BORING NUMBER

49

CLIE	NT Cherc	kee Na	tion Entertainr	nent	_ PROJE	CT NAI	ME N	lational C	heroke	e Natio	n Park			
PRO	JECT NO.	25674	8 Rev. 1		_ PROJE	CT LO	CATIO	N Sallisa	aw, Oł	<				
DAT	E STARTE	D <u>2/21</u>	/19	COMPLETED 2/21/19	SURFA	CE ELE	VATI	ON		BI	ENCHI	MARK EL.		
DRIL	LER CW			DRILL RIG 2015 CME 55	GROU	ND WAT	ER L	EVELS						
HAM	IMER TYPE	Auto		_	A	T TIME	OF D	RILLING	None)				
LOG	GED BY _	CJ		CHECKED BY RTH		T END	OF DI	RILLING						
₹ NOT	ES				_									
BLOGS/BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Uı	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	2 40	JNIT WT (60 8 N VALUE (10 60 MC 10 60	0 100 80 LL ⊢I	ELEVATION (ft)
B/BORING		STR				SA	RE	C(BL(M.	■ SH	HEAR S	STRENGT 2 3	80 H (ksf) ■ 4	
ATION PARK-SUE	0.D.		Soft, Moist	AN CLAY, w/ Gravel, Brown, Medi		SPT 1		3-3-3 (6)	1.25		-			
CHEROKEE NA	CFA - 4.5"				3.8 ft									
8-NAT'L			SANDY SH	HALE, Highly Weathered, Brown, S	oft 5.0 ft	SPT 2		14-17-40 (57)	4.5	0		A		
5 5				Bottom of borehole at 5.0 feet.										
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 08:08 - S:\(\text{MASTER PROJECT FILE\(\text{2019\)}\)OKICICHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\(\text{BORING LOGS\(\text{GP}\)}\) DEPTH \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \														

GEOTECHNICAL BORING LOG

BORING NUMBER

50

CLIE	NT Chero	okee Nati	on Entertain	ment	P	ROJEC	T NAN	/E _N	lational Cl	heroke	e Natio	n Park				
PRO	JECT NO.	256748	Rev. 1		P	ROJEC	T LOC	CATIO	N Sallisa	aw, Ok	(
DAT	E STARTE	D <u>2/26/1</u>	19	COMPLETED 2/26	6/19 S	URFAC	E ELE	VATI	ON		в	ENCH	/IARK E	L		
DRIL	LER RD			DRILL RIG D50	G	ROUNE	WAT	ER L	EVELS							
HAM	IMER TYPE	E Auto		_		AT	TIME	OF D	RILLING	None)					
LOG	GED BY _	JG		CHECKED BY RT	Ή				RILLING							
RON R	ES															
IG LOGS/BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DESCRI			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	9 40 20 4 PL	60 N VALU 10 6 MC		00	ELEVATION (ft)
OR S		STE					S)	<u>~</u>	B	مَ				GTH (ks		1
ATION PARK-SUB\B(0.D.		Very Soft,	AT CLAY, Reddish Bro		_/ X	SPT 1		0-0-0 (0)	4			_	3 4		
OKEE N.	- 4.5"						ST 2	100		2.75	0					
18-NAT'L CHER	CFA		SANDY S	HALE, Highly Weather	ed, Gray & Brown	4.2 ft 5.2 ft	SPT 3		12-12-18- 19 (30)	4.5	0	^				
5674		- / -/-		Bottom of borehole a							1					1
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\(2019\) OKIC\(C\) HEROKEE NATION ENT-256748-NAT\. CHEROKEE NATION PARK-SUB\(B\) BORING LOGS\(B\) DEPTH \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \																

GEOTECHNICAL BORING LOG

BORING NUMBER

51

-	CLIE	NT Cher	okee Nat	tion Entertainment	PROJI	ECT NAM	/IE _N	lational Cl	neroke	ee Nation Park
þ	PRO.	JECT NO.	256748	8 Rev. 1	PROJI	ECT LOC	CATIO	N Sallisa	aw, OK	K
ŀ	DATE	STARTE	ED 2/26/	/19	SURF	ACE ELE	VATI	ON		BENCHMARK EL.
ŀ	DRIL	LER RD		DRILL RIG D50	GROU	ND WAT	ER L	EVELS		
ŀ	IAMI	MER TYP	E Auto			AT TIME	OF D	RILLING	None	e
h	_OG(GED BY	JG	CHECKED BY RTH		AT END	OF DI	RILLING		
G I	NOTE	ES								
UB\BORING LOGS\BORING LOGS	(ff)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) → 20 40 60 80 100 A N VALUE A 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) □ 1 2 3 4
N PARK-SI	0	1		TOPSOIL - LEAN CLAY, Trace Sand, Dark Brown, Stiff, Moist SANDY FAT CLAY, Shaley, Gray & Tan, Stiff,	0.7 ft Moist	SPT 1		3-4-5 (9)	3.75	5 🛕 🔾
ATIO				(CH)	2.0 ft					1
OKEE N		5" O.D.		CLAYEY SAND, Trace Gravel, Reddish Brown Medium Dense to Dense, Slightly Moist (SC)	,	ST 2	100		3.5	d
I'L CHER	_	CFA - 4.5"			4.2 ft	SPT 3		11-12-14 (26)	4.5	0 🛦
6748-NA	5	O		SANDSTONE, Fine Grained, Poorly to Well Cemented, Brown, Soft to Medium Hard						
NT-25	4				0.5.4	- IODT				
NC -			11111	Refusal at 6.5 feet.	0.5 11	SPT 4	\vdash	50-50/0"	4.5	<u> </u>
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT\. CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\B										
30RING LOG										

GEOTECHNICAL BORING LOG

BORING NUMBER

52

PAGE 1 OF 1

CLIE	NT Chero	okee Na	ation Entertainn	nent	PROJE	CT NAN	/E_N	National Cl	neroke	e Natio	on Park			
PRO	JECT NO.	25674	8 Rev. 1		_ PROJE	CT LOC	ATIC	N Sallisa	aw, Ok	(
DATI	E STARTE	D 2/21	/19	COMPLETED 2/21/19	SURFA	CE ELE	VATI	ON		в	ENCHMAR	RK EL.		
DRIL	LER LB			DRILL RIG D50	GROU	ND WAT	ER L	EVELS						
НАМ	MER TYPE	E Auto				AT TIME	OF D	RILLING	None	:				
LOG	GED BY _	JH		CHECKED BY RTH	_ /	AT END	OF D	RILLING						
NOT	ES				_									
							_	(0		20	DRY UNI	T WT ((pcf) ♦ 0 100	
	20	SYMBOL		MATERIAL RECORDERION		F.R.	% } }	1 H	PEN.	2	▲ N V 20 40	ALUE 4 60		N O
DEPTH (ft)	DRILLING METHOD	ΑSY	1.1	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET I (tsf)		PL N	1C	LL	ELEVATION (ft)
	R₩	STRATA	Ur	nified Soil Classification System		AMF	R R	865	00	2	20 40	60	─ 80	╽出
		ST				S	E .		<u> </u>	■ SI	HEAR STF		H (ksf)	
ناي		-A 7 A			N 2 #						1 2	3	4	₩
0			TOPSOIL - Soft, Moist	LEAN CLAY, Trace Sand, Dark B	rown, 3								:	
	4.5" O.D.		CLAYEY S Moist (SC)	AND, Red Brown & Tan, Dense, S	lightly	SPT 1		7-12-22 (34)	4.5	0	A	:		
i 5	- A				3.0 ft	_	1					:	:	
	CFA		SANDY SH Sandstone	IALE, Highly Weathered, Gray Bro Lenses	wn, Soft	SPT 2	_	25-50/5"	4.5	0		:	4	
			SHALE, Gr	ay, Soft to Medium Hard		_		l			•		•	
ź I				Defugal at 4.4 feet										

Refusal at 4.4 feet. Bottom of borehole at 4.4 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\. MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT-268748-NATI'

GEOTECHNICAL BORING LOG

BORING NUMBER

53

														AGE I C	ו וכ
CLIE	NT Cher	okee Na	ation Entertainn	nent		_ PROJE	CT NAM	/IE _N	lational C	heroke	e Nation I	Park			
PRO	JECT NO.	25674	l8 Rev. 1			_ PROJE	CT LOC	CATIO	N Sallisa	aw, Ok	(
DAT	E STARTE	D 2/21	1/19	COMPLETED	2/21/19	SURFA	CE ELE	VATI	ON		BEN	CHMAR	K EL.		
DRIL	LER LB			DRILL RIG D	050	_ GROUN	ND WAT	ER LI	EVELS						
HAM	IMER TYPE	E Auto				A	T TIME	OF D	RILLING	None	!				
LOG	GED BY	JH		CHECKED BY	RTH		T END	OF DI	RILLING						
ਜ਼ੂ NOT	ES					_									
BYBORING LOGS/BORING LOGS DEPTH (ff)	DRILLING METHOD	STRATA SYMBOL	SCRIPTION fication System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 Pl H 20	40	60 8Ö ALUE 4 60 1C	<u>5 100</u>	ELEVATION (ft)		
CHEROKEE NATION PARK-SUB/BORING	CFA - 4.5" O.D.	3/1/2/31	Soft, Moist		t 2.6 feet.		SPT SPT 2		50/3"		0			,	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S3, MASTER PROJECT FILE\2019\OK\C\CHEROKE NATION ENT-256748-NATI-



4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

GEOTECHNICAL BORING LOG

BORING NUMBER

54

	-1 1	F	ax: (417) 864	1-6004		11111		•			P	AGE 1 C)F 1
CLI	ENT Chero	kee Nat	ion Entertainn	ment		PROJE	CT NAM	/IE N	ational C	heroke	e Nation Park		
PR	OJECT NO.	256748	3 Rev. 1			PROJE	CT LOC	CATIO	N Sallisa	aw, OK			
					2/27/19	SURFA	CE ELE	VATIO	ON		BENCHMARK EL		
				DRILL RIG D5	50		ND WAT						
	MMER TYPE			-									
. I			Due to Steep		RTH	,	AI END	OF DE	RILLING				
	TES Oliset	20 300	Due to Steep	Grade							A DDV LINIT WT (n	of) 🛕	
DEPTH (#)		STRATA SYMBOL	Uı	MATERIAL DES				RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 60 SHEAR STRENGTH 1 2 3	100 80 LL -1 80	ELEVATION (ft)
0	0.0	711/	TOPSOIL -	- SANDY LEAN C	LAY, Dark Brown,	<u>8:5</u> ∄	SPT 1		2-50/0"	0	: O : :	: 4	<u> </u>
	CFA - 4.5" (, Well Cemented, 0.5 feet.	Tan,							

GEOTECHNICAL BORING LOG

BORING NUMBER

55

PAGE 1 OF 1

	CLIE	NT Cherc	okee Na	ation Entertainn	nent	PROJE	CT NAM	/E _N	lational C	heroke	ee Natio	n Park	(
	PRO	JECT NO.	25674	l8 Rev. 1		PROJE	CT LOC	CATIO	N Sallisa	aw, Oł	<					
	DATE	STARTE	D 2/26	6/19	COMPLETED 2/26/19	SURFA	CE ELE	VATI	ON		В	ENCH	MARK E	iL		
	DRIL	LER RD			DRILL RIG _D50	GROU	ND WAT	ER L	EVELS							
	HAM	MER TYPE	E Auto			A	AT TIME	OF D	RILLING	None)					
	LOG	GED BY _	JG		CHECKED BY RTH		AT END	OF DI	RILLING							
ر ح	NOTI	ES				-										
ZING LOGS		(1)	SYMBOL				/PE	% /	ED NTS	PEN.	20	<u>40</u> ▲	60 N VALU		0	
B/BOKING LOGS/BOF	DEPTH (ft)	DRILLING METHOD	STRATA SYN	Ur	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTI BLOW COUI (N VALUE	POCKET PE (tsf)	2	PL 	MC 40 6 STREN	60 80 LL 60 80 IGTH (ksf) 3 4		(#)
ALION PARK-SU	0 -	0.D.		Soft, Wet	SANDY LEAN CLAY, Dark Brown, T CLAY, Shaley, Red, Soft to Very (CH)		SPT 1		1-1-2 (3)	2	<u> </u>	0				
CHEKOKEE N		CFA - 4.5"		SANDY SH Brown, Soft	IALE, Highly Weathered, Dark Brov	3.1 ft vn w/	SPT 2		3-4-15 (19)	4.5	4	0				
748-NATL	5			Brown, Gon		5.0 ft	SPT 3		5-21-22 (43)	4.5	0		A			
256	Ü				Bottom of borehole at 5.0 feet.											

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\. MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-

GEOTECHNICAL BORING LOG

BORING NUMBER

56

			tion Entertainn							ee Nation Park
DATE DRIL HAM LOG	LER <u>RD</u> MER TYPI	D 2/26	/19		SURFA GROUI	ND WAT	EVATION LICENSE	EVELS RILLING	_None	BENCHMARK EL.
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) → 20 40 60 80 100 N VALUE ↑ 20 40 60 80 PL MC LL ↑ 20 40 60 80 SHEAR STRENGTH (ksf) □ 1 2 3 4
0	CFA - 4.5" O.D.		Stiff, Moist LEAN CLA SANDSTOI Soft FAT CLAY,	LEAN CLAY, Trace Sand, Dark B Y, Tan, Stiff, Moist (CL) NE BOULDER, Tan, Highly Weath Shaley, Tan, Stiff, Moist (CH) NE, Fine Grained, Poorly to Well	1.0/ft 1.5/ft	1		3-5-7 (12)	3.25	A
DEPTH OF THE STATE				Bottom of borehole at 3.5 feet.						

GEOTECHNICAL BORING LOG

BORING NUMBER

57

CLIE	NT Cherc	kee Nat	ion Entertair	nment		PROJE	CT NAI	ME N	lational C	heroke	e Nat	ion Parl	k		
PRO.	JECT NO.	256748	3 Rev. 1			_ PROJE	CT LO	CATIO	N Sallis	aw, Oł	<				
					2/21/19						[BENCH	MARK EL	.	
DRIL	LER CW			_ DRILL RIG _2	2015 CME 55	GROU	ND WA	TER L	EVELS						
HAM	MER TYPE	Auto		_			AT TIME	OF D	RILLING	None)				
1	GED BY _	CJ		_ CHECKED BY	r RTH	_ /	AT END	OF DI	RILLING						
NOTI	ES					_									
9019		OL.					ш	%	S		1 2	0 40		<u>8Ö ´100 </u>	
Ĭ Į	99	SYMBOL		MATERIAL DE	SCRIPTION		SAMPLE TYPE NUMBER	₹ %	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)			N VALUE 40 60		ELEVATION (ft)
DEPTH (ft)	DRILLING METHOD	A S					MBE.	RECOVERY (RQD %)	REC CO /ALI	(ET		PL	МС	LL	(#)
	絽	STRATA	(Jnified Soil Class	ification System		M N	(R)	0.N 0.N	ò		-	40 60		Ë
		STF					Ś	<u>~</u>	O BL	٩	3 S			STH (ksf)	7
S O		(A 12 · X				0 5 ft						1	2 3	4	
*			TOPSOIL	LEAN CLAY, T Stiff, Moist	race Sand, Dark B	rowry. 5 II	V 3P I		3-1-4	0.25	A	0		•	
하 - 임	<u>Б</u> .				Medium Stiff, Moist	(CH)	1		(5)					•	
≚ ≰	o L											:		:	
	4.5"											:		:	
Ž	CFA -		- Shaley I	Below 3'								:		:	
	O					4 E #	SPT		5-9-16					:	
A A			CHALLI	liably Maatharad	, Tan to Brown, So	4.5 ft ft 5.0 ft	2		(25)	3.25		^		:	
5			OI IALL, I		ehole at 5.0 feet.							<u> </u>	<u>. i i.</u>	· · · · · · · · · · · · · · · · · · ·	
BORING LOG - PPI - PPI SID I EMPLAI E.GDI - 7/1/19 09:08 - S:_ MASI ER PROJECT PILEZO19/OKIC/CHEROREE NATION EN 1-256/48-NA 1'L CHEROREE NATION EN 1-256/48-															
KING LOG-I															
2															

GEOTECHNICAL BORING LOG

BORING NUMBER

58

PAGE 1 OF 1

CLIE	NT Cherc	kee Na	ation Entertainn	nent	_ PROJE	CT NAM	/E _N	lational Cl	neroke	e Nation Park	·		
PRO	JECT NO.	25674	8 Rev. 1		_ PROJE	CT LOC	CATIO	N Sallisa	aw, OK	(
DAT	E STARTE	D 2/21	/19	COMPLETED 2/21/19	_ SURFA	CE ELE	VATI	ON		BENCHN	IARK EL		
DRIL	LER CW			DRILL RIG 2015 CME 55	_ GROU	ND WAT	ER L	EVELS					
HAM	IMER TYPE	_ Auto			A	T TIME	OF D	RILLING	None	!			
LOG	GED BY _	CJ		CHECKED BY RTH		T END	OF DI	RILLING _					
NOT	ES				_								
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	TOPSOIL -	MATERIAL DESCRIPTION nified Soil Classification System LEAN CLAY, Trace Sand, Dark E	Brown 0.5 ft		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 PL 20 4 SHEAR S	60 8 N VALUE 10 60 MC 40 60	80 100 80 LL 80 TH (ksf)	ELEVATION (ft)
	A - 4.5" O.D.		Medium De	AND, Trace Gravel, Brown & Darkense, Slightly Moist (SC) IALE, Highly Weathered, Gray w/	2.0 ft	1		(16)		OA			
5	CFA			Dettern of harabala at 5.0 fact	5.0 ft	SPT 2		10-16-20 (36)	4.5	0 🛦			
				Bottom of borehole at 5.0 feet.									

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - St. MASTER PROJECT FILE/2019/OKIC/CHEROKEE NATION ENT

GEOTECHNICAL BORING LOG

BORING NUMBER

59

			()											AGE I C	ו דו
CLIE	NT Chero	kee Na	ation Entertainm	nent		PROJE	CT NAM	/E _N	lational C	neroke	e Nation P	ark			
PRO.	JECT NO.	25674	l8 Rev. 1			PROJE	CT LOC	CATIO	N Sallisa	aw, Ok	(
DATE	STARTE	2/27	7/19	COMPLETED	2/27/19	SURFA	CE ELE	VATI	ON		BENC	HMARK	(EL		
DRIL	LER CW			DRILL RIG 20	15 CME	GROU	ND WAT	ER L	EVELS						
HAM	MER TYPE	Auto				A	AT TIME	OF D	RILLING	None	!				
LOG	GED BY _C	CJ		CHECKED BY	RTH	_ /	AT END	OF DI	RILLING						
NOTI	ES					_									
O DEPTH (ft)	CFA - 4.5" O.D. DRILLING METHOD	STRATA SYMBOL	TOPSOIL - Medium Stir SANDY FA Medium Stir	ff, Moist T CLAY, Tan to F ff to Very Hard, N	ication System ace Sand, Dark Brown w/ Moist (CH)	Gray,	SPT 1		CORRECTED 3-3-4 (L. 12-12-12-12-12-12-12-12-12-12-12-12-12-1	1 DOCKET PEN.	20 ° 20 PL 1— 20	N VAL 40 MC	0 80 -UE 60 -60	100	ELEVATION (ft)
5				NE, Fine Grained n, Medium Hard Bottom of boreh	I, Well Cemented, ole at 5.0 feet.										

GEOTECHNICAL BORING LOG

BORING NUMBER

60

1				nt				lational Cl			n Park	(
DAT	E STARTE	ED <u>2/26</u>	6/19 (COMPLETED 2/26/19 DRILL RIG D50	SURFA	CE ELE	VATI			BI		MARK E			
LOC	GED BY	JG	(CHECKED BY RTH											
DEPTH OCCUSION OCCUS. CF	(0.0	STRATA SYMBOL	М	ATERIAL DESCRIPTION ed Soil Classification Syst		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	PL HEAR :	MC 40 6	80 6 E A 60 8 LL 60 8 GTH (k	100 30 30	ELEVATION (ft)
ON PARK-SOB			Medium Stiff,	CLAY, Shaley, Brown, Me		SPT 1		1-2-3 (5)	1.25	A	0	2 ;	3 4	4 	
A I C CHENOREE			SANDY SHAL	.E, Highly Weathered, Bro	4.0 ft	SPT 2		3-6-8 (14)	3.5	△I€)	1			
5 - 520/46-10/	CFA - 4.5" O.D			E, Dark Brown, Soft to Me	6.0 ft	SPT 3		10-30-40 (70)	4.5	0			<u> </u>		
TENOME NATIO						SPT 4		7-50/5"	4.5	0				_	
10 10					11.3 ft	SPT 5		50/3"							
ביים ביים ביים ביים ביים ביים ביים ביים			Вс	Refusal at 11.3 feet. ttom of borehole at 11.3 f		SPT 6		50/0"			<u>:</u>	:	:	:	
IG LOG- PPI- PPISID IEMPLAIE.GDI - 77779 09:08 - S. MADIEK PROJEI															

GEOTECHNICAL BORING LOG

BORING NUMBER

61

CLIE	NT Cher	okee Na	ation Entertainment	PROJE	CT NAM	/IE N	lational Cl	neroke	e Natio	on Park		
PRO	JECT NO.	25674	8 Rev. 1	PROJE	CT LOC	CATIO	N Sallisa	aw, Oł	(
DAT	E STARTE	D 2/28	3/19 COMPLETED 2/28/19	SURFA	CE ELE	VATIO	ON		В	ENCHMARK	EL	
DRIL	LER RD		DRILL RIG D50	GROU	ND WAT	ER LI	EVELS					
HAM	MER TYPE	E Auto	<u> </u>	A	T TIME	OF D	RILLING	None	1			
LOG	GED BY _	JG	CHECKED BY RTH	A	T END	OF DE	RILLING					
ु иот	ES Offset	t 20' SW	V Due to Steep Grade									
3										DRY UNIT V		
200		30			Щ	%	D TS	į	20	0 40 60 ▲ N VALU		- _
[-	DRILLING METHOD	¥	MATERIAL DESCRIPTION		품품	% %	ENG ENG ENG ENG ENG ENG ENG ENG ENG ENG	PEN.	2	20 40	60 80	ē
DEPTH (ft)		A S	Unified Soil Classification System) JMB		YAL AL	(tsf.		PL MC	LL	E E
	문필	STRATA SYMBOL	Offined Soli Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET F (tsf)	2	20 40	60 80	ELEVATION (ft)
S/BC/K		ST			Ø	<u> </u>		-	□ SI	HEAR STREM	NGTH (ksf)	
0		71 1/2	TOPSOIL - LEAN CLAY, Trace Sand, Dark	0.7 ft						<u>1 2</u>	3 4	+
AK A		7////	Brown, Soft, Moist	0.7 IL	SPT 1		2-1-3 (4)	1.25	A	0		
Z _			SANDY LEAN CLAY, Red Tan, Very Loose, Sli	ghtly	A '		(4)					
<u> </u>	. .		Moist (CL)									
뷥				3.0 ft								
# 			SANDY SHALE, w/ Sandstone Lenses, Highly									
5 			Weathered, Brown, Medium Hard to Soft		SPT 2	1	50/5"		0			↑
AN-	•											
5	1 6											
<u> </u>												
NO NO	5" 0	77			SPT		10-25-46	2.25				
<u>-</u> ≨	4.	77			3		(71)	2.20				
# 	CFA	77										
취		77		9.0 ft								
<u> </u>	. ■		COALY SHALE, Moderately Weathered, Black		SPT 4		6-25-33	3.5		O .	<u>.</u>	
Š			Gray, Soft		4		(58)			<u>.</u>		.]]
10												
타 -	•											
) 	.											
Ž Ž				12.5 ft								
<u> </u>			SHALE, Black & Dark Gray, Soft to Medium Ha									
Δ 				13:8 ft	X SPT		50/4"	4.5	0			<u> </u>
- 80			SANDSTONE, Gray, Medium Hard Refusal at 14.0 feet.		SPT		50/0"					
			Bottom of borehole at 14.0 feet.		6							
-												
HE E												
돌 기												
AING LUG - PPI - PPI S I D I EMPLAIE.GD												
2												
<u> </u>												
5												
2												
<u> </u>												

GEOTECHNICAL BORING LOG

BORING NUMBER

62

CLIE	NT Chero	okee Nat	on Entertainm	ent	PROJ	ECT NAM	ME N	National C	heroke	ee Nation Park
PRO	JECT NO.	256748	Rev. 1		_ PROJ	ECT LO	CATIC	N Sallis	aw, Oł	(
					_ SURF	ACE ELE	VATI	ON		BENCHMARK EL.
	LER RD			DRILL RIG D50	_	ND WAT				
	MER TYPE									}
						AT END	OF D	RILLING		
NOI	=S				_	1		<u> </u>	1	A DDV HAHT MT (c. st) A
SIBORING LOGS/BORING LOG DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) \$\int 20 40 60 80 100\$ A N VALUE \$\text{\tilite\text{\te\text{\text{\text{\text{\texi\text{\text{\texi}\text{\text{\texic}\text{\text{\text{\text{\text{\text{\texi{\text{\texi{\te
NATH-ON PARK-SOL	CFA - 4.5" O.D.		Stiff, Moist	LEAN CLAY, Trace Sand, Dark B		1		3-3-8 (11)		№
BORNG LOG - PPI - PPI SID I EMPLAI E.GDI - 7/1/19 09:08 - 53, MASI ER PROJECT PILEZO19/ORIC/CHEROREE NATION EN 1-236/48-NATI CHEROREE NATION EN 1-236/48-NATION EN 1-236/48-N				Bottom of borehole at 3.1 feet.						

GEOTECHNICAL BORING LOG

BORING NUMBER

63

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CLIE	NT Cherol	cee Na	ation Entertainn	nent	PROJE	CT NAM	ME N	lational C	heroke	ee Nation Park	
PRO	JECT NO.	25674	18 Rev. 1		_ PROJE	CT LO	CATIO	N Sallis	aw, Ok	<	
DATI	E STARTED	2/26	6/19	COMPLETED 2/26/19	SURFA	CE ELE	EVATI	ON		BENCHMARK EL.	
DRIL	LER CW			DRILL RIG 2015 CME	GROU	ND WAT	TER LI	EVELS			
HAM	IMER TYPE	Auto)		A	T TIME	OF D	RILLING	None	}	
LOG	GED BY _C	J		CHECKED BY RTH		T END	OF DI	RILLING			
NOT	ES				_						
DEPTH (#)	DRILLING METHOD	STRATA SYMBOL	─\ TOPSOIL -	MATERIAL DESCRIPTION iffied Soil Classification System LEAN CLAY, Trace Sand, Dark B	rown,3 ft	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)
440-1471 L CHERONEE NATION FANA	CFA - 4.5" O.D.		∖ Very Soft, I SANDY LE	Moist AN CLAY, Reddish Brown, Very S Very Moist to Moist (CL)		SPT 2		0-0-0 (0) 8-7-12 (19)	0.254		
5				Bottom of borehole at 5.0 feet.				•			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT

GEOTECHNICAL BORING LOG

BORING NUMBER

64

CLIE	NT Cherc	kee Na	ation Entertainn	nent	PROJE	CT NAI	ME N	lational C	heroke	e Natio	on Park		
PRO	JECT NO.	25674	18 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, Ok	(
DAT	E STARTE	D 2/26	6/19	COMPLETED 2/26/19	SURFA	CE ELE	VATI	ON		в	ENCHMARK	EL	
DRIL	LER CW			DRILL RIG 2015 CME	GROU	ND WAT	ER L	EVELS					
HAN	IMER TYPE	_ Auto)	_	,	AT TIME	OF D	RILLING	None	!			
LOG	GED BY _	CJ		CHECKED BY RTH									
ਜ਼ੂ NOT	ES												
DRING LOGS/BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION nified Soil Classification Systen	ı	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	N VAL 40 PL MC 20 40	80 100 UE 60 80	ELEVATION (ft)
OKEE NATION PARK-SUB\B	- 4.5" O.D.		∖ Hard, Moist	- LEAN CLAY, Trace Sand, Dar t NE, Weakly Cemented, Highly		SPT 1		7-17-27 (44)	_		1 2	3 4	
3748-NAT'L CHERC	CFA		SANDY SH Weathered	HALE, w/ Sandstone Lenses, H I, Tan & Gray, Soft	ighly 5.0 ft	SPT 2		30-40-44 (84)	4.5	0		A	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\(2019\)OKIC\(C\)HEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\)BORING LOGS\(BORING													

GEOTECHNICAL BORING LOG

BORING NUMBER

65

CLIE	NT Cher	okee Na	ation Entertainment	PROJE	CT NAI	ME N	National C	heroke	e Nation Pa	ark		
PRO	JECT NO.	25674	48 Rev. 1	PROJE	CT LO	CATIC	N Sallis	aw, Oł	(
DAT	E STARTE	D 2/26	6/19 COMPLETED 2/26/19	SURFA	CE ELE	EVATI	ON		BENC	HMARK EL.		
DRIL	LER CW		DRILL RIG 2015 CME	GROU	ND WAT	ΓER L	EVELS					
HAM	IMER TYPI	E Auto)		AT TIME	OF D	RILLING	None)			
			CHECKED BY RTH		AT END	OF D	RILLING					
	ES											
SUBREORING LOGS/BORING LOGS.C DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System TOPSOIL - LEAN CLAY, Trace Sand, Dark Bro	ωνγ Ω .5 ft	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 20 PL 20 20	Y UNIT WT 10 60 8 N VALUE 40 60 MC 40 60 R STRENGT 2 3	80 LL 80	ELEVATION (ft)
ON PARK			\Stiff, Moist CLAYEY SAND, Trace Gravel, Red Tan, Mediu		SPT 1		7-7-7 (14)	1.75	^ O			
E NATIO	4.5" 0.1		Dense, Moist (SC)	2.5 ft								
HEROKE	CFA - 4		SANDY SHALE, Highly Weathered, Tan & Gra	y, Soft								
-NAT'L C				5.0 ft	SPT 2		17-39-49 (88)	3.75	0		A	
5 5		1. 1	Bottom of borehole at 5.0 feet.								•	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:\(\text{MASTER PROJECT FILE}\(2019\)\(\text{OK}\)\(\text{C}\)\(\text{FROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\)BORING LOGS\(\text{BORING LOGS.GPU}\) OF THE COST OST OF THE COST OF THE COST OF THE COST OF THE COST OST OF THE COST OST OST OST OST OST OST OST OST OST												

GEOTECHNICAL BORING LOG

BORING NUMBER

66

	/												FAGL	1 OF 1
CLIE	NT Chero	kee Na	ation Entertainn	nent		PROJE	CT NAM	/IE _N	ational C	heroke	e Nation	Park		
PRO.	JECT NO.	25674	18 Rev. 1			PROJE	CT LO	CATIO	N Sallisa	aw, Ok	(
DATE	STARTE	2/26	6/19	COMPLETED	2/26/19	SURFA	CE ELE	VATI	ON		BEN	ICHMARK	EL	
1					015 CME									
1)				T TIME	OF D	RILLING	None	:			
				CHECKED BY	RTH									
.														
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PI H 20	40 60 ▲ N VAL 40 L MC 40	60 80	ELEVATION (ft)
	O.D.		Soft, Moist		ace Sand, Dark Bross sh Brown, Soft, Mo		SPT 1		1-1-1 (2)	2.75	:			
LOG-TRIPTINE LINE LAND SOURCE OF THE MANAGENER TRACECT THE LOG INVALIDATION EN 1-200 46-1471 L CHIENDRE PATION	CFA - 4.5" O		Weathered SANDSTO	ALE, w/ Sandsto , Reddish Tan, S NE, Fine Grained Tan, Soft to Med Refusal at Bottom of boreh	dium Hard 4.8 feet.	3.8 ft 4.8 ft	SPT 2 SPT 3		17-13- 65/1" 65/2"	2.25				

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

CLIE	NT Cher	okee Na	ation Entertainn	nent	PROJE	CT NAM	/E _N	lational Cl	heroke	e Nation	Park			
PRO	JECT NO.	25674	48 Rev. 1		PROJE	CT LOC	ATIC	N Sallisa	aw, Oł	(
DAT	E STARTE	D 2/20	6/19	COMPLETED 2/26/19	SURFA	CE ELE	VATI	ON		BE	NCHMAR	KEL.		
DRIL	LER CW			DRILL RIG 2015 CME	GROUN	ND WAT	ER L	EVELS						
HAM	IMER TYPE	E Auto)		4	T TIME	OF D	RILLING	None)				
LOG	GED BY _	CJ		CHECKED BY RTH		T END	OF D	RILLING _						
ਤੂੰ NOT	ES				_									
B'BORING LOGS'BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 F 20	PL M	0 80 LUE 4 60	80 LL 	ELEVATION (ft)
ATL CHEROKEE NATION PARK-SUE	CFA - 4.5" O.D.		LEAN CLA (CL)	LEAN CLAY, Trace Sand, Dark Br Y, w/ Sand, Reddish Brown, Soft, N NE, w/ Clay Lenses, Fine Grained, nented, Tan, Soft to Medium Hard	Moist 3.5 ft	SPT 1		1-1-1 (2) 30-65/5"	1.5	• 0				

Refusal at 4.5 feet. Bottom of borehole at 4.5 feet.

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

														• •
CLIE	NT Cherc	kee Na	ation Entertainm	nent	PROJE	CT NAM	/IE _N	National Cl	neroke	e Nation F	ark			
PRO.	JECT NO.	25674	18 Rev. 1		PROJE	CT LOC	ATIC	N Sallisa	aw, Oł	(
DATE	E STARTE	D 2/26	6/19	COMPLETED 2/26/19	SURFA	CE ELE	VATI	ON		BEN	CHMAR	RK EL.		
DRIL	LER CW			DRILL RIG 2015 CME	GROUN	ND WAT	ER L	EVELS						
HAM	MER TYPE	_ Auto)		Δ	T TIME	OF D	RILLING	None	:				
LOG	GED BY _	CJ		CHECKED BY RTH	Δ	T END	OF D	RILLING						
NOT	ES													
DEPTH (ft)	MATERIAL DESCRIPTION Unified Soil Classification System Unified Soil Classification System Output Description Unified Soil Classification System Output Description Unified Soil Classification System Output Description Output Descri					SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	40 6 N VA 40	ALUE 60 MC 60	100	ELEVATION (ft)
0	CFA - 4.5" O.D.		Soft, Moist	SANDY LEAN CLAY, Dark Brown, AN CLAY, Reddish Brown, Soft, Mo	ist (CL) 3.3 ft	SPT 1		1-3-1 (4)	0.25		:		*	
<u></u>				Brown, Soft to Medium Hard	4.3 ft	2		40-65/3"		0 :		:		
				D - f 1 - 4 4 0 f 4										

Refusal at 4.3 feet. Bottom of borehole at 4.3 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S3. MASTER PROJECT FILE\2019\OK\C\CHEROKE NATION ENT-256748-N.

GEOTECHNICAL BORING LOG

BORING NUMBER

69

CL	IENT	Che	rok	kee Na	ation Entertainn	nent		PROJE	CT NAN	/IE _N	lational C	heroke	e Natio	on Park	(
PF	ROJE	CT NO	٠_	25674	l8 Rev. 1			PROJE	CT LOC	ATIC	N Sallis	aw, OK						
D/	ATE S	STARTI	ED	2/20)/19	COMPLETED	2/20/19	SURFA	CE ELE	VATI	ON		В	ENCH	MARK E	iL		
DF	RILLE	R LB				DRILL RIG D	50	GROUN	ID WAT	ER L	EVELS							
H/	MME	ER TYP	Έ	Auto				4	T TIME	OF D	RILLING	None						
LC	GGE	D BY	JI	Н		CHECKED BY	RTH	Δ	T END	OF D	RILLING							
E NO	OTES	s																
DEPTH DEPTH		DRILLING METHOD		STRATA SYMBOL		MATERIAL DES	SCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 ▲ 1 20 4 PL HEAR	MC MC MC STREN	80 80 LL	00	ELEVATION (ft)
					TOPSOIL -	LEAN CLAY, Tra	ace Sand, Dark Bro	own, 0.2 #						:	<u> </u>	5 4		
					Soft, Moist	AN CLAY, Tan, S	Stiff, Very Moist (Cl	3.0 ft	SPT 1		3-3-7 (10)	1	▲ ∈	1				
	-				CLAYEY S. Increasing	AND, Reddish Br Shale Lenses Wit	rown, Dense, Moist h Depth		SPT 2		8-12-13 (25)	4.25	O 					
5/007-1)		SANDY SH Soft to Med	IALE, Highly Wea	athered, Tan to Bro	wn,										
	_ [4.5° O.D.)						SPT 3		20-43- 50/5"	4.5	0					
		CFA -)						SPT 4		23-14-18 (32)	4.5	0	A				
10))											;	 			
- - - -	-	1						12.0 ft						:				
<u>}</u> _	-		,		COAL, Blac	ck, Soft		12.U IL						O				
	-			Z	SHALE, Gr	av Soft		14.0 ft	SPT		8-16-22	4.5	0	4				
3								15.0 ft	5		(38)			<u> </u>	:			
AING EOG - PPI - PPI S I D TEMPLATE.GUT - 7777 3	J					Bottom of boreho	ole at 15.0 feet.											

GEOTECHNICAL BORING LOG

BORING NUMBER

70

CLIE	NT Chero	okee Na	ation Entertainment	PROJE	CT NAM	/IE _N	lational Cl	neroke	e Natio	n Park			
PRO.	JECT NO.	25674	48 Rev. 1	PROJE	CT LOC	CATIO	N Sallisa	aw, OK	(
DATE	STARTE	D 2/20	0/19 COMPLETED 2/20/19	SURFA	CE ELE	VATI	ON		В	ENCHMA	RK EL		
DRIL	LER LB		DRILL RIG _D50	GROU	ND WAT	ER L	EVELS						
HAM	MER TYPE	E Auto	0	A	AT TIME	OF D	RILLING	None	!				
LOG	GED BY _	JH	CHECKED BY RTH		AT END	OF DI	RILLING _						
NOTE	ES												
3									•	DRY UN	IT WT (pcf)	•	
2		STRATA SYMBOL			出	%	CORRECTED BLOW COUNTS (N VALUE)	ż	20		60 80 1 ∕ALUE ▲	100	2
	DRILLING METHOD	l X	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)		POCKET PEN. (tsf)	2	0 40	60 8	0	ELEVATION (ft)
DEPTH (ft)	当市	¥	Unified Soil Classification System		PLE	SOVE	× CKE	KE)		PL	MC LL		EVA (ft)
2	≅⊠	\ <u>\</u>			MA Z	ZEC (F		200	2	20 40	60 8	0	E
NDG/K		S			0,		ш	_	 31		RENGTH (ks	sf) 🗖	
0		11/1	TOPSOIL - LEAN CLAY, Trace Sand, Dark Br	own. 0.3 ft						<u>12</u>	3 4	•	
Ϋ́Υ –			Soft, Moist										
	9		CLAYEY SAND, Trace Gravel, Reddish Tan, \ Dense to Medium Dense, Moist to Slightly Moi	st (SC)	SPT 1		8-50/4"	3.75	0				
<u> </u>			Increasing Shale Seams and Sandstone w/ Dep	th`´									
	Ь				SPT		33-11-11		0				
<u> </u>					2		(22)						
Ž-04 Ž-04	1			5.0 ft						: ::			
5	P		SANDY SHALE, Highly Weathered, Reddish T Dark Gray w/ Brown, Soft	an to									
	_i		,,		V								
	o				SPT 3		18-21-30 (51)	4.5	0		A		
Ž	4.5"				_								
	CFA -				Vont		11 10 00						
<u> </u>					SPT 4		11-18-22 (40)	4.5	0	A			
	•												
10													
		77											
	L												
F -													
<u> </u>	1												
ON MASIER PROJE	•	777											
6-6	4			4= 0.5	SPT 5		8-11-25 (36)	4.5	0	A			
2 15			Dottom of horobala at 45 0 fr at	15.0 ft			. ,			<u> </u>			
['0			Bottom of borehole at 15.0 feet.										
<u>-</u>													
=													
2													
<u> </u>													
5													
KING LUG- PPI- PPI 3 ID TEMPLATE.GD													
<u> </u>													

GEOTECHNICAL BORING LOG

BORING NUMBER

			rax. (417) 804-6004										PAGE	1 0	F 1
CLIE	NT Chero	kee Na	ation Entertainment		PROJE	CT NAM	NE N	lational C	heroke	e Natio	n Park				
PRO	JECT NO.	25674	48 Rev. 1		PROJE	CT LO	CATIO	N Sallisa	aw, OK						
DATE	STARTE	D _2/28	8/19 COMPLETED	2/28/19	SURFA	CE ELE	VATI	ON		BE	ENCHI	IARK E	L		
DRIL	LER RD		DRILL RIG _D	50	GROU	ND WAT	ER LI	EVELS							
1	MER TYPE							RILLING	11 ft						
1			CHECKED BY	RTH				RILLING							
					-		J								
										•	DRY L	JNIT W	T (pcf)		
		J G				ш	%	2			40	60 I VALUI	80 10	00	
	920	ME	 MATERIAL DE:	SCRIPTION		구유	<u>~</u> @	ENE ENE		2	0 4	0 6	80		<u>6</u>
DEPTH (ft)	글토	Y S				LE .		A88	(tsf)		PL	МС	LL		¥(£)
	DRILLING METHOD	STRATA SYMBOL	Unified Soil Classit	fication System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		-	$\overline{}$,	ELEVATION (ft)
		STF				8		요됨	ا م				GTH (kst		ш
					004								3 4	<i>′</i>	
0			TOPSOIL - SANDY LEAN (Very Stiff, Moist	CLAY, Dark Brown,	0.2#	▼ SPT		4-6-10	3	0			:		
			CLAYEY SAND, w/ Gravel,	Reddish Brown, Me	edium	1		(16)					:		
L _			Dense, Slightly Moist (SC)										:		
					3.0 ft								:		
F -			FAT CLAY, Trace Sand, Sh	aley, Reddish Brow									:		
			Stiff to Stiff, Slightly Moist (CH) Î	, ,	SPT 2		3-8-12 (20)	4.5	l.	\		:		
							-	(=-)		:			:		
5															
													:		
	<u> </u>					SPT		5-5-10					:		
 	5" 0.		CANDY CHALE HELLING	-4h t- D t- D	7.0 ft	3		(15)	4.5	<u> </u>			:		
	4.5		SANDY SHALE, Highly We Brown, Very Soft to Soft	athered, Brown to D	ark		1						:		
	CFA.		•			VCDT		T 40 40					:		
L -		77				SPT 4		5-12-18 (30)	4.5	0			:		
	•						-			:			:		
10											• • • • • • • •				
		7	▼												
			_							:			:		
-	•												:		
			- Dark Brown & Wet Below	12.5'									:		
	- 6					V] [3-30-20-					:		
-						SPT 5		20	2.75	0		A	:		
	1				15.0 ft			(50)		:			:		
15			Bottom of boreh	ole at 15.0 feet.											
															ļ

GEOTECHNICAL BORING LOG

BORING NUMBER

72

1			ation Entertainment							Park		
			48 Rev. 1				N Sallisa			01114514		
1			8/19						BEN	CHMARK I	=L	
1			DRILL RIG 2015 CIVIE				RILLING	None				
1			CHECKED BY RTH									
_			E Due to Steep Grade	′	AI LIND	01 01	IXILLIIVO _					
			- Bus to Steep Grade						♦ DI	RY UNIT V	/T (ncf)	
בר פר		占			ш	%	ွှေ				80 100	
E E	OC OC	YMB	MATERIAL DESCRIPTION		FR		ËŽ()		20	40 (60 80	_ <u>N</u> O
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	PL	_ MC	LL	ELEVATION (ft)
	ద	<u>F</u>	Offined Soil Glassification System		N N	REC (R	ROJS ROJS		20	40	60 80	_
NO N		ST			0)		<u> </u>		SHE	_	IGTH (ksf)	1
0	L	71 1 _N 71	TOPSOIL - LEAN CLAY, Trace Sand, Dark	0.7 ft	Vapr		0.5.7		:	<u>2</u> :	3 4 : :	
,			Brown, Stiff, Moist		SPT 1		3-5-7 (12)	1.25	A O			
			SANDY FAT CLAY, Trace Gravel, Tan, Stif (CH)	II, IVIOISI		-			:	:		
¥				0.0.5								
<u> </u>	•		FAT CLAY, w/ Gravel, Shaley, Reddish Bro	3.0 ft					:	:		
			Stiff, Moist (CH)	Wii, VCiy	SPT	-	0.7.10					
T AN					2		8-7-10 (17)	3	A O	:	1	
5	B			5.5 ft					· · · · · · · · · · · · · · · · · · ·		<u> </u>	
			SANDY SHALE, Highly Weathered, Brown	w/ Dark								
	0.D.		Brown, Soft		SPT		8-16-18	4.25	0	A		
<u> </u>	.5 <u>.</u>				3		(34)	1.20		_ :		
<u> </u>	4 - ۷											
Z I	CFA								:	:		
					SPT 4		9-23-34 (57)	4.5	0	4	N.	
10												
ğ									:	:		
	9											
MASIER PROJECT									:	:		
0-00				450#	SPT 5		27-34-46 (80)	4.5	0		A	
<u>15</u>		7-7-	Bottom of borehole at 15.0 feet.	15.0 ft					:	:	: :	
			25.05.11 51 251511016 at 10.0 166t.									
35												
4												
E E E												
<u> </u>												
<u>.</u>												
and LOG - PFI - PFI S ID TEMPLATE.GD												
2												



GEOTECHNICAL BORING LOG

BORING NUMBER

73.1

PAGE 1 OF 1

CLIE	NT Chero	kee Na	ation Entertainm	nent		PROJE	CT NAM	/IE _N	lational Cl	heroke	e Nation Pa	ark			
PRO.	JECT NO.	25674	18 Rev. 1			PROJE	CT LO	CATIO	N Sallisa	aw, OK					
DATE	STARTE	2/28	8/19	COMPLETED	2/28/19	SURFA	CE ELE	VATI	ON		BENC	HMAR	K EL.		
DRIL	LER RD			DRILL RIG _D	50	GROU	ID WAT	ER LI	EVELS						
HAMI	MER TYPE	Auto)			A	T TIME	OF D	RILLING	None					
LOGG	GED BY _	G		CHECKED BY	RTH	A	T END	OF DI	RILLING						
NOTE	S Offset	40' SV	V Due to Steep	Grade, Augers K	(icked Off at 12' and	d Boring	was ten	minate	ed and Of	fset an	additional	2 feet			
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 20 PL 20	40 6 N VA 40 M	ALUE 60	100	ELEVATION (ft)
0	" O.D.		TOPSOIL - Very Stiff, M		Sand, Dark Brown,	0.3 ft 1.0 ft					:	:	:		
	CFA - 4.5		to Very Har	AN CLAY, w Gra d, Moist (CL) Refusal at Bottom of boreh		ery Soft									

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OKICKCHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ



GEOTECHNICAL BORING LOG

BORING NUMBER

73.2

CLIE	NT Chero	okee Na	ation Entertainn	nent	PROJE	CT NAM	ME N	lational C	heroke	e Natio	on Par	k		
PRO.	JECT NO.	25674	l8 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, Ok	(
DATE	STARTE	D 2/28	3/19	COMPLETED 2/28/19	SURFA	CE ELE	VATI	ON		В	ENCH	MARK E	L	
DRIL	LER RD			DRILL RIG _D50	GROUI	ND WAT	ER LI	EVELS						
	MER TYPE							RILLING	6 ft					
				CHECKED BY RTH	,	AT END	OF DI	RILLING	6 ft					
٦l			V Due to Steep											
			·							4	DRY	LINIT W	T (pcf) ◆	
		ᅵᅥ				111	%	S) 40	60	80 100	_
	<u> </u>	MB		MATERIAL RECORDERION		는 된 된		ENTE ENTE	PEN.	2		N VALU		O
DEPTH (ft)	DRILLING METHOD	\S\		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET I		PL	МС	LL	ELEVATION (ft)
	ME.	AT/	Ur	nified Soil Classification System		MPI	(R)	N V	SCK)		 20	\longrightarrow	80 80	LE
		STRATA SYMBOL				SA	R	SP BL(PC				GTH (ksf) 🗖	⊣ "
					0.2.#						1		3 4	
0			TOPSOIL - Very Stiff, M	· LEAN CLAY, w/ Sand, Dark Bro	wn, 0.3 ft.	SPT		0-0-0	1.5		:			
<u> </u>				AN CLAY, w Gravel, Dark Brown	. Verv Soft	1		(0)	1.5		₽ ⊢ :			
			to Very Har	rd, Moist (CL)	., ,		1				:			
	- 1													
	•													
	Ь					SPT	-	40.0/="						
					4.5 ft	2		12-3/5"	3.25	0		:		↑
	1		SANDSTO	NE BOULDER, Fine Grained, Po							<u>.</u>			
5	•			Highly Weathered, Brown, Soft AND, w/ Gravel, Brown, Medium	5.5 ft						:			
			Moist (SC)	AND, W/ Graver, brown, Medium	Dense,		1				:			
	Ο.Ο				7.3 ft	SPT 3		4-8-15 (23)	2	0	A			
<u>≨</u> ⊔	1.5		SANDSTO	NE BOULDER, Fine Grained, We				(=0)						
			Cemented,	Highly Weathered, Brown, Soft	8.5/ft						:			
	CFA		SANDY LE	AN CLAY, Red Tan, Very Hard, V	Wet 9.0/ft	X SPT		50/5"		0				▲
			<u> </u>	NE BOULDER, Fine Grained, We	eakly	_4_	1							
10	L			Highly Weathered, Brown, Soft										.
			SANDY SH	HALE, Highly Weathered, Brown,	Soft							:		
	9													
											:			
											:	:		
											:			
<u></u>						SPT	.]	6-12-12						
5	1				15.0 ft	5		(24)	2.5			:		
15				Bottom of borehole at 15.0 feet.	10.011						•		· ·	
3														
i														
NING EGG - FFT - FFT OID IEWITEALE.GD														
2														
5														



GEOTECHNICAL BORING LOG

BORING NUMBER

74

PAGE 1 OF 1

-	CLIEN	NT Chero	kee N	ation Entertainr	nent	PROJI	ECT NAI	VIE N	lational C	heroke	e Nation Park	
ŀ	PROJ	ECT NO.	2567	48 Rev. 1		PROJI	ECT LO	CATIO	N Sallis	aw, Ok	(
- 1	DATE	STARTE	3 /1	/19	COMPLETED 3/1/19	SURF	ACE ELE	EVATION	ON		BENCHMARK EL.	
- [1	DRILL	ER CW			DRILL RIG 2015 CME	GROU	ND WAT	ΓER LI	EVELS			
- 1				0		_			RILLING	2 ft		
				<u> </u>							t	
- 1	NOTE		<i></i>		One one of the one of	_ '	AI LIID	0, 0,	I TILLING	1.17 1	<u>.</u>	
SS.GF	NOIL	.5		T		_	1				A DDV/INITIA/T (DA	
3 LOC									w		◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100	
Ž.	_	<u>ں</u> ں	SYMBOL				SAMPLE TYPE NUMBER	% ≿:(c	CORRECTED BLOW COUNTS (N VALUE)	PEN.	▲ N VALUE ▲ 20 40 60 80	ELEVATION (ft)
SBC	(#) (#)	DRILLING METHOD			MATERIAL DESCRIPTION		.Е.Т 1ВЕ	ÆR D%		ET F		f) AT
	Д П	뙲	TA	Uı	nified Soil Classification System		4	SS SS SS SS SS SS SS SS SS SS SS SS SS	RR W (CKE t	PL MC LL ├───────────────────────────────────	EV.
SING			STRATA				SAN	RECOVERY (RQD %)	25 25 ()	POCKET I	20 40 60 80	Ш
3/BOI			S						_		■ SHEAR STRENGTH (ksf) ■ 1 2 3 4	
K-SU	0	J.			Y LEAN CLAY, w/ sand, Dark Brow	n, 0.3 ft	GB				Q .	
PAR -	4	SAMPLE			iff, Moist (CL) SAND, w/ gravel and cobbles, Tan, I	Donoo	<u></u> GB	1				
NOL		S ON		Moist (SC)		2.2 ft	2	4				
E NA	-	<u> </u>		1 <u>₹</u>	Refusal at 2.2 feet.	2.2 10					: : : :	
SKE		_			Bottom of borehole at 2.2 feet.							
빙											0	
AT'L												
748-N												
-2567												
ENT												
NOL												
E NA												
N N												
띩												
K K K												
19/0												
LE\20												
CT FI												
COLE												
R PR												
ASTE												
.:\ M_												
89-8												
60 6												
7/1/1												
-TG												
TE.G												
MPL												
I STI												
- PF												
- PP												
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(\)2019\(\)QK\(\)C\(\)CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\(\)BORING LOGS\(\)BORING												
NG NG												
BOF												

GEOTECHNICAL BORING LOG

BORING NUMBER

75

- 1			ation Entertainr	ment				iational Ci			ion Pa	IK		
	JECT NO.							N Sallisa						
1				COMPLETED							BENCH	HMARK E	L	
	LER <u>CW</u>					ND WAT								
_ I)					RILLING						
1						AT END	OF D	rilling _	6.5 ft					
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE/2019/OK/C/CHERRKEE NATION ENT-2567/48-NAT'L CHERRKEE NATION PARK-SUB/BORING LOGS/GPJ OF DEPTH OF DEPTH	ES								I		♠ DDV	/	/T (===f) 🛕	
3 LOC		占						Ø			20 4	0 60		
	ର ଦ	SYMBOL				SAMPLE TYPE NUMBER	% <u>\</u>	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		20	N VALU	E ▲ 80 80	NO
DEPTH (ft)	DRILLING METHOD	\ SY		MATERIAL DESCRIPTION		LET	RECOVERY (RQD %)	ALUS	ET F		PL	MC	LL	TK#
OI DE	NE.	STRATA	U	Inified Soil Classification System		MP	(R)	N N N	S S		20	$\overline{}$	—— 50 80	ELEVATION (ft)
ORIN N		STR				S	R	SA	M				GTH (ksf)	
		31/2:31			0.5.6						1		3 4	
RK-SL O		<u> </u>	TOPSOIL Medium St	- LEAN CLAY, Trace Sand, Dark tiff. Moist	S Brown, 5 II	V 25 I	-	1-3-3	0.5		: O	:	: :	
지 			LEAN CLA	AY, w/ Sand, Tan Brown, Medium	Stiff to	1		(6)	0.0	_		:		
ATIC 			Soft, Moist	t (CL)								:		
GE N											:	:		
- 186 	1										:	:		
	<u>.</u>					SPT		1-1-3			:	:		
-NAT	.5" O.D					2		(4)	1		H O H			
5 5	4						1				• • • • • • • • • • • • • • • • • • • •			
ZT-25	CFA				6.0 ft							:		
NO E			SANDY LE	EAN CLAY, Trace Gravel, Light G , Very Moist (CL)	Gray & Tan,	SPT	-	27-23-39	0		:	:		
MATIC			very riard,	, very moist (OL)		3		(62)	"		O :	:		
~ _												:		
ERO	Ь				9.0 ft		-							
		(/////	SANDSTO	DNE, Fine Grained, Poorly to Wel	II	SPT 4		40-52- 65/2"	3.5	0				A
90k	\		Cemented	, Tan, Soft to Medium Hard	9.9 ft							-		
E/201				Refusal at 9.9 feet. Bottom of borehole at 9.9 feet.										
린				bottom of boreliole at 9.9 leet.										
SEC														
PRC														
STEK														
ΨÄ														
- S:														
RO: 60														
1/19														
1 - 7/														
GD GD														
PLAT														
TEM TEM														
STD														
핕														
<u>ë</u>														
-90														
NGL														
30RI														



4168 W. Kearney

BORING NUMBER

	47		pringfield, Mis elephone: (4			RING								78
			ax: (417) 864				LO					PAG	E 1 0)F 1
CLIEN	NT Chero	kee Nat	ion Entertainn	nent		PROJE	CT NAI	ME N	ational C	heroke	e Nation Park			
	IECT NO.					_			N Sallis					
				COMPLETED _		_			· · · · · ·		BENCHMAR	K EL		
				DRILL RIG 201	15 CME					NI				
					DTU									
				CHECKED BY _		. <i>*</i>	AI END	OF DI	VILLING .					
BIBORING LOGS/BORING LOGS/G	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESC	CRIPTION	-	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 PL M	0 80 ALUE ▲ 60 8 IC LL 60 8 ENGTH (k	100 30 30	ELEVATION (ft)
0	SAMPLE	11 7111 71 11 7	TOPSOIL - Dark Browr	LEAN CLAY, w/ En, Soft, Moist	Boulders, Gravel,	& Sand,	m GB				0	:	:	
1		1, 1, 1,		NE, Fine Grained,	W 11 C	1.4 ft \ 1.5 ft	✓ 1 GB						:	
BOKING LOG - PPI - PPI SID I EMPLAIE.GDI - 7/1/19 UG/08 - SY, MASI EK PROJECT PILEZO19/OKIC/CHEKOREE NATION EN 1-256/48-NATI CHEKOREE NATION EN 1-256/48-NATION EN 1-256/48-NATI	HAND		Brown, Med	Refusal at a Bottom of boreho			2							

GEOTECHNICAL BORING LOG

BORING NUMBER

79

			ion Entertainm							e Nation Park
DATI DRIL HAM LOG	LER RD	D <u>2/28/</u> E Auto	8 Rev. 1 19	DRILL RIG D50	SURF# GROU	ACE ELE ND WAT AT TIME	EVATION LICENTIAL CONTRACT CON	EVELS RILLING	None	BENCHMARK EL.
SIBORING LOGS/BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) \$\limes\$ 20 40 60 80 100 A N VALUE \$\limes\$ 80 \$\limes\$ 80 PL MC LL \$\limes\$ 20 40 60 80 SHEAR STRENGTH (ksf) \$\limes\$ 1 2 3 4
NATION PARK-SUE	CFA - 4.5" O.D.		Very Stiff, N CLAYEY SA Moist (SC)	LEAN CLAY, w/ Sand, Dark Brown Moist AND, w/ Gravel, Tan, Medium Dens NE, Fine Grained, Poorly to Well		SPT 1	-	3-6-12 (18) 50/0"	0.75	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S. MASTER PROJECT FILE/2019/OK/C/CHEROKEE NATION ENT-258748-NATL CHEROKEE NATION PARK-SUB/BORING LOGS/BORING LOGS/GPJ DEPTH O DEPTH O (ft) LOG (



4168 W. Kearney Springfield, Missouri 65803

GEOTECHNICAL

BORING NUMBER

			elephone: (4 ax: (417) 864	17) 864-6000 1-6004	ВО	RING	LO	G			2105	00
	- OI						OT 114	\		<u> </u>	PAGE	1 OF
											e Nation Park	
	IECT NO.				0/4/40				N Sallis			
											BENCHMARK EL.	
)15 CME							
					RTH	,	T END	OF DE	RILLING			
NOTE							PE	%	ED (z.	◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100 ▲ N VALUE ▲	
<u>=</u> (±)	DRILLING METHOD	A SYMBOL		MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 60 80 PL MC LL	ELEVATION
,	DR	STRATA	U	ication System		SAMF	RECC (R	COR BLOW (N)	POC	20 40 60 80 SHEAR STRENGTH (ksf)		
0	<u></u>	3/1///	¬ TOPSOIL ·	- LEAN CLAY, w/	Sand and Gravel,	0.3 #	GB				1 2 3 4	_
_	ND SAMPLE			n, Soft, Moist EAN CLAY, w/ Gra oist (CL)	avel, Brown, Mediu	m Stiff, 2:2 ft	M 1 GB 2	/			0	
	HAND				I, Poorly Cemented		GB 3				<u> </u>	
			DIOWII TO L	ight Gray, Soft Refusal at				ı				
				Bottom of boreh	ole at 2.2 feet.							
				Bottom of boreh	ole at 2.2 feet.							



GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Nat	ion Entertainm	ent	PROJ	ECT NAM	/E _N	lational C	heroke	e Nation P	ark			
PRO.	JECT NO.	256748	Rev. 1		PROJ	ECT LOC	CATIO	N Sallisa	aw, OK					
DATE	E STARTED	2/25/	19	COMPLETED 2/25/19	SURF	ACE ELE	VATI	ON		BENC	HMAR	K EL.		
DRIL	LER RD			DRILL RIG D50	GROU	ND WAT	ER L	EVELS						
HAM	MER TYPE	Auto				AT TIME	OF D	RILLING	None					
LOG	GED BY _J	G		CHECKED BY RTH		AT END	OF DI	RILLING						
NOT	ES													
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4	40	0 80 ALUE 4 60	80 LL -1 -80	ELEVATION (ft)
0	CFA - 4.5" O.D.		Stiff to Hard CLAYEY SA Slightly Mois SANDSTON Cemented,	AND, w/ Gravel, Tan, Very Dense,	0.3 ff 0.9 ft 1.6 ft			10-50/5"		0				

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - 8:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT'L CHEROI



GEOTECHNICAL BORING LOG

BORING NUMBER

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С	LIEN	IT Chero	kee Na	ation Entertain	ment	•	PROJE	CT NAM	VIE N	lational C	heroke	e Nation Pa	ark		
Р	ROJ	ECT NO.	25674	8 Rev. 1						N Sallis					
						2/25/19		CE ELE	EVATION	ON		BENC	HMARK	EL.	
D	RILL	ER RD			DRILL RIG	D50	GROU	ND WAT	ΓER LI	EVELS					
- 1											None	:			
- 1						Y RTH									
- 1					_					•					
ING LOGS.0			SYMBOL					뮙	%	CORRECTED BLOW COUNTS (N VALUE)	z	20 4		WT (pcf) ◆ 80 100 UE ▲	z
쀎		DRILLING METHOD	N.		MATERIAL DE	ESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)		POCKET PEN. (tsf)	20	40	60 80	ELEVATION (ft)
LOGS/BO	Œ	플트		L	Inified Soil Class	sification System		PLE		A S S S S S S S S S S S S S S S S S S S	Ä.	PL L	MC	LL	EVA (#
		≥	STRATA			•		SAN	REC (I	SOS	NO.	20	40	60 80	_
BOF			ν					"		ш		SHEA 1	R STRE	NGTH (ksf) 🗖 3 4	
PARK-SUE	0	.5" O.D.	7, 1 ^N . 7,	Stiff to Ha	rd, Moist	CLAY, Dark Brown,		SPT 1		11-24- 50/2"		0			<u> </u>
<u> </u>		4	: : : : :		DNE, Fine Graine I, Tan, Soft to M	ed, Poorly to Well edium Hard	1.7 ft	SPT		50/0"				<u> </u>	
T FILE'2019)OKIC'CHEROKEE NATION ENT-256748-NAT'L CHEROKEE		CFA				at 1.7 feet. ehole at 1.7 feet.		2							
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS.GPJ DEPTH DEPTH A															

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

CLIE	NT Chero	kee Na	ation Entertainm	nent	PROJE	ECT NAM	/IE _N	lational C	heroke	e Natior	ı Park			
PRO	JECT NO.	25674	18 Rev. 1		PROJE	ECT LOC	CATIO	N Sallisa	aw, Ok	(
DAT	E STARTE	2/2	5/19	COMPLETED 2/25/19	SURFA	ACE ELE	VATI	ON		BE	NCHM	ARK EL	.	
DRIL	LER RD			DRILL RIG D50	GROU	ND WAT	ER LI	EVELS						
HAM	MER TYPE	Auto)			AT TIME	OF D	RILLING	None	1				
LOG	GED BY _	IG		CHECKED BY RTH		AT END	OF DI	RILLING						
NOT	ES													
DEPTH (ft)	4.5" O.D. DRILLING METHOD	STRATA SYMBOL	TOPSOIL - Stiff, Moist	MATERIAL DESCRIPTION iified Soil Classification System LEAN CLAY, w/ Sand, Dark Brown AND, w/ Gravel, Red Tan, Medium st (SC)			RECOVERY % (RQD %)	CORRECTED CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 1 20	40 N 40 10 10 10 10 10 10 10 10 10 1	60 VALUE 0 60 MC 0 60	LL 0 80 GTH (ksf) •	ELEVATION (ft)
5	CFA -		SANDY SH Soft to Med		4.1 ft & Gray, 5.3 ft	SPT 2	-	6-9-20 (29)	2.75	0	A			
				Refusal at 5.3 feet. Bottom of borehole at 5.3 feet.		SPT 3		50/0"						1

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S.\. MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT



4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

GEOTECHNICAL BORING LOG

BORING NUMBER

84

CLIENT Cherokee Nation Entertainment PROJECT NO. 256748 Rev. 1 DATE STARTED 2/25/19 COM DRILLER RD DRII HAMMER TYPE Auto LOGGED BY JG CHE NOTES O O O O O O O O O O O O O O O O O O O							
PROJECT NO. 256748 Rev. 1 DATE STARTED 2/25/19 COM DRILLER RD DRII HAMMER TYPE Auto CHE LOGGED BY JG CHE	<u> </u>	PRO.IF	CT NAM	MF N	ational Cl	heroke	PAGE 1 OF
DATE STARTED _2/25/19 COM DRILLER _RD DRI HAMMER TYPE _Auto LOGGED BY _JG CHE							
DRILLER RD DRII HAMMER TYPE Auto LOGGED BY JG CHE							
HAMMER TYPE Auto LOGGED BY JG CHE							
LOGGED BY JG CHE						None	•
_	ECKED BY RTH						
MATI CHEROKE IN A CONTROL OF STRIP TO CONTROL					_		
Stiff to Hard, Moist CLAYEY SAND, Moist (SC) SANDSTONE, Fire Reddish Tan, Me	ERIAL DESCRIPTION Soil Classification System DY LEAN CLAY, Dark Brown,	0.2 _# -		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 A N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4
CLAYEY SAND, Moist (SC) SANDSTONE, Fi Reddish Tan, Me Botto	st	1:4/#	1		50/1"	1.5	O
SANDSTONE, Fi Reddish Tan, Me	w/ Gravel, Brown, Very Dense	, 1.4 IT	SPT		50/0"		
Reddish Tan, Me	ne Grained, Well Cemented,		2				
MATE MOTES MOTES MASTER PROJECT FILE 2011 10 06:06 - St. MASTER PROJECT FILE 2011 1	Refusal at 1.4 feet. m of borehole at 1.4 feet.						
ANNO LOG - PPI -							

GEOTECHNICAL BORING LOG

BORING NUMBER

85

				•										
CLIE	NT Cher	okee Na	ation Entertainn	nent	_ PROJE	CT NAM	/IE _N	lational C	heroke	e Nation I	Park			
PRO	JECT NO.	25674	18 Rev. 1		PROJE	CT LOC	CATIO	N Sallis	aw, OK	(
1				COMPLETED 2/21/19										
1				DRILL RIG _D50										
									Mana					
1			1											
LOG	GED BY	JH		CHECKED BY RTH	_	T END	OF DI	RILLING						
NOT	ES				_									
DEPTH (#)	DRILLING METHOD	STRATA SYMBOL	Uı	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	N VAL	80 UE ▲ 60 & LL 60 &	100 30 30	ELEVATION (ft)
0		111/17	TOPSOIL -	LEAN CLAY, w/ Boulders & Grav	el & ^{0.3} ft					:	:	:	:	
			∖ Sand, Dark SANDY LE	s Brown, Soft, Moist AN CLAY, w/ Gravel, Red Tan, M , Moist (CL)		SPT 1		0-4-4 (8)	2.25	A O				
	4.5" O.D.				5.0 ft	SPT 2		3-4-6 (10)	1.25	A O				
5	CFA-		SANDY SH	HALE, Highly Weathered, Reddish	Tan, Soft									
 - 			SANDSTO	NE, Fine Grained, Poorly to Well	7.0 ft	SPT 3		40-45-48 (93)	3.25	0			A	
- - -	1			Brown, Soft to Medium Hard		SPT 4		50/2"	,	0				
					9.4 ft	ODT		50/01		<u> </u>			<u>:</u>	
				Refusal at 9.4 feet. Bottom of borehole at 9.4 feet.		SPT 5		50/0"					,	

PpI

4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

GEOTECHNICAL BORING LOG

BORING NUMBER

86

CLIE	NT Ch	ero	kee Na	ation Entertainn	ment	PROJE	ECT N	AME	<u> N</u>	ational Cl	heroke	e Nati	on Par	·k			
PRO.	JECT N	Ο.	25674	18 Rev. 1		PROJE	CT L	OCA	TIO	N Sallisa	aw, Ok	<					
DATE	E STAR	TE	2/26	6/19	COMPLETED 2/26/19	SURFA	CE E	LEV	ATIO	ON		В	ENCH	MARK I	EL		
1					DRILL RIG 2015 CME												
	MER TY										6 ft						
1					CHECKED BY RTH												
										_							
						_		_	_			4	DRY	LINIT W	VT (pcf)	•	
			ᅵᆸ					%	.	_	<u> </u>	20) 40	60	80 10	00	
	92	1	SYMBOL		MATERIAL DESCRIPTION		<u> </u>	; °`	<u>;</u>	HE (H	PEN	:	20	N VALU	JE ▲ 60 80	ı	ON
DEPTH (ft)	크		\S\		MATERIAL DESCRIPTION				١٥٩	A SEC	ET		PL				(ft)
	DRILLING		STRATA	Uı	nified Soil Classification System		SAMPLE TYPE		(RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		-	$\overline{}$,	ELEVATION (ft)
			STR				S	2	=	O.H.	M				IGTH (kst		Ш
			. 4 7 4			V 3 H								2	-		
0			7. 7.	─ TOPSOIL - Medium Sti	LEAN CLAY, w/ Sand & Gravel	, Brown;	V si	РΤ		4-4-3		A (`				
-				SANDSTO	NE, Weakly Cemented, Highly V	Veathered,				(7)							
		L		Fine Graine	ed, Red & Tan, Very Soft	,			Ī					:			
		ľ												:			
-	D					3.3 ft							:	:			
	.5" 0.			SANDY SH	HALE, w/ Sandstone Lenses, Hig I, Gray & Brown, Soft to Hard	hly	V _o		İ	10 10 10				:			
	- 4.5			vveamered	i, Gray & Brown, Soit to Hard		SI	2		10-10-13 (23)	4.5	0	A	:			
5	CFA	L							-						<u> </u>		
		ľ		∇										:			
:			77				V _{SI}	РΤ	Ī	17-39-	4.5	0					
- -								3		65/2"	4.5		:			4	
-			77			8.4 ft											
				SHALE, Lig	ght Gray to Gray w/ Very Thin Da ry Thin Bedding, Medium Hard to	ark Gray							:				
				Moderately	Hard	,								:			
10	.						N		89				.; 				
							 	(70)				:				
-																	
							П										
	g						Ш										
<u>-</u>	Ž						Ш										
	CORE BARREL - NQ						N	Q (8	97 87)								
15	AR							2 (8	87)								
	H H						Ш						:	:			
	SOF													:			
: : :							Ш							:			
<u> </u> -													:	:			
													:	:			
-													:	:			
							Ŋ	Q 1	100 85)				. <u>;</u>	<u>.</u>	<u>;</u>		
20) (00)					:			
-																	
													:	:			



GEOTECHNICAL BORING LOG

BORING NUMBER

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			Nation Entertainment 6748 Rev. 1	PROJECT NA					'k		
LOGS.GPJ DEPTH (ft)	(0.0	STRATA SYMBOL	MATERIAL DESCRIPTIO	LE TYPE	RECOVERY % (RQD %)	OH C	POCKET PEN. (tsf)	DRY 20 40 20 PL 20	UNIT WT () 60 80 N VALUE 4 40 60 STRENGT 2 3	80 LL -1 80	ELEVATION (ft)
ROKEE NATION PARK SUBBORING LOGS BORING	CORE BARREL - NQ		SHALE, Light Gray to Gray w/ Very T Bands, Very Thin Bedding, Medium H Moderately Hard (continued) - Very Dark Gray to Black & Soft Belo	NQ 4	100 (58)						

Refusal at 28.4 feet. Bottom of borehole at 28.4 feet.



4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

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	11/2		elephone: (4 [.] ax: (417) 864	17) 864-6000 I-6004	ВС	RING	LO	G				1	PAGE 1 (OF 1
CLIE	NT Chero	kee Nati	on Entertainn	ment		PROJE	CT NA	ME N	lational C	⊥ heroke	e Nation Parl		7.02	
												··		
					2/21/19							MARK EL.		
	LER LB				50									
									RILLING	None				
					RTH									
NOT	ES													
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DES	ication System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 20 PL	WC 40 60 STRENGT 2 3	80 LL 	ELEVATION (ft)
ON PARR-50	- 4.5" O.D		Soft, Moist	AND, Reddish Br	ace Sand, Dark Br	1.5 ft	SPT 1	-	10-50/4"	4.25	0			
<u> </u>	4	:::::		NE, Fine Grained	d, Poorly to Well	2.1/ft			50/1"		b :			
S S	Ö		Cemented, Hard	Reddish Brown t	to Tan, Soft to Med	lium	SPT 2	l		•				
BORING LOG - PPI - PPI S ID TEMPLATE.GDT - 77719 09:08 - 8: MASTER PROJECT PILEZOT9/ORIC/CHEROREE NATION EN 1-256/48-NATI CHEROREE NATION EN 1-256/48-NATION EN 1-256/48-NAT														

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Na	ation Entertainm	nent	PROJE	CT NAM	/IE _N	National Ch	neroke	e Nation	Park			
PRO.	JECT NO.	25674	l8 Rev. 1		PROJE	CT LOC	ATIC	N Sallisa	aw, OK	(
DATE	STARTE	2/21	1/19	COMPLETED 2/21/19	SURFA	CE ELE	VATI	ON		BEN	ICHMARK	EL		
DRIL	LER LB			DRILL RIG D50	GROU	ND WAT	ER L	EVELS						
HAM	MER TYPE	Auto			A	AT TIME	OF D	RILLING	None					
LOG	GED BY _	H		CHECKED BY RTH		AT END	OF D	RILLING _						
NOT	ES				-									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Un	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 P	▲ N VAL	80 0 UE ▲ 60 8 LL 60 8	100 30	ELEVATION (ft)
0	.D.		TOPSOIL - Soft, Moist	LEAN CLAY, Trace Sand, Dark Br	$-$ own, $\frac{0.3 \text{ ft}}{}$:		
	4.5" O.		SANDY LEA Moist (CL)	AN CLAY, Brown, Soft to Hard, Sli	ghlty 2.0 ft	SPT 1		0-7-50/3"	1.75	0			4	
	CFA -			NE, Fine Grained, Poorly to Well Reddish Tan to Light Tan, Soft to	Medium 3.6 ft									
				Refusal at 3.6 feet. Bottom of borehole at 3.6 feet.		SPT 2		50/1"						

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-1

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CLIE	NT Che	rokee Na	ation Entertainm	ent	_ PROJE	ECT NAI	ME N	lational C	heroke	e Nation Pa	rk		
DAT	E START	ED 2/21	/19	COMPLETED _2/21/19 DRILL RIG _D50	SURFA	CE ELE	VATI						
				DRILL RIG _D30				RILLING	13 ft				
1				CHECKED BY RTH				RILLING					
NOT	ES				_								
	DRILLING METHOD	STRATA SYMBOL	Un	MATERIAL DESCRIPTION ified Soil Classification System			RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 20 PL 1— 20	VUNIT WT (0 60 86 N VALUE 40 60 MC 40 60 R STRENGT 2 3	80 LL 	ELEVATION (ft)
0			─ TOPSOIL - Soft, Moist	LEAN CLAY, Trace Sand, Dark B	Frown, $\frac{3\pi}{2}$	-				:		:	
			Stiff, Slightly	l From 1.75' to 3'	2.0 ft	SPT 1		2-11-11 (22)	3.25	C.			
Z – .	(77	SANDY SH	ALE, Highly Weathered, Brown, S	Soft	ST				:		:	7.77
						2	75		3	O:		•	4
- KNI-0										:		:	
5] <u>.</u>									:			
	A - 4.5" O.D					SPT 3		10-25-39 (64)	4.5	0	^		
	CFA					SPT 4		20-33-45 (78)	4.5	0		A	
2	1									:			
10													
			¥		13.0 ft								
<u> </u>			SANDY SH	ALE, Gray, Soft to Medium Hard Refusal at 13.8 feet.	13.8 ft	SPT 5	_	50/3"	4.5	0 :			
אואס בסס-ודון - דון סום ובואדבאו ב. סם - זין זין ט שינסי			1	Bottom of borehole at 13.8 feet.		<u> </u>	I						
TING FOO													

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

	CLIE	NT Chero	kee Na	ation Entertainn	nent	_ PROJE	CT NAM	/E _N	lational C	heroke	e Nation Pa	ark			
ŀ	PRO	JECT NO.	25674	18 Rev. 1		_ PROJE	CT LO	CATIO	N Sallis	aw, Oł	(
ŀ	DATI	STARTE	D <u>2/2</u>	1/19	COMPLETED 2/21/19	_ SURFA	CE ELE	VATI	ON		BENC	HMAR	K EL.		
ļ	DRIL	LER LB			DRILL RIG D50	_ GROU	TAW DI	ER L	EVELS						
ļ	HAM	MER TYPE	Auto)		4	AT TIME	OF D	RILLING	3 ft					
ļ	LOG	GED BY _	JH		CHECKED BY RTH		AT END	OF DI	RILLING	4 ft					
<u>કુ</u> ા	NOT	ES				_									
KING LUGS		(0.0	SYMBOL				J.	% .	ED NTS	PEN.	20 4	10 6 N V	00 80 ALUE ▲		z
ZING LOGO/BOT	DEPTH (ft)	DRILLING METHOD	STRATA SYM	Ur	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PE (tsf)	20 PL 	40	IC 60	LL H 80	ELEVATION (ft)
200			S						_		SHEA 1	2 2	ENG I	H (ksf) 🗖 4	
AKN-90	0 _			Soft, Moist	LEAN CLAY, Trace Sand, Dark E							:			
E NATION F	_	.5" O.D.		SANDY LE	AN CLAY, Brown, Soft to Stiff, Wo	et (CL)	SPT 1		0-0-4 (4)	1.25	▲ Ö				
-NAI'L CHEKUNE	-	CFA - 4		∑ ▼ - Very Mois	it & Shaley Below 3.5'	5.0 ft	SPT 2		5-6-9 (15)	1		-1			
-256/46	5		<u> </u>		Bottom of borehole at 5.0 feet.	5.5 K					I	•	:_	i	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

CLII	ENT Cher	okee Na	tion Entertainn	nent	PROJI	ECT NAI	ME N	lational C	heroke	ee Nation Park	_
DA1 DRI	LLER LB	D 2/21		DRILL RIG _D50	SURFA	ACE ELE	EVATION LI	EVELS		SENCHMARK EL.	
				CHECKED BY RTH	_ '	AT END	OF DI	RILLING			_
B/BORING LOGS/G DEPTH (ft)	NG OD	STRATA SYMBOL		MATERIAL DESCRIPTION ified Soil Classification System	_	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) • 20 40 60 80 100 A N VALUE • 20 40 60 80 PL MC LL • 40 60 80 SHEAR STRENGTH (ksf) ■ 1 2 3 4	(#)
EROKEE NATION PARK-SU	CFA - 4.5" O.D.	3 V 2 3 V	Soft, Moist SANDY LE Hard, Moist SANDSTO	LEAN CLAY, Trace Sand, Dark I AN CLAY, Trace Gravel, Tan, Sti t (CL) NE, Fine Grained, Poorly to Well Reddish Tan, Soft to Medium Ha	ff to 1.8 ft	1		20-50/3"	1.25		
BORING LOG - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(2019\)(OK\C\CHEROKEE NATION ENT-256748-NATL CHEROKEE NATION PARK-SUB\BORING LOGS\)BORING LOGS. PPI - PRI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(2019\)(OK\C\CHEROKEE NATION ENT-256748-NATL CHEROKEE NATION PARK-SUB\BORING LOGS\)(BORING LOGS\)(B				Bottom of borehole at 3.5 feet.							

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

	CLIE	NT Cherc	kee Nat	tion Entertainment	PROJ	ECT NA	ME N	National C	heroke	e Nati	on Parl	<		
	PRO.	JECT NO.	256748	8 Rev. 1	_ PROJ	ECT LO	CATIC	N Sallis	aw, Oł	(
	DATE	STARTE	D <u>2/26/</u>	/19 COMPLETED 2/26/19	_ SURF	ACE ELI	EVATI	ON		B	ENCH	MARK EL.		
	DRIL	LER CW		DRILL RIG 2015 CME 55	_ GROL	IND WA	TER L	EVELS						
	HAMI	MER TYPE	Auto			AT TIME	OF D	RILLING	None	!				
	LOG	GED BY _	CJ	CHECKED BY RTH	_	AT END	OF D	RILLING						
GPJ	NOTE	ES			_									
JGS.(4	DRY	UNIT WT (pcf) 🔷	
VG L(2 Z			ш	%	ည		20		60 80 N VALUE ⊿		4_
SOR!	ı	NG OD	SYMBOL	MATERIAL DESCRIPTION		구유	% ₹ %	ENE ENE	H.			40 60	80	ELEVATION (ft)
GS/E	DEPTH (ft)	DRILLING METHOD				SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL	MC	LL	¥£
G LC	5	吊	STRATA	Unified Soil Classification System		₹		N S S	Š		—	40 60	 80	l E
ORIN			STF			Ś	₩		g.			STRENGT		
UB\B	0		11.7.7								1	2 3	4	
RK-S	0			CLAYEY SAND, w/ Gravel, Dark Brown & Re ¬ Very Dense, Moist (SC)	d, 0.7 ft	SP1	Γ	7-39- 65/2"	1.75		0		:	A
N PA	-	O.D.		SANDSTONE, Fine Grained, Poorly to Well		A '	+	00/2			:		:	
ATIO		بت		Cemented, Tan, Soft to Medium Hard									:	
EE N		4 - 4											•	
Š-	+	CFA									1		:	
					4.2 ft	SPT	Г	65/2"	7	0			:	†
NAT.				Refusal at 4.2 feet.)						•	
9748				Bottom of borehole at 4.2 feet.										
T-25														
EN														
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N N														
HER														
CICIC														
9\OK														
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· S:														
90:08														
1/19 (
//														
.GD														
LATE														
EMP														
PIS														
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(\)2019\(\)0K\(\)C\(\)C\(\)HEROKEE NATION ENT-258748-NAT\(\). CHEROKEE NATION PARK-SUB\(\)BORING LOGS\(\)BORING LOGS\(\)														
G-P														
3 LO														
RIN														
띪														

GEOTECHNICAL BORING LOG

BORING NUMBER

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	CLIE	NT Cherc	kee Na	ation Entertainr	ment	PROJE	ECT NAI	ME N	lational C	heroke	e Nati	on Park			
	PRO.	JECT NO.	25674	18 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, Ok	(
	DATE	STARTE	D 2/2	7/19	COMPLETED 2/27/19	SURFA	CE ELE	VATI	ON		E	BENCH	/IARK E	L	
	DRIL	LER CW			DRILL RIG 2015 CME 55	GROU	ND WAT	ER LI	EVELS						
)						None	:				
					CHECKED BY RTH										
- 1						_ ′	L,\D	O. D.							
3S.G	11011					_						DDV	IN II T 147	T (f) 🛕	
) FOO									(0			0 40		T (pcf) ♦ 80 100	
Ä		യറ	SYMBOL				Y PE	× ~	ED NŢ(Ä		<u>▲ ۱</u> 20	N VALUE 10 6		Z
S/BC	H ()	필호			MATERIAL DESCRIPTION		E T	ÆR D%	ECT SOUN	T:€	,				d∰ £
LOG	DEPTH (ft)	DRILLING METHOD	STRATA	U	Inified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL ├──	MC	LL ——	ELEVATION (ft)
SING			TR/				SAN	RE(25 8 8	<u>B</u>			10 6		⊣ ⊞
3/BOI			S						_		1			GTH (ksf)	
-SUE	0		71 1/1	TOPSOIL -	- SANDY LEAN CLAY, Dark Brow	_{/n,} 0.5 ft			0.0.7			:	: :	:	
PAR				Stiff, Moist		(2)	SPT		3-3-7 (10)	1.25	_	0			
NO		<u>.</u>		SANDY FA	AT CLAY, Tan & Red, Stiff, Moist	(CH)		-	. ,			:		:	
NAT	-	5" 0												:	
Ä		4				3.0 ft						:		:	
HER		CFA		SANDY SH	HALE, Highly Weathered, Brown &	& Dark									
길	-			Brown, Vei	ry Soπ		SPT		13-9-17	3.25		<u> </u>		: : :	
-N-8		•				5.0 ft	2		(26)	3.23				: : :	
9674	5				Bottom of borehole at 5.0 feet.							•	•	•	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\(\)2019\(\)OK\(\)C\(\)CHEROKEE NATION ENT-256748-NATIL CHEROKEE NATION PARK-SUB\(\)BORING LOGS\(\)BORING LOGS\(\)BORING LOGS\(\)GDRING LOGS\(\)															
30RING L															

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CLIE	NT Cher	okee Na	ation Entertainm	nent	PROJE	CT NAM	ME N	National C	heroke	e Natio	n Park				
PRO	JECT NO.	25674	18 Rev. 1		PROJE	CT LO	CATIC	N Sallisa	aw, Ok	(
DATI	E STARTE	D 2/27	7/19	COMPLETED <u>2/27/19</u>	SURFA	CE ELE	VATI	ON		В	ENCHI	/IARK E	L		
DRIL	LER RD			DRILL RIG D50	GROUN	ND WAT	ER L	EVELS							
HAM	MER TYP	E Auto	1		Δ	T TIME	OF D	RILLING	None						
LOG	GED BY _	JG		CHECKED BY RTH	A	T END	OF D	RILLING							
ਤੂੰ NOT।	ES														
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	9 40 0 4 PL 20 4	60 N VALU 10 6 MC 10 6	0 80	00	ELEVATION (ft)
ATL CHEROKEE NATION PARK-SUI	CFA - 4.5" O.D.		Very Stiff, M CLAYEY SA Dense, Moi	AND, Trace Gravel, Brown, Medium st (SC) ALE, Highly Weathered, Brown, So	3.0 ft	SPT 1		3-7-11 (18)	4.5	0					

Refusal at 4.5 feet. Bottom of borehole at 4.5 feet.

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					ment								n Park			
S.GPJ	DATE DRIL HAMI LOG	LER <u>CW</u> MER TYPE GED BY <u>(</u>	D 2/18 E Auto	3/19	CHECKED BY RT	CME 55	SURFA GROUI	CE ELE ND WAT	EVATION LE	EVELS RILLING	None	В			-	
3/BORING LOGS/BORING LOGS	DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DESCRI nified Soil Classificatio			SAMPLE TYPE NUMBER	RCOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	PL 40	MC 60 TRENG	80 100 80 LL 80 TH (ksf)	ELEVATION (ft)
EROKEE NATION PARK-SUI	0	CFA - 4.5" O.D.		Soft, Moist CLAYEY S Loose to L	- LEAN CLAY, Trace S SAND, Trace Roots, Doose, Wet (SC)			SPT 1		1-1-3 (4)	0.75	• ()			
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\\Q19\\OKC\\CHEROKEE NATION ENT-256748-NATIL CHEROKEE NATION PARK-SUB\BORING LOGS\\BORING LOGS\\PHING HOGS\\PHING FOR SOFT	5				Bottom of borehole a	at 5.0 feet.	5.0 ft	2		(7)						
DRING LOG - PPI - PPI ST																

GEOTECHNICAL BORING LOG

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CLIE	NT Cherc	kee N	ation Entertain	ment	_ PROJE	CT NAI	ME N	lational C	heroke	e Nation	Park		
PRO	JECT NO.	2567	48 Rev. 1		_ PROJE	CT LO	CATIO	N Sallis	aw, Ok	(
DAT	E STARTE	D <u>2/1</u>	8/19	COMPLETED _2/18/19	_ SURFA	CE ELE	VATI	ON		BEN	CHMARK	EL	
DRIL	LER LB			DRILL RIG _D50	_ GROU	TAW DI	ER L	EVELS					
HAM	IMER TYPE	_ Auto)	_		AT TIME	OF D	RILLING	2.67	ft			
LOG	GED BY _	JH		CHECKED BY RTH	_ /	AT END	OF DI	RILLING	2.17 f	t			
∄ иот	ES				_								
BORING LOGS/BORING LOGS. DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DESCRIPTION Inified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 P 1 20	40 60 ▲ N VAL 40 L MC 40 AR STREI	60 80 LL 60 80 NGTH (ksf) •	ELEVATION (ft)
SUB O		711. 7	TOPSOIL	- LEAN CLAY, Trace Sand, Dark E	Brown0.5 ft					1	<u>2</u> :	3 4	
OKEE NATION PARK-	4.5" O.D.		∖ Soft, Moist	t AY, w/ Sand, Brown & Red, Very So		SPT 1		0-0-11 (11)		△ ○	1		
NAT'L CHER	CFA		SANDY LE Wet to Mo	EAN CLAY, Shaley, Brown & Tan, ist (CLS)	Very Stiff, 5.0 ft	SPT 2		10-12-12 (24)	1.75	0_			
5748		1/////	1	Bottom of borehole at 5.0 feet.	J.0 It					:	<u> </u>	· · · · · · · · · · · · · · · · · · ·	
BORING LOG - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\(2019\)OKIC\(CHEROKEE\) NATION ENT-256748-NAT'L CHEROKEE\) NATION ENT-256748-NAT'L CHEROKEE\) NATION PARK-SUB\(BORING\) LOGS\(BORING\) LOGS\(BORING\) LOGS\(BORING\) LOGS\(BORING\) LOGS\(BORING\) LOGS\(BORING\) DEPTH A CONTRACT OF A CON													

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	CLIE	NT Chero	kee Na	ation Entertainn	nent	_ PROJE	CT NAM	/IE _N	lational Cl	heroke	e Nation	Park			
	PRO.	JECT NO.	25674	18 Rev. 1		_ PROJE	CT LOC	CATIO	N Sallisa	aw, Ok	(
	DATE	STARTE	D _2/20	0/19	COMPLETED 2/20/19	SURFA	CE ELE	VATI	ON		BEN	NCHMAI	RK EL.		
	DRIL	LER LB			DRILL RIG D50	_ GROU	ND WAT	ER LI	EVELS						
	HAM	MER TYPE	Auto)		A	T TIME	OF D	RILLING	None	!				
	LOG	GED BY _	JH		CHECKED BY RTH		T END	OF DI	RILLING						
<u> </u>	NOTI	S Offset	10' NV	V		_									
ING LOGS		_	SYMBOL				PE	%	STI (PEN.	◆ C 20			Ö 100	
원 :	Ξ.	ING	λX		MATERIAL DESCRIPTION		ET.	%) %)		H_(20	40	60	80	Ē_
2019	DEPTH (ft)	DRILLING METHOD	STRATA S	Ur	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET (tsf)	P 20		MC	LL ─- <i>80</i>	ELEVATION (ft)
B/BCRIN			STF				/S	교	S BL	ğ				H (ksf)	
AKK-VC	0			TOPSOIL - Soft, Moist	LEAN CLAY, Trace Sand, Dark B	Brown, 0.3 ft						:	:	:	
- NATION P		4.5" O.D.		CLAYEY S. (SC)	AND, Brown, Medium Dense, Slig	htly Moist	SPT 1		3-5-8 (13)		04				
HRCR.		CFA - 4		- Shaley Se	eams Below 3'										
NAI'L C						5.0 ft	SPT 2		11-19-33 (52)	4.5	0		A		
-25674	5				Bottom of borehole at 5.0 feet.		_				•	-		•	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT

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C	LIEI	NT Chero	kee N	ation Entertain	ment		PROJ	ECT NAI	ME N	National C	heroke	e Natio	on Parl	<		
				48 Rev. 1						N Sallis						
						D 2/27/19						В	ENCH	MARK E	L	
		LER RD				D50										
- 1)												
- 1						BY RTH		AT END	OF DI	RILLING						
S.G.	IOTE		_	1				_		I		r				
RING LOG		ن 0	SYMBOL					SAMPLE TYPE NUMBER	%	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	40	60 N VALU		N N
S/BO	æ (#)	흑			MATERIAL [DESCRIPTION		ТВЕГ	ÆR D%		ET P			40 6		∄ ¥¥ £
	1	DRILLING METHOD	STRATA	U	nified Soil Cla	ssification Syst	em	A P	RECOVERY (RQD %)	N V C	S T		PL —	MC	LL ———————————————————————————————————	ELEVATION (ft)
RING) TR					SAI	R		8				<u>60 80</u> GTH (ksf) ■	┧Ш
JB/BC			0)												3 4	
N PARK-SU	0			Stiff, Moist		Trace Sand, D		SPT 1		2-1-8 (9)	1.5	^ 0				
ATIO		0.0			•		,		1							
		. 5.4														
Š	-	CFA-		- Shaley, v	// Gravel Belov	w 3'							:			
틸		2		,,				SPT	.	3-3-6			:			
-NAT							5.0 f	1 2		(9)	3.25	_	0			
96748	5		,,,,,,		Bottom of bo	rehole at 5.0 fe					1	l		<u></u>	<u> </u>	
BORING LOG - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS.GPJ																
30RING LOG-																

GEOTECHNICAL BORING LOG

BORING NUMBER

99

	CLIE	NT Chero	kee Na	ation Enter	tainment		PROJE	CT NAI	ME N	lational C	heroke	e Nation I	Park		
S.GPJ	DATE DRILI HAMI LOGO	LER <u>LB</u> MER TYPE GED BY <u>.</u>	2/20 :_Auto	0/19	COMPL DRILL I		SURFA	ACE ELE ND WAT AT TIME	EVATION LICENTIAL CONTRACT CON	EVELS RILLING	None	BEN			
B/BORING LOGS/BORING LOGS	DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		Unified Soil	AL DESCRIPTION Classification System			RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	N VALU 40 6 - MC 40 6 AR STREN	80 100	ELEVATION (ft)
NAT'L CHEROKEE NATION PARK-SU	0	CFA - 4.5" O.D.	7 × 7	POOR Dense	Noist LY-GRADED to Very Denso STONE, Fine	LAY, Trace Sand, Darl SAND, w/ Gravel, Tan e, Slightly Moist (SP) Grained, Poorly to We t to Medium Hard	1.5 ft	SPT 1		20-50/5"		0			
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE!2019\OK\C\CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ	5				Bottom	of borehole at 5.0 feet.									

GEOTECHNICAL BORING LOG

BORING NUMBER

100

NT Cherc	kee Nat	tion Entertainr	ment	PROJE	CT NAM	ME N	lational C	heroke	ee Nation Park		
JECT NO.	256748	8 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, Oł	<		
E STARTE	D 2/28/	/19	COMPLETED 2/28/19	SURFA	CE ELE	EVATIO	ON		BENCHMARK	K EL	
LER CW			DRILL RIG 2015 CME 55	GROU	TAW DI	ER LI	EVELS				
IMER TYPE	Auto		_		AT TIME	OF D	RILLING	None	•		
GED BY _	CJ		CHECKED BY RTH		AT END	OF DE	RILLING				
ES											
ING	SYMBOL		MATERIAL DESCRIPTION		: TYPE 3ER	ERY %	CTED DUNTS JUE)	r PEN.	20 40 60 ▲ N VAI	<u>8Ö 100</u> _UE ▲	NOIL
DRILL	STRATA S	U	nified Soil Classification System		SAMPLE	RECOVE (RQD	CORRE BLOW CO (N VAI	POCKET (tsf	20 40 ■ SHEAR STRE	60 80 ENGTH (ksf)	ELEVATION (ft)
).D.		Moist (SC) SANDY FA) AT CLAY, w/ Gravel, Tan & Brow				1-3-3 (6)		A O	3 4	
- 4.5"											
				5.0 ft	SPT 2		8-10-10 (20)	1.5	A O		
			Bottom of borehole at 5.0 feet.							•	
	DECT NO. E STARTE LLER CW IMER TYPE GED BY METHOD METHOD METHOD	E STARTED 2/28 LER CW IMER TYPE Auto GED BY CJ TES OOO OOO OOO OOO OOO OOO OOO OOO OOO O	SECT NO. 256748 Rev. 1 E STARTED 2/28/19 LER CW IMER TYPE Auto GED BY CJ ES	SECT NO. 256748 Rev. 1 E STARTED 2/28/19 COMPLETED 2/28/19 DRILL RIG 2015 CME 55 IMER TYPE Auto GED BY CJ CHECKED BY RTH TES MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Lo Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brow Stiff to Very Stiff, Moist (CH)	PROJECT NO. 256748 Rev. 1 E STARTED 2/28/19 COMPLETED 2/28/19 SURFA LER CW DRILL RIG 2015 CME 55 GROUI IMER TYPE Auto GED BY CJ CHECKED BY RTH DRILL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Loose, Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) 5.0 ft	SECT NO. 256748 Rev. 1 E STARTED 2/28/19 COMPLETED 2/28/19 SURFACE ELE GROUND WAT IMER TYPE Auto GED BY CJ CHECKED BY RTH AT END SES MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Loose, Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) SPT 2.00 15.9 ft SPT 2.015 CME 55 GROUND WAT AT TIME AT END SURFACE ELE GROUND WAT AT TIME AT END SPT 1 SPT 5.0 ft	PROJECT LOCATION E STARTED 2/28/19 COMPLETED 2/28/19 SURFACE ELEVATION LER CW DRILL RIG 2015 CME 55 GROUND WATER LIGHT MATERIAL DESCRIPTION GED BY CJ CHECKED BY RTH AT END OF DRIES MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Loose, Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) SPT 1 SPT 2	PROJECT LOCATION Sallis E STARTED 2/28/19 COMPLETED 2/28/19 SURFACE ELEVATION LER CW DRILL RIG 2015 CME 55 IMER TYPE Auto GED BY CJ CHECKED BY RTH AT END OF DRILLING ES MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Loose, Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) PROJECT LOCATION Sallis SURFACE ELEVATION GROUND WATER LEVELS AT TIME OF DRILLING AT END OF DRILLING SLANDON MOIST (SC) SANDY FAT CLAY, w/ Gravel, Dark Brown, Loose, Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) SPT (20) 8-10-10 (20)	PROJECT LOCATION Sallisaw, Of STARTED 2/28/19 COMPLETED 2/28/19 SURFACE ELEVATION LER CW DRILL RIG 2015 CME 55 GROUND WATER LEVELS IMER TYPE Auto AT TIME OF DRILLING IGED BY CJ CHECKED BY RTH AT END OF DRILLING ESS MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Loose, 0.5 ft Moist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) SPT 1-3-3 (6) SPT 2 8-10-10 (20) 1.5	PROJECT NO. 256748 Rev. 1 E STARTED 2/28/19 COMPLETED 2/28/19 SURFACE ELEVATION BENCHMARK LER CW DRILL RIG 2015 CME 55 GROUND WATER LEVELS IMMER TYPE Auto GED BY CJ CHECKED BY RTH AT END OF DRILLING SES MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, W/ Gravel, Dark Brown, Loose, O.5 ft Moist (SC) SANDY FAT CLAY, W/ Gravel, Tan & Brown, Medium Stiff to Very Stiff, Moist (CH) PROJECT LOCATION Sallisaw, OK SURFACE ELEVATION BENCHMARK SURFACE ELEVATION BENCHMARK GROUND WATER LEVELS AT TIME OF DRILLING AT END OF DRILLING O DRY UNIT 20 40 60 A N VAI 20	ESTARTED 2/28/19 COMPLETED 2/28/19 SURFACE ELEVATION BENCHMARK EL. LER CW DRILL RIG 2015 CME 55 GROUND WATER LEVELS AT TIME OF DRILLING GED BY CJ CHECKED BY RTH AT END OF DRILLING ES MATERIAL DESCRIPTION Unified Soil Classification System CLAYEY SAND, w/ Gravel, Dark Brown, Loose, 0.5 ft Noist (SC) SANDY FAT CLAY, w/ Gravel, Tan & Brown, Medium CLAYEY SAND, w/ Gravel, Tan & Brown, Medium SPT 2.0 ft SPT 2.0

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Cherc	okee Na	ation Entertainn	nent		PROJE	CT NAM	/E _N	lational Cl	neroke	e Nation I	Park			
PRO	JECT NO.	25674	8 Rev. 1			PROJE	CT LOC	CATIO	N Sallisa	aw, OK					
DATI	E STARTE	D 2/28	3/19	COMPLETED	2/28/19	SURFA	CE ELE	VATI	ON		BEN	CHMARK	(EL		
DRIL	LER CW			DRILL RIG _2	015 CME 55	GROU	ND WAT	ER LI	EVELS						
нам	MER TYPE	E Auto				A	T TIME	OF D	RILLING	None					
LOG	GED BY _	CJ		CHECKED BY	RTH	A	T END	OF DI	RILLING _						
NOT	ES														
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 Pl H 20	▲ N VAI 40	0 80 LUE 60 C L	80 LL H	ELEVATION (ft)
0	CFA - 4.5" O.D.	4 1/2 - 1/4	Hard, Moist	t	CLAY, Brown, Very d, Poorly to Well dium Hard	0.3 ft 3.5 ft	SPT 1		16-23- 65/2"		0	2	3	4	
		'		Refusal at Bottom of boreh			SPT 2		65/0"	,					

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT-256748-NA



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\perp																
	CLIE	NT Chero	okee Na	tion Entertainm	nent		PROJE	CT NAI	ME N	lational C	heroke	e Nation P	ark			
F	PRO.	JECT NO.	25674	8 Rev. 1			PROJE	CT LO	CATIO	N Sallis	aw, OK	(
[DATE	STARTE	D 2/28	/19	COMPLETED	2/28/19	SURFA	CE ELE	EVATI	ON		BENC	HMAR	KEL.		
[DRIL	LER CW			DRILL RIG 2	015 CME 55	GROUN	ID WAT	TER LI	EVELS						
	HAMI	MER TYPE	E Auto				Α	T TIME	OF D	RILLING	None					
L	LOG	GED BY _	CJ		CHECKED BY	RTH	A	T END	OF DI	RILLING						
<u>a</u> N	NOTE	ES					_									
KING LOGS	ОЕР'Н (#)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DE	SCRIPTION fication System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL I— 20	MVA 40 MO 40 R STRI	0 80 LUE 4 60 C	<u>) 100</u>	ELEVATION (ft)
OKEE NATION PARK-SU	0 _	CFA - 4.5" O.D.	1. 14.17.	SANDSTO	NE, Fine Graine Tan, Soft to Me	t 1.4 feet.	, Very 0.9 ft 1.4 ft	SPT 1	-	5-10- 65/3"	1.25	0			,	
۲I																

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT-256748-NAT\L CHER

GEOTECHNICAL BORING LOG

BORING NUMBER

103

CLIE	NT Cherc	kee Na	tion Entertainm	nent	PROJI	ECT NAM	NE N	lational C	heroke	e Nati	on Par	k	
PRO	JECT NO.	25674	8 Rev. 1		_ PROJI	ECT LOC	CATIO	N Sallis	aw, Oł	(
DATI	E STARTE	D 2/28	/19	COMPLETED 2/28/19	SURF	ACE ELE	VATI	ON		E	BENCH	MARK EL.	
DRIL	LER RD			DRILL RIG D50	GROU	ND WAT	ER L	EVELS					
НАМ	MER TYPE	Auto				AT TIME	OF D	RILLING	None)			
LOG	GED BY _	JG		CHECKED BY RTH		AT END	OF DI	RILLING					
B NOT	ES				_								
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION nified Soil Classification System			RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2	0 40 20 PL 20	UNIT WT (pcf) ◆ 0 60 80 100 N VALUE ↓ 40 60 80 MC LL 40 60 80 STRENGTH (ksf) □ 2 3 4	ELEVATION (ft)
X 장 0			TOPSOIL - Very Loose	CLAYEY GRAVEL, Dark Brown,	0.2#	SPT		9-2-2	1.75		0		
Ž			•	T CLAY, Red, Soft, Moist (CH)		1		(4)	1.73				
O A O	0			, ,									
	- 4.5"												
Š	CFA				3.5 ft								
ATLCH				NE, Fine Grained, Poorly to Well Tan, Soft to Medium Hard	4.5 ft	SPT 2		15-50	4.5	0			
V-84-N				Refusal at 4.5 feet. Bottom of borehole at 4.5 feet.		SPT 3		50/0"	1.75				
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S3_MASTER PROJECT FILE/2019/OKIC/CHEROKEE NATION ENT-256/748-NATL CHEROKEE NATION ENT-256/748-NATL CHEROKEE NATION PARK-SUBIBORING LOGS/GPJ DE PTH ON DEPTH ON DEP													



4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

GEOTECHNICAL BORING LOG

BORING NUMBER

104.1

			lephone: (41 x: (417) 864-		BC	RING	LO	G				PAGE 1 C)F 1
CLI	ENT Chero	kee Natio	on Entertainm	ent		PROJE	CT NAI	ME N	ational C	l heroke	ee Nation Park		
											BENCHMARK EL		
					50								
HAI	MMER TYPE									None			
- 1				CHECKED BY	RTH		T END	OF DI	RILLING				
ਜ਼ੁ ਅ ਹ	TES												
DEPATH DEPTH (#)	DRILLING METHOD	STRATA SYMBOL	Un	MATERIAL DES	ication System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT 20 40 60 N VALUE 20 40 60 PL MC 20 40 60 SHEAR STRENG 1 2 3	80 100 80 LL 80	ELEVATION (ft)
NATION PARK-SC	CFA - 4.5" O.D		Soft, Moist CLAYEY SA	AND, Reddish B	ace Sand, Dark Br rown, Very Dense, LE, Highly Weathe	1.3 ft	SPT	-	50/4"	1.75	0	4	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE/2019/OK/C/CHEROKEE NATION EN 1-256/48-NAT'L CHEROKEE NATION PARK-SUB/BORING LOGS/GP/ DEPTH O (#)				Refusal at Bottom of boreh									



GEOTECHNICAL BORING LOG

BORING NUMBER

104.2

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CLIE	NT Chero	kee Nat	ion Entertainm	nent		PROJE	CT NAM	NE N	lational C	heroke	e Nation Pa	ırk		
PROJ	JECT NO.	256748	Rev. 1			PROJE	CT LOC	CATIO	N Sallisa	aw, OK	(
DATE	STARTE	2/20/	19	COMPLETED	2/20/19	SURFA	CE ELE	VATIO	ON		BENCI	HMARK EL.	·	
DRILI	LER LB			DRILL RIG _D	50	GROU	ND WAT	ER LI	EVELS					
HAMI	MER TYPE	Auto					AT TIME	OF D	RILLING	None				
LOGG	GED BY _	Н		CHECKED BY	RTH		AT END	OF DE	RILLING					
NOTE	S Offset	5' NE D	ue to Auger R	efusal										
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 20 PL — 20	N VALUE 40 60	80 100 80 LL 	ELEVATION (ft)
0	CFA - 4.5" O.D.		Soft, Moist CLAYEY SA Slightly Moi SANDSTOR	AND, Reddish Bi ist (SC) NE, Fine Grained Tan to Brown, S	rown, Very Dense, d, Poorly to Well soft to Medium Hard	1.3 ft 2.0 ft								
				Refusal at	i 2.0 feet.									

Bottom of borehole at 2.0 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OKIC\CHEROKEE NATION ENT-256748-NATI. CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ

GEOTECHNICAL BORING LOG

BORING NUMBER

105



GEOTECHNICAL BORING LOG

BORING NUMBER

106

ROJECT NO.	rokee Natio												
TE STARTE		on Entertainm	ent	_ PROJE	CT NAI	ME N	lational Cl	heroke	e Natio	n Park	(
	256748	Rev. 1		_ PROJE	CT LO	CATIO	N Sallisa	aw, OK					
WILED ID	ED <u>2/20/1</u>	9	COMPLETED 2/20/19	_ SURFA	CE ELE	EVATIO	ON		В	ENCHI	MARK EI	L	
RILLER LB	i		DRILL RIG D50	_ GROUN	ID WAT	ER LI	EVELS						
MMER TYP	PE Auto			Α	T TIME	OF D	RILLING	None					
GGED BY	JH		CHECKED BY RTH	_ A	T END	OF DE	RILLING						
TES				_									
									•			Γ (pcf) ♦	
	30L				Щ	%	CORRECTED BLOW COUNTS (N VALUE)	 z	20		60 N VALUE	80 100 = 🛦	-
(#) DRILLING METHOD	SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	# <u>N</u>	POCKET PEN. (tsf)	2		40 60		Įģ
(ff) DRILLING METHOD					ÄB MB	등의	A SE	(ET		PL	МС	LL	¥€
R M	STRATA	Un	ified Soil Classification System		₽₽	E E	80 ×	00	2	20 -	4 0 60		ELEVATION (#)
	STE				Ŋ	L L	O H	-	□ SI	HEAR	STREN	GTH (ksf)]_
	74 1× 14	TOROGU	. FANOLAY T	0.5 ft						1	2 3	4	
		TOPSOIL - Soft, Moist	LEAN CLAY, Trace Sand, Dark E	srown; · · · ·						:		:	
		CLAYEY SA	AND, w/ Sandy Shale Seams, Tra	ice	SPT	1	4-6-8			:			
jo		Gravel, Reddish Bro	own to Brown, Medium Dense to I	Dense,	1 1		(14)	2.25	O				
4.5"		Slightly Moi		ŕ		┨						:	
CFA-													
O					SPT] [9-12-15					:	
				5.0 ft	2		(27)	4.5	0	A		:	
	1////		Bottom of borehole at 5.0 feet.	0.0 1.	V					<u> </u>	<u>: :</u>		

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Cherokee Nation Ent	ertainment	PROJE	CT NAN	/E N	lational Cl	neroke	e Nation I	Park		
PROJECT NO. 256748 Rev. 1	1	PROJE	CT LOC	ATIO	N Sallisa	aw, Ok	(
DATE STARTED 2/20/19	COMPLETED 2/20/19	SURFA	CE ELE	VATI	ON		BEN	CHMARK EL.		
DRILLER LB	DRILL RIG _D50	GROUI	ND WAT	ER L	EVELS					
HAMMER TYPE Auto		ļ	AT TIME	OF D	RILLING	None	•			
LOGGED BY JH	CHECKED BY RTH	ļ	AT END	OF DI	RILLING					
NOTES Offset 5' S Due to Ov	erhead Obstacles									
DEPTH (ft) DRILLING METHOD STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 Pl H 20	N VALUE 40 60	80 80 LL H 80	ELEVATION (ft)
SAN SAN	SOIL - LEAN CLAY, Trace Sand, Dark Bro Moist YEY SAND, Trace Gravel, Brown, Very De (SC) DSTONE, Fine Grained, Poorly to Well lented, Brown, Soft to Medium Hard	ense,	SPT 1		10-25-30 (55) 50/5"	4.5	0	<u> </u>	7	
5	Bottom of borehole at 5.0 feet.									

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT

GEOTECHNICAL BORING LOG

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	· 		on Entertainn								on Park			
DAT DRIL HAM LOG	E STARTI LER LB IMER TYP GED BY	PE Auto	19		SURFA GROU	ACE ELE ND WAT AT TIME	EVATION LICENTIAL CONTRACT CON	ON EVELS PRILLING	None	В				
B/BORING LOGS/BORING LOGS.(DEPTH (ft)	(0.5	STRATA SYMBOL		MATERIAL DESCRIPTIO)N	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 N N 20 40 PL 1 40	MC 60 60 MC 60 TRENGTH	80 LL 	ELEVATION (ft)
OKEE NATION PARK-SU			Soft, Moist	RAVEL, w/ Sand, Reddish	Brown, Medium	SPT 1	•	4-4-12 (16)		(P	1			
KICICHEROKEE NATION ENT-256748-NATL CHERC	CFA - 4.5" O.D.		Stiff, Moist	AN CLAY, w/ Gravel, Redo (CL) HALE, w/ Intermittent Sands , Brown, Medium Hard	5.0 ft stone Seams,	SPT 2 SPT 3	-	9-12-12 (24) 50/5"	4.5	0				
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE/2019/OK/C/CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB/BORING LOGS/GPJ O DEPTH O (ft) O (ft)				Bottom of borehole at 10.0	10.0 ft) feet.									

GEOTECHNICAL BORING LOG

BORING NUMBER

109

0	LIEI	NT Chero	kee Na	ation Enter	tainment	'	PROJE	ECT NAI	ME N	lational C	heroke	e Nati	on Park			
F	PRO.	IECT NO.	25674	8 Rev. 1			PROJE	ECT LO	CATIO	N Sallis	aw, Oł	(
[ATE	STARTE	D _2/20)/19	COMPLETE	ED 2/20/19	SURFA	ACE ELI	EVATI	ON		E	BENCHM	ARK EL.	·	
[RIL	LER LB			DRILL RIG	D50	GROU	ND WA	ΓER LI	EVELS						
H	IMAI	MER TYPE	Auto					AT TIME	OF D	RILLING	4 ft					
L	.OG	GED BY _	JH		CHECKED	BY RTH		AT END	OF DI	RILLING	4 ft					
<u>B</u>	IOTE	s														
068													DRY U			
NGL			SYMBOL					ᆔ	%	CORRECTED BLOW COUNTS (N VALUE)	z	2		60 8 VALUE		-
	=	DRILLING METHOD	₹		MATERIAL I	DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)		POCKET PEN. (tsf)	:	20 40			<u>€</u>
LOGS/BOI	إ€	걸듭	\(\brace{\brace}{2} \)		Unified Soil Cla	ssification System		PLE	S G	V SC	E st		PL	MC	ĻĻ	<u>`</u>
NG L	'	₽≥	STRATA		Offined Con Old	oomoution Cyclem		MAZ	EC F	POS POS POS POS POS POS POS POS POS POS	000		20 40	60	80	ELEVATION (ft)
BOR			ST					0)		<u> </u>	"				TH (ksf)	
-SUB	0		1/ 1 _N 1/	→ TOPS	OII - I FAN CLAY	, Trace Sand, Dark I	Brown 0.3 ft						<u>1 2</u>	<u>3</u>	<u>4</u> :	
ARK				Soft, N	Noist									:	:	
NOI		<u>-</u>			Y LEAN CLAY, Br y Stiff, Wet to Very	own to Reddish Bro Moist (CL)	wn, Stiff	SPT	-	0-6-6	0		0	:	: : :	
INAT	+	5" 0			, ,	(- /		1		(12)	"			:	:	
OKE		4												:	:	
Ä		CFA		_					-					:	:	
計	+			Ţ				SPT	-	5-8-12	2.5		A	:	:	
48-N/	5						5.0 ft	2		(20)				<u> </u>	<u>:</u>	
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-266748-NAT\. CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\B																
SORING L																

GEOTECHNICAL BORING LOG

BORING NUMBER

110

CLII	ENT Cher	okee Nat	ion Entertainm	nent	PROJI	ECT NAI	ME N	lational C	heroke	e Natio	n Park		
PRO	DJECT NO.	256748	Rev. 1		PROJI	ECT LO	CATIO	N Sallis	aw, Ol	<			
DAT	E STARTE	D 2/20/	19	COMPLETED 2/20/19	SURF	ACE ELI	EVATI	ON		BE	NCHMARK	EL	
DRI	LLER LB			DRILL RIG D50	GROU	ND WA	TER L	EVELS					
HAN	MER TYP	E Auto				AT TIME	OF D	RILLING	2 ft				
LOC	GED BY _	JH		CHECKED BY RTH		AT END	OF DI	RILLING	4 ft				
ਜ਼ੂ NO 1	TES												
HAN	MMER TYPI GGED BY _ TES	STRATA SYMBOL STRATA SYMBOL	Ur TOPSOIL - Very Soft, M	CHECKED BY RTH MATERIAL DESCRIPTION iffied Soil Classification System LEAN CLAY, Trace Sand, Dark Moist AN CLAY, Trace Gravel, Brown,	Brown, 3 ft	SAMPLE TYPE AL AUGUSTA	RECOVERY % IQ 40 40 (RQD %)	RILLING		20 20 20 30 20	DRY UNIT \(\) 40 60 \(\) 40 \(\) 40 \(\) PL \(\) 40 \(\) 40 \(\) EAR STREI	80 100 UE ▲ 60 80	ELEVATION (ft)
NG LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09.													

GEOTECHNICAL BORING LOG

BORING NUMBER

111

									1					
CLIE	NT Cher	okee Na	ation Entertainm	nent	_ PROJE	CT NAM	NE N	ational C	heroke	ee Natio	n Par	k		
PROJ	JECT NO.	25674	18 Rev. 1		_ PROJE	CT LOC	CATIO	N Sallis	aw, Oł	<				
DATE	STARTE	D 6/1	1/19	COMPLETED 6/11/19	_ SURFA	CE ELE	VATI	ON		В	ENCH	IMARK EI	L	
DRIL	LER CW			DRILL RIG 2015 CME-55	GROU	ND WAT	ER LI	EVELS						
HAMI	MER TYPE	E Auto)		,	AT TIME	OF D	RILLING	None)				
LOGG	GED BY _	CJ		CHECKED BY RTH		AT END	OF DI	RILLING						
NOTE	ES				_									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION ified Soil Classification System	0.2#	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 2 2	9 40 20 PL 20	N VALUE 40 60 MC 40 60	80 100 80 80 LL 0 80 GTH (ksf)	ELEVATION (ft)
8 0	ł		TOPSOIL (: SANDY LE.	2") AN CLAY, Brown w/ Red, Moist, \$	0.2/#- Soft (CL)	SPT 1		3-1-3 (4)	1	A O				
					3.0 ft									
	<u>i</u>		SHALE, Tra	ace Coal, Highly Weathered, Gray	yish						:		:	
	5" 0		Brown w/ B	lack, Dry, Very Soft to Soft		SPT		10-9-17	4.75				:	
5	4.					2		(26)	4.73				:	
5	CFA										: :			
							-			-			:	
	l					SPT 3		23-40- 65/1"	4.75	0				A
							1 1			-				
	•				8.2 ft									
		1///	SANDSTOI	NE, Fine Grained, Highly Weathe ledium Hard	red, 8.8 ft	SPT		65/2"		0	<u> </u>		:	
				sal on Sandstone		4			-					
2			3	Refusal at 8.8 feet. Bottom of borehole at 8.8 feet.										
1				bottom of poremole at 6.6 feet.										
5														
5														
8														
2														
9														
5														

GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

CLIE	NT Cherc	kee Na	tion Entertainm	nent	PROJE	CT NAI	ME N	lational C	heroke	e Nation P	ark			
PRO.	JECT NO.	25674	8 Rev. 1		PROJE	CT LO	CATIO	N Sallis	aw, OK					
DATE	STARTE	D <u>6/11</u>	/19	COMPLETED <u>6/11/19</u>	SURFA	CE ELE	VATI	ON		BENO	HMAR	EL.		
DRIL	LER CW			DRILL RIG 2015 CME-55	GROUN	TAW DI	ER L	EVELS						
HAM	MER TYPE	<u>Auto</u>			Δ	T TIME	OF D	RILLING	None					
LOG	GED BY _	CJ		CHECKED BY RTH	A	T END	OF DI	RILLING						
NOT	ES													
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	40	0 80 LUE ▲ 60	80 LL 	ELEVATION (ft)
0	CFA - 4.5" O.D.		SANDSTO	3") AN CLAY, Brown w/ Gray, Moist, So NE, Fine Grained, Highly Weathered ledium Hard	3.0 ft	ST 1 SPT 2	79	65/1"	2	0			4	

Auger Refusal on Sandstone Refusal at 3.8 feet. Bottom of borehole at 3.8 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S3_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT'

GEOTECHNICAL BORING LOG

BORING NUMBER

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	CLIE	NT Chero	kee Na	ation Entertainm	nent	PROJE	CT NAM	/IE _N	lational Cl	heroke	e Nation F	Park			
	PRO	JECT NO.	25674	18 Rev. 1		PROJE	CT LOC	CATIC	N Sallisa	aw, Oł	<				
	DATE	STARTE	D 6/1	1/19	COMPLETED 6/11/19	SURFA	CE ELE	VATI	ON		BEN	CHMAR	K EL.		
	DRIL	LER CW			DRILL RIG 2015 CME-55	GROU	ND WAT	ER L	EVELS						
	HAMI	MER TYPE	E Auto)		4	AT TIME	OF D	RILLING	None)				
	LOG	GED BY _	CJ		CHECKED BY RTH	A	AT END	OF D	RILLING						
GPJ	NOTE	ES													
PARK-SUB/BORING LOGS/BORING LOGS.	DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System	0.3 ft	S	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL F 20	▲ N VA 40 . M	0 80 ALUE 60	100	ELEVATION (ft)
:NT-256748-NAT'L CHEROKEE NATION PARK-SI	0	CFA - 4.5" O.D.		SHALEY LE Stiff (CL)	4") AN CLAY, Brown, Moist, Soft (CL) EAN CLAY, w/ Sand, Brown, Moist, NE, Fine Grained, Highly Weathered	3.0 ft Very 5.8 ft	SPT 1	83	1-1-1 (2)	0.25	№	7		•	
TIONE				Dry, Soft	NE, Fine Grained, Figniy Weathered	6.9 ft			17-65/3"	4.5	0	<u> </u>	<u> </u>		<u> </u>

Auger Refusal on Sandstone Refusal at 6.9 feet. Bottom of borehole at 6.9 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NA

GEOTECHNICAL BORING LOG

BORING NUMBER

114

-															PAGE	I OF I
			ion Entertainr							lational C			on Park	(
1	JECT NO. STARTE			COMPLETE						N <u>Sallis</u>			ENCU	MADK	 :I	
				DRILL RIG								P	LINCHI	VIAINT E	· L ·	
					2010 ONIL-0	<u> </u>					None					
1				- CHECKED I	BY RTH											
1							_									
O DEPTH (#)	DRILLING	SYMBOL		MATERIAL [DESCRIPTION			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 ▲ I	60 N VALU	/T (pcf) ◆ 80 100 IE ▲ 60 80	ELEVATION
	DR.	STRATA	U	nified Soil Clas	ssification Sys	stem		AMP NU	0 0 0 8	80 80 80 80 80 80 80 80 80 80 80 80 80 8	Š		—	$\overline{}$	 50 80	Ë
		STE						Ŋ	~	BL	۵	■ S			GTH (ksf)	
0	1		TOPSOIL SANDY LE	(3") EAN CLAY, Bro	own, Moist, Sc		0.3 ft	SPT 1		1-1-3 (4)	1.75	▲ C	:	2	3 4	
	.5" O.D.		SHALE, w	Sand, Trace (Coal, Highly W		3.7 ft Dry,	SPT		8-12-14						
5	CFA - 4.5			own w/ Black,			<i>3.</i>	2		(26)	4.5		○ ▲			
				NE, w/ Interbeathered, Gray		ine Graine Medium H		SPT 3		22-65/5"	4.5					
		\ <i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	Auger Refu		one I at 8.6 feet. rehole at 8.6 f		6.0 IL	SPT 4		65/1"	4.5	-	:	<u>:</u>	<u>: :</u>	

GEOTECHNICAL BORING LOG

BORING NUMBER

115

														_ : -	
CLIE	NT Cherc	okee Na	ation Entertainm	nent	_ PROJE	CT NAI	/IE _N	lational C	heroke	e Nati	on Pa	rk			
PRO.	JECT NO.	25674	l8 Rev. 1		_ PROJE	CT LO	CATIO	N Sallisa	aw, Oł	<					
DATE	STARTE	D <u>6/11</u>	1/19	COMPLETED 6/11/19	_ SURFA	CE ELE	VATI	ON		E	BENCH	MARK	EL		
				DRILL RIG 2015 CME-55											
								RILLING	None)					
				CHECKED BY RTH				RILLING							
					_			-							
					_						DRY	' UNIT V	VT (pcf)	•	
		占				ш	%	S	 	1 2	0 40	0 60	80 1	00	
-	5 G	MB		MATERIAL DECORIDATION		는 교		HE (i	JE			N VALU		0	NO NO
DEPTH (ft)	크	S		MATERIAL DESCRIPTION		LE		A S S S	ET tsf)		PL	МС	LL		(ft)
	DRILLING METHOD	AT/	Un	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		. ∟ 20	$\overline{}$	——i 60 8	n	ELEVATION (ft)
		STRATA SYMBOL				S	E	ΩÄ,	M	■ S			NGTH (k		Ш
					0.0.0						1		3 4	. '	
0			TOPSOIL (2	•	0.2#	SPT		3-3-3	0.05			:			
+ +			SANDY LEA	AN CLAY, Brown, Moist, Medium	Stiff (CL)	1		(6)	0.25	A	0	:			
							1				:				
											:	:			
┡╶┤	. •														
	O.D				3.8 ft		-			<u> </u> 	:				
╠┤┤	נָט		SHALEY LE	EAN TO FAT CLAY, Trace Sand,	Brown,	SPT 2		4-8-13 (21)	4.5		<u></u>	:			
	4 - 4		Slightly Mol	st, Very Stiff (CL-CH)				(21)			.; .,		. ;		
5	CFA		011415.7	0 1 11 11 11 11 11 15	5.5 ft										
╟╶┤			Gray & Blad	ace Coal, Highly Weathered, Dry, ck, Soft	Brown &	SPT	1 1		 						
	L		,	•		3		22-65/5"	4.5		O				
											:				
	9				8.2 ft							:			
		////	SANDSTON Tan Dry M	NE, Fine Grained, Highly Weather ledium Hard	red, 8.8 ft	SPT		65/4"	4.5	0		:			
				sal on Sandstone		4	1								
			J	Refusal at 8.8 feet. Bottom of borehole at 8.8 feet.											
				bottom of borenole at 6.6 leet.											
:															

GEOTECHNICAL BORING LOG

BORING NUMBER

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/	Fax. (417) 00					PAGE 1	OF 1
CLIENT Chero	kee Nation Entertain	ment	PROJECT NAM	E National Cl	neroke	ee Nation Park	
PROJECT NO.	256748 Rev. 1		PROJECT LOCA	ATION Sallisa	aw, Ok	<	
DATE STARTED	o 6/11/19	COMPLETED <u>6/11/19</u>	SURFACE ELEV	/ATION		BENCHMARK EL.	
DRILLER CW		DRILL RIG _2015 CME-55	GROUND WATE	R LEVELS			
HAMMER TYPE	Auto		AT TIME	OF DRILLING	None)	
		CHECKED BY RTH					
				_			
DEPTH (ft) DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Jnified Soil Classification System	SAMPLE TYPE NUMBER	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) → 20 40 60 80 100 A N VALUE A 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) ■ 1 2 3 4	ELEVATION
- 4.5" O.D.	LEAN CL/	(1") AY, Trace Sand, Tan to Brown, Mo	oist, Soft SPT 1	1-1-3 (4)	1.25		
CFA	SANDY S Gray, Dry,	HALE, Highly Weathered, Brown i , Soft	to Light SPT 2	65/5"	1	0	
5			6.0 ft				
-	SANDSTO	ONE, Fine Grained, Highly Weath	6.3 ft	65/1"		<u> </u>	<u></u>
	Augel Rei	fusal on Sandstone Refusal at 6.3 feet. Bottom of borehole at 6.3 feet.					

GEOTECHNICAL BORING LOG

BORING NUMBER

117

															<u> </u>
CLIE	NT Che	rokee Nat	ion Entertainm	ient		PROJE	ECT NAM	/E _N	lational C	heroke	e Nation	Park			
PRO.	JECT NO	_256748	Rev. 1			PROJE	CT LOC	CATIO	N Sallis	aw, Oł	(
DATE	E STARTI	ED <u>6/11/</u>	19	COMPLETED 6	6/11/19	SURFA	CE ELE	VATI	ON		BEN	ICHMAR	(EL		
DRIL	LER _CV	/		DRILL RIG 201	5 CME-55	GROU	ND WAT	ER L	EVELS						
HAMI	MER TYP	E Auto				,	AT TIME	OF D	RILLING	None	1				
LOG	GED BY	CJ		CHECKED BY _	RTH	/	AT END	OF DI	RILLING						
NOTE	ES					-									
O DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Un	MATERIAL DESC		0.3 ft		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 P I 20	40 60 ▲ N VAI 40 L MO 40	C LL 60 8 60 8 60 8 ENGTH (k	100 30 CLAY 14 A A A A A A A A A A A A A A A A A A A	(#)
 	D.			4") AN CLAY, Trace (Very Soft (CL)	Chert, Brown w/ C		SPT 1		1-1-0 (1)	1.5	•				
	Ö					4.0 ft									
5	CFA - 4.5"		SHALEY LE Moist, Very	EAN CLAY, w/ Sar Stiff (CL)	nd, Reddish Brow		ST 2	83		4.5	0 ⊩	1		5.8 128	
			SHALE Tra	ace Coal, Highly W	Jeathered Gray	6.1 ft & Tan	SPT		20 05/5"	4.5					
			w/ Black & I	Red, Dry, Soft	veathered, Gray (8.3 ft	3	_	20-65/5"	4.5	0 :			Î	
			SANDSTON	JE Fine Crained	Highly Woothers								:	:	
			√ Gray to Blad Auger Refu	NE, Fine Grained, ck & Brown, Dry, I sal on Sandstone Refusal at & Bottom of boreho	Medium Hard 3.8 feet.		SPT 4		65/4"	4.5	0				

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Na	ation Entertainm	nent	PROJE	CT NAM	/IE _N	lational C	heroke	e Natior	Park			
PRO.	JECT NO.	25674	18 Rev. 1		PROJE	CT LO	CATIO	N Sallisa	aw, OK	(
DATE	E STARTE	6/1	1/19	COMPLETED 6/11/19	SURFA	CE ELE	VATI	ON		BE	NCHMA	RK EL.		
DRIL	LER CW			DRILL RIG 2015 CME-55	GROU	TAW DI	ER LI	EVELS						
HAM	MER TYPE	Auto)			AT TIME	OF D	RILLING	None					
LOG	GED BY _C	J		CHECKED BY RTH		AT END	OF DI	RILLING						
NOT	ES													
		OL.				111	%	σ Ø		• 1 20	40		<u>8Ö 100 </u>	
	20	SYMBOL		MATERIAL DESCRIPTION		F.R.			PEN.	20		VALUE 60		NO NO
DEPTH (ft)	DRILLING METHOD		Ur	MATERIAL DESCRIPTION iffied Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET I		—	MC	LL —	ELEVATION (ft)
		STRATA				SAN	RE(SP	Ğ.	20			80	d
		S						_		□ SH 1	EAR ST 2	RENG I	ΓH (ksf) 🗖 4	
0			TOPSOIL (: SANDY LE. (CL)	2") AN CLAY, Tan to Gray w/ Red, Moi	0.2 #- st, Soft	ST 1	100		0.75	0				
	1 - 4.5" O.D.				4.1 ft	Vanz		- 40.04						
	CFA		SHALE, Tra Gray w/ Re	ace Coal, Highly Weathered, Tan to d & Black, Dry, Very Soft	Light 4.9 ft	SPT 2		7-13-21 (34)	4.75	0	A			
5				NE, Fine Grained, Highly Weathered ay, Dry, Very Soft to Medium Hard	d, Tan			05/0"						
<u> </u>					6.7 ft	SPT 3		65/2"		<u> </u>	<u> </u>	:		
:			Auger Refu	sal on Sandstone										

Auger Refusal on Sandstone Refusal at 6.7 feet. Bottom of borehole at 6.7 feet.

GEOTECHNICAL BORING LOG

BORING NUMBER

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CLI	ENT Cher	okee Na	ation Entertainm	nent	PROJE	CT NAM	NE N	lational Cl	heroke	e Nation Pa	ark			
PRO	JECT NO.	_25674	l8 Rev. 1		PROJE	CT LO	CATIO	N Sallisa	aw, Oł	<				
DAT	E STARTE	ED <u>6/1</u>	1/19	COMPLETED 6/11/19	SURFA	CE ELE	VATI	ON		BENC	HMARK	EL.		
DRI	LLER CW	/		DRILL RIG 2015 CME-55	GROU	ND WAT	ER L	EVELS						
HAN	MER TYP	E Auto			A	AT TIME	OF D	RILLING	None)				
LOG	GED BY	CJ		CHECKED BY RTH	A	AT END	OF DI	RILLING						
FON	TES													
DEPTH (#)	DRILLING	STRATA SYMBOL	Ur	MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4	M()	0 80 -UE ▲ 60 	80 LL H 80	ELEVATION (ft)
L CHERORE NATION PARK-SUB	ST S					ST 1	96	65/4"	1.25	0			4	

Auger Refusal on Sandstone Refusal at 4.2 feet. Bottom of borehole at 4.2 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:08 - S._MASTER PROJECT FILE\Z019\OK\C\CHEROKEE NATION ENT-256748-NA\



4168 W. Kearney Springfield, Missouri 65803

GEOTECHNICAL

BORING NUMBER

120

	14	lephone: (4′ x: (417) 864	17) 864-6000 6004	ВО	RING) LO	G			PAGE 1 OF 1
CLI	ENT Cherok				DPO IE	CT NA	ME N	lational C	heroke	ee Nation Park
	DJECT NO.							N Sallis		
				6/11/19						
				0/11/19 015 CME-55						BENCHWARK EL.
1	LLER <u>CW</u> IMER TYPE			TIS CIVIE-55					None	
				DTU						<u>e</u>
				RTH	,	AI END	OF DI	KILLING .		
	TES	TOPSOIL (SANDY LE Wet, Hard SANDSTO Brown to G	MATERIAL DES nified Soil Classif 2") AN CLAY, w/ Ch (CL)	ert Gravel, Brown, I, Highly Weathered 1.2 feet.	0:6/₹ 1.2/ft	ш	RECOVERY % (RQD %)	CORRECTED 919 16-91 (N VALUE)	b POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100
BORING LOG - PPI - PPI STD TEP										

GEOTECHNICAL BORING LOG

BORING NUMBER

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-															
				nent				lational C							
1								N Sallis							
DATE	STARTE	ED <u>6/11</u>	/19	COMPLETED <u>6/11/19</u>	_ SURFA	ACE ELE	VATI	ON		BE	ENCHM	ARK E	L		
DRIL	LER _CV	/		DRILL RIG 2015 CME-55	_ GROU	ND WA	TER LI	EVELS							
HAMI	MER TYP	E Auto				AT TIME	OF D	RILLING	None						
LOG	GED BY	CJ		CHECKED BY RTH	_	AT END	OF DI	RILLING							
NOTE	ES				_										
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 20 SH	40 N 0 40 PL 0 40 HEAR S	MC O 6	60 81 LL 60 81 GTH (ks	00 0	ELEVATION (ft)
0		17777	\ TOPSOIL (2"\	0.2 _/ #					1	:		3 4 : :		
				AN CLAY, Brown, Moist, Stiff (CL)	/	ST 1	100		0.75	0				•	
					3.0 ft						:				
			SHALEY LE Moist, Stiff	EAN TO FAT CLAY, w/ Sand, Brov (CL-CH)	wn,					:	:				
<u> </u>			Worst, Othi	(OL-OH)		SPT		5-7-8	4.5	<u> </u>	.	-			
	1					2		(15)					: : :		
5	o.														
-	O.D					ST									
	4.5"				7.0 ft	3	100		3.75	C :) :				
	CFA -		SHALE, w/ Tan, Very S	Sand, Highly Weathered, Dry, Gra	ay w/										
-	5		ran, very c	SOIL TO SOIL											
						SPT	1	17-65/2"	4	0	:		: :		
						4_	1				:				
10													: :		
										:	:				
											:				
	•														
					13.6 ft	Терт		65/1"	1 1 5		:				
				Refusal on Shale Refusal at 13.6 feet. Bottom of borehole at 13.6 feet.		SP1 5	l '	65/1"	4.5						
2															
Í															
[
1															

GEOTECHNICAL BORING LOG

BORING NUMBER

122

				nent						e Nation Park			
DATI DRIL HAM LOG	E START LER <u>CV</u> MER TYF GED BY	PE Auto	0/19	COMPLETED 6/10/19 DRILL RIG 2015 CME-55 CHECKED BY RTH	_ SURFA _ GROU	ACE ELE ND WAT AT TIME	EVATI ER L OF D	EVELS PRILLING	None				
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 PL	60 8 VALUE 0 60 MC 0 60 TRENGI	80 LL 	ELEVATION (ft)
ARE NATION PARK-SO			TOPSOIL (3") AN CLAY, Brown, Moist, Very Stiff	0.3 ft. F (CL) 3.0 ft	SPT 1	-	5-10-14 (24)	0	^			
200/46-NATIC CHERO			Moist, Hard		5.5 ft	SPT 2		17-13-22 (35)		^			
COCHERONE IN THE COLOR OF THE C	CFA - 4.5" O.D.		Soft	ghly Weathered, Gray to Tan, Dry, ack w/ Trace Coal Below 8'1"	Very	SPT		22-39-53					
10 10 10 10 10 10 10 10						3		(92)					
15 15				Bottom of borehole at 15.0 feet.	15.0 ft	SPT 4	-	65/3"					
ing LOG - PPI - PPI STD TEMPLATE.CDT - 771													

GEOTECHNICAL BORING LOG

BORING NUMBER

123

	100												1 70		' '
CLIE	NT Che	rokee Na	tion Entertainn	nent	_ PROJE	CT NAM	NE N	lational Cl	neroke	e Natio	n Park				
PRO.	IECT NO	. 25674	8 Rev. 1		_ PROJE	CT LO	CATIO	N Sallisa	aw, OK						
DATE	STARTI	ED <u>6/10</u>)/19	COMPLETED <u>6/10/19</u>	SURFA	CE ELE	VATI	ON		ВЕ	ENCHM	ARK E	L		
DRIL	LER CV	V		DRILL RIG 2015 CME-55	GROUI	ND WAT	ER LI	EVELS							
								RILLING	None						
LOGG	GED BY	CJ		CHECKED BY RTH				RILLING							
NOTE	s														
					_	111	,0	- 0		♦ 20		60	80 1	•	
	20	MB		MATERIAL RECORDERION		YPI	% (}		SEN	20		VALUI		0	NO
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL	МС	LL		ELEVATION (ft)
	PRI ME	YAT/	Uı	nified Soil Classification System		MP		N N	Š	20	—	$\overline{}$,	:LE)
		STR				S	<u> </u>	SA	g		IEAR S				"
		:A 7 A			N 2 #					1	2			Ĺ	
0			TOPSOIL (•	0.2#	SPT		4-4-12	1.25	∆ C	, :				
-			SANDY LE	AN CLAY, Brown, Moist, Very Stiff	1.7 ft	1		(16)	1.23		' :	:	:		
	Ì	//////////////////////////////////////	SHALE Tr	ace Coal, Highly Weathered, Brow			1			:	:				
			w/ Black, D	ry, Very Soft to Soft	ii a Olay					:	:				
-	9										:				
						ODT	1 1	10 11 00		į	:				
						SPT 2		16-14-20 (34)	4.5	0	_		:		
5 5							-					:			.
	o.									:	:	:			
	O.D										:	:	:		
	4.5"									:	:	:	:		
<u> </u>											:				
 	CFA									:	:	:	:		
						SPT		22-65/5"		0	:	:	:		
						3	-	22 00/0			:	:	:		
10															.
											:				
-1															
											:		:		
					13 8 ft					_ :	:				
			Split-Spoor	n Refusal on Shale	13.8 ft	SPT 4	\vdash	65/4"	3	<u> </u>	<u> </u>	<u>:</u>	:	•	
55.			5F 5P301	Refusal at 13.8 feet. Bottom of borehole at 13.8 feet.			,								
				DOMOTH OF DOTETION AL 13.0 1881.											
9															
\$															
יאס בססירודיון ויסוס ובאיו באוביסס															
=															
-															
5															
2															

GEOTECHNICAL BORING LOG

BORING NUMBER

124

			1 dx. (+17) 00+	- 000-1										PAG	E 1 0	F 1
CLIE	NT Cherc	kee Na	ation Entertainn	nent		PROJE	ECT NAI	ME N	lational C	heroke	e Natio	on Park	(
PRO.	JECT NO.	25674	18 Rev. 1			PROJE	ECT LO	CATIO	N Sallis	aw, Ok	(
DATE	STARTE	D 6/1	1/19	COMPLETED	6/11/19	SURFA	ACE ELE	EVATI	ON		в	ENCH	MARK E	L		
DRIL	LER CW			DRILL RIG 2	015 CME-55	GROU	ND WAT	TER LI	EVELS							
1)						RILLING	None						
LOG	GED BY	CJ		CHECKED BY	RTH				RILLING							
_						_			-							
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Uı	MATERIAL DE			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	0 40 ▲ 1 20 4 PL 1 20 4 HEAR	MC 40 6 STREN	80 1 E A 60 8 LL 60 8	00	ELEVATION (ft)
0			TOPSOIL (out Cross & Dark M	0.2#	SPT		3-3-5	1.25	A C	:	:			
[Medium St	iff (CH)	w/ Gray & Red, Mo	oist,			(8)	1.20			:			
<u> </u>	Ь															
						3.2 ft						:	:			
	Ö.Ö.		SHALE, Hi	ghly Weathered,	Gray, Dry, Soft		†		CE/E!!							
	.5" 0						SPT 2		65/5"	2	0	:	:		1	
2-0	4-4											:	<u>:</u>	: : :		
5	CFA											:				
<u>-</u>																
	L															
												:				
Z – –						ΩΩft										
<u> </u>			Auger Refu	ısal on Shale		0.0 11	SPT 3	\vdash	65/3"		0	<u>:</u>	:	<u>: :</u>		
			7 tagor 1 tore	Refusal a			[]	,								
2				Bottom of borel	nole at 8.8 feet.											
3																
OKN.																
(o')																
60.60																
2																
<u>:</u>																
Ė																
-1																

GEOTECHNICAL BORING LOG

BORING NUMBER

125

PAGE 1 OF 1

CLIE	NT Chero	kee Na	ation Entertainme	ent	PROJE	CT NAM	ME N	National Cl	neroke	e Nation P	ark		
PRO	JECT NO.	25674	l8 Rev. 1		PROJE	CT LO	CATIC	N Sallisa	aw, Ok	(
DAT	E STARTEI	D 6/10	0/19	COMPLETED <u>6/10/19</u>	SURFA	CE ELE	EVATI	ON		BENC	HMAR	K EL.	
DRIL	LER CW			DRILL RIG 2015 CME-55	GROU	ND WAT	ER L	EVELS					
HAM	IMER TYPE	_ Auto			A	AT TIME	OF D	RILLING	None				
LOG	GED BY _	CJ		CHECKED BY RTH	A	AT END	OF D	rilling _					
ਜ਼ੂ NOT	ES												
B'BORING LOGS'BORING LOGS. DEPTH (ft)	STRA			MATERIAL DESCRIPTION fied Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 ° 20 PL 1— 20	40 60 N VA 40 M	0 8 LUE 60 C	ELEVATION (ft)
E NATION PARK-SU	0 C SANDY Hard (C)			N CLAY, Brown, Wet, Very Soft to E, Fine Grained, Highly Weathered		▼ SPT		1-1-65/4"	0.5				

Auger Refusal on Sandstone Refusal at 2.5 feet. Bottom of borehole at 2.5 feet.

GEOTECHNICAL BORING LOG

BORING NUMBER

126

PAGE 1 OF 1

CLIE	NT Che	erokee Na	<u>ation Entertainn</u>	nent	PROJE	CT NAM	/IE _N	lational Cl	neroke	e Nation Par	k		
PRO	JECT NO) . 25674	18 Rev. 1		PROJE	CT LO	CATIC	N Sallisa	aw, OK	(
DATI	E START	ΓΕD <u>6/1</u>	1/19	COMPLETED 6/11/19	SURFA	CE ELE	VATI	ON		BENCH	MARK EL.		
DRIL	LER C	W		DRILL RIG 2015 CME-55	GROUN	ND WAT	ER L	EVELS					
HAM	MER TY	PE Auto)		4	T TIME	OF D	RILLING	None	1			
LOG	GED BY	CJ		CHECKED BY RTH		T END	OF D	RILLING _					
NOT	ES				-								
2002		70				111	. 0	. ග		20 40		100	
H H	NG OD	SYMBOL		MATERIAL DESCRIPTION		TYPE	ERY %	CTED SUNT	PEN.		N VALUE 4 40 60	80	NOIL
DEPTH (ft)	DRILLING METHOD	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET (tsf)	PL ├── 20	$\overline{}$	LL —I	ELEVATION (ft)		
BIBORING	_	STRATA				SA	RE	OC BLC	PC	■ SHEAR	<u>40 60</u> STRENGT 2 3	80 H (ksf) □] Ш
0			∖ TOPSOIL (2")	0.2/#					:	<u> </u>	- 4 :	
0 - 0			SANDY LE Soft (CL)	AN CLAY, Brown w/ Red & Gray, N	loist,	ST 1	100		0.25	: □ ::			
L L					3.0 ft								
	<u>. </u>			ANDY LEAN CLAY, Reddish Brown	n, Moist,								
) 	SHALEY SANDY LEAN CLAY, Reddish Brow Stiff (CL)					ST 2	67		4.5	0	•	•	
500740-NA1	CFA -		0.0 %							:			
<u>-</u>			CHALE To	ace Coal, Highly Weathered, Tan w	6.3 ft	SPT		12-27-					
<u> </u>	-		Dry, Soft	ace Coal, Highly Weathered, Tan w	/ ыаск,	3		65/5"	2.75	0		4	
 					9.4 ft	SPT 4		33-65/5"	4.5	0			<u> </u>
5			Auger Refu	ısal on Shale									-

Auger Refusal on Shale Refusal at 9.4 feet. Bottom of borehole at 9.4 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S:_MASTER PROJECT FILE\2019\

4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000

GEOTECHNICAL BORING LOG

BORING NUMBER

127

			Fax: (417) 864-	·6004									PAGE	1 OF 1
CLIE	NT Chero	okee Na	ation Entertainm	ent		PROJE	CT NAI	ME N	lational C	heroke	e Nation F	ark		
PRO.	JECT NO.	25674	l8 Rev. 1			_ PROJE	CT LO	CATIO	N Sallisa	aw, OK	(
DATE	E STARTE	D 6/12	2/19	COMPLETED	6/12/19	SURFA	CE ELE	VATI	ON		BENG	CHMARK	EL	
DRIL	LER CW			DRILL RIG 20	15 CME-55	GROU	ND WAT	TER LI	EVELS					
HAM	MER TYPE	E Auto				A	T TIME	OF D	RILLING	None				
LOG	GED BY _	CJ		CHECKED BY	RTH		T END	OF DI	RILLING					
NOT	ES					_								
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Un	MATERIAL DES		0.54	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	40 60 ▲ N VALU 40 MC 40	VT (pcf)	ELEVATION (ft)
0		/////	TOPSOIL (6		Organias Braum	0.5 ft	▼ SPT	.	3-3-5	0.5	A O	:		
-			Medium Stif	f (CL)	Organics, Brown	, IVIOIST,	1		(8)					
	4 - 4.5" O.D.					3.3 ft								
	CFA		SHALEY SA Stiff (CL)	AY, Brown, Moist,	very	SPT	.]	5-9-12						
			, ,				2		(21)	2.5	○ ▲			
5						5.4 ft	SPT		65/1"				•	
OEDTH (#) 0			-	sal on Sandstone Refusal at Bottom of boreh	5.5 feet.									

GEOTECHNICAL BORING LOG

BORING NUMBER

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CI	LIENT	Chero	okee Nati	on Entertainn	nent	PROJE	CT NAI	ME N	lational C	heroke	e Nat	ion Parl	k		
			256748		001101 5750 0110110				N Sallis						
					COMPLETED 6/12/19						_ '	BENCH	MARK E	:L	
	RILLER				DRILL RIG 2015 CME-55		ND WAT			Nana					
					CHECKED BY RTH										
- 1					CHECKED BY KIR		AI END	OF DI	KILLING .						
GS.G	J. LO .											► DRV	LINIT W	/T (pcf) ♦	1
G LO			占				ш	%	S	<u> </u>		0 40	60	8Ö 100	
I GR	9	50	SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	° % %	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)			N VALU 40 - 6		ELEVATION (ft)
LOGS/BOP DEPTH	€ }	METHOD					MBF	N N	REC SO AL	(ET)		PL	МС	LL	(#)
	1	5,8	STRATA	Ur	nified Soil Classification Syste	em	AMP	RECOVERY (RQD %)	Ä Š Š Š Š Š	00		20	$\overline{}$	I 60 80	
BORII			ST				S	E	В	-	5			IGTH (ksf)	
SUB.)	Б	711/	TOPSOIL (5")	0.4 ft						<u>1</u> :	<u>2</u> :	<u>3 4</u> : :	
ARK.		ľ		LEAN TO F	FAT CLAY, w/ Sand and Grav	el, Brown to	SPT		7-1-4 (5)	2.5	A (S			
NOI		9		Tan, Moist,	Medium Stiff (CL-CH)			-				:	:		
ENA F	1	•													
S E	4	4													
빙					IALE I Bakk 1874 - 46 - 4 T-4	3.7 ft		-							
YAT'L	Fight G				IALE, Highly Weathered, Tan & Red, Dry, Very Soft to Soft		SPT 2		4-25-23 (48)	1	0		A		
3748-1	4						A	1					<u> </u>		
IT-256	5 - A														
N E		1					SPT		65/5"	4.5	0	:	:		†
NATIO	+	7										:			
Ä		4													
HERO		Ь				8.9 ft	X SPT	-	65/5"	4.5	0	:	:		
KICIO KICIO				Auger Refu	sal on Shale		4						•	•	
019/0					Refusal at 8.9 feet. Bottom of borehole at 8.9 fee	et.									
ILE\2															
ECT															
ROJE															
TER															
MAS															
·S.															
60:60															
/1/19															
7-TC															
TE.GI															
MPLA															
D TE															
BORING LOG - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S:_MASTER PROJECT FILE\(2019\)(OK\C\CHEROKEE NATION ENT-256748-NAT\). CHEROKEE NATION PARK-SUB\)BORING LOGS\(BORING LOGS\) BORING L															
<u>PI-F</u>															
3G-F															
NGL															
BORI															

GEOTECHNICAL BORING LOG

BORING NUMBER

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	CT NO			nent		_			lational C			лпа	I IX			
DATE S						_			N Sallis							
				COMPLETED _							В	ENCH	IMARK I	EL		
				DRILL RIG 20	15 CME-55											
HAMME	R TYPE	Auto		-		Δ	T TIME	OF D	RILLING	None						
LOGGEI	D BY _	CJ		CHECKED BY	RTH		T END	OF DI	RILLING							
NOTES						_										
		BOL					PE	%	DI C	z.	20) 4(UNIT V 0 60 N VALU	80 -	• 100	z
(#)	DRILLING METHOD	TA SYMBOL	Uı	MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	2	PL			0	ELEVATION (#)
	۵≥	STRATA 8			·		SAN	REC (S S S S S S S S S S S S S S S S S S S	POC		20 HEAR 1	40 R STREN 2	IGTH (k	80 sf) ■ 4	_ ਜ
0	Б		TOPSOIL ((2")		0.2 _/ #	SPT		1-1-1			<u> </u>	:	:	:	
	1		SANDY LE Moist, Soft	AN CLAY, Trace ((CL)	Chert, Brown w/	Gray,	1		(2)	0.5	A	0				
	1		SHALEV S	ANDY LEAN TO F	EAT CLAV Brow	3.0 ft								:		
-	1			, Very Stiff to Hard		vii vv/	SPT 2		8-13-13 (26)	4.5		^				
5																
4.5" O.D	j ?															
CFA-1	. 4					9.0 ft										
	1		SHALE, Tra & Black, Dr	ace Coal, Highly V ry, Very Soft to So	Veathered, Gray ft		SPT 3		5-14-26 (40)	4.5	0	: : : : :	A			
10	1													:		
	ł															
	ł					14.4 ft	SPT 4		18-65/5"	4.5	0				4	
			Split-Spoor	n Refusal on Shale Refusal at 1								•			•	

GEOTECHNICAL BORING LOG

BORING NUMBER

130

			tion Entertainr	ment						ee Nation Pa	ırk		
DAT DRIL HAM LOG	LER <u>CW</u> MER TYPE GED BY _	D 6/12/ ■ Auto	/19	COMPLETED 6/12/19 DRILL RIG 2015 CME-55 CHECKED BY RTH	SURF	ACE ELE IND WAT AT TIME	EVATION LICENTIAL PROPERTY IN COMMENT OF DEPTH 1	EVELS PRILLING	None	BENCI		EL	
SIBORING LOGS/BORING LOGS DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 20 PL 20 SHEAF	0 60 N VALU 40 6 MC 40 6 R STREN	LL 60 80 IGTH (ksf)	ELEVATION (ft)
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 08:09 - S. MASTER PROJECT FILE/2019/OK/C/CHEROKEE NATION ENT-2567/48-NATL CHEROKEE NATION PARK-SUB/BORING LOGS/GPJ LOGS/GPJ COGS/GPJ C	CFA-4.5" O.D.		SANDSTO w/ Gray & I	(A") NE, Fine Grained, Highly Weather Red, Dry, Very Soft to Medium Hausal on Sandstone Refusal at 5.9 feet. Bottom of borehole at 5.9 feet.	4.5 ft red, Tan	SPT 1		3-5-4 (9) 8-7-17 (24)	2		2	3 4	

GEOTECHNICAL BORING LOG

BORING NUMBER

131

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- 1				tion Entertainr	ment				National C			n Park			
				8 Rev. 1					N Sallis						
- 1									ON		BI	ENCHM	IARK E	L	
- 1					DRILL RIG 2015 CME-55										
H/	AMMER	TYPE	Auto		-		AT TIME	OF D	RILLING	None	:				
					CHECKED BY RTH		AT END	OF D	RILLING						
G NC	DTES _					_									
SUB/BORING LOGS/BORING LOGS		METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION inified Soil Classification System	0.5 ft	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20	40 0 4 PL 10 4 HEAR S	60 N VALUI 0 6 MC 40 6	0 80 LL 0 80 GTH (ksf)	ELEVATION (ft)
E NATION PARK-S	5" O.D.			SANDY LE Gray & Red	(6") EAN CLAY, w/ Gravel, Tan to Brow d, Moist, Stiff (CL)		SP1	_	4-7-7 (14)	3					
56748-NAT'L CHEROKEE	CFA - 4.	}		w/ Red, Dr ¬ SANDSTO	ighly Weathered, Light Gray to Tar y, Soft DNE, Fine Grained, Highly Weathel to Tan, Dry, Medium Hard	4.9 π 5.3 ⁄ft	SP1	- -	10-26- 65/5"	4.25	0				
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT\LCHEROKEE NATION PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S:_MASTER PROJECT FILE\2019\OK\C\CHEROKEE NATION ENT-256748-NAT\LCHEROKEE NATION PARK-SUB\BORNING LOGS\BORNING LOGS\GP\ \begin{array}{ c c c c c c c c c c c c c c c c c c c				Auger Retu	usal on Sandstone Refusal at 5.3 feet. Bottom of borehole at 5.3 feet.										



GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Natio	on Entertainm	nent	PROJE	CT NAM	/IE N	lational C	heroke	e Nation P	ark			
PRO.	JECT NO.	256748	Rev. 1		PROJE	CT LO	OITA	N Sallisa	aw, Ok	(
DATE	STARTE	6/12/1	9	COMPLETED 6/12/19	SURFA	CE ELE	VATIO	ON		BENG	CHMAR	K EL.		
DRIL	LER CW			DRILL RIG 2015 CME-55	GROU	ND WAT	ER LI	EVELS						
НАМІ	MER TYPE	Auto				AT TIME	OF D	RILLING	None					
LOG	GED BY _(CJ		CHECKED BY RTH	_ /	AT END	OF DE	RILLING						
NOTE	ES				_									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DESCRIPTION ified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL H 20	40	0 80 LUE 60 C	100	ELEVATION (ft)
0	CFA - 4.5" O.D.		SANDSTO	AN CLAY, w/ Gravel, Brown to Red ff (CL) NE, Fine Grained, Highly Weathere	2.0 ft	SPT 1		3-4-3 (7)	2.5	A O				
	J		Dry, Mediur Auger Refu	sal on Sandstone										

Auger Refusal on Sandstone Refusal at 2.0 feet. Bottom of borehole at 2.0 feet.

GEOTECHNICAL BORING LOG

BORING NUMBER

133

	100													1 70	JL 1 0	
CLIE	NT Cher	okee Na	tion Entertainn	nent		PROJE	CT NAM	/IE _N	lational C	heroke	e Natio	on Pa	rk			
PRO	JECT NO.	25674	8 Rev. 1			PROJE	CT LO	CATIO	N Sallisa	aw, Ok	(
DAT	E STARTE	D 6/12	/19	COMPLETED 6/	12/19	SURFA	CE ELE	VATI	ON		В	ENCH	IMARK I	EL		
DRIL	LER CW	1		DRILL RIG 2015	5 CME-55	GROU	ND WAT	ER LI	EVELS							
					_				RILLING	None	:					
1				CHECKED BY R	RTH				RILLING							
.				· ····												
											_	DDV	'UNIT V	/T (nof	\ <u> </u>	
		ᅵ႕					111		. ග	١.	20) 4(0 60	80		.
	<u> </u>	STRATA SYMBOL					SAMPLE TYPE NUMBER	% ≿::	CORRECTED BLOW COUNTS (N VALUE)	PEN.		20	N VALU		80	ELEVATION (ft)
DEPTH (ft)	독운	S		MATERIAL DESCI	RIPTION		LE T ABE	VER D %	A L COE	St.	_					# AT
	DRILLING METHOD	ATA	Uı	nified Soil Classifica	tion System		MPI	RECOVERY (RQD %)	N N	POCKET I (tsf)		PL	MC			LEV LEV
	_) TR					SA	H	SPC BCG	S		20 HEAR	40 R STREN		80 kef\ □	Ш
		0,										1		3	4	
0			TOPSOIL (0.1/tt	SPT		3-3-3				-			
<u> </u>	. ■		SANDY LE	AN CLAY, Trace Or st, Medium Stiff (CL	rganics, Brown w ໂ	/ Gray	1		(6)	2.25		O :	į			
			a rea, moi	st, McGiain Guii (GE	-/			1 1					:	:		
															:	
 	4		01141 = 1/0			3.0 ft										
<u> </u>	B		Very Stiff to	ANDY LEAN TO FA Hard (CL-CH)	AT CLAY, Brown	Moist,		-							:	
- 1	1 1		·	, ,			SPT 2		7-13-13 (26)	4.5		_			:	
<u> </u>									(20)					<u>.</u>		.
5	O.D												:	:	:	
<u>-</u>														:	:	
	- A															
<u> </u>	CFA													:		
	1												:	:	:	
						9.2 ft	V						:		:	
			SHALE, Tra	ace Coal, Highly We	eathered, Black &		SPT 3		10-16-21 (37)	4.5		<u>;</u>	A	:	:	
10			Brown, Dry	, Very Soft	,			-						<u>.</u>		.
-	1					11.7 ft							:			
			SANDSTO	NE, Fine Grained, H	Highly Weathered	l,12.3 ft							:			
		[././/]		Medium Hard	_		SPT		65/0"					•	•	
			Auger Refu	ısal on Sandstone Refusal at 12	.3 feet.		4									
5				Bottom of borehole	at 12.3 feet.											
8																
5																
{																
ייס בססים ביייון ביין בייין ביין בייים																
2																
5																
:																I

GEOTECHNICAL BORING LOG

BORING NUMBER

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1			ion Entertainr	ment				National C			n Park			
1		256748						N Sallis						
1				COMPLETED 6/12/19						В	ENCH	/IARK E	iL	
				DRILL RIG 2015 CME-55										
								RILLING						
	•			CHECKED BY RTH	_	AT END	OF D	RILLING						
O (#)	ES										DRY	INIT W	/T (pcf)	
		占				ш	9	ွှေ) 20	40	60	80 10	00
ı	S C	SYMBOL		MATERIAL DESCRIPTION		유	RY (%	HENG HENG HENG HENG HENG HENG HENG HENG	E E	2		VALU	60 80	ELEVATION (#)
DEPTH (ft)	DRILLING METHOD	A S,	1.16			SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		PL	MC	LL	.VAT
	R M	STRATA	U	nified Soil Classification System		AME	(R	805	000	2	20 4	10 6	50 80)
		ST				S	٣		-	■ SI			IGTH (ks	f) 🗖
0		7 <u>1 1</u> N - 7 <u>1</u>	TOPSOIL ((6")	0.5 ft						<u>1 </u>	<u>2</u> :	<u>3 4</u> : :	
<u> </u>			CLAYEY S	SAND, w/ Gravel, Fine Grained, Bro	own to	SPT 1		1-7-20 (27)		0	A	:		
	9		Tan, Moist	, Medium Dense (SC) NE, w/ Shale, Fine Grained, Highly			-	. ,	1			:		
-			Weathered	I, Light Gray to Tan w/ Black, Dry,	oft						:			
. -												:		
	ġ.						1			_	:	:		
<u> </u>	O.D	////			4.5 ft	SPT 2		12-16-20 (36)	3.5	0	A	:		
5	- 4.5"		SHALE, Tr	ace Coal, Highly Weathered, Black , Very Soft	. &			(00)						
	CFA -		Diowii, Diy	, very soit										
-	ਹ					SPT		17-65/5"	4.5		:	•		
<u> </u>						3	-				:	:		T
						SPT		10-13-	4.5		:	:		
					9.9 ft	4		65/5"						
			Auger Refu	usal on Shale Refusal at 9.9 feet.										
				Bottom of borehole at 9.9 feet.										
1														

GEOTECHNICAL BORING LOG

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CLIE	NT Cher	okee Nat	tion Entertainn	nent		PROJE	CT NAM	/E _N	lational C	heroke	e Natio	n Park			
PRO.	JECT NO.	256748	3 Rev. 1			PROJE	CT LOC	CATIO	N Sallis	aw, Ok	(
DATE	E STARTE	D 6/12/	<u>′19</u>	COMPLETED	o 6/12/19	SURFA	CE ELE	VATI	ON		BI	ENCHMA	RK EL.		
DRIL	LER CW			DRILL RIG _	2015 CME-55	GROUN	ND WAT	ER L	EVELS						
HAM	MER TYPE	E Auto				A	T TIME	OF D	RILLING	None	1				
LOG	GED BY _	CJ		CHECKED B	Y RTH		T END	OF DI	RILLING						
NOTI	ES														
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL		MATERIAL DI			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 2	PL 0 40	60 8 /ALUE 60 MC 60 RENG	80 100 80 LL	ELEVATION (ft)
CHEROREE NATION PARK-SUBIBURING	CFA - 4.5" O.D.		Medium Sti	Gravel, Brown w/ F	3.4 ft	SPT 1		3-3-4 (7)	1.75		1 2	3	4		
		1////		vn, Dry, Mediur		ereu, 4.1 ft	2		03/3	<u> 0.73</u>			<u> </u>	<u> </u>	<u> </u>
<u> </u>			Auger Refu	sal on Sandsto	ne										

Auger Refusal on Sandstone Refusal at 4.1 feet. Bottom of borehole at 4.1 feet.

GEOTECHNICAL BORING LOG

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CLIE	NT Cher	okee Nat	ion Entertainm	nent	PROJE	ECT NAM	/E _N	lational Cl	heroke	e Nation P	ark			
PRO	JECT NO.	256748	3 Rev. 1		_ PROJE	ECT LOC	CATIC	N Sallisa	aw, Ok	(
DATI	E STARTE	D 6/12/	19	COMPLETED <u>6/12/19</u>	_ SURF	ACE ELE	VATI	ON		BENC	HMARK	EL		
DRIL	LER CW	1		DRILL RIG 2015 CME-55	_ GROU	ND WAT	ER L	EVELS						
НАМ	IMER TYPI	E Auto			1	AT TIME	OF D	RILLING	None	!				
LOG	GED BY _	CJ		CHECKED BY RTH	_ /	AT END	OF D	RILLING _						
NOT	ES				_									
		SYMBOL				/PE	% (ED NTS	PEN.	20	N VAL	80 _UE ▲	100	Z
DEPTH (ft)	DRILLING	STRATA SYN	Ur	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PI (tsf)	20 PL 	MC 40	60	80 L 1 80	ELEVATION (ft)
		S						_		SHEA 1	R STRE 2	:NGTH 3	(kst) □ 4	
0	0.D.		TOPSOIL (: SANDY LE, Medium Sti	AN CLAY, w/ Gravel, Brown w/ Re	0.2 # ed, Moist,	SPT 1		3-3-3 (6)	0.75	▲ O				
	CFA - 4.5"		1		4.4 ft	SPT 2		65/1"		0			4	
-			SANDSTO	NE, Fine Grained, Highly Weather	ed, Tän									

Dry, Medium Hard

Auger Refusal on Sandstone Refusal at 4.4 feet.
Bottom of borehole at 4.4 feet.

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CLIE	NT Che	rokee Na	ation Entertainm	ent	PROJE	CT NAM	/IE N	lational C	heroke	e Nation	Park			
								N Sallis						
				COMPLETED 6/11/19						BEI	NCHMAR	K EL		
1				DRILL RIG 2015 CME-55					Nama					
				CHECKED BY DITH										
.				CHECKED BY RTH	_ ′	AI END	OF DI	KILLING .						
					_					<u> </u>	JBV LINII	T WT (pcf)	<u> </u>	
		6				ш	Q	S	<u>.</u>	20	40 6	60 8Ö ´		
	S C	STRATA SYMBOL		MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RY .	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20		ALUE ▲ 60 8	0	ELEVATION (ft)
DEPTH (ft)	DRILLING METHOD	A S		ified Soil Classification System) MBI	RECOVERY (RQD %)	NEC VAL	(tsf)	F	PL M	IC LL		(ft)
	R M	RAT	On	illed Soli Classification System		NAM N	REC(R	S S S		20		60 8	80	
		ST				0)		ОМ			_	RENGTH (k	sf) 🗖	
0		7/1///	── TOPSOIL (4	! ")	0.3 ft	SPT		65/4"		<u>1</u> 0:	<u>2</u> :	<u>3</u> 2	4 : 4	
			LEAN CLAY	, Trace Sand & Gravel, Brown, I	Moist,	1				:	:	:	: : :	
			Hard (CL)										: :	
										:	:	:	: : :	
					3.2 ft								:	
5				AN TO FAT CLAY, w/ Sand, Trate to Gray w/ Red, Moist, Very Stift		Vant								
			2121721, 12211		(===:,	SPT 2		8-9-9 (18)	4	A ()		:	
5 5							-						: :	
										:	:	:	: : :	
	Ö.												:	
	.5 <u>"</u> 0.				7.6 ft									
	4-4		SHALE, Tra	ce Coal, Highly Weathered, Gra	y to Brown					:	:	:	· · ·	
	CFA		w/ Black & I	Red, Dry, Very Soft to Soft			-					:	· ·	
						SPT 3		9-17-20 (37)	4.5	O	_	:		
10							-						: : :	
										:	:	:	: : :	
													: :	
										:	:	:	: : :	
						X SPT	1	65/3"	4.5	0				
						4				:	:	:	: : :	
15				Bottom of borehole at 15.0 feet.	15.0 ft					:	:	:	:	
			l	DOMOTH OF DOTETION AT 13.0 IEEL.										
3														
<u>i</u>														
3														



GEOTECHNICAL BORING LOG

BORING NUMBER

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CLI	ENT Cherc	kee Na	ation Entertainn	nent	PROJI	ECT NAM	/IE _N	lational C	heroke	e Nation Pa	ark			
PR	OJECT NO.	25674	l8 Rev. 1		PROJI	ECT LOC	CATIO	N Sallis	aw, OK	(
DA ⁻	TE STARTE	D <u>6/11</u>	1/19	COMPLETED <u>6/11/19</u>	SURF	ACE ELE	VATI	ON		BENC	HMAR	K EL.		
DRI	ILLER CW			DRILL RIG Hand Sample	GROU	ND WAT	ER LI	EVELS						
HAI	MMER TYPE	Auto	ı			AT TIME	OF D	RILLING	None					
LO	GGED BY _	CJ		CHECKED BY RTH		AT END	OF DI	RILLING						
, NO	TES													
DEPTH (#)		STRATA SYMBOL	Ur	MATERIAL DESCRIPTION nified Soil Classification System			RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 20 PL 1— 20	40 R STRI	0 80 LUE 4 60 C	100	ELEVATION (ft)
0	D SAMPLE			2") AN CLAY, Trace Gravel & Boulders, an, Moist (CL)	0.2 # 1.8 ft	GB 1				0				
	HAN		Refusal on	Sandstone Refusal at 1.8 feet. Bottom of borehole at 1.8 feet.					•					

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S:_MASTER PROJECT FILE\2019\OKICKCHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS\GPJ



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					l									102 1 0	'' '
CLIE	NT Chero	kee Na	ation Entertainn	nent		PROJE	CT NAI	ME N	lational C	heroke	e Nation Pa	ark			
PRO.	JECT NO.	25674	8 Rev. 1			PROJE	CT LO	CATIO	N Sallis	aw, OK	(
DATE	STARTE	6 /11	/19	COMPLETED	6/11/19	SURFA	CE ELE	VATI	ON		BENC	HMARK	(EL		
DRIL	LER CW			DRILL RIG Ha	and Sample	GROU	TAW DI	ER LI	EVELS						
HAMI	MER TYPE	Auto				A	T TIME	OF D	RILLING	None					
LOGG	GED BY _(CJ		CHECKED BY	RTH		T END	OF DI	RILLING						
NOTE	ES														
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4	40	0 80 LUE ▲ 60	80 LL H 80	ELEVATION (ft)
0	HAND SAMPLE		w/ Gray & F	AN CLAY, Trace Red, Moist (CL)	Gravel & Boulders	0.1/ft s, Brown 2.2 ft	GB 1				O				
	主		Refusal on	Sandstone											

Refusal on Sandstone Refusal at 2.2 feet. Bottom of borehole at 2.2 feet.



GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIE	NT Chero	kee Na	tion Entertainm	nent		PROJE	CT NAM	/IE _N	lational C	heroke	e Nation P	ark			
PRO.	JECT NO.	25674	8 Rev. 1			PROJE	CT LO	CATIO	N Sallisa	aw, OK	(
DATE	STARTE	6/11	/19	COMPLETED	6/11/19	SURFA	CE ELE	VATI	ON		BENC	HMAR	K EL.		
DRIL	LER CW			DRILL RIG H	and Sample	GROU	ND WAT	ER LI	EVELS						
HAM	MER TYPE	Auto					AT TIME	OF D	RILLING	None					
LOG	GED BY _	J		CHECKED BY	RTH	_ /	AT END	OF DI	RILLING						
NOTE	ES					_									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DES			S)	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 ° 20 PL 1— 20	40 6 N VA 40 W	ALUE 60	<u>) 100 </u>	ELEVATION (ft)
0	TOPSOIL (4") SANDY LEAN CLAY, Brown, Dry (CL)					0.3 ft 1.2 ft	m GB 1				···O	:	•	<u>:</u>	
Refusal on Sandstone Refusal at 1.2 feet. Bottom of borehole at 1.2 feet.															



4168 W. Kearney

GEOTECHNICAL

BORING NUMBER

	40		pringfield, Mis elephone: (4		BO	ORING	310	G			1	41
_	76		ax: (417) 864					•			PAGE 1 C)F 1
CLIE	NT Chero	kee Nat	tion Entertainr	nent		PROJE	ECT NAI	ME_N	lational C	heroke	ee Nation Park	
PRO	JECT NO.	256748	3 Rev. 1			_ PROJE	ECT LO	CATIO	N Sallis	aw, Ok	<	
DATI	E STARTEI	6 /11/	19	COMPLETED _	6/11/19	_ SURF	ACE ELE	EVATI	ON		BENCHMARK EL.	
	LER CW			DRILL RIG Ha	ind Sample	_ GROU	ND WA	ΓER LI	EVELS			
HAM	MER TYPE	Auto		-			AT TIME	OF D	RILLING	None)	
		CJ		CHECKED BY	RTH		AT END	OF D	RILLING			
NOT	ES					_						
BOKING LOG - PPI - PPI S ID TEMPLATE.GDT - 77719 09:09 - S.: MASTER PROJECT PILEZOT9/OKIC/CHEROREE NATION EN 1-236/48-NATI CHEROREE NATION PARK-SUB/BOKING LOGS/GDD DEPTH O (ft)	9 ₀	SYMBOL					Y PE	% } (TED INTS E)	л Х Э	DRY UNIT WT (pcf) ◆ 20 40 60 80 100 ▲ N VALUE ▲ 20 40 60 80	NO.
DEPTH (ft)	지 기본	SYI		MATERIAL DES	CRIPTION		LE T	VER D %	PEC.	ET P	DI MC II	₹£
DE	DRILLING METHOD	STRATA	U	nified Soil Classifi	cation System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	PL MC LL 20 40 60 80	ELEVATION (ft)
2882		o									1 2 3 4	
0	1PLE		TOPSOIL	· ,	Oracial Direct	0.3 ft - 0.7 ft	M GB	$oxedsymbol{oxed}$			O	
Z Z	SAM		SANDY LE Moist (CL)	EAN CLAY, Trace	Gravel, Brown to	ıan,		-				
Z N	HAND		Refusal on	Sandstone Refusal at	0.7 feet							
YE I	Ì			Bottom of boreho								
퓨 정												
) - -												
4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8												
7967-												
2												
X X												
S S S S S S S S S S S S S S S S S S S												
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CLIE	NT Chero	kee Na	ation Entertainm	nent		PROJE	CT NAM	/E N	ational Cl	neroke	e Nation Par	k			
PRO.	JECT NO.	25674	l8 Rev. 1			PROJE	CT LOC	OITA	N Sallisa	aw, OK	<u>, </u>				
DATE	STARTE	6/11	1/19	COMPLETED	6/11/19	SURFA	CE ELE	VATIO	ON		BENCH	MARK	EL		
DRIL	LER CW			DRILL RIG H	and Sample	GROU	ND WAT	ER LI	EVELS						
HAM	MER TYPE	Auto					AT TIME	OF D	RILLING	None					
LOG	GED BY _C	CJ		CHECKED BY	RTH	_ /	AT END	OF DE	RILLING						
.						_									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 PL	0 60 N VALU 40 MC 40	80 UE 4 60 L	80 L 80	ELEVATION (ft)
0	PLE		TOPSOIL (0.2 ft 	m GB 1				0		:	:	
	HAND SAMPLE	r / / - / - / - / - / - / - / - / -	Refusal on	AN CLAY, Browr Sandstone Refusal at Bottom of boreh	0.8 feet.						,		•	•	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S._MASTER PROJECT FILE\\QUIDO\OK\C\\CHEROKEE NATION ENT-256748-NAT\L CHEF



4168 W. Kearney Springfield, Missouri 65803

GEOTECHNICAL

BORING NUMBER

		Т		17) 864-6000 1-6004	ВО	RINC	S LO	G						05.4
01.15	IT Observed					DDO II	TOT NAS	4F \	l - 4' 1 O		- N-6 D		PAGE 1	OF 1
			ion Entertainr	nent							ee Nation Park			
1	ECT NO.			OOMBI ETED	0/40/40				N Sallis			IADIC EL		
					6/12/19						BENCHIN	ARK EL.		
1	LER CW			DRILL RIG 20	15 CME-55		ND WAT			N1				
	MER TYPE			-	D.T. (9			
		J		_ CHECKED BY	RTH	4	AI END	OF DI	RILLING					
NOTE	:5													
DENBORING LOGS/BORING LOG DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U	MATERIAL DES		0.2.#		RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 20 4 PL 20 4 SHEAR S		80 LL 	ELEVATION (ft)
3K-SI 0	O.D		↑ TOPSOIL (0.8 /#	SPT 1		3-65/2"		0		:	\
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S:_MASTER PROJECT FILE\(2019\)(OK\C\C\HEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\)BORING LOGS GPJ OR DEPTH ON THE CONTRACT OR CONTRACT FILE\(2019\)(OK\C\C\HEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\)BORING LOGS\(3019\)(OK\C\C)	CFA - 4.5"		to Light Gra	NE, Fine Grained ay, Dry, Soft usal on Sandstone Refusal at Bottom of boreh	0.8 feet.	d, Tanj								



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CLI	NT Cher	okee Na	tion Entertainr	ment	_ PROJE	ECT NAI	ME N	lational C	heroke	ee Nation Park
1	JECT NO.				_	CT LO	CATIO	N Sallis	aw, Ok	<
1				COMPLETED <u>6/12/19</u>		CE ELE	EVATI	ON		BENCHMARK EL.
DRII	LER CW	<u> </u>		DRILL RIG 2015 CME-55	_ GROU	ND WAT	TER LI	EVELS		
HAN	MER TYP	E Auto		-		AT TIME	OF D	RILLING	None	9
LOG	GED BY _	CJ		CHECKED BY RTH		AT END	OF DI	RILLING		
ਜੂ ਜ਼ਹਾ	ES				_					
SORING LOGS	DQ QC	SYMBOL		MATERIAL DESCRIPTION		TYPE	RY % %)	TED OUNTS UE)	PEN.	◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100 ▲ N VALUE ▲ 20 40 60 80 ♀
DEPTH (ft)	DRILLING	STRATA S	U	nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)
	_: :	.474			0.5.6					1 2 3 4
PARK-SU	.5" O.D	////	SANDSTO	(6") NE, Fine Grained, Highly Weather ay, Dry, Soft	0.5 ft ed, Tan 1.4 ft	SPT 1		10-44- 65/1"	2.5	0
BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S. MASTER PROJECT FILE/2019/OKIC/CHEROKEE NATION ENT-256748-NATL CHEROKEE NATION PARK-SUB/BORING LOGS/GPJ DEPTH DEPTH DEPTH O (ft)	CFA			Refusal at 1.4 feet. Bottom of borehole at 1.4 feet.						



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CLIE	NT Chero	kee Nat	ion Entertainm	nent		PROJE	CT NAM	/IE _N	lational C	heroke	e Nation P	ark			
PRO.	JECT NO.	256748	3 Rev. 1			PROJE	CT LO	CATIO	N Sallisa	aw, OK					
DATE	STARTE	6/12/	19	COMPLETED	6/12/19	SURFA	CE ELE	VATI	ON		BENC	HMAR	K EL.		
DRIL	LER CW			DRILL RIG 20)15 CME-55	GROU	ND WAT	ER LI	EVELS						
HAMI	MER TYPE	Auto					AT TIME	OF D	RILLING	None					
LOG	GED BY _C	J		CHECKED BY	RTH		AT END	OF DE	RILLING						
NOTE	ES														
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	Ur	MATERIAL DES			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20 PL I- 20	40	60 8Ö ALUE 4 60 IC	100	ELEVATION (ft)
0	CFA+4.5" O.D.		SANDSTON to Light Gra	AN CLAY, w/ Gra	1.7 feet.		m GB 1	-			0				

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 7/1/19 09:09 - S.\. MASTER PROJECT FILE\(\text{LE}\(\text{LE}\(\text{LO}\) 10) OKIC/CHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\(\text{BORING}\) LOGS\(\text{BORING}\) LOGS\(\text{LOF}\)





CLIENT Cherokee Nation Entertainment

PROJECT NAME National Cherokee Nation Park

PROJECT LOCATION Sallisaw, OK

PROJECT NO. 256748 Rev. 1

LITHOLOGIC SYMBOLS (Unified Soil Classification System)



BLDRCBBL: Boulders and cobbles



CH: USCS High Plasticity Clay



CHG: USCS High Plasticity Gravelly Clay



CHS: USCS High Plasticity Sandy Clay



CL: USCS Low Plasticity Clay



CL-CH: USCS Low to High Plasticity Clay



CLG: USCS Low Plasticity Gravelly Clay



CL-ML: USCS Low Plasticity Silty Clay



CLS: USCS Low Plasticity Sandy Clay



COAL: Coal



GC: USCS Clayey Gravel



SANDSTONE: Sandstone



SC: USCS Clayey Sand



SHALE: Shale



SP: USCS Poorly-graded Sand



TOPSOIL: Topsoil

SAMPLER SYMBOLS



Grab Sample



NQ



Standard Penetration Test



Shelby Tube

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)

PI - PLASTIC INDEX (%)

W - MOISTURE CONTENT (%)

DD - DRY DENSITY (PCF)

NP - NON PLASTIC

-200 - PERCENT PASSING NO. 200 SIEVE

PP - POCKET PENETROMETER (TSF)

TV - TORVANE

PID - PHOTOIONIZATION DETECTOR

UC - UNCONFINED COMPRESSION

ppm - PARTS PER MILLION

Water Level at Time

→ Drilling, or as Shown

Water Level at End of Drilling, or as Shown

Water Level After 24

Hours, or as Shown



APPENDIX III - GENERAL NOTES

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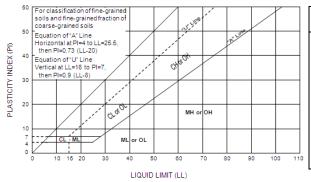


GENERAL NOTES

SOIL PROPERTIES & DESCRIPTIONS

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu)	Pocket Penetrometer Strength	N-Value
	(psf)	(tsf)	(blows/ft)
Very Soft	<500	<0.25	0-1
Soft	500-1000	0.25-0.50	2-4
Medium Stiff	1001-2000	0.50-1.00	5-8
Stiff	2001-4000	1.00-2.00	9-15
Very Stiff	4001-8000	2.00-4.00	16-30
Hard	>8000	>4.00	31-60
Very Hard			>60



Group Symbol	Group Name
CL –	Lean Clay
ML –	Silt
OL –	Organic Clay
	or Silt
CH –	Fat Clay
MH –	Elastic Silt
OH –	Organic Clay
	or Silt
PT –	Peat
CL-CH -	Lean to Fat
	Clay

Plasticity		Moisture	
Description	Liquid Limit (LL)	Descriptive Term	Guide
Lean	<45%	Dry	No indication of water
Lean to Fat	45-49%	Moist	Indication of water
Fat	≥50%	Wet	Visible water

Fine Grained Soil Sub Classification	Percent (by weight) of Total Sample
Terms: SILT, LEAN CLAY, FAT CLAY, ELASTIC SILT	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders with sand, with gravel, with cobbles, with boulders scattered sand, scattered gravel, scattered cobbles, scattered boulders a trace sand, a trace gravel, a few cobbles, a few boulders	>30-50] >15-30] – secondary coarse grained constituents 5-15] <5]
The relationship of clay and silt constituents is based on plasticity and normally determined by performing index tasts. Refined classic	

The relationship of clay and silt constituents is based on plasticity and normally determined by performing index tests. Refined classifications are based on Atterberg Limits tests and the Plasticity Chart.

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	N-VALUE
Very Loose	0-4
Loose	5-10
Medium Dense	11-24
Dense	25-50
Verv Dense	≥51

MOISTURE CONDITION		
Descriptive Term	Guide	
Dry	No indication of water	
Moist	Damp but no visible water	
Wet	Visible free water, usually	
	soil is below water table.	

**GRAIN SIZE IDENTIFICATION			
Name	Size Limits	Familiar Example	
Boulder Cobbles Coarse Gravel Fine Gravel Coarse Sand Medium Sand Fine Sand* Fines	12 in. or more 3 in. to 12 in. ¾-in. to 3 in. No. 4 sieve to ¾-in. No. 10 sieve to No. 4 sieve No. 40 sieve to No. 10 sieve No. 200 sieve to No. 40 sieve Less than No. 200 sieve	Larger than basketball Grapefruit Orange or lemon Grape or pea Rock salt Sugar, table salt Powdered sugar	

*Particles finer than fine sand cannot be discerned with the naked eye at a distance of 8 inches.

Coarse Grained Soil Sub Classification	Percent (by weight) of Total Sample	
Terms: GRAVEL, SAND, COBBLES, BOULDERS	PRIMARY CONSTITUENT	
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]	
with gravel, with sand, with cobbles, with boulders	>15-30] – secondary coarse grained constituents	
scattered gravel, scattered sand, scattered cobbles, scattered	5-15]	
boulders	<5]	
a trace gravel, a trace sand, a few cobbles, a few boulders		
Silty (MH & ML)*, clayey (CL & CH)*	<15]	
(with silt, with clay)*	5-15] – secondary fine grained constituents	
(trace silt, trace clay)*	<5]	
*Index tests and/or plasticity tests are performed to determine whether the term "silt" or "clay" is used.		

^{*}Modified after Ref. ASTM D2487-93 & D2488-93

^{**}Modified after Ref. Oregon DOT 1987 & FHWA 1997

^{***}Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987



GENERAL NOTES

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)		
Description of Rock Quality *RQD (%		
Very Poor	< 25	
Poor	25-50	
Fair	50-75	
Good	75-90	
Excellent	90-100	

*RQD is defined as the total length of sound core pieces 4 in. or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

SCALE OF RELATIVE ROCK HARDNESS			
Term	Field Identification	Approx. Unconfined Compressive Strength (tsf)	
Extremely Soft	Can be indented by thumbnail	2.6-10	
Very Soft	Can be peeled by pocket knife	10-50	
Soft	Soft Can be peeled with difficulty by pocket knife		
Medium Hard Can be grooved 2 mm deep by firm pressure of knife		260-520	
Moderately Hard			
Hard	· ·		
Very Hard Cannot be scratched by knife or sharp pick >2610			

	DEGREE OF WEATHERING		
Slightly Weathered Rock generally fresh, joints stained and discolo extends into rock up to 25mm (1 in), open joints contain clay, core rings under hammer impact.		Rock generally fresh, joints stained and discoloration extends into rock up to 25mm (1 in), open joints may contain clay, core rings under hammer impact.	
Weathered Rock mass is decomposed 50% or less, signification portions of rock show discoloration and weather effects, cores cannot be broken by hand or scraped knife.		Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.	
	Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.	

Weathered	Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.	
Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.	

VOIDS		
Pit	Voids barely seen with the naked eye to 6mm *1/4-inch)	
Vug	Voids 6 to 50mm (1/4 to 2 inches) in diameter	
Cavity	50 to 6000mm (2 to 24 inches) in diameter	
Cave	> 600mm	

GRAIN SIZE (TYPICALLY FOR SEDIMENTARY ROCKS)			
<u>Description</u>	<u>Diameter</u> (mm)	Field Identification	
Very Coarse Grained	>4.76		
Coarse Grained	2.0-4.76	Individual grains can easily be distinguished by eye.	
Medium Grained	0.42-2.0	Individual grains can be distinguished by eye.	
Fine Grained	0.074-0.42	Individual grains can be distinguished by eye with difficulty.	
Very Fine Grained	<0.074	Individual grains cannot be distinguished by unaided eye.	

BEDDING THCK	NESS
Very Thick Bedded	> 3' Thick
Thick Bedded	1' to 3' Thick
Medium Bedded	4" to 1' Thick
Thin Bedded	1-1/4" to 4" Thick
Very Thin Bedded	½" to 1-1/4" Thick
Thickly Laminated	1/8" to ½" Thick
Thinly Laminated	1/8" or less (paper thin)

DRILLING NOTES

	Drilling & Sampling Symbols							
NQ – Rock Core (2-inch diameter)	CFA- Continuous Flight (Solid Stem) Auger	WB – Wash Bore or Mud Rotary						
HQ – Rock Core (3-inch diameter)	SS – Split Spoon Sampler	TP – Test Pit						
HSA – Hollow Stem Auger	ST – Shelby Tube	HA – Hand Auger						
Soil Sample Types								

Shelby Tube Samples: Relatively undisturbed soil samples were obtained from the borings using thin wall (Shelby) tube samplers pushed hydraulically into the soil in advance of drilling. This sampling, which is considered to be undisturbed, was performed in accordance with the requirements of ASTM D 1587. This type of sample is considered best for the testing of "in-situ" soil properties such as natural density and strength characteristics. The use of this sampling method is basically restricted to soil containing little to no chert fragments and to softer shale deposits.

Split Spoon Samples: The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot of an 18-inch long, 2-inch O.D. split-barrel sampler with a 140 lb. hammer falling a distance of 30 inches. The Standard Penetration Test is carried out according to ASTM D-1586.

Water Level Measurements

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, shallow groundwater may indicate a perched condition. Caution is merited when interpreting shortterm water level readings from open bore holes. Accurate water levels are best determined from piezometers.

Automatic Hammer

Palmerton and Parrish, Inc.'s CME's are equipped with automatic hammers. The conventional method used to obtain disturbed soil samples used a safety hammer operated by company personnel with a cat head and rope. However, use of an automatic hammer allows a greater mechanical efficiency to be achieved in the field while performing a Standard Penetration resistance test based upon automatic hammer efficiencies calibrated using dynamic testing techniques.

^{*}Modified after Ref. ASTM D2487-93 & D2488-93

^{**}Modified after Ref. Oregon DOT 1987 & FHWA 1997

^{***}Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987



APPENDIX IV – SUMMARY OF LABORATORY RESULTS

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

LIENT Cheroke ROJECT NO. 2						JECT NAME JECT LOCA ⁻	TION Sallisa	aw, OK			
Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
1	0.0							26.2			
1	3.5							21.4			
1	6.0							17.4			
1	8.5							16.6			
2	0.0	28	17	11				27.9			
2	3.5							24.8			
2	6.0							22.1			
2	8.5							21.9			
2	13.5							11.1			
3	0.0							31.1			
3	3.5							28.1			
3	6.0							26.8			
3	8.5							32.1			
3	13.5							3.9			
4	0.0							25.8			
4	3.5							19.8			
4	6.0							17.7			
4	8.0	54	17	37				24.5	100.7	4,570	
4	13.5							12.1			
5	0.0							26.6			
5	3.5							23.4			
5	6.0	49	16	33				21.3	107.0	4,516	
5	8.5							26.1			
5	13.5							5.1			
5	18.5							3.6			
6	0.0							29.7			
6	3.0							15.8	115.2	3,016	
6	6.0				4.75	96		25.3			
6	8.5							25.3			
7	0.0							29.1			
7	3.5							10.8			
7	6.0							8.0			
7	8.5							6.0			
8	0.0							30.6			
8	3.5							8.8			
8	6.0							7.7			
8	8.5							7.7			
9	0.0							26.0			
9	3.5							10.4			
10	0.0							24.7			
10	3.5							18.1			
11	0.0							24.1			
11	3.5							20.1			

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

CLIENT Cherokee Nation Entertainment

PROJECT NO. 256748 Rev. 1

PROJECT NAME National Cherokee Nation Park

	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	12	0.0							24.4			
	12	3.5				19	69		20.2			
GP.	12	6.0							28.1			
-068	12	8.5							16.4			
ING I	13	1.0	40	16	24				22.9			
BOR	13	3.5							22.5			
ogs	14	0.0							33.2			
NGL	14	3.5							15.3			
BOR	15	0.0							22.5			
SUB	15	3.5	44	15	29				23.4			
ARK	16	0.0							23.7			
ONP	16	3.5							16.2			
NAT	17	0.0							23.0			
PROJECT FILE\2019)OKICICHEROKEE NATION ENT\256748-NAT'L CHEROKEE NATION PARK-SUB\BORING LOGS\BORING LOGS.GPJ	17	3.5							19.9			
ERO.	18	0.0							13.1			
힐	18	3.5							6.7			
-N-N	19	1.0				19	59		17.1			
56748	19	3.0							4.3			
NT-2	19	6.0							5.8			
ONE	19	8.5							7.8			
NAT	19	13.5							8.9			
Ä	20	0.0							23.4			
ĒRS	20	3.5							7.6			
5	21	1.0							18.1			
9\OK	21	3.0							12.4			
=\201	21	6.0							13.7			
릺	21	9.5							13.5			
SPEC	22	1.0	42	16	26				21.0			
	22	3.0							18.5			
STEF	22	6.0							16.7			
MA	22	8.5							13.9			
5 - S:	23	0.0							24.0			
LAB SUMMARY - PPI STD TEMPLATE.GDT - 7/1/19 09:15 - S:\ MASTER	23	3.5							15.6			
7/1/15	24	1.0				19	86		22.8			
DT-	24	3.0	31	19	12				18.0			
TE.G	24	6.0							12.3			
MPLA	24	8.0							15.9			
) TE	24	13.5							6.7			
JI STI	25	0.0							22.9			
- P	25	3.5	44	16	28				18.3			
MAR	25	6.0							14.9			
SUM	25	8.5							14.1			
ΓAΒ	26	0.0							20.8			

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

CLIENT Cherokee Nation Entertainment

PROJECT NAME National Cherokee Nation Park

 PROJECT NO.
 256748 Rev. 1

 PROJECT LOCATION
 Sallisaw, OK

	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	26	3.5							19.8			
	27	0.0							19.9			
.GPJ	27	3.5							7.0			
ogs	28	1.0							10.6			
NGL	28	3.5							6.6			
BOR	29	0.0							8.1			
ogs	30	0.0							6.0			
PROJECT FILE/2019/OKICICHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUBIBORING LOGS'BORING LOGS.GPJ	30	3.5	46	21	25				17.0			
BOR	30	5.0							14.9			
SUB	30	8.5							13.4			
ARK-	30	13.5							12.0			
ON P	30	18.5							12.5			
NAT	31	0.0							13.1			
KEE	31	3.5				19	77		17.9			
ĒRO	31	6.0							15.0			
힐	31	8.5							14.5			
-NAT	31	13.5							9.8			
56748	32	0.0							15.7			
NT-2	33	0.0							16.2			
ONE	34	0.0							17.6			
NATI	34	3.0							15.4			
KEE	34	6.0							12.1			
ERO	34	8.0							9.4			
9	34	13.0							9.5			
9\OK	34	18.5							8.1			
1/201	35	0.0							27.9			
	35	3.5							18.9			
CEC	35	6.0							11.8			
	35	8.5							10.9			
STEF	35	13.5							10.2			
M	36	0.0							25.1			
LAB SUMMARY - PPI STD TEMPLATE.GDT - 7/1/19 09:15 - S:_MASTER	36	3.5							25.0			
9 09:1	36	6.0							13.3			
7/1/15	36	8.5							12.0			
<u>- 10</u>	36	13.5							10.8			
TE.G	37	0.0							14.9			
WPLA	37	3.5							30.6			
	37	6.0							13.0			
J STI	37	8.5							13.4			
- H	37	13.5							13.5			
MAR	38	0.0							21.4			
SUM	38	3.5							18.1			
LAB	38	6.0							12.3			

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

CLIENT Cherokee Nation Entertainment

PROJECT NAME National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 PROJECT LOCATION Sallisaw, OK

F	<u> </u>							Tierr <u>came</u>			Coho	
	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	38	8.5							12.3			
Ĺ	38	13.5							13.1			
	39	0.0							6.0			
	39	3.5							8.7			
	40	0.0				19	29		13.1			
	40	3.5							21.6			
	40	6.0							17.7			
	40	8.5							22.2			
	40	13.5							14.6			
	41	0.0							11.9			
	41	3.5	55	19	36				27.0			
	41	6.0							12.9			
	41	8.5							12.7			
	41	13.5							10.9			
	42	0.0							24.2			
	42	3.5							7.7			
	43	0.0							20.4			
	43	3.5							12.7			
	44	0.0							25.9			
	44	3.5							22.8			
	44	6.0							16.0			
	44	8.5							4.8			
	45	0.0							27.6			
	45	3.5							26.4			
	45	6.0							16.4			
	45	8.5							15.9			
	46	0.0							25.1			
	46	3.5							11.0			
	47	0.0							22.7			
	47	3.5	37	18	19				21.6			
	48	0.0							22.2			
	48	3.5							9.5			
	49	0.0	24	17	7				18.4			
	49	3.5							9.3			
	50	0.0							27.0			
	50	2.0							10.9			
	50	3.2							13.5			
	51	0.0							16.9			
	51	2.2							18.1			
	51	2.8							15.9			
	52	1.0				25	27		9.2			
L	52	3.5							6.6			
	53	1.0							4.7			

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

CLIENT Cherokee Nation Entertainment

PROJECT NAME National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 PROJECT LOCATION Sallisaw, OK

	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	53	2.4							4.4			
	54	0.0							30.1			
.GPJ	55	0.0							33.4			
.068	55	2.0							30.4			
NGL	55	3.5							15.4			
BORI	56	0.0							12.9			
)GS/	57	0.0							24.2			
NG L(57	3.5							20.8			
30RI	58	0.0							11.1			
SUBNE	58	3.5							23.0			
KK-	59	0.0							19.9			
N P	59	3.5							20.2			
¥TK	60	0.0							31.0			
	60	2.5	50	16	34				19.5			
ERO	60	5.5							10.7			
LCH	60	7.5							12.1			
-NAT	61	0.0							23.3			
6748	61	3.5							6.0			
JT-25	61	6.0							14.1			
N E	61	8.5							20.3			
ATIO	61	13.5							12.2			
PROJECT FILE/2019/OKICICHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUBIBORING LOGS'BORING LOGS.GPJ	62	0.0				37.5	33		13.7			
ERO	63	0.0							22.1			
SCH	63	3.5							22.1			
)OK	64	0.0							11.2			
72018	64	3.5							11.9			
	65	0.0							17.2			
JECT	65	3.5							10.4			
PRO	66	0.0							17.8			
TER	66	3.5							10.3			
MAS	66	4.7							3.6			
- S:	67	0.0				19	72		19.7			
09:15	67	3.5							3.9			
/1/19	68	0.0	30	17	13				26.0			
7-7	68	3.5							4.9			
E.G.	69	1.0	30	15	15				18.4			
PLA	69	3.0							12.9			
TEM	69	5.0							11.8			
STD	69	6.0							10.9			
q.	69	8.0							11.2			
/ARY	69	12.5							22.6			
LAB SUMMARY - PPI STD TEMPLATE.GDT - 7/1/19 09:15 - S:\ MASTER	69	13.5							16.2			
LAB §	70	1.0							12.7			
			•		•							

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

PROJECT NAME National Cherokee Nation Park **CLIENT** Cherokee Nation Entertainment

	PROJECT NO	256748 Rev. 1				PRO.		FION Sallisa	aw, OK			
	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
Γ	70	3.0				25	38		9.5			
	70	6.0							12.0			
GP.	70	8.0							13.3			
OGS	70	13.5							15.1			
NG NG	71	0.0							11.4			
BOR	71	3.0	57	18	39	19	87	СН	25.5			
\SS(71	6.0							15.8			
] [2]	71	8.0							13.9			
Š	71	13.0							15.0			
SUB/E	72	0.0							24.5			
*\ *\ *\	72	3.5	60	20	40				22.9			
2 2	72	6.0							18.0			
Y I	72	8.5							16.0			
	72	13.5							13.2			
ž Š	73.2	0.0	27	18	9	9.5	55	CL	19.9			
ᆰ	73.2	3.5							14.6			
Z -	73.2	6.0							12.3			
5748-	73.2	8.5							6.4			
1-256	73.2	13.5							21.7			
Z Z Z	74	0.0							38.3			
A I O	74	3.5							21.4			
	75	0.0							21.5			
ᇵ	75	3.5	29	18	11	9.5	72	CL	22.9			
	75	6.0							20.9			
	75	8.5							10.3			
2019	78	0.0							34.1			
FILE	79	0.0							19.8			
	80	0.0							66.2			
핡	80	0.3							11.6			
뷥	81	0.0							11.0			
MAN	82	0.0							5.9			
:s-	83	0.0				25	25		11.2			
09:15	83	3.5							17.1			
LAB SUMMARY - PPI STO TEMPLE, GDT - 17/179 09:15 - S.; MASTER PROJECT FILE/2019/0K/CCHEROKEE NATION ENTRY-SPARK-SUBBORING LOGS/GPJ.	84	0.0							14.3			
<u>'</u>	85	1.0				19	67		17.2			
E.GE	85	3.0							15.8			
PLA	85	6.0							14.1			
I EM	85	8.0							10.7			
STD	85	9.5							6.0			
計	86	0.0							17.1			
MRY 	86	3.5							11.4			
NOMP NOMP	86	6.0							10.3			
ABS	87	1.0							8.6			

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PROJECT NO. 256748 Rev. 1

4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

PROJECT NAME National Cherokee Nation Park CLIENT Cherokee Nation Entertainment

F	11.00201 11.01 <u>20</u>	1	I	I	I			Tiert came	1			
	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	87	1.9							0.6			
	88	1.0							14.9			
9. P	88	3.5							1.6			
KOJECI FILEZZIJANOKUCHEROREE NATION EN 1-236/48-NATI CHEROREE NATION FARK-SUBBORING LOGS.GFD	89	1.0				19	62		19.5			
J S	89	3.0							16.6	114.9	7,768	
בק בק בק	89	6.0							12.2			
ρς 	89	8.0							10.6			
2	89	13.5							7.5			
ב ב	90	1.0							21.2			
	90	3.5	35	17	18				21.0			
֡֝֝֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֡֓֓֓֓֓֡֡֓֓֓֡֡֡֓֓֓֡֡֓֓֡֡֡֡	91	1.0							14.4			
	91	3.0							5.7			
[92	0.0							26.8			
	92	3.5							5.7			
ב ב ב	93	0.0							26.2			
	93	3.5							25.5			
<u> </u>	94	0.0							8.3			
07.40	94	3.5							4.6			
27-11	95	0.0							19.8			
	95	3.5				25	46		14.2			
	96	1.0	28	19	9				14.9			
	96	3.5							17.9			
	97	1.0							8.5			
	97	3.5							10.8			
5	98	0.0							15.2			
	98	3.5							27.1			
	99	1.0							5.4			
	99	3.5							3.5			
	100	0.0							13.9			
	100	3.5							24.4			
Ź	101	0.0							8.0			
j C	101	3.5							3.0			
60.	102	0.0							14.7			
8	103	0.0							24.9			
<u>:</u> [103	3.5							7.4			
i i	104.1	1.0							16.2			
SUMMARY - PPISID IEMPLAIE.GDI - //1/19 09:15 - 5:_MASIER P	104.1	2.3							3.6			
	105	1.0							10.1			
	105	3.5							12.9			
+	106	1.0							9.5			
ÄL	106	3.5							15.0			
	107	1.0				37.5	22		5.8			
LAB	107	3.5							5.7			

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

CLIENT Cherokee Nation Entertainment

PROJECT NO. <u>256748 Rev. 1</u>

PROJECT NAME National Cherokee Nation Park

	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	108	1.0	30	13	17	25	42	GC	12.5			
	108	3.0							16.6			
.GPJ	108	6.0							7.1			
900	108	8.5							3.7			
NG L	109	1.0							21.3			
PROJECT FILE/2019/OKICICHEROKEE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUBIBORING LOGS'BORING LOGS.GPJ	109	3.5							21.6			
068	110	1.0							21.9			
NGL	110	3.5							14.6			
30R	111	0.0							16.8			
SUB/	111	3.5							18.5			
ARK-	111	6.0							12.8			
N P	111	8.5							2.4			
ĭ	112	1.0							18.0			
	112	3.0							17.6			
ERO	113	0.0							18.7			
LCH	113	3.5	35	15	20				18.6	110.8	3,853	
Ϋ́	113	6.0							13.8			
6748	114	0.0							16.3			
T-25	114	3.5							20.5			
Ш Х	114	6.0							12.4			
ĕ	114	8.5							15.5			
	115	0.0							29.6			
ERO	115	3.5							20.8			
잉	115	6.0							20.5			
8	115	8.5							13.8			
72018	116	0.0							20.5			
	116	3.5							12.6			
ECI	116	6.0							1.9			
	117	0.0							20.0			
STER	117	3.5	42	19	23				11.5	128.0	5,800	
MA	117	6.0							12.3			
- S:\	117	8.5							21.9			
09:15	118	0.0							19.1			
/1/19	118	3.5							15.3			
<u>-</u> -[119	0.0							21.7			
E.G.	119	3.5							3.6			
PLA'	120	0.0							21.7			
LAB SUMMARY - PPI STD TEMPLATE.GDT - 7/1/19 09:15 - S:_MASTER	121	0.0							18.2	112.0	1,560	
IST	121	3.5	46	20	26				21.4			
<u>a</u>	121	6.0							18.9			
ÅRY 	121	8.5							11.4			
M M M	121	13.5							6.1			
ABS	122	0.0							21.9			

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4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

CLIENT Cherokee Nation Entertainment

PROJECT NAME National Cherokee Nation Park

PROJECT NO. 256748 Rev. 1 PROJECT LOCATION Sallisaw, OK

	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	123	0.0							19.6			
	123	3.5							9.5			
.GPJ	123	8.5							11.3			
LAB SUMMARY - PPI SID TEMPLATE GDT - 7/1/19 09:15 - 53; MASTER PROJECT FILEZOT9/OK/C/CHEROKEE NATION EN T-256/48-NATT CHEROKEE NATION PARK-SUBBORING LOGS/GPO	123	13.5							10.9			
	124	0.0							17.7			
BOR	124	3.5							9.9			
0.05S	124	8.5							4.3			
	125	0.0							21.6			
200	126	0.0	32	16	16				21.3			
90s	126	3.5							18.5	109.9	3,049	
¥ 	126	6.0							11.5			
	126	8.5							10.8			
<u>₹</u>	127	0.0							23.0			
1 1 1 1	127	3.5							14.6			
# Z	127	5.4							4.5			
<u> </u>	128	0.0							17.3			
¥ 	128	3.5							10.1			
26/40	128	6.0							8.0			
	128	8.5							7.0			
	129	0.0							29.4			
<u> </u>	129	3.5							18.8			
H H	129	8.5							14.7			
#L	129	13.5							15.5			
[2] [2]	130	0.0							26.0			
5	131	0.0							14.2			
	131	3.5							15.6			
<u> </u>	132	0.0							17.3			
	133	0.0							20.3			
Ž	133	3.5							18.3			
<u> </u>	133	8.5							18.3			
Ž ∴	134	0.0							6.4			
2	134	3.5							16.2			
60.6	134	6.0							15.7			
1/1/	134	8.5							13.8			
<u>-</u>	135	0.0							14.8			
	135	3.5							13.5			
MP[_	136	0.0							17.6			
	136	3.5							7.3			
	137	0.0							15.7			
<u> </u>	137	3.5							24.4			
MAK MAK	137	8.5							17.8			
NOS	137	13.5							11.8			
	138	0.0							11.9			



SUMMARY OF LABORATORY RESULTS

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CLIENT Cherokee Nation Entertainment

PROJECT NAME National Cherokee Nation Park

PROJECT NO. 25	56748 Rev. 1	PROJECT LOCATION	Sallisaw, Or
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	Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class- ification	Water Content (%)	Dry Density (pcf)	Cohe- sion (psf)	Void Ratio
	139	0.0							17.9			
	140	0.0							18.5			
.GPJ	141	0.0							20.5			
OGS	142	0.0							29.4			
NGL	146	0.0							4.4			
OGS/BORING LOGS	147	0.0		·					10.8			
OGS	148	0.0							15.6			

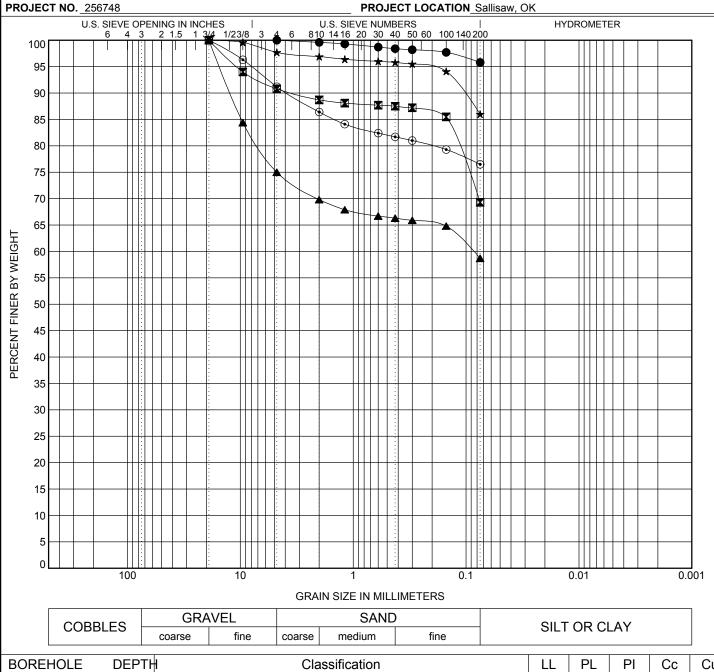
LAB SUMMARY - PPI STD TEMPLATE.GDT - 7/1/19 09:15 - S.\. MASTER PROJECT FILE\(\text{2019}\)\OKICCHEROKE NATION ENT-25678-NAT'L CHEROKEE NATION PARK-SUB\(\text{BORING}\)\DOS\(\text{BORING}\)\OKICCHEROKE NATION ENT-256748-NAT'L CHEROKEE NATION PARK-SUB\(\text{BORING}\)\OKICCHEROKE OF S\(\text{DORING}\)\OKICCHEROKE OF S\(\text{DORING}\)\OKICCHEROKE OF S\(\text{DORING}\)\OKICCHEROKE OF S\(\text{DORING}\)\OKICCHEROKE OF S\(\text{DORING}\)\OXID AND S\(



APPENDIX V - GRAIN SIZE ANALYSIS

4168 W. Kearney St. Springfield, MO 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

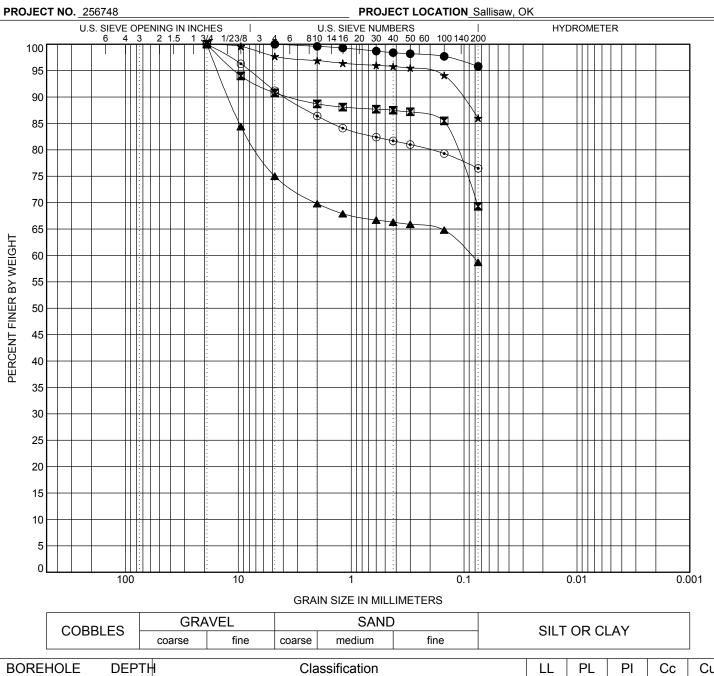
CLIENT Cherokee Nation Entertainment



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9 14:13 - 8	6		6.0)								Γ CL																					
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.:GDT	24		1.0	_								N C					<u> </u>												\vdash		_		
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GRAIN SIZE - PPI STD TEMPLATE.GDT - 3/19/1 \odot $ \star \star \star \bullet $ $ \star \bullet $ $ \star \bullet $	12		3.5	_	19														\dagger		9.2				21.		\dagger				69.3		
Ë. P.	19		1.0	-	19			0.0	87												25.				16.						58.7		
¥ SIZ	24		1.0		19																2.3				11.						86.0		
GR _A	31		3.5	5	19	9															8.8	8			14.	7					76.5	5	

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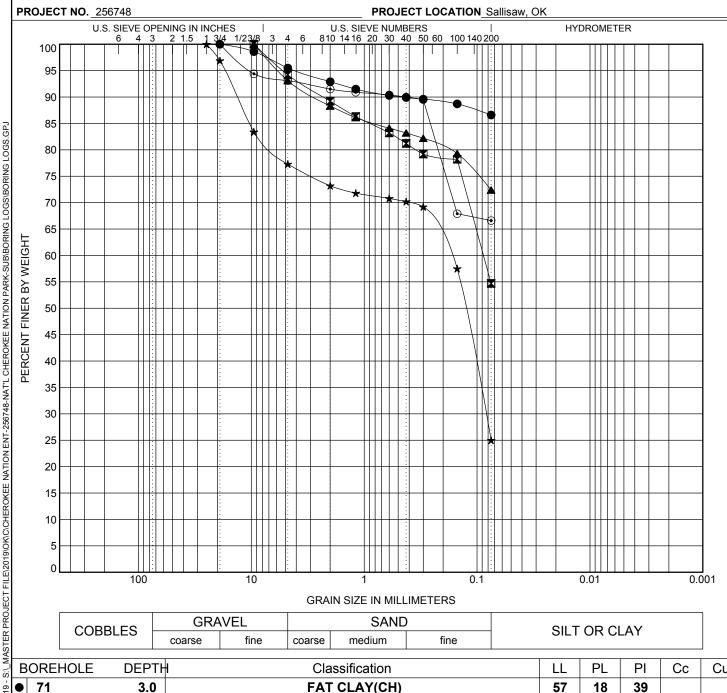


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ASTE	### ASTER PROJECT FILEZO19/OK/C/CHEROKEE NATION ENT-256748-NATI CHEROKEE NATION PARK-SUB/BORING LOGS/BORING LOGS/GPU 10 100 COBBLES COBBRES			coarse	oarse fine coarse medium fine																												
	BOREHOLE DEPTH						Classification									LL		F	L		PI		Сс	Cu									
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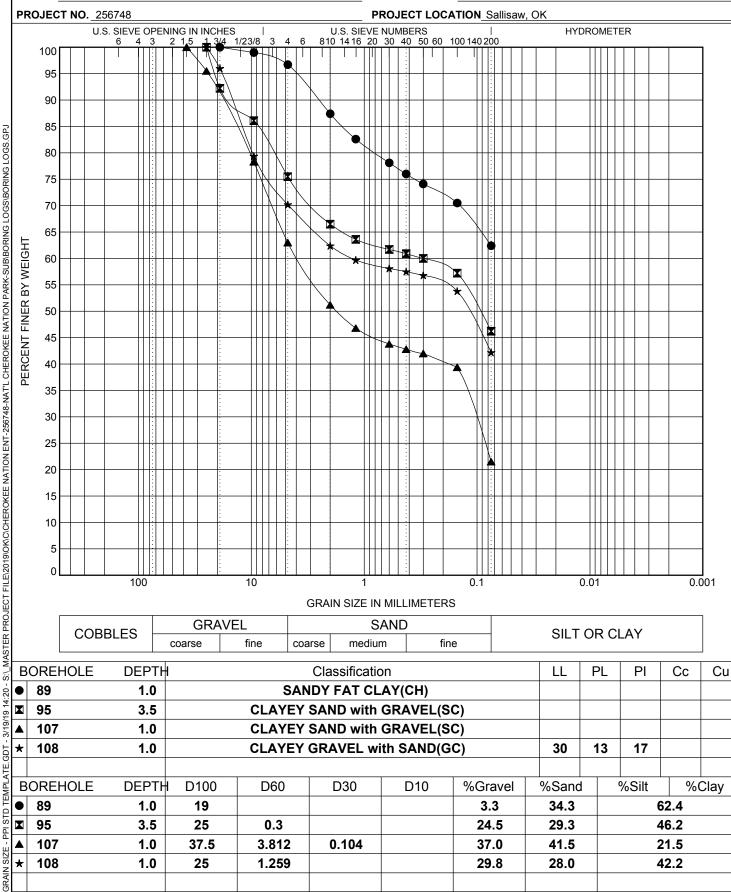


S:_	В	OREHOLE	DEPTH			Classification	on		LL	PL	PI	Сс	Cu
14:19 -	•	71	3.0			FAT CLAY(CH)		57	18	39		
19 14	X	73.2	0.0		SAN	DY LEAN C	LAY(CL)		27	18	9		
3/19/	•	75	3.5		LEAN	CLAY with	SAND(CL)		29	18	11		
GDT -	*	83	0.0		CLAYEY	SAND with	GRAVEL(S	SC)					
	•	85	1.0		SAN	IDY FAT CL	AY(CH)						
MPL/	В	OREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	d l	%Silt	%(Clay
D.TE	•	71	3.0	19				4.5	8.9		8	36.6	
PI STD		73.2	0.0	9.5	0.088			5.8	39.5		;	54.7	
Щ.	A	75	3.5	9.5				6.9	20.7		7	72.4	
N SIZE	*	83	0.0	25	0.174	0.083		22.7	52.3		2	25.0	
GRAIN	\odot	85	1.0	19				6.9	26.5			66.6	



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1	95	3.5		CLAYEY	SAND with	GRAVEL(S	SC)				
4	107	1.0		CLAYEY	SAND with	GRAVEL(S	SC)				
4	108	1.0		CLAYEY	GRAVEL wi	th SAND(G	SC)	30	13	17	
į											
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand		%Silt	%Clay
•	89	1.0	19				3.3	34.3		6	2.4
		3.5	25	0.3			24.5	29.3		4	6.2
4	107	1.0	37.5	3.812	0.104		37.0	41.5		2	1.5
14	108	1.0	25	1.259			29.8	28.0		4	2.2

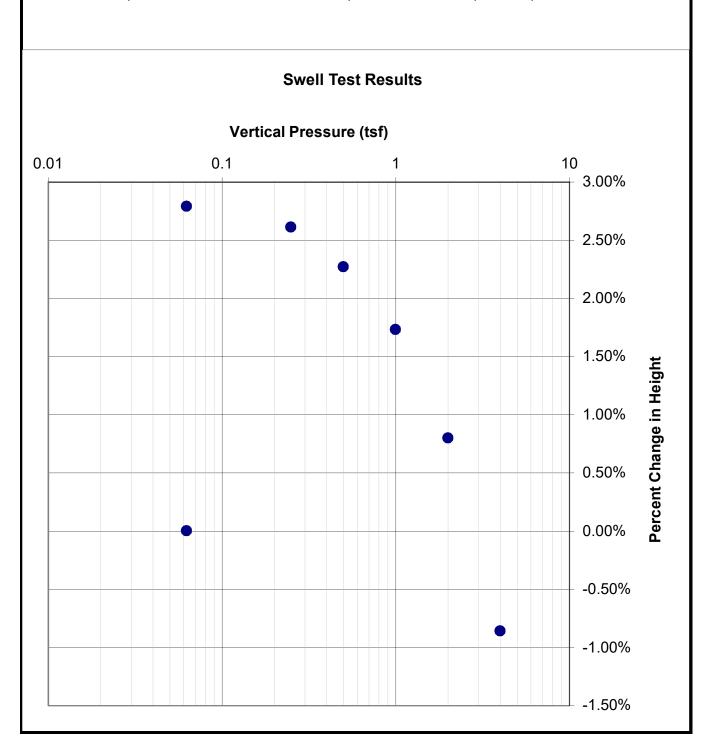


APPENDIX VI – SWELL TEST RESULTS

Palmerton & Parrish, Inc.

4168 W. Kearney St. - Springfield, MO 65803 Phone: (417) 864-6000 Fax: (417) 864-6004

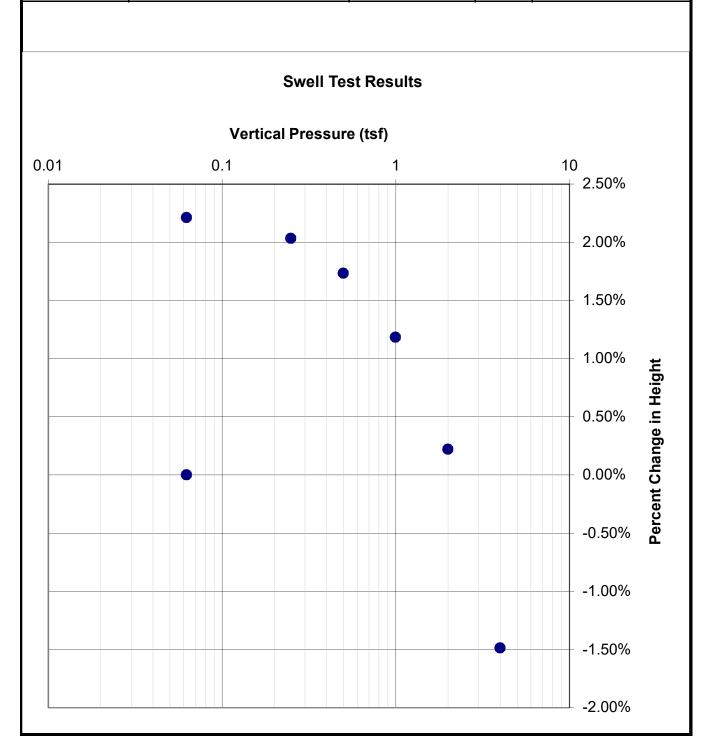
Client:	Cherokee Nation Entertainment	Dry Unit Wt lbs/cf	99.6	% Swell
Project:	National Cherokee Nation Park	Trimmings M%	24.5%	2.79%
Boring	B-4	Specimen M%	27.0%	2.19/0
Depth	8'-10'	Liquid Limit	54	Swell Pressure (TSF)
Description:		Plastic Limit	17	3.00 TSF
Description:		Plastic Index	37	3.00 19F



Palmerton & Parrish, Inc.

4168 W. Kearney St. - Springfield, MO 65803 Phone: (417) 864-6000 Fax: (417) 864-6004

Client:	Cherokee Nation Entertainment	Dry Unit Wt lbs/cf	105.8	% Swell
Project:	National Cherokee Nation Park	Trimmings M%	21.3%	2.21%
Boring	B-5	Specimen M%	22.3%	2.21/0
Depth	6'-8'	Liquid Limit	49	Swell Pressure (TSF)
Description:		Plastic Limit	16	2.30 TSF
Description.		Plastic Index	33	2.30 13F





APPENDIX VII - ROCK CORE PHOTOGRAPHS



Rock Core Photographs

4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com



Boring 86 8.4 feet to 18.4 feet



Boring 86 18.4 feet to 28.4 feet

PPI Project No. 256748 Page i



APPENDIX VIII - IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you - assumedly a client representative - interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared solely for the client. Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnicalengineering report did not read it in its entirety. Do not rely on an executive summary. Do not read selected elements only. Read this report in full.

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- · the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnicalengineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- · help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, but be certain to note conspicuously that you've included the material for informational purposes only. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, only from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and be sure to allow enough time to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated subsurface environmental problems have led to project failures. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. Geotechnical engineers are not building-envelope or mold specialists.



Telephone: 301/565-2733 e-mail: info@geoprofessional.org www.geoprofessional.org

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APPENDIX B ADDENDA

Addendum No. 1

NATIONAL CHEROKEE NATION PARK PHASE I SITE INFRASTRUCTURE IMPROVEMENTS

Bids Received Until: **5:00 pm Thursday, July 14, 2022**Cherokee Nation Businesses, LLC
777 W. Cherokee St.
Catoosa, Oklahoma 74015

This addendum modifies the plans and bid documents for the subject project and shall become a part of the contract documents. Bidders shall acknowledge receipt of this addendum in the bid schedule form and on the outside of your bid envelope. Failure to do so may subject bidder to disqualification.

Please note the following corrections, revisions and clarifications to the subject project bidding documents:

1. Final Plans

The Final Plans should be removed and replaced with "National Cherokee Nation Park – Final Plans – Addendum No. 1"

Final Plans have been revised, major changes are as follows:

- Added "Boat Launch Improvements" Final Plans as Added Alternate No. 1.
- Revisions to Planning and Landscape Architecture Plans.
- Added Dumpster Pads and Restroom Facilities Locations.
- Added utility services to center open space on western RV area.
- Added RV parking/pad space numbering for clarity.

2. Bid Proposal Schedule and Technical Specifications Booklet

The Bid Proposal Schedule and Technical Specifications Booklet should be removed and replaced with "National Cherokee Nation Park – Bid Proposal Schedule and Technical Specifications Booklet – Addendum No. 1"

Bid Proposal Schedule has been revised as noted below:

- Added "Section VI Added Alternate No. 1 Boat Ramp Improvements"
- Minor quantity updates in Sections I, II and III to reflect plan changes discussed in Item 1 of this addendum.

Technical Specifications have been revised as noted below:

- Added Boat Ramp Specifications
- Added Architectural Specifications

3. Bid Schedule - Total Contract Time

Total Contract Time has been updated to $\underline{600}$ calendar days for final completion, including $\underline{50}$ inclement weather days.

Please acknowledge the receipt of A	ddendum No. 1 on the outside	e of your Bid Envelope and in the
Bid Schedule form. Prepared By: Halff and Associates, Inc. Project Engineer	6/24/2022 Date	KEVIN J. GRONWALDT 32956
Receipt of This Addendum is Herel Company	oy Acknowledged:	— OAZAHOMI
Printed Name		
Signature	Date	

Addendum No. 2

NATIONAL CHEROKEE NATION PARK PHASE I SITE INFRASTRUCTURE IMPROVEMENTS

Bids Received Until: **5:00 pm Thursday, July 14, 2022** Cherokee Nation Businesses, LLC 777 W. Cherokee St. Catoosa, Oklahoma 74015

This addendum modifies the plans and bid documents for the subject project and shall become a part of the contract documents. Bidders shall acknowledge receipt of this addendum in the bid schedule form and on the outside of your bid envelope. Failure to do so may subject bidder to disqualification.

Please note the following corrections, revisions and clarifications to the subject project bidding documents:

- 1. Final Plans Remove the following sheets and replace with attached sheets revisions:
 - A. Demolition Plans Sheets C9 thru C11 and C13 thru C21
 - B. Paving Plans Sheet C24
 - C. Utility Plans Sheets C74, C78, C79, C82, and C85 thru C88
 - D. Erosion Control Plans Sheet C127
 - E. W/WW Treatment Plants and Pump Station Plans Sheets W1 thru W3, W7 thru W9, and W21 thru W30
 - F. Landscape Plans Sheets L01, L04, L08 thru L13, L15, and L16

These revisions address the following:

- Clearing limits and area for proposed water and sanitary sewer line installations.
- Tree protection and selective clearing in relation to proposed paving and utilities.
- PLA plan references in relation to entry/exit and roundabout paying.
- Notes to address discharge permit for WWTP.
- Miscellaneous WTP and WWTP notes and specification references.
- Minor Landscape updates
- 2. Bid Proposal Schedule and Technical Specifications Booklet

The "Bid Proposal Schedule – Addendum No. 1" should be removed and replaced with "National Cherokee Nation Park – Bid Proposal Schedule – Addendum No. 2"

Bid Proposal Schedule has been revised as noted below:

- Bid Item No. I-13 Quantity revised to 23,593 SF
- Bid Item No. I-15 Quantity revised to 492 SY

- Bid Item No. I-16 Quantity revised to 63 SY
- Bid Item No. I-17 Quantity revised to 52 SY
- Bid Item No. II-11 Quantity revised to 4,480 LF
- Bid Item No. I-47 Quantity revised to 5,000 SF
- Bid Item No. I-51 Added Bid Item for Restroom Facility Allowance

Add the attached Wastewater Treatment Plant Specifications to the Booklet

Add the following bid item specifications:

BID ITEM NO. I-47: 7-INCH THICK, 4,000 PSI STAINED AND STAMPED DECORATIVE REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

The work for "7-inch Thick, 4,000 psi Stained and Stamped Decorative Reinforced Portland Cement Concrete Pavement" pay item shall conform to the provisions of ODOT Specification Sections 414 and 701.

The bid quantity was established for bidding purposes only. Quantities for payment will be based on the amount of decorative pavement actually installed, complete in place.

Stained and stamped decorative concrete pavement shall be constructed in accordance with the lengths and widths as shown on the plans and shall be poured 7-inches thick with #3 bars on 24" centers.

Integral coloring shall be "Platinum" or "Natural Gray" or approved equal and shall be submitted and approved by the Owner prior to installation.

Patterning shall be "Ashlar" or "Cobble Stone" or approved equal and shall be submitted and approved by the Owner prior to installation.

In addition to the requirements of the standard specifications, decorative pavement shall be in accordance with the manufacturer specifications. This includes their requirements for expansion joints, joint filler board, and concrete mix.

All work performed must be of the same manufacturer and all materials used, including concrete mix, must be the same for the entire project. Color hardeners and release agents as recommended by the tooling manufacturer shall be used.

Measurement and Payment for 7-inch Thick, 4,000 psi Stained and Stamped Decorative Reinforced Portland Cement Concrete Pavement shall be by the square foot (SF) and shall include thickened edge, integral colored concrete, patterning, reinforcing steel, jointing, curing compound, sealing materials, labor, equipment, and incidentals necessary to complete the work.

BID ITEM NO. I-51: RESTROOM FACILITY ALLOWANCE

This bid item shall be used at the discretion of the Nation for payment for all materials, labor, and other incidentals necessary for the installation of a prefabricated restroom facility that will include men's, women's and family restrooms, laundry facility, at minimum three (3) shower rooms, one of which being ADA accessible, and maintenance area. Contractor shall provide submittal for proposed restroom facility for Nation and Engineer approval prior to commencing

installation. This item will only pay for work performed at the direction of the Nation and Engineer. Any work performed without authorization of the Nation shall not be paid under this bid item. At the completion of the project, funds not utilized in this item shall be removed from the contract agreement via a construction change order. The amount for this item shall be included with their bid and is set for all bidders at \$600,000 and is not to be altered.

- 3. The following are RFI's that came up during the "Questions and Answers" period and the responses given:
 - A. **Q:** Since this project is being governed by ODOT specs, will the asphalt be indexed? Will the price be firm or an escalation be allowed per the ODOT spec 411.06(B)?
 - **A:** For bidding purposes, these items will be bid as a <u>firm</u> unit price. This is a special provision allowed by ODOT when the contract pay units of measure are by ton. Since the modified provisions for measurement and payment provided with each Asphalt bid item are to measure and pay by <u>square yard</u>, ODOT 411.06(B)(2) Paragraph 2 states "when the units of measure in this contract for the items of work listed in the table do not correspond with the units shown in the table (i.e. Asphalt Concrete paid by the square yard, etc.), those items will not be subject to the terms of this special provision or any asphalt binder price adjustment." However, the Nation is open to considering indexed pricing and this can be discussed further at the preconstruction meeting.
 - B. Q: Please provide Silt Fence Quantity for the Phase 1 portion, it is provided for the Addendum 1 Boat Launch Improvements.
 A: Phase 1 silt fencing is bid differently than the Boat Launch Improvements. Silt fence quantities are provided on the Phase 1 plan sheets for reference, but silt fence quantity and cost is subsidiary to Bid Item No. I-4. Total Phase 1 plan quantity for silt fencing is approximately 8,950 linear feet.
 - C. Q: Please provide Geo-Tech Borehole Layout with current Site Plan.A: This will be considered for request through the Geotech consultant but will not be available during the bidding phase.
 - D. Q: Please provide Circles shown on the Demolition Plans on all sheets.
 A: This has been addressed in the revised demolition sheets provided with this addendum.
 - E. **Q:** Please provide specifications and plans for the demolition areas of the proposed SS and Water to be constructed outside of current Demolition Plan Sheets
 - **A:** This has been addressed in the revised demolition sheets provided with this addendum.
 - F. **Q:** Please provide CADD files.

A: CADD files will be made available after the bid opening to the awarded bidder. Files will not be provided during the bidding phase.

G. **Q:** Addendum 1 Plans show to remove concrete for an old set of bathrooms. Has the septic system for them been removed? And if not Please provide Specifications on how you would like them removed.

A: The septic system holding tank has been confirmed to have been removed previously by the Nation. If any part of the system or piping remains upon removal/excavation activities, existing lines shall be cut, plugged and abandoned in place at a cost subsidiary to the project.

- H. Q: Who is the regulation authority (ODEQ, EPA, etc..) on the Phase 1 and Addendum 1 areas inside the boundaries of the Cherokee Nation owned land and who is for the area on the C of E owned part in Addendum 1?
 A: The Cherokee Nation Environmental Protection Commission (EPC) for land inside the boundary line. United States Army Corps of Engineers (USACE) for land outside the boundary line. Nation EPC is actively engaged in coordination with the USACE on this project.
- I. Q: The Specification for Pay Item No. I-5 states it is to be paid out monthly. Will CN consider 100% payment up front? Can this be changed to match ODOT Specifications payment of two installments?
 A: The Nation is open to paying this bid-item 100% up-front. This can be discussed further at the preconstruction meeting.
- J. **Q:** Please update Quantities and Plans to show removal of gravel under pavement in areas to be graded.

A: Please refer to the specifications for Bid Items I-6, I-7, and I-20 thru I-22 for clarifications on subgrade removal under existing pavement to establish proposed grades.

- K. Q: Granite is stated on the Plans and Specifications may we substitute limestone?
 A: Yes, approved equals will be considered by the Nation and/or Engineer per Bid Items I-28 and I-29 specifications.
- L. Q: Please provide Striping Plans and Specifications for Phase 1.
 A: Any and all proposed striping or signage is shown on the Pavement Plans, see Bid Item I-40 in specifications booklet for further details.
- M. Q: Is Owner Providing all Quality Control Testing for Fill, Asphalt and Concrete? A: Yes, Nation will be handling testing.
- N. Q: Will the custom lettering be required as shown on the ODOT Storm Drain Detail located on sheet C134?A: No.

O. **Q:** What grade of oil (on asphalt) is required? PG 64-22 or other?

A: 64-22 minimum is required; RAP shall not be greater than 25%.

P. **Q:** Where is the staging area indicated?

A: Staging Area location(s) will be discussed and decided at the preconstruction meeting. Park land will be allowed for use.

Q. **Q:** Gasket & Bell restraint at all joints or bends only?

A: Jointing shall be per manufacturer recommendations and per requirements of AWWA as stated in the ODOT specifications.

R. **Q:** Is the Nation considering Cost Plus on materials only?

A: The Nation will evaluate this at the preconstruction meeting. The Nation is open to paying partial payment for materials on hand and then full payment once materials are installed complete in place.

S. **Q:** If Contractor brings any significant VE savings to the CN, will the contractor receive any percentage of the savings back?

A: The Nation will consider this as an option. Percentage to Contractor is currently TBD.

T. **Q:** General Note 6 on Sheet W1 states to place 12" of topsoil. The other Notes and Specifications throughout the Plans state 4", please clarify.

A: Topsoil shall be 4" throughout, not shall be revised.

U. **Q:** Please confirm discharge permit values. S&L can't provide a plant to meet an unknown discharge permit. Phase 1 and Phase 2 show Effluent Limits of 10 TSS mg/L and 15 BOD mg/L. Previously, we were told Effluent Limits of 30 TSS mg/L and 30 BOD mg/L; the plant shown W25 / W 26 / W 27 was designed 30/30. If the Effluent Limits are lower, it would require a larger and more expensive plant. Please confirm discharge permit values.

A: Target permit values will be 30 BOD / 30 TSS for bidding purposes.

V. **Q:** No specifications were provided that relate to the wastewater treatment plant. Please provide relevant sections.

A: WWTP specifications are provided with this addendum

W. Q: 12" or 16" overflow line [at Water Treatment Plant]?

A: 12"

X. **Q:** Model/Detail for Eyewash Station.

A: This will be provided with the specifications in this addendum.

Y. **Q:** Cookson Electric has not completed the design at this time for Main Line extension. Item B under General Site Plan Notes on sheet E001 cannot be performed, please advise.

A: Halff and the Nation are coordinating with Cookson Hills on this. This will be discussed further at the preconstruction meeting.

Z. Q: On Sheet E001, Electrical Legend the symbol for the RV Pedestals calls out for a NEMA 5-30R receptacle but most RV Pedestals have a type TT30R configuration. Please confirm that the desired receptacle type is a NEMA 5-30R.
A: The 30A receptacle is type TT as indicated in the Pedestal cut sheet and it's integrated in the Pedestal. See cutsheet for RV Pedestal:



U5200-XL-75



Catalog Number	U5200-XL-75 Cutout Size		One Single Pole 20 Ampere
Marketing Product Description	Unmetered Small Closing Plate TT30 1450 520GR Single Pedestal Direct Bury		Breaker and One Single Pole 30 Ampere Breaker and One Double Pole 50 Ampere Breaker
UPC	784572258198	Cable Entry	Underground
Length (IN)	5.188	Terminal	Double Mechanical
Width (IN)	8.688	Insulation	Glass Polyester
Height (IN)	64.5	Mounting	Pedestal
Brand Name	Milbank	Enclosure	G90 Galvanized Steel with
Туре	Unmetered Power Supply		Powder Coat Finish
Special Features	Single Pole 20 Ampere Breaker and Single Pole 30 Ampere Breaker and Double Pole 50 Ampere Breaker	Jaw Quantity	0 Terminals
		Bypass Type	No Bypass
		Number of Meter Positions	Single Power Head
Application	RV Power	Equipment Ground	2 Barrel Ground Lug and Ground Bar
Standard	UL Listed;Type 3R	III A Consider	
Voltage Rating	Up to 240 Volts Alternating	Hub Opening	Small Closing Plate
	Current	Line Side Wire Range	6 AWG - 350 kcmil
Amperage Rating	125 Continuous Ampere	Number Branch Circuits	2
Phase	1 Phase	Number Of Receptacles	3
Frequency Rating	60 Hertz	Receptacle Configuration	One NEMA 14-50 and One
Size	5.188L x 8.688W x 64.5H		NEMA TT30 and One NEMA 5-20 Ground Fault
Number Of Cutouts	3		

Please consult serving utility for their requirements prior to ordering or installing, as specifications and approvals vary by utility and may require local electrical inspector approval. All installations must be installed by a licensed electrician and must comply with all national and local codes, laws and regulations. Wilhbank reserves the right to make changes in specifications and features shown without notice or obligation.

AA. Q: The Unit Price Bid Schedule on Pay Item No. IV-16 gives a description of a MARINA PANELBOARD that is 100A MLO. There at MLO panelboards scheduled for the project. Is this intended to be Panel A: Yes, this is LP3A and per plans MCB.	
BB. Q: There is no electric metering shown for any of the electrical so Will this facility be primary metered or should each service be metered i accordance with Cookson Hills Electric Standards? A: This will be primary metered.	
CC. Q: May we grind all trees and shrubs under 6" in diameter? A: Yes.	
DD. Q: May we burn to dispose of removed trees, shrubs and brush? A: Yes.	
EE.Q: Can we substitute 6' T-Posts for the Lodgepole tree supports? A: No. Lodgepoles shall be used per plan details.	
FF. Q: Can we substitute industry standard straps for the Hemp ties? A: Yes.	
Please acknowledge the receipt of Addendum No. 2 on the outside of your Bid Envelope a Bid Schedule form.	and in the
Prepared By: Halff and Associates, Inc. 7/8/2022 Project Engineer Date	ENGINES
Receipt of This Addendum is Hereby Acknowledged:	SSS
Receipt of This Addendum is Hereby Acknowledged.	
Company	
Printed Name	

Date

Signature