Sabine River Authority of Texas

ADDENDUM NO. 2

Owner:	Sabine River Authority of Texas
Project:	N Bayou Rd & Bayou Fork Rd Roadway and Drainage Improvements - RFB 23-1210
Project No.:	SRA22771
Addendum No.	2
Addendum Date:	October 24, 2023

The following additions, deletions, changes, or clarifications to the proposal documents are hereby made a part of the originally issued documents for the above referenced project as fully and as completely as though the same were included therein. Offerors must acknowledge receipt of this Addendum in the space provided on the Bid Form, Article 5.03.

Approved by:	**Freese and Nichols, Inc.**
Name:	**Scott Kirby, P.E.**
Date:	**October 24, 2023**

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Sabine River Authority of Texas

Clarification:

Bid Item Number 6 – "Chip Seal" will consist of the following component parts:

- The Seal Coat will consist of ASPH(AC-20-5TR or AC-20XP) applied at 0.32 Gal/ SY and AGGR(Type-PB Gr-4 or Ty-PL Gr-4 SAC-A) applied at 1/130 CY/SY.
- Two (2) pass application of chip seal.
- Payment for Item 6 – "Chip Seal" will be made by the SY, which includes the seal coat and aggregate.

A copy of the Geotechnical Report has been attached for reference.

- The attached Geotechnical Report recommends a different pavement design from the plan set. The design of the roadway section was modified during value engineering. The report should be used for existing condition information only.

See Geotechnical Report Attached

[END OF ADDENDUM NO.2]

GEOTECHNICAL ENGINEERING REPORT

SRA TOLEDO BEND FISHING TOURNAMENT SITE

HEMPHILL, TEXAS

GEOTECHNICAL ENGINEERING REPORT

SRA Toledo Bend Fishing Tournament Site

Hemphill, Texas

Prepared by:

Riner Engineering, Inc.

Prepared for:

Freese and Nichols, Inc.
10497 Town and Country Way, Suite 500
Houston, Texas 77024

Attention: Mr. James “JB” Ferguson

March 22, 2023

RINER Project No. 22-0769

TEXAS ENGINEERING FIRM REGISTRATION NO. F-17076

Riner Engineering

GEOTECHNICAL AND MATERIALS ENGINEERING, TESTING AND INSPECTION

March 22, 2023

Mr. James "JB" Ferguson
Freese and Nichols, Inc.
10497 Town and Country Road, Suite 500
Houston, Texas 77024

Re: GEOTECHNICAL ENGINEERING REPORT
SRA Toledo Bend Fishing Tournament Site
Hemphill, Texas
RINER Project No. 22-0769

Dear Mr. Ferguson:

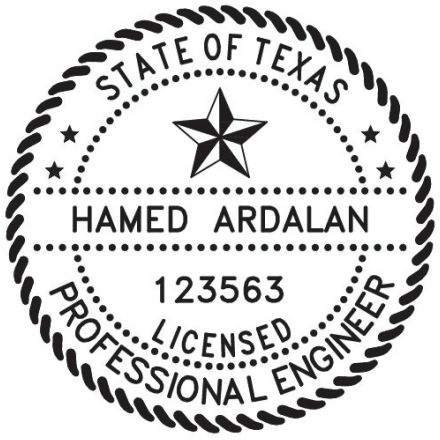
Riner Engineering, Inc. (RINER) is pleased to submit this Geotechnical Engineering Report for the referenced project. We appreciate the opportunity of working with you. Please contact us if you have any questions or require additional services.

Respectfully submitted,

Arif Mohammad Aziz

Arif Mohammad Aziz, M.S., E.I.T.
Project Engineer

Hamed Ardalan, Ph.D., P.E.
Vice President - Engineering Director



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Texas Engineering Firm Registration No. F-17076

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GEOTECHNICAL ENGINEERING REPORT

SRA Toledo Bend Fishing Tournament Site
Hemphill, Texas

1.0 INTRODUCTION

Project Location. The project alignment includes North Bayou Road from Old Sabinetown Road to Bayou Fork Road, Bayou Fork Road from North Bayou Road to Vantage Point Road, and Vantage Point Road from Bayou Fork Road to Bonnies Lane, in Hemphill, Texas. The general location and orientation of the site are provided in Appendix A - Project Location Diagrams.

Project Description. The project consists of the proposed replacement of approximately 3.75-miles gravel roadways with a two-lane asphalt pavement.

Project Authorization. This geotechnical investigation was authorized by Ms. Stephanie Stephenson with Freese and Nichols, Inc. and performed in accordance with RINER Proposal No. P22-0763 dated September 8, 2022.

Purpose and Methodology. The principal purposes of this investigation were to evaluate the general soil conditions at the proposed site and to develop geotechnical engineering design recommendations. To accomplish its intended purposes, the study was conducted in the following phases:

1. Drill sample borings to evaluate the soil conditions at the boring locations and to obtain soil samples;
2. Conduct laboratory tests on selected samples recovered from the borings to establish the pertinent engineering characteristics of the soils; and
3. Perform engineering analyses, using field and laboratory data, to develop design criteria.

Required Review. Detailed design plans and traffic information were not available at the time of preparation of this report. Recommendations in our report are contingent upon RINER reviewing and approving in writing the following design items prior to construction:

- Site grading plan,
- Detailed traffic information, and
- Detailed plans and cross-sections of the pavement.

Cautionary Statement Regarding Use of this Report. As with any geotechnical engineering report, this report presents technical information and provides detailed technical recommendations for civil and structural engineering design and construction purposes.

RINER, by necessity, has assumed the user of this document possesses the technical acumen to understand and properly utilize the information and recommendations provided herein. RINER strives to be clear in its presentation and, like the user, does not want potentially detrimental misinterpretation or misunderstanding of this report. Therefore, we encourage any user of this report with questions regarding its content to contact RINER for clarification. Clarification will be provided verbally and/or issued by RINER in the form of a report addendum, as appropriate.

Report Specificity. This report was prepared to meet the specific needs of the client for the specific project identified. Recommendations contained herein should not be applied to any other project at this site by the client or anyone else without the explicit approval of RINER.

2.0 FIELD INVESTIGATION

Subsurface Investigation. The subsurface investigation for this project is summarized in the following table. Boring locations are provided in Appendix B - Boring Location Diagram.

Boring Nos.	Depth, feet bgs[1]	Date Drilled	Location[2]
B-01 to B-40	10	11/14/2022 to 11/15/2022	Along the Alignment of Proposed Asphalt Roadways

Notes:
1. bgs = below ground surface
2. Boring locations provided in Appendix B - Boring Location Diagram should be considered approximate. Boring locations of B-01 to B-29 were surveyed after the drilling operations were completed. Survey data for borings B-01 to B-29 presented in the boring logs provided in Appendix C - Boring Logs and Laboratory Results are as provided by the client in PNEZD format.

Boring Logs. Subsurface conditions were defined using the sample borings. Boring logs generated during this study are included in Appendix C - Boring Logs and Laboratory Results. Borings were advanced between sample intervals using continuous flight auger drilling procedures.

Cohesive Soil Sampling. Cohesive soil samples were generally obtained using Shelby tube samplers in general accordance with American Society for Testing and Materials (ASTM) D1587. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the undisturbed soils by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency using a hand penetrometer, sealed, and packaged to maintain "in situ" moisture content.

Consistency of Cohesive Soils. The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the undisturbed sample at a constant rate to a depth of 0.25-inch. The results

of these tests are tabulated at the respective sample depths on the boring logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+.

Granular Soil Sampling. Granular soil samples were generally obtained using split-barrel sampling procedures in general accordance with ASTM D1586. In the split-barrel procedure, a disturbed sample is obtained in a standard 2-inch outside diameter (OD) split barrel sampling spoon driven 18-inches into the ground using a 140-pound (lb) hammer falling freely 30 inches. The number of blows for the last 12-inches of a standard 18-inch penetration is recorded as the Standard Penetration Test resistance (N-value). The N-values are recorded on the boring logs at the depth of sampling. Samples were sealed and returned to our laboratory for further examination and testing.

Groundwater Observations. Groundwater observations are shown on the boring logs.

Borehole Plugging. Upon completion of the borings, the boreholes were backfilled from the top and plugged at the surface soil cuttings.

3.0 LABORATORY TESTING

RINER performs visual classification and any of a number of laboratory tests, as appropriate, to define pertinent engineering characteristics of the soils encountered. Tests are performed in general accordance with ASTM or other standards and the results included at the respective sample depths on the boring logs or separately tabulated, as appropriate, and included in Appendix C - Boring Logs and Laboratory Results. Laboratory tests and procedures routinely utilized, as appropriate, for geotechnical investigations are tabulated in the following table.

Test Procedure	Description
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D1140	Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D1883	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D2166	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
ASTM D2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2217	Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Test Procedure	Description
ASTM D2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D4220	Standard Practices for Preserving and Transporting Soil Samples
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
Manufacturer's Instructions	Soil Strength Determination Using a Torvane

4.0 SITE CONDITIONS

4.1 General

Site Photographs. Representative photographs of the site at the time of this investigation are provided in "Appendix D - Site Photographs".

Geologic Formation. Based on available surface geology maps and our experience, it appears this site is located in the Yegua Formation, Cook Mountain Formation, Sparta Sand, and Carrizo Sand near mapped contact with Terrace Deposits. A geologic atlas and USGS formation description are provided in "Appendix E – Geologic Information". Soils within the Yegua Formation can generally be characterized as clay with minor beds of sandstone. Soils within the Cook Mountain Formation can generally be characterized as sand, marl, clay, and limestone. Soils within the Sparta Sand and Carrizo Sand Formation can generally be characterized as sand and clay. Soils within the Terrace Deposits can generally be characterized as silt, sand, gravel, and clay.

Geologic Faults. A geologic fault study was beyond the scope of this investigation.

4.2 Soil

Stratigraphy. Descriptions of the various strata and their approximate depths and thickness per the Unified Soil Classification System (USCS) are provided on the boring logs included in "Appendix C - Boring Logs and Laboratory Results". Terms and symbols used in the USCS are presented in "Appendix F – Unified Soil Classification System". A summary of the stratigraphy indicated by the borings is provided in the following table.

Generalized Subsurface Conditions Along the Alignment of Proposed Asphalt Roadways (Borings B-01 to B-40)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	2- to 4.5-inches	BASE	2- to 4.5-Inch BASE.
2- to 4.5-inches	2	SAND AND CLAY FILL	Soft to hard FAT CLAY (CH) / FAT CLAY WITH SAND (CH) / SANDY FAT CLAY (CH) FILL, stiff to hard SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) FILL, very stiff CLAYEY SAND (SC) FILL, and SILTY, CLAYEY SAND (SC-SM) FILL.
2	10	VARIABLE CLAY AND SAND	Medium Dense to dense SILTY SAND (SM), soft to hard CLAYEY SAND (SC), soft to hard SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL), and soft to hard SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) / FAT CLAY (CH).
Note: Boring Termination Depth = 10 feet bgs.			

Moisture Change Susceptibility of Near Surface Soils. The sandy/silty soils encountered at and near the ground surface at this site are very susceptible to changes in moisture. The presence of surface water due to precipitation or groundwater may result in a decrease in the ability to compact and work with the soil. It is common for these soils to pump when subjected to high levels of moisture. In addition, these soils located at and near the ground surface will allow surface water to infiltrate until the water becomes perched on a less permeable layer at depth. Soils of this type are especially prone to requiring the implementation of wet weather/soft subgrade recommendations provided in this report.

Swell Potential based on Atterberg Limits. Atterberg (plastic and liquid) limits were performed on 42 shallow clayey soil samples obtained at depths between 0- and 8-feet bgs. The plasticity index of the samples was between 16 and 74 with indicating that the clayey soils have a moderate to high potential for shrinking and swelling with changes in soil moisture content.

4.3 Groundwater

Groundwater Levels. The borings were advanced using auger drilling and intermittent sampling methods in order to observe groundwater seepage levels. Groundwater levels encountered in the borings during this investigation are identified in the following table.

Boring No.	Depth Groundwater Initially Encountered (feet, bgs)	Groundwater Depth after 15 Minutes (feet, bgs)
B-01 to B-40	Not Encountered	Not Measured

Long-term Groundwater Monitoring. Long-term monitoring of groundwater conditions via piezometers was not performed during this investigation and was beyond the scope of this study. Long-term monitoring can reveal groundwater levels materially different than those encountered during measurements taken while drilling the borings.

Groundwater Fluctuations. Future construction activities may alter the surface and subsurface drainage characteristics of this site. It is difficult to accurately predict the magnitude of subsurface water fluctuations that might occur based upon short-term observations. The groundwater level should be expected to fluctuate throughout the years with variations in precipitation.

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Potential Vertical Soil Movements

TxDOT Method Tex-124-E. Potential Vertical Rise (PVR) calculations were performed in general accordance with the Texas Department of Transportation (TxDOT) Method Tex-124-E. The Tex-124-E method is empirical and is based on the Atterberg limits and moisture content of the subsurface soils. The calculated PVR is an empirical estimate of a soil's potential for swell based upon the soil's plasticity index, applied loading (due to structures or overburden), and antecedent moisture condition. The wetter a soil's antecedent moisture condition, the lower its calculated PVR will be for a given plasticity index and load. However, soil with a higher antecedent moisture content will be more susceptible to shrinkage due to drying. Maintaining a consistent moisture content in the soil is the key to minimizing both heave and shrinkage related structural problems.

Calculated PVR using TxDOT Method Tex-124-E. PVR calculations were performed in general accordance with the Texas Department of Transportation (TxDOT) Method Tex-124-E. The Tex-124-E method is empirical and is based on the Atterberg limits and moisture content of the subsurface soils. The calculated PVR is an empirical estimate of a soil's potential for swell based upon the soil's plasticity index, applied loading (due to structures or overburden), and antecedent moisture condition. The PVR calculated using TxDOT Method Tex-124-E is about 1- to 2.5-inches assuming an average to wet antecedent moisture condition. The calculated PVR is consistent with soil moisture conditions at the time this investigation was conducted. An 8-feet zone of seasonal moisture variation was used in our analysis based on local experience.

5.2 Construction Excavations

Applicability. Recommendations in this section apply to short-term construction-related excavations for this project.

Sloped Excavations. All sloped short-term construction excavations on-site should be designed in accordance with Occupational Safety and Health Administration (OSHA) excavation standards. Borings from this investigation indicated that the soils may be classified per OSHA regulations as Type C from the ground surface to a depth of 10-feet bgs. Short-term construction excavations may be constructed with a maximum slope of 1.5:1, horizontal to vertical (H:V), to a depth of 10-feet bgs. If excavations are to be deeper than 10-feet, we should be contacted to evaluate the excavation. Recommendations provided herein are not valid for any long-term or permanent slopes on-site.

Shored Excavations. As an alternative to sloped excavations, vertical short-term construction excavations may be used in conjunction with trench boxes or other shoring systems. Shoring systems should be designed using an equivalent fluid weight of 85 pcf above the groundwater table and 105 pcf below the groundwater table. Surcharge pressures at the ground surface due to dead and live loads should be added to the lateral earth pressures where they may occur. Lateral surcharge pressures should be assumed to act as a uniform pressure along the upper 10-feet of the excavation based on a lateral earth coefficient of 0.5. Surcharge loads set back behind the excavation at a horizontal distance equal to or greater than the excavation depth may be ignored. We recommend that no more than 200-feet of unshored excavation should be open at any one time to prevent the possibility of failure and excessive ground movement to occur. We also recommend that unshored excavations do not remain open for a period of time longer than 24-hours.

Limitations. Recommendations provided herein assume there are no nearby structures or other improvements which might be detrimentally affected by the construction excavation. Before proceeding, we should be contacted to evaluate construction excavations with the potential to affect nearby structures or other improvements.

Excavation Monitoring. Excavations should be monitored to confirm site soil conditions consistent with those encountered in the borings drilled as part of this study. Discrepancies in soil conditions should be brought to the attention of RINER for review and revision of recommendations, as appropriate.

5.3 Groundwater Control

Groundwater was not encountered during the subsurface investigation. If groundwater is encountered during excavation, dewatering to bring the groundwater below the bottom of excavations may be required. Dewatering could consist of standard sump pits and pumping procedures, which may be adequate to control seepage on a local basis during excavation. Supplemental dewatering will be required in areas where standard sump pits and pumping is not effective. Supplemental dewatering could include submersible pumps in slotted casings, well points, or eductors. The contractor should submit a groundwater control plan, prepared by a licensed engineer experienced in that type of work.

5.4 Earthwork

5.4.1 Site Preparation

In the area of improvements, all concrete, trees, stumps, brush, debris, septic tanks, abandoned structures, roots, vegetation, rubbish and any other undesirable matter should be removed and properly disposed. All vegetation should be removed and the exposed surface should be scarified to an additional depth of at least 6 inches. It is the intent of these recommendations to provide a loose surface with no features that would tend to prevent uniform compaction by the equipment to be used.

5.4.2 Proofroll

Paving subgrades should be proofrolled with a fully loaded tandem axle dump truck or similar pneumatic-tire equipment to locate areas of loose subgrade. In areas to be cut, the proofroll should be performed after the final grade is established. In areas to be filled, the proofroll should be performed prior to fill placement. Areas of loose or soft subgrade encountered in the proofroll should be removed and replaced with engineered fill, moisture conditioned (dried or wetted, as needed) and compacted in place.

5.4.3 Grading and Drainage

Every attempt should be made to limit the extreme wetting or drying of the subsurface soils because swelling and shrinkage of these soils will result. Standard construction practices of providing good surface water drainage should be used. A positive slope of the ground away from any pavement should be provided. Ditches or swales should be provided to carry the run-off water both during and after construction.

Root systems from trees and shrubs can draw a substantial amount of water from the clay soils at this site, causing the clays to dry and shrink. This could cause settlement beneath

grade-supported slabs such as walks and paving. Trees and large bushes should be located a distance equal to at least one-half their anticipated mature height away from pavements.

5.4.4 Wet Weather/Soft Subgrade

Soft and/or wet surface soils may be encountered during construction, especially following periods of wet weather. Wet or soft surface soils can present difficulties for compaction and other construction equipment. If specified compaction cannot be achieved due to soft or wet surface soils, one of the following corrective measures will be required:

1. Removal of the wet and/or soft soil and replacement with select fill,
2. Chemical treatment of the wet and/or soft soil to improve the subgrade stability, or
3. If allowed by the schedule, drying by natural means.

Chemical treatment is usually the most effective way to improve soft and/or wet surface soils. RINER should be contacted for additional recommendations if chemical treatment is planned due to wet and/or soft soils.

5.4.5 Fill

Select Fill. The select fill should have a Liquid Limit less than 35 and Plasticity Index between 8 and 20. The select fill should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per Tex-113-E) and at a moisture content within ±2 percentage points of optimum.

Lime-treated Native Clay Soil. Based on the laboratory testing conducted for this investigation, the native clay on-site soils will not meet specifications for select fill outlined in the section titled “Fill”. As an alternative to importing select fill, the native clay soil may be blended with lime to reduce the plasticity index to meet select fill requirements. Based on our experience, we expect that it will require between 3- and 8-percent lime (by dry unit weight) to reduce the plasticity index of the native clay soils to select fill requirements. Prior to selecting this alternative, lime series tests should be performed to assess the amount of lime required.

Fill Restrictions. Select fill l should consist of those materials meeting the requirements stated. Select fill and general fill should not contain material greater than 4-inches in any direction, debris, vegetation, waste material, environmentally contaminated material, or any other unsuitable material.

Unsuitable Materials. Materials considered unsuitable for use as select fill or general fill include low and high plasticity silt (ML and MH), silty clay (CL-ML), organic clay and silt (OH and OL) and highly organic soils such as peat (Pt). These soils may be used for site grading and restoration in unimproved areas as approved by the Geotechnical Engineer. Soil placed

in unimproved areas should be placed in loose lifts not exceeding 10-inches and should be compacted to at least 92 percent maximum dry density (per ASTM D-698) and at a moisture content within ±4 percentage points of optimum.

5.4.6 Testing

Required Testing and Inspections. Construction monitoring services must be provided for all construction activities according to TxDOT specifications. We recommended that at least three compaction tests (i.e. field density and moisture content test) be performed for every 1,000 linear feet of roadway per lift, per day.

Liability Limitations. Since proper field inspection and testing are critical to the design recommendations provided herein, RINER cannot assume responsibility or liability for recommendations provided in this report if construction inspection and/or testing is performed by another party.

5.5 Demolition Considerations

Applicability. Recommendations in this section apply to the removal of any existing utilities or pavement which may be present on this site.

General. Special care should be taken in the demolition and removal of existing utilities and pavements to minimize disturbance of the subgrade. Excessive disturbance of the subgrade resulting from demolition activities can have serious detrimental effects on planned paving elements.

Existing Utilities. Existing utilities and bedding to be abandoned should be completely removed. Existing utilities and bedding may be abandoned in place if they do not interfere with planned development. Utilities which are abandoned in place should be properly pressure-grouted to completely fill the utility.

Backfill. Excavations resulting from the excavation of existing foundations and utilities should be backfilled in accordance with Section 5.4.5 - Fill.

Other Buried Structures. Other types of buried structures (wells, cisterns, etc.) could be located on the site. If encountered, RINER should be contacted to address these types of structures on a case-by-case basis.

5.6 Loading on Buried Structures

Uplift. Buried water-tight structures are subjected to uplift forces caused by differential water levels adjacent to and within the structure. Soils with any appreciable silt or sand content will likely become saturated during periods of heavy rainfall and the effective static water level will be at the ground surface. For design purposes, we recommend the groundwater level be assumed at the ground surface. Resistance to uplift pressure is provided by soil skin friction and the dead weight of the structure. Skin friction should be neglected for the upper 3 feet of soil. A skin friction of 200 pounds per square foot (psf) may be used below a depth of 3 feet.

Lateral Pressure. Lateral pressures on buried structures due to soil loading can be determined using an equivalent fluid weight of 105 pcf. This includes hydrostatic pressure but does not include surcharge loads. The lateral load produced by a surcharge may be computed as 50 percent of the vertical surcharge pressure applied as a constant pressure over the full depth of the buried structure. Surcharge loads located a horizontal distance equal to or greater than the buried structure depth may be ignored.

Vertical Pressure. Vertical pressures on buried structures due to soil loading can be determined using an equivalent fluid weight of 125 pcf. This does not include surcharge loads. The vertical load produced by a surcharge may be computed as 100 percent of the vertical surcharge pressure applied as a constant pressure over the full width of the buried structure.

5.7 Buried Pipe

Applicability. Recommendations in this section are applicable to the design of buried piping placed by open cut methods associated with this project.

Pressure on Buried Pipe. Design recommendations provided in the "Loading on Buried Structures" section of this report apply to buried piping.

Thrust Restraints. Resistance to lateral forces at thrust blocks will be developed by friction developed along the base of the thrust block and passive earth pressure acting on the vertical face of the block. We recommend a coefficient of base friction of 0.23 along the base of the thrust block. Passive resistance on the vertical face of the thrust block may be calculated using the allowable passive earth pressures presented in the following table.

Allowable Passive Earth Pressure by Material Type	
Material	Allowable Passive Pressure (psf)
Sand	100 x Depth in Feet
Native Clay and Clayey Sand	2,000
Compacted Clay Fill	1,500
Note: Passive resistance should be neglected for any portion of the thrust block within 3 feet of the final site grade. The allowable passive resistance for native clays and clayey sand is based on the thrust block bearing directly against vertical, undisturbed cuts in these materials.	

Bedding and Backfill. Pipe bedding and pipe-zone backfill for the water and sanitary sewer piping should be in accordance with TxDOT standard specification Item 400 or the local equivalent. The pipe-zone consists of all materials surrounding the pipe in the trench from six (6) inches below the pipe to 12 inches above the pipe.

Trench Backfill. Excavated site soils will be utilized to backfill the trenches above the pipe-zone. Backfilled soil should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per ASTM D-698) and at a moisture content between optimum and 4 percent above optimum moisture content.

Trench Settlement. Settlement of backfill should be anticipated. Even for properly compacted backfill, fills in excess of 8 to 10 feet are still subject to settlements over time of about 1 to 2 percent of the total fill thickness. This level of settlement can be significant for fills beneath streets. Therefore, close coordination and monitoring should be performed to reduce the potential for future movement.

5.8 Flexible Pavement Recommendations

General. Recommendations for flexible pavement and preparation of the pavement subgrade are provided in the following sections. We understand the proposed roadway will consist of 2 lanes (one lane in each direction).

Traffic Information. Based on the provided information, we understand the proposed asphalt roadways will generally be serving residential properties and will generally be subject to automobiles, light to medium trucks, RVs, and boat trailers. We understand the heavy (18-wheel) truck traffic on these roadways will be minimal. A traffic study indicating the number and type of vehicles on which to base the pavement design was not provided at the time of writing this report. Therefore, our recommendations are based upon our experience with similar projects assuming normal vehicular loading. ***Any unusual loading conditions should be brought to our attention prior to finalizing the pavement design so that we may assess and modify our recommendations as necessary.***

5.8.1 Flexible Pavement

Flexible Pavement Design Parameters. The following design parameters were assumed in our pavement analysis and design. The assumed values are based on the AASHTO 1993 Pavement Design Guideline and our experience with similar projects.

Flexible Pavement Design Parameters	
Item	Description/Value
Pavement Design Life	20 years
Subgrade Soils	LEAN TO FAT CLAY AND SAND
Reliability	90%
Drainage Coefficient	1.0 (1)
Overall Standard Deviation	0.45
Initial Serviceability	4.20
Terminal Serviceability	2.00
Subgrade Resilient Modulus	4,000 psi
Layer Coefficient for Asphalt Layer	0.44
Layer Coefficient for Crushed (Graded) Stone Base	0.14
Layer Coefficient for Chemically Stabilized Subgrade Soil [2]	0.11

Notes:

1. Drainage coefficient is based on the assumption that good drainage quality prevails over the life of the pavement and that the pavement structure is exposed between 5 to 25 percent of the time to moisture levels approaching saturation.
2. Recommendations for subgrade stabilization reagent are provided in section 5.8.2 Pavement Subgrade.

Flexible Pavement Section. The following asphalt pavement sections (2 options) are recommended for the project per AASHTO 1993 Pavement Design Guideline and our experience with similar projects.:

Flexible Pavement Sections				
Option	Equivalent Single Axle Loads (ESALs) per Design Lane	Equivalent Number of Loaded Heavy (18-wheel) Truck Passes per Day per Direction	Material	Thickness (in.)
I	166,000	9	Type C Asphalt Layer	2.0
			Crushed (Graded) Stone Base	10.0
			Chemically Stabilized Subgrade Soil	8.0
II	400,000	22	Type C Asphalt Layer	3.0
			Crushed (Graded) Stone Base	10.0
			Chemically Stabilized Subgrade Soil	8.0

Note:

1. Asphaltic concrete pavement should comply with TxDOT Standard Specifications, Item 340, "Dense-Graded Hot-Mix Asphalt (Method)", or local equivalent.
2. The base course should comply with TxDOT Standard Specifications, Item 247, Grade 1-2, Type A, "Flexible Base", or equivalent.
3. Recommendations for subgrade stabilization reagent are provided in section 5.8.2 Pavement Subgrade.
4. Prime Coat is needed between flexible base and asphalt layers.
5. Tack Coat is needed between every HMA lifts.

Alternate Flexible Pavement Section. In the above provided flexible pavement sections, the 8-inch chemically stabilized subgrade can be substituted with a Tensar TriAx TX 5 Geogrid or equivalent placed under the base course (over the subgrade soil). **The prepared subgrade soil should be proof rolled no earlier than 72 hours prior to placement of the geogrid.**

5.8.2 Pavement Subgrade

Potential Vertical Soil Movements. We have assumed that site treatment will not be performed within the pavement areas for this project. As a result, pavements will be subjected to the calculated PVR for this site. Based on the information gathered during this investigation, a pavement constructed on-grade will be subject to potential vertical movements of 1 to 2.5-inches. Because heave is generally associated with a source of water, it can occur differentially. Edge lift, excessive cracking, corner breaks, and poor ride quality are just a few of the many examples of pavement issues that can occur when in-situ PVR values are high. We should be contacted to provide PVR mitigation strategies to help reduce potential movements if desired. Strategies available for reducing potential soil movements include soil stabilization with lime or cement, removal of the on-site expansive soils and replacement with select fill.

Subgrade Preparation. Fat clay, lean clay, clayey sand, and silty, clayey sand are expected to be encountered or exposed at pavement subgrade. The pavement subgrade should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per Tex-113-E) and at a moisture content within ±2 percentage points of optimum.

Where clayey soils are encountered, we recommend the subgrade be stabilized using the following:

Reagent	Application Rate (Pounds per square yard)	Application Depth (inches)
Lime	36	8

Lime stabilization should be performed in accordance with TxDOT Standard Specifications, Item 260, "Lime Stabilized Subgrade", or local equivalent.

Where sandy and silty soils are encountered, we recommend the subgrade be stabilized using either of the following:

Reagent	Application Rate (Pounds per square yard)	Application Depth (inches)
Portland Cement	31	8
70% Flyash/30% Lime Blend	48	8

Cement stabilization should be performed in accordance with TxDOT Standard Specifications, Item 275, "Portland Cement Treated Materials" or local equivalent, and lime-fly ash stabilization should be performed in accordance with TxDOT Standard Specifications, Item 265, "Lime-Fly Ash Treatment of Materials Used as Subgrade" or local equivalent.

This 8-inches of treatment is a required part of the pavement design and is not a part of site and subgrade preparation for wet/soft subgrade conditions.

Alternate Subgrade Preparation. Cement Stabilized sand may be used for as a substitute for in-place stabilized subgrade soil. Cement stabilized sand mixture should consist of not less than 1.5 sacks of Portland Cement per ton of material mixture. Cement stabilized sand should conform to the Harris County Specification Item 433, "Cement Stabilized Sand Bedding and Backfill Material" or local equivalent.

6.0 GENERAL COMMENTS

Data Assumptions. By necessity, geotechnical engineering design recommendations are based on a limited amount of information about subsurface conditions. In the analysis, the geotechnical engineer must assume subsurface conditions are similar to those encountered in the borings. The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of the field investigation and on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the borings at the time they were completed.

Subsurface Anomalies. Anomalies in subsurface conditions are often revealed during construction. If during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present in excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

Change of Conditions. If there is a substantial lapse of time between submission of this report and the start of the work at the site, if conditions have changed due either to natural causes or to construction operations at or adjacent to the site, or if structure locations, structural loads or finish grades are changed, we should be promptly informed and retained to review our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse.

Design Review. Recommendations in our report are contingent upon RINER reviewing and approving in writing the following design items prior to construction:

- Site grading plan,
- Detailed traffic information, and
- Detailed plans and cross-sections of the pavement.

Construction Materials Testing and Inspection. RINER should be retained to observe earthwork and foundation installation and perform materials evaluation and testing during the construction phase of the project. This enables RINER's geotechnical engineer to stay abreast of the project and to be readily available to evaluate unanticipated conditions, to conduct additional tests if required and, when necessary, to recommend alternative solutions to unanticipated conditions. It is proposed that construction phase observation and materials testing commence by the project geotechnical engineer (RINER) at the outset of the project. Experience has shown that the most suitable method for procuring these services is for the owner to contact directly with the project geotechnical engineer. This results in a clear, direct line of communication between the owner and the owner's design engineers and the geotechnical engineer.

Report Recommendations are Preliminary. Until the recommended construction phase services are performed by RINER, the recommendations contained in this report on such items as final foundation bearing elevations, final depth of undercut of expansive soils for non-expansive earth fill pads and other such subsurface-related recommendations should be considered as preliminary.

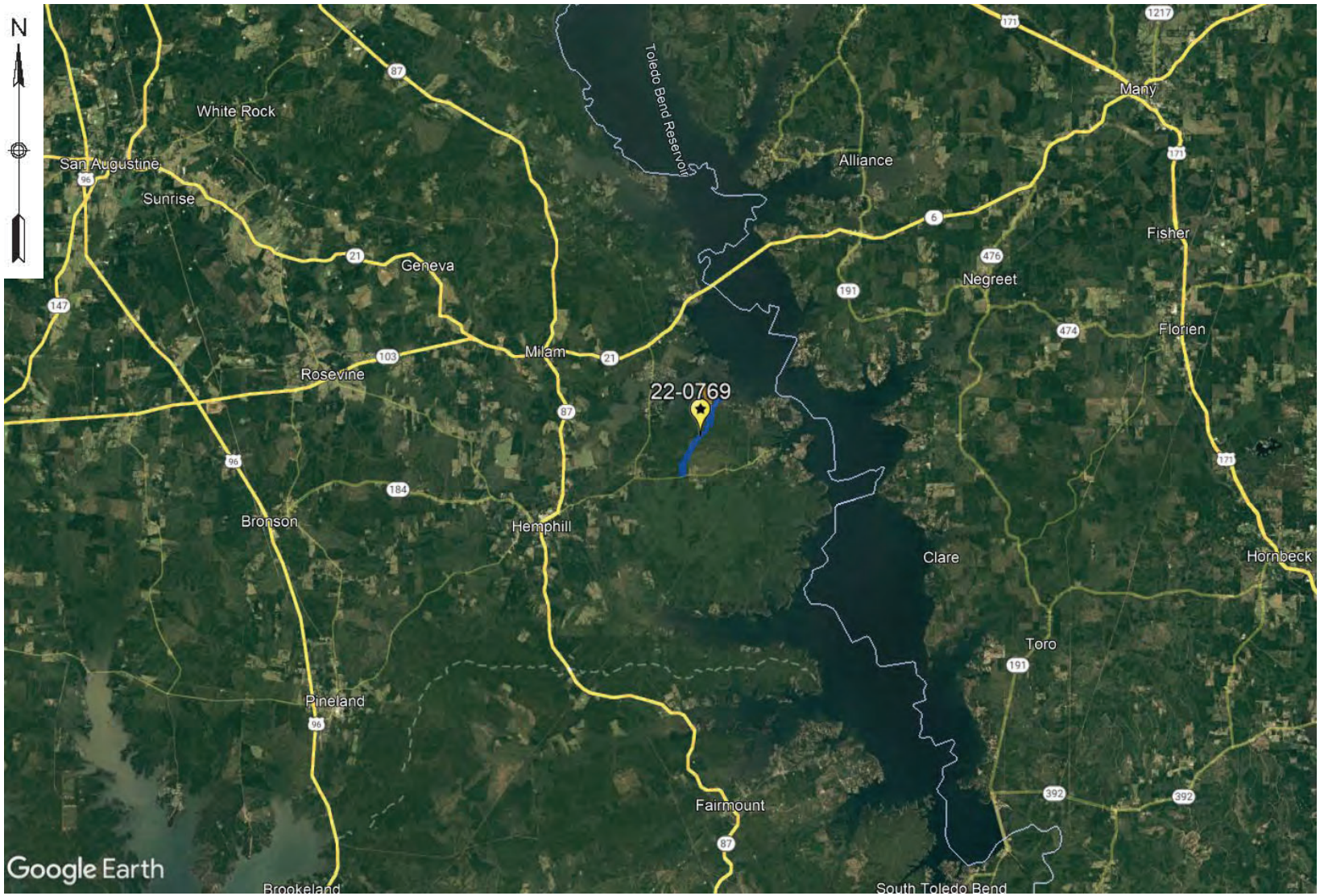
Liability Limitation. RINER cannot assume responsibility or liability for recommendations provided in this report if construction inspection and/or testing recommended herein is performed by another party.

Warranty. This report has been prepared for the exclusive use of the Client and their designated agents for specific application to design of this project. We have used that

degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

Appendix A - Project Location Diagrams

PROJECT LOCATION DIAGRAM - GENERAL



RINER Project No. 22-0769

SRA Toledo Bend Fishing Tournament Site

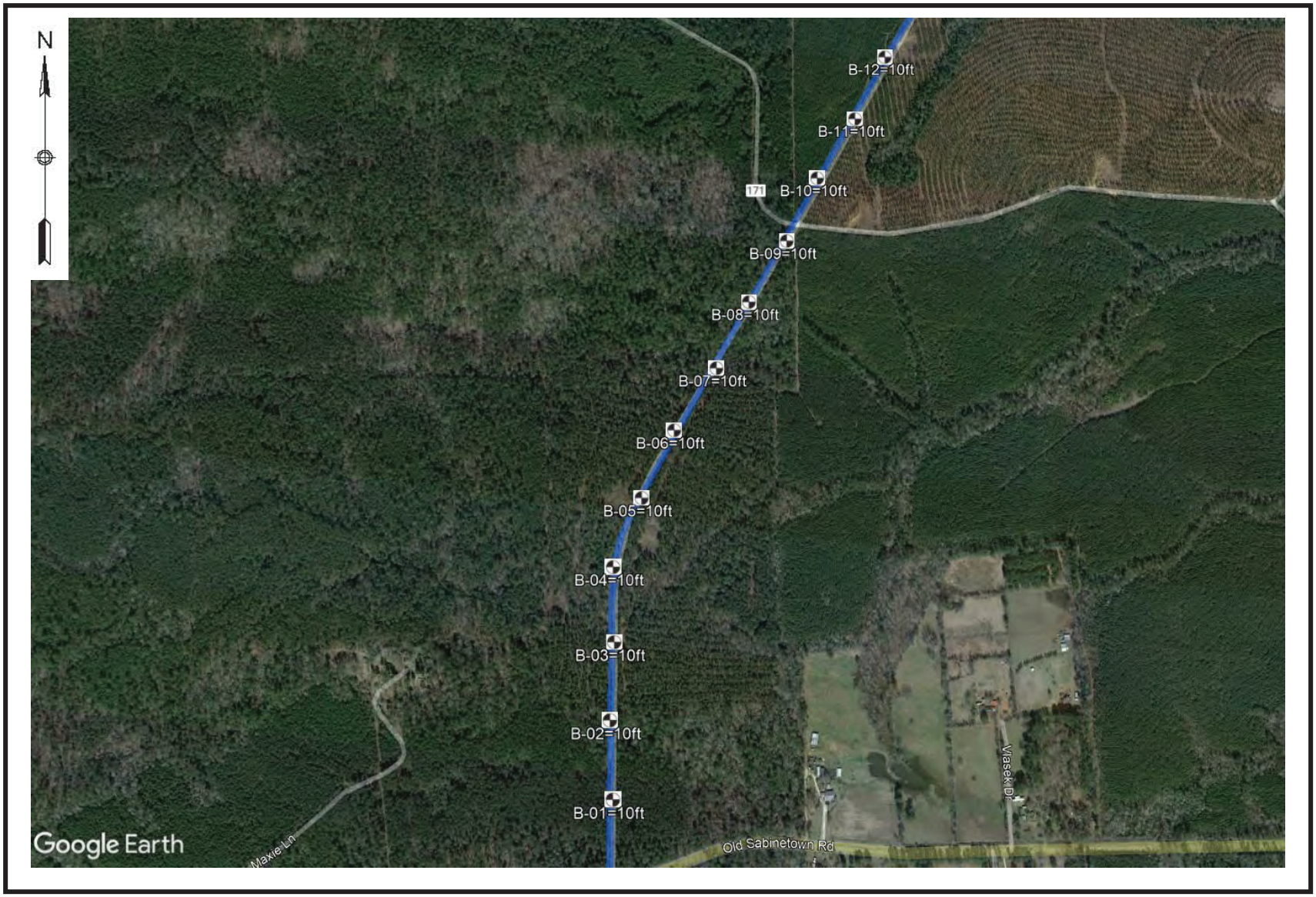
PROJECT LOCATION DIAGRAM - LOCAL

RINER Project No. 22-0769

SRA Toledo Bend Fishing Tournament Site

Appendix B - Boring Location Diagram

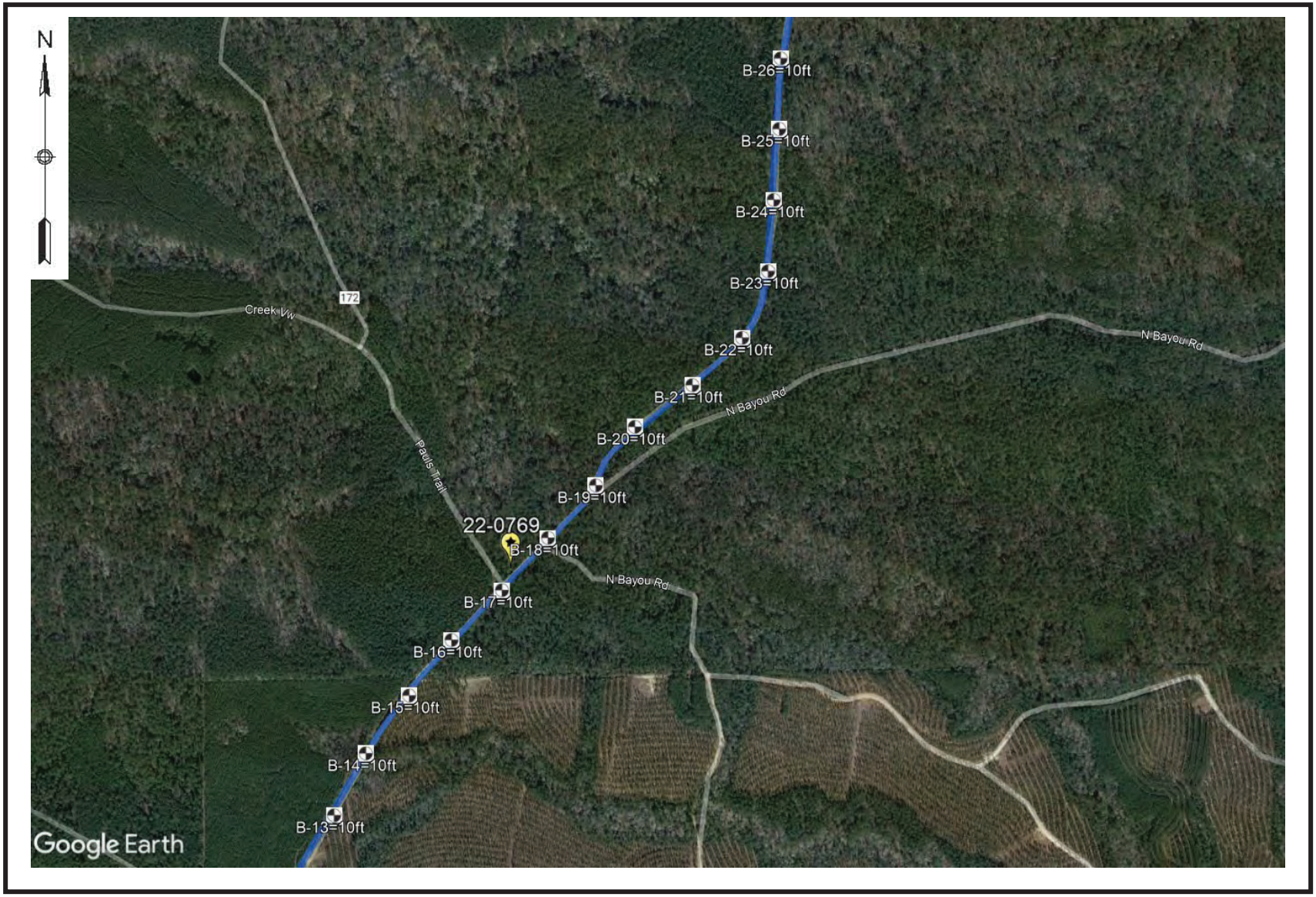
BORING LOCATION DIAGRAM- B-01 to B-12



RINER Project No. 22-0769

SRA Toledo Bend Fishing Tournament Site

BORING LOCATION DIAGRAM – B-13 to B-26



RINER Project No. 22-0769

SRA Toledo Bend Fishing Tournament Site

BORING LOCATION DIAGRAM- B-27 to B-40

RINER Project No. 22-0769

SRA Toledo Bend Fishing Tournament Site

Appendix C - Boring Logs and Laboratory Results

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-01

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 308.877 ft **NORTHING** 10522252.27
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346159.554
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 3-Inch BASE.													
307.5			FAT CLAY WITH SAND (CH) FILL - Soft, gray and brown.	ST			1.00	0.3				39	63	21	42	73
	2.5		SANDY LEAN CLAY (CL) - Hard, light brown and reddish brown, with sand pockets.	ST			4.50+	1.0				18				
305.0			SILTY SAND (SM) - Medium dense, light gray and light brown.	SS		10-13-15 (28)						14				36
302.5	5.0			SS		8-16-14 (30)						20				
300.0	7.5			SS		4-7-11 (18)										
	10.0															

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
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BORING NUMBER B-02

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 299.614 ft **NORTHING** 10522789.87
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346115.957
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			SANDY LEAN CLAY (CL) FILL - Hard, gray and brown.	ST			4.50+	2.0				16	41	19	22	64
297.5																
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Firm to hard, light brown and reddish brown.	ST			4.50+	2.3								
295.0																
	5.0			ST			4.00	1.9				20				
292.5																
	7.5			ST			4.50+	1.8								
290.0																
	10.0			ST			1.50	0.5				18				

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-03

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 282.72 ft **NORTHING** 10523367.98
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346098.089
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
282.5	0.0		PAVEMENT - 2-Inch BASE.													
			SANDY LEAN CLAY (CL) FILL - Stiff, gray and brown.	ST			2.50	1.0				17				
280.0	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff to very stiff, light brown and reddish brown.	ST			3.00	1.3				14	29	13	16	70
277.5	5.0			ST			4.00	1.8								
275.0	7.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Very stiff, light brown and reddish brown.	ST			4.00	2.0				16				
	10.0			ST			4.00									

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-04

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 281.105 ft **NORTHING** 10523775.75
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346073.41
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 3-Inch BASE.													
280.0			SANDY LEAN CLAY (CL) FILL - Gray and brown.	AU								16	33	16	17	54
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	1.4								
277.5				ST			4.50+	1.8				18				
	5.0															
275.0			SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Very stiff to hard, light brown and reddish brown.	ST			4.50+	2.0								
	7.5															
272.5				ST			4.00	1.4				68				
	10.0															

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-05

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 286.382 ft **NORTHING** 10524253.88
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346225.173
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
285.0			FAT CLAY WITH SAND (CH) FILL - Hard, gray and brown.	ST			4.50+	1.9				34	81	19	62	72
	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Very stiff to hard, light brown and reddish brown.	ST			4.00	1.8				40				
282.5																
	5.0			ST			4.50+	2.0								
280.0																
	7.5			ST			4.00	1.9				30				
277.5																
	10.0			ST			4.50+	1.9								

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-06

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 281.517 ft **NORTHING** 10524729.77
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346441.704
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
280.0			CLAYEY SAND (SC) FILL - Very stiff, gray and reddish brown.	ST			4.00					18	42	15	27	38
277.5	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Soft to very stiff, light brown and reddish brown.	ST			4.00									
275.0	5.0			ST			1.00	0.3				31				
272.5	7.5			ST			1.00	0.3								
	10.0			ST			1.50	0.5				40				

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-07

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 292.452 ft **NORTHING** 10525180.94
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346678.622
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			CLAYEY SAND (SC) FILL - Very stiff, gray and brown.	ST			4.00					16	36	18	18	49
290.0	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.1				21				
287.5	5.0			ST			4.50+	2.1								
285.0	7.5			ST			4.50+	2.0				21				
282.5	10.0			ST			4.50+	2.1								

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-08

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 276.286 ft **NORTHING** 10525645.82
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4346889.559
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
275.0			SANDY LEAN CLAY (CL) FILL - Gray and brown.	AU								12	30	11	19	60
	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.3								
272.5																
	5.0			ST			4.50+	2.4				20				
270.0																
	7.5			ST			4.50+	2.4								
267.5																
	10.0			ST			4.50+	2.3				24				

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-09

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 274.878 ft **NORTHING** 10526069.23
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4347112.711
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			FAT CLAY WITH SAND (CH) FILL - Very stiff, gray and brown.	ST			4.00	1.5				32	97	23	74	84
272.5	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Very stiff to hard, light brown and reddish brown.	ST			4.50+	1.9								
270.0	5.0			ST			4.50+	1.9								
267.5	7.5			ST			4.50+	1.8				24				
265.0	10.0			ST			4.00	1.6								

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-10

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 270.28 ft **NORTHING** 10526555.57
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4347333.427
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
270.0	0.0		PAVEMENT - 2-Inch BASE.													
			FAT CLAY WITH SAND (CH) FILL - Hard, gray and brown.	ST			4.50+	2.0				14				
267.5	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Stiff, light brown and reddish brown.	ST			3.00	1.1				23	57	20	37	75
265.0	5.0			ST			2.50	1.0				23				
262.5	7.5			ST			2.50	0.8								
	10.0			ST			3.00	0.8				14				

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-11

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 265.445 ft **NORTHING** 10526983.63
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4347556.055
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
265.0			SANDY FAT CLAY (CH) FILL - Stiff, gray and brown.	ST			2.00	1.0				34	71	21	50	68
	2.5		FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Firm to stiff, light brown and reddish brown.													
262.5				ST			2.00	0.8								
	5.0			ST			2.00	0.8								
260.0				ST			2.00	0.8				28				
	7.5															
257.5				ST			1.50	0.8								
	10.0															

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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BORING NUMBER B-12

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 255.63 ft **NORTHING** 10527433.12
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4347759.977
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
255.0			FAT CLAY WITH SAND (CH) FILL - Stiff, gray and brown.	ST			2.00	1.0				25				
	2.5		FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Firm to stiff, light brown and reddish brown.													
252.5				ST			2.50	1.0				27	71	21	50	88
	5.0			ST			1.50	0.5				29				
250.0																
	7.5			ST			3.00	1.3				41	93	21	72	94
247.5																
				ST			3.00	1.3								
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-13

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 248.926 ft **NORTHING** 10527887.48
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4347995.405
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
247.5			FAT CLAY WITH SAND (CH) FILL - Hard, gray and brown.	ST			4.50+	1.9				21	55	22	33	77
	2.5		FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.0				23				
245.0			SANDY LEAN CLAY (CL) - Very stiff to hard, light brown and reddish brown, with sand pockets.													
	5.0			ST			4.50+	2.0								
242.5																
	7.5			ST			4.50+	2.4				17				
240.0																
	10.0			ST			4.00									

Bottom of hole at 10.0 feet.

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BORING NUMBER B-14

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 248.239 ft **NORTHING** 10528365.92
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4348208.03
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
247.5			SILTY, CLAYEY SAND (SC-SM) FILL - Light brown.	AU								5				21
	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Very stiff to hard, light brown and reddish brown.	ST			4.50+	2.4								
245.0																
	5.0			ST			4.50+	2.4				21				
242.5																
	7.5			ST			4.50+	2.0								
240.0																
	10.0			ST			4.00	1.6				22				

Bottom of hole at 10.0 feet.

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BORING NUMBER B-15

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 252.112 ft **NORTHING** 10528795.85
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4348472.209
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			LEAN CLAY WITH SAND (CL) FILL - Hard, light brown and reddish brown.	ST			4.50+	2.4				19	49	23	26	79
250.0																
	2.5		FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.1				21				
247.5																
	5.0		SANDY LEAN CLAY (CL) - Soft to hard, light brown and reddish brown.	ST			4.50+	1.9								
245.0				ST			1.00					19				
	7.5															
				ST			4.50+	0.8								
242.5																
	10.0															

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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BORING NUMBER B-16

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/14/22 **COMPLETED** 11/14/22
GROUND ELEVATION 260.243 ft **NORTHING** 10529152.92
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4348754.327
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
260.0	0.0		PAVEMENT - 2-Inch BASE.													
			FAT CLAY (CH) FILL - Gray and brown.	AU								20	73	21	52	87
257.5	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Very stiff to hard, light brown and reddish brown.	ST			4.50+	2.4								
255.0	5.0			ST			4.50+	2.4				23				
252.5	7.5			ST			4.50+	2.4								
	10.0			ST			4.00	1.0				23				

Bottom of hole at 10.0 feet.

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BORING NUMBER B-17

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 265.845 ft **NORTHING** 10529544.89
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4349104.017
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
265.0			SANDY LEAN CLAY (CL) FILL - Hard, light brown and reddish brown.	ST			4.50+	2.4				13	30	14	16	60
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	2.4				16				
262.5																
	5.0			ST			4.50+	2.4								
260.0																
	7.5			ST			4.50+	1.3				17				
257.5																
	10.0			ST			4.50+	1.8								

Bottom of hole at 10.0 feet.

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BORING NUMBER B-18

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 268.364 ft **NORTHING** 10529902.1
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4349388.093
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
267.5			SILTY, CLAYEY SAND (SC-SM) FILL - Light brown.	AU								7				32
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff to hard, light brown and reddish brown.	ST			4.50+	2.3								
265.0																
	5.0			ST			4.50+	2.3				20				
262.5																
	7.5			ST			4.50+	2.1								
260.0																
	10.0			ST			2.0	0.8				26				

Bottom of hole at 10.0 feet.

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BORING NUMBER B-19

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 271.341 ft **NORTHING** 10530285.21
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4349719.497
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
270.0			SANDY LEAN CLAY (CL) FILL - Hard, light brown and reddish brown.	ST			4.50+	1.50				13				
	2.5		SILTY SAND (SM) - Medium dense, light brown.	SS		8-7-16 (23)						6				50
267.5			SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.													
	5.0			ST			4.50+	2.3								
265.0				ST			4.50+	2.1				14				
	7.5															
262.5				ST			4.50+	2.1								
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-20

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 279.591 ft **NORTHING** 10530725.66
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4349959.288
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								19				26
277.5			SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.													
	2.5			ST			4.50+	2.0								
275.0																
	5.0			ST			4.50+	2.0				15				
272.5																
	7.5			ST			4.50+	1.8								
270.0																
	10.0			ST			4.50+	1.8				12				

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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BORING NUMBER B-21

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 287.216 ft **NORTHING** 10531093.54
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350373.101
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								8				
285.0	2.5		SANDY FAT CLAY (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.4				19	58	20	38	50
282.5	5.0		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	1.9								
280.0	7.5			ST			4.50+	1.6				13				
277.5	10.0			ST			4.50+	1.6								

Bottom of hole at 10.0 feet.

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BORING NUMBER B-22

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 293.021 ft **NORTHING** 10531408.03
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350688.056
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
292.5			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								5				20
	2.5		SILTY SAND (SM) - Medium dense, light gray and light brown.	SS		7-10-9 (19)										
290.0																
	5.0		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	2.1				15				
287.5																
	7.5			ST			4.50+	2.4								
285.0																
	10.0			ST			4.50+	1.8				11				

Bottom of hole at 10.0 feet.

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BORING NUMBER B-23

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 279.667 ft **NORTHING** 10531869.61
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350848.568
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	ST								13				23
277.5																
	2.5		CLAYEY SAND (SC) - Soft to hard, light brown and reddish brown.	ST			1.00	0.3				8				
275.0																
	5.0			ST			4.50+	2.3								
272.5																
	7.5			ST			4.50+	2.4				13	29	15	14	46
270.0																
	10.0			ST			4.50+	1.3								

Bottom of hole at 10.0 feet.

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BORING NUMBER B-24

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 286.114 ft **NORTHING** 10532399.29
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350858.671
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
285.0			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								10				31
	2.5		SILTY SAND (SM) - Medium dense, light gray and light brown.	SS		9-13-10 (23)										
282.5																
	5.0		SANDY LEAN CLAY (CL) - Hard, light brown and reddish brown.	ST			4.50+	2.4				15				
280.0				ST			4.50+	2.4								
	7.5															
277.5				ST			4.50+	2.3				12				
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-25

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 288.529 ft **NORTHING** 10532920.15
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350836.384
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
287.5			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								9				33
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff to very stiff, light brown and reddish brown.	ST			3.00	1.0				9				
285.0																
	5.0			ST			2.00	0.8								
282.5																
	7.5			ST			3.50	1.5				21				
280.0																
	10.0			ST			2.00	1.0								

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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BORING NUMBER B-26

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 280.152 ft **NORTHING** 10533386.37
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350867.728
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
280.0	0.0		PAVEMENT - 4.5-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								11				29
277.5	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Soft to very stiff, light brown and reddish brown.	ST			4.00	1.8								
275.0	5.0			ST			1.00	0.5				22				
272.5	7.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Stiff, light brown and reddish brown.	ST			2.00	1.0								
	10.0			ST			2.50	1.0				37				

Bottom of hole at 10.0 feet.

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BORING NUMBER B-27

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 274.965 ft **NORTHING** 10533868.93
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350928.691
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								12				28
272.5	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	1.0								
270.0	5.0			ST			4.50+	1.0								
			SILTY SAND (SM) - Medium dense, light gray and light brown.	SS		7-10-13 (23)						4				
267.5	7.5															
			FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.1								
265.0	10.0															

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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BORING NUMBER B-28

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 267.529 ft **NORTHING** 10534355.78
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4350963.712
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
267.5	0.0		PAVEMENT - 2-Inch BASE.													
			SANDY LEAN CLAY (CL) FILL - Hard, light brown and reddish brown.	ST			4.50+	2.4				14				
265.0	2.5		CLAYEY SAND (SC) - Very stiff to hard, light brown and reddish brown.	ST			4.50+	2.4				11	51	16	35	30
262.5	5.0			ST			3.50	1.9				18				
			SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Stiff, light brown and reddish brown.	ST			2.50	1.3								
260.0	7.5			ST			3.00	1.3				27				
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-29

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION 268.497 ft **NORTHING** 10534862.38
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** 4351027.327
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES Survey data as provided by client in PNEZD format
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
267.5			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								12				35
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	2.4				10				
265.0																
	5.0			ST			4.50+	2.4								
262.5			SILTY SAND (SM) - Dense, light gray and light brown.	SS		12-16-18 (34)						9				
	7.5															
260.0				SS		13-16-19 (35)										
	10.0															

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

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BORING NUMBER B-30

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			SANDY FAT CLAY (CH) FILL - Very stiff, gray and brown.	ST			4.00	1.8				27	63	24	39	60
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff to very stiff, light brown and reddish brown.	ST			4.00	1.9								
	5.0			ST			3.50	1.8				24				
	7.5			ST			3.50	1.5								
				ST			2.50	1.1				25				
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-31

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 4-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								13				15
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff, light brown and reddish brown.	ST			2.50	0.8				28				
	5.0			ST			3.00	1.3								
	7.5			ST			2.50	1.0				22				
			SILTY SAND (SM) - Light gray and light brown, with clay pockets.	ST												
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-32

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			CLAYEY SAND SAND (SC) FILL - Light gray and light brown.	AU								14	31	15	16	33
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	1.5								
	5.0			ST			4.50+	1.4				9				
	7.5			ST			4.50+	2.0								
			SILTY SAND (SM) - Medium dense, light gray and light brown.	SS		8-12-16 (28)						8				
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-33

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			CLAYEY SAND SAND (SC) FILL - Gray and light brown.	AU								16	45	20	25	43
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff to hard, light brown and reddish brown.	ST			4.50+	2.4								
	5.0			ST			4.50+	1.6								
	7.5			ST			4.50+	1.3				11				
	10.0			ST			3.00	1.6								

Bottom of hole at 10.0 feet.

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BORING NUMBER B-34

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								7				
	2.5		FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST			4.50+	2.4				17	54	21	33	87
	5.0			ST			4.50+	2.4				19				
	7.5			ST			4.50+	2.4								
	10.0			ST			4.50+	2.4				25				

Bottom of hole at 10.0 feet.

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BORING NUMBER B-35

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 3-Inch BASE.													
			FAT CLAY (CH) FILL - Hard, gray and brown.	ST			4.50+	2.4				24	75	24	51	87
	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Firm to hard, light brown and reddish brown.	ST			4.50+	2.4				32				
	5.0			ST			1.50	0.3								
	7.5			ST			4.50+	0.5				40				
				ST												
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-36

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			CLAYEY SAND SAND (SC) FILL - Light gray and reddish brown.	AU								12	30	20	10	45
	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Stiff to hard, light brown and reddish brown.	ST			4.50+	2.4								
	5.0			ST			4.50+	2.4				37				
	7.5			ST			4.50+	2.4								
				ST			2.00	0.3				45				
	10.0															

Bottom of hole at 10.0 feet.

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BORING NUMBER B-37

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			FAT CLAY WITH SAND (CH) FILL - Very stiff, gray and brown.	ST			4.00	2.0				27				
	2.5		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Hard, light brown and reddish brown.	ST								30	66	21	45	59
	5.0			ST			4.50+	2.4								
	7.5			ST			4.50+	2.4				36				
	10.0			ST			4.50+	2.4								

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-38

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			CLAYEY SAND SAND (SC) FILL - Light gray and reddish brown.	AU								17	40	15	25	45
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Hard, light brown and reddish brown.	ST			4.50+	2.1								
	5.0			ST								12				
	7.5			ST			4.50+	2.0								
			SILTY SAND (SM) - Dense, light gray and light brown.	SS		10-14-17 (31)						10				
	10.0															

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-39

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
													LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		PAVEMENT - 2-Inch BASE.													
			CLAYEY SAND SAND (SC) FILL - Reddish brown.	AU								10	34	16	18	49
	2.5		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Very stiff to hard, light brown and reddish brown.	ST			4.50+	2.4				20				
	5.0			ST			4.50+	1.0								
	7.5			ST			4.00	1.3				11				
				ST			3.50	0.8								
	10.0															

Bottom of hole at 10.0 feet.

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-40

CLIENT Freese and Nichols, Inc.
PROJECT NAME SRA Toledo Bend Fishing Tournament Site
PROJECT NUMBER 22-0769
PROJECT LOCATION Hemphill, Texas
DATE STARTED 11/15/22 **COMPLETED** 11/15/22
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR RINER
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 10 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.C. **CHECKED BY** A.A.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		PAVEMENT - 2-Inch BASE.													
			SILTY, CLAYEY SAND SAND (SC-SM) FILL - Light gray and light brown.	AU								5				23
	2.5		SILTY SAND (SM) - Medium dense to dense, light gray and light brown.	SS		8-11-15 (26)										
	5.0			SS		9-12-14 (26)						9				
	7.5			SS		20-14-17 (31)										
				SS		8-14-18 (32)						5				
	10.0															

Bottom of hole at 10.0 feet.

NEW TEMPLATE W/T ELEVATION 22-0769.GPJ NEW GINT TEMP.GDT 3/22/23

Appendix D - Site Photographs

SITE PHOTOGRAPHS

Facing Northeast at Boring B-01

Facing Northeast at Boring B-03

Facing Northwest at Boring B-22

Facing East at Boring B-23

SITE PHOTOGRAPHS

Facing North at Boring B-24

Facing North at Boring B-25

Facing Northeast at Boring B-26

Facing East at Boring B-27

SITE PHOTOGRAPHS

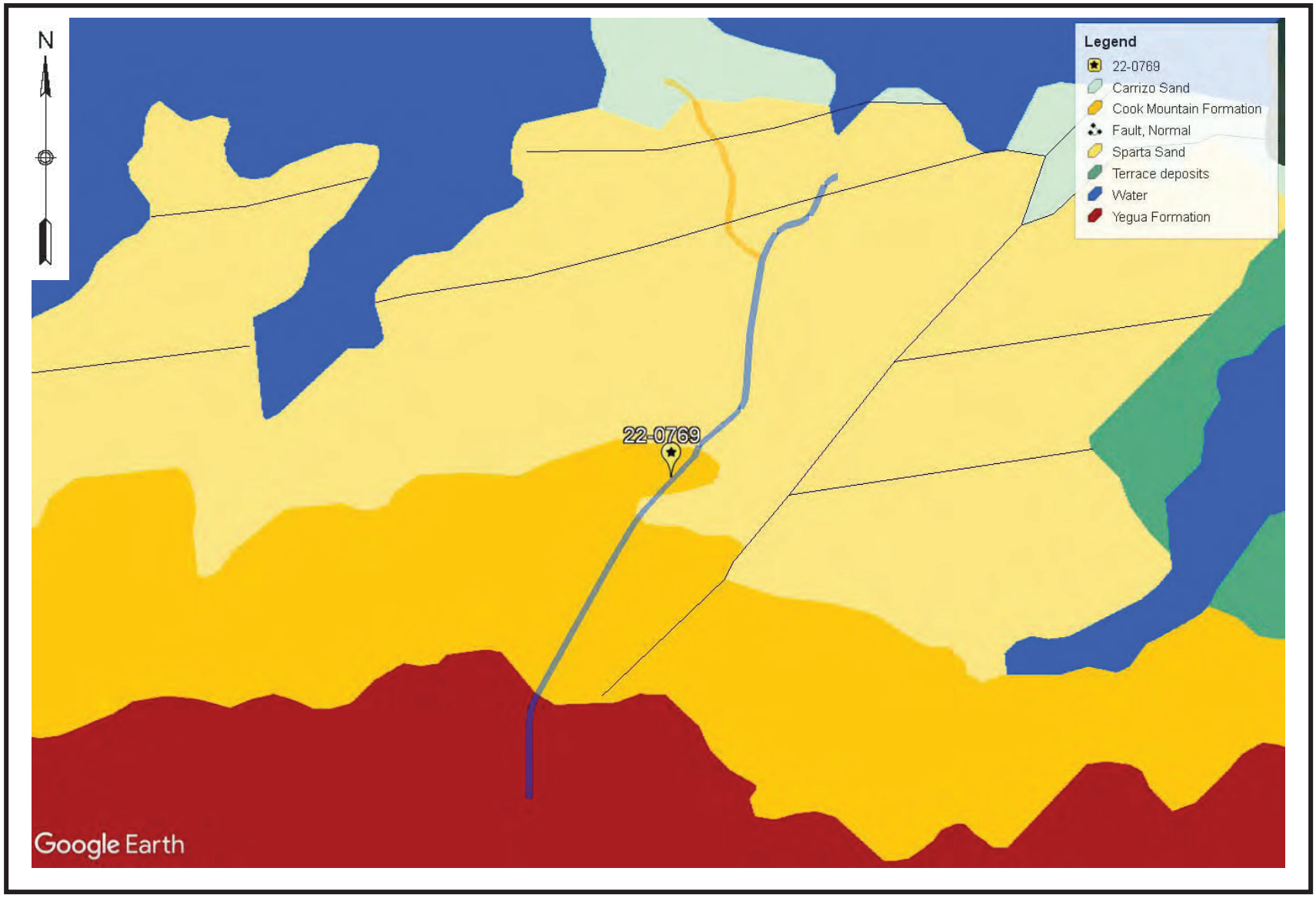
Facing Southwest at Boring B-28

Facing West at Boring B-29

Facing Southeast at Boring B-30

Appendix E - Geologic Information

GEOLOGIC ATLAS



RINER Project No. 22-0769

SRA Toledo Bend Fishing Tournament Site

Mineral Resources On-Line Spatial Data

Yegua Formation

Yegua Formation

State	Texas
Name	Yegua Formation
Geologic age	Phanerozoic | Cenozoic | Tertiary | Eocene-Middle
Original map label	Ey
Comments	clay with minor beds of sandstone, some concretionary limestone beds and lenses of oyster shells. sandst fine grained, calcar., glauconitic, massive, laminated, crossbedded; fossil wood; Volcanic ash included. silicified tuff containing an oyster and gastropod fauna (Eargle, 1968); 1,000 ft thick in San Antonio Sheet (1974). In East Texas and Gulf Coast to Rio Grande: Overlies Cook Mt. Formation; overlain by Caddell Fm. Unit is sandstone, clay, and lignite. Sandst. is mostly quartz and some chert, fine-grained, laminated, corssbedded; clay, lignitic, sandy, bentonitic, well laminated, lentils of lignite. In Seguin Sheet unit is about 1000 ft thick.
Primary rock type	clay or mud
Secondary rock type	sandstone
Other rock types	limestone; coal
Lithologic constituents	Major Sedimentary > Clastic > Sandstone *(Bed)* Sedimentary > Clastic > Mudstone > Claystone *(Bed)* Incidental Igneous > Volcanic *(Pyroclastic, air fall)* Sedimentary > Coal > Lignite *(Bed)* Sedimentary > Carbonate > Limestone *(Bed)*
Map references	Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000
Unit references	Eargle, D.H., 1968, Nomenclature of formations of Claiborne Group, Middle Eocene, coastal plain of Texas: U.S. Geological Survey Bulletin 1251-D.

[http://pubs.er.usgs.gov/publication/b1251D]

Bureau of Economic Geology, 1970, Waco Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Bureau of Economic Geology, 1974, San Antonio Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Bureau of Economic Geology, 1974, Seguin Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Bureau of Economic Geology, 1976, Crystal City-Eagle Pass Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Bureau of Economic Geology, 1967, Palestine Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Counties Angelina - Atascosa - Bastrop - Brazos - Burleson - Fayette - Frio - Gonzales - Houston - Karnes - La Salle - Lee - McMullen - Madison - Nacogdoches - Sabine - San Augustine - Starr - Uvalde - Walker - Webb - Wilson - Zapata

Show this information as [XML] - [JSON]

(https://www.usgs.gov/)

Mineral Resources (https://www.usgs.gov/energy-and-minerals/mineral-resources-program) / Online Spatial Data (/) / Geology (/geology/) / by state (/geology/state/) / Mississippi (/geology/state/state.php?state=MS)

Cook Mountain formation

XML (/geology/state/xml/MSEOcm;0) | JSON (/geology/state/json/MSEOcm;0)

(Claiborne group), Southeast of Pearl River, marl, limestone, glauconitic sand, and chocolate-colored clay; northwest of Pearl River, predominantly chocolate-colored clay with some glauconitic sand.

State	Mississippi (/geology/state/state.php?state=MS)
Name	Cook Mountain formation
Geologic age	Eocene
Lithologic constituents	Major Unconsolidated > Coarse-detrital > Sand *Cook Mountain formation - (Claiborne group), Southeast of Pearl River, marl, limestone, glauconitic sand, and chocolate-colored clay; northwest of Pearl River, predominantly chocolate-colored clay with some glauconitic sand.* Unconsolidated > Marl *Cook Mountain formation - (Claiborne group), Southeast of Pearl River, marl, limestone, glauconitic sand, and chocolate-colored clay; northwest of Pearl River, predominantly chocolate-colored clay with some glauconitic sand.* Minor Unconsolidated > Fine-detrital > Clay *Cook Mountain formation - (Claiborne group), Southeast of Pearl River, marl, limestone, glauconitic sand, and chocolate-colored clay; northwest of Pearl River, predominantly chocolate-colored clay with some glauconitic sand.* Incidental Sedimentary > Carbonate > Limestone *Cook Mountain formation - (Claiborne group), Southeast of Pearl River, marl, limestone, glauconitic sand, and chocolate-colored clay; northwest of Pearl River, predominantly chocolate-colored clay with some glauconitic sand.*
Comments	Secondary unit descriptions from USGS Lexicon website (MS002) and MS004: The Cook Mountain Formation is best exposed in Newton Co., MS, on the south side of I-20 at the Newton exit, in NW1/4NE1/4 sec. 26, T6N, R11E. Varies in thickness in the subsurface, from 47 ft to 135 ft. Thickens downdip. Mapped as a single unit, but two members discussed in text: Potterchitto and Gordon Creek Shale. Basal Archusa Marl Member is not recognized in Newton Co., either at the surface or in the subsurface. Disconformably overlies the Kosciusko Formation and conformably underlies the Cockfield Formation. Age is middle Eocene. Geologic map. Measured section. Stratigraphic column (Merrill and others, 1985).

References	Moore, William Halsell, 1969, reprinted 1985, Geologic Map of Mississippi, Compiled by Bicker, A. R., Jr., a revision of the geologic map published by the MS Geological Survey in 1945 in cooperation with the USGS, revised from data submitted by Dr. E. E. Russell of MS State University from published reports of the MS Geological Survey and from field revisions, Mercury Maps Inc., Jackson, MS., scale 1:500,000.
	USGS Geologic Names lexicon found at: http://ngmdb.usgs.gov/Geolex/ https://ngmdb.usgs.gov/Geolex/search (https://ngmdb.usgs.gov/Geolex/search)
	Merrill, R.K., Sims, J.J., Jr., Gann, D.E. and Liles, K.J., 1985, Newton County geology and mineral resources [Mississippi]: Mississippi Office of Geology Bulletin, no. 126, 108 p.
NGMDB product	NGMDB product page for 16555 (https://ngmdb.usgs.gov/Prodesc/proddesc_16555.htm)
Counties	Attala (/geology/state/fips-unit.php?code=f28007) - Carroll (/geology/state/fips-unit.php?code=f28015) - Clarke (/geology/state/fips-unit.php?code=f28023) - Holmes (/geology/state/fips-unit.php?code=f28051) - Jasper (/geology/state/fips-unit.php?code=f28061) - Lauderdale (/geology/state/fips-unit.php?code=f28075) - Leake (/geology/state/fips-unit.php?code=f28079) - Madison (/geology/state/fips-unit.php?code=f28089) - Newton (/geology/state/fips-unit.php?code=f28101) - Scott (/geology/state/fips-unit.php?code=f28123)

XML JSON

Sparta Sand

Sparta Sand

State	Texas
Name	Sparta Sand
Geologic age	Eocene
Lithologic constituents	Major Sedimentary > Clastic > Sandstone *(Bed)* Minor Sedimentary > Clastic > Mudstone > Claystone *(Bed)* Sedimentary > Clastic > Siltstone *(Bed)* Incidental Sedimentary > Coal *(Bed)*
Comments	Quartz sand, v. fine to fine grained, lt. gray, v. pale orange, grayish-brn to brownish-gray, sl. cohesive from silt and clay matrix, massive, locally crossbedded, well sorted, micaceous, interbeds of sandy or silty clay, locally carbonaceous; some hard, brown ferruginous sandstone near base; lignite beds locally present near top, 130 +-ft thick in San Antonio Sheet (1974), 130-150 ft in Seguin Sheet (1974), 150-250 ft in Crystal City-Eagle Pass Sheet (1976)170 +-ft thick in Tyler Sheet (1964), 50+- ft in Texarkana Sheet (1966)..
References	Bureau of Economic Geology, 1974, San Antonio Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000. Bureau of Economic Geology, 1974, Seguin Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000. Bureau of Economic Geology, 1976, Crystal City-Eagle Pass Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000. Bureau of Economic Geology, 1965, Tyler sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin,

scale 1:250,000.

Bureau of Economic Geology, 1966, Texarkana Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Bureau of Economic Geology, 1967, Palestine Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000.

NGMDB product	NGMDB product page for 68390
Counties	Anderson - Angelina - Atascosa - Bastrop - Blanco - Brazos - Burleson - Camp - Cass - Cherokee - Fayette - Frio - Gillespie - Gonzales - Harrison - Henderson - Houston - Kimble - Lee - Leon - Marion - Mason - Menard - Milam - Morris - Nacogdoches - Robertson - Rusk - Sabine - San Augustine - Shelby - Smith - Upshur - Van Zandt - Wilson - Wood

(https://www.usgs.gov/)

Mineral Resources (https://www.usgs.gov/energy-and-minerals/mineral-resources-program) / Online Spatial Data (/) / Geology (/geology/) / by state (/geology/state/) / Texas (/geology/state/state.php?state=TX)

Reklaw Formation, Carrizo Sand, and Wilcox and Midway Groups, undivided

XML (/geology/state/xml/TXEOPNu;0) | JSON (/geology/state/json/TXEOPNu;0)

Shapefile (/geology/state/unit-shape.php?unit=TXEOPNu;0)

Reklaw Formation, Carrizo Sand, and Wilcox and Midway Groups, undivided

State	Texas (/geology/state/state.php?state=TX)
Name	Reklaw Formation, Carrizo Sand, and Wilcox and Midway Groups, undivided
Geologic age	Paleocene and Eocene
Lithologic constituents	Major Sedimentary > Clastic > Mixed-clastic > Sandstone-mudstone *(Bed)* Incidental Sedimentary > Coal > Lignite *(Bed)*
Comments	from top down: about 30-40 ft of quartz sand and silty clay, about 50 ft of quartz sand, about 700 ft of silty and sandy clay containing local beds of clay, lignite, silt and quartz sand; about 500-600 ft of clay.
References	Bureau of Economic Geology, 1974, Austin Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000. Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000.
NGMDB product	NGMDB product page for 68390 (https://ngmdb.usgs.gov/Prodesc/proddesc_68390.htm)
Counties	Smith (/geology/state/fips-unit.php?code=f48423)

Mineral Resources On-Line Spatial Data

Terrace deposits

Terrace deposits

State	Texas
Name	Terrace deposits
Geologic age	Phanerozoic | Cenozoic | Quaternary | Pleistocene Holocene
Original map label	Qt
Comments	Sand, silt, clay, and gravel in various proportions, with gravel more prodominent in older, higher terrace deposits. Locally indurated with calcium carbonate (caliche) in terraces along streams. Along Colorado River clasts mostly limest., chert, quartz, and various igneous and metamorphic rocks from Llano region and Edwards Plateau. Includes point bar, natural levee, stream channel deposits along valley walls; probably in large part correlatives of Deweyville, Beaumont, Lissie, and Willis deposits. In upland regions (Rolling Plains, Edwards Plateau, etc.) unit includes fluvial terrace deposits, undivided. Light-brown, reddish-brown, gray, or yellowish-brown, gravelly quartz and lithic sand and silt to sandy gravel (Moore and Wermund, 1993). Deposits become increasingly fine grained on Coastal and Nueces Plains. Locally, calcium carbonate-cemented quartz sand, silt, clay, and gravel intermixed and interbedded. Low terraces of major rivers are capped by 2-4 m of clayey sand and silt. Sandy gravel on higher terraces varies somewhat in composition from river to river. Gravel commonly is rounded to angular limestone and chert pebbles and cobbles, some boulders, sparse igneous pebbles along Brazos river in places. In Bastrop Co., a deposit 27 m above Colorado River contains the Lava Creek B (Pearlette O) volcanic ash (age 0.6 Ma). Along the Frio, Leona, and Sabinal Rivers east of Uvalde, gravel is chiefly basalt and pyclastic clasts, locally cemented by iro oxide. Gravel along the Rio Grande is subrounded clasts of locally derived limestone and chert and rounded clasts of basalt, volcanic

porphyry, quartzite, milky quartz, and banded chalcedony derived from the west.

Primary rock type terrace

Secondary rock type sand

Other rock types gravel; silt; clay or mud

Lithologic constituents

Major

Unconsolidated > Fine-detrital > Silt *(Bed)*
Unconsolidated > Coarse-detrital > Sand *(Bed)*

Minor

Unconsolidated > Coarse-detrital > Gravel *(Bed)*
Unconsolidated > Fine-detrital > Clay *(Bed)*

Map references Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000

Unit references Moore, D.W. and Wermund, E.G., Jr., 1993a, Quaternary geologic map of the Austin 4 x 6 degree quadrangle, United States: U.S. Geological Survey Miscellaneous Investigations Series Map I-1420 (NH-14), scale 1:1,000,000.
[http://pubs.er.usgs.gov/publication/i1420(NH14)]

Bureau of Economic Geology, 1975, Beeville-Bay City Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Bureau of Economic Geology, 1974, Seguin Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Counties Anderson - Angelina - Archer - Armstrong - Atascosa - Austin - Bandera - Bastrop - Baylor - Bee - Bell - Bexar - Blanco - Borden - Bosque - Bowie - Brazos - Brewster - Briscoe - Brown - Burleson - Burnet - Caldwell - Callahan - Camp - Cass - Cherokee - Childress - Clay - Coke - Coleman - Collin - Collingsworth - Colorado - Comal - Comanche - Concho - Cooke - Coryell - Cottle - Crane - Crosby - Dallam - Dallas - Delta - Denton - DeWitt - Dickens - Dimmit - Donley - Duval - Eastland - Ellis - Erath - Falls - Fannin - Fayette - Fisher - Foard - Franklin - Freestone - Frio - Garza - Gillespie - Glasscock - Goliad - Gonzales - Gray - Grayson - Gregg - Grimes - Guadalupe - Hall - Hamilton - Hansford - Hardeman - Hardin - Harris - Harrison - Hartley - Haskell - Hays - Hemphill - Henderson - Hidalgo - Hill - Hood - Hopkins - Houston - Hunt - Hutchinson - Jackson - Jasper - Jeff Davis - Jim Wells - Johnson - Jones - Karnes - Kaufman - Kendall - Kent - Kerr - Kimble - Kinney - Knox - Lamar - Lampasas - La Salle - Lavaca - Lee - Leon - Limestone - Lipscomb - Live Oak - Llano - McCulloch - McLennan - McMullen - Madison - Marion - Mason - Maverick - Medina - Menard - Midland - Milam - Mills - Mitchell - Montague - Montgomery - Moore - Morris - Motley - Nacogdoches - Navarro - Newton - Nolan - Oldham - Palo Pinto - Panola - Parker - Pecos - Polk - Potter - Rains - Reagan - Red River - Reeves - Refugio - Roberts - Robertson - Rockwall - Runnels - Rusk - Sabine - San Augustine - San Jacinto - San Patricio - San Saba - Schleicher - Scurry - Shackelford - Shelby -

Smith - Somervell - Starr - Stephens - Stonewall - Tarrant - Taylor - Throckmorton - Titus - Tom Green - Travis - Trinity - Tyler - Upshur - Uvalde - Val Verde - Van Zandt - Victoria - Walker - Waller - Washington - Webb - Wheeler - Wichita - Wilbarger - Williamson - Wilson - Wise - Wood - Young - Zapata - Zavala

Show this information as [XML] - [JSON]

Appendix F - Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

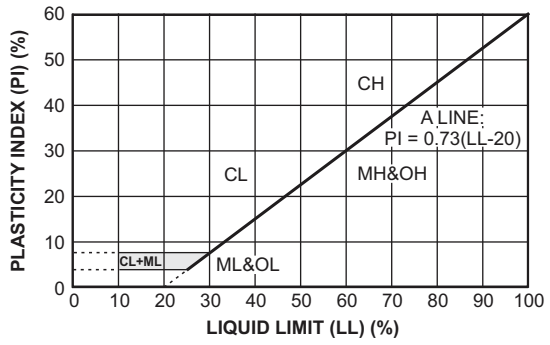
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



TERMS DESCRIBING SOIL CONSISTENCY

Fine Grained Soils		Coarse Grained Soils		
Description	Penetrometer Reading (tsf)	Penetration Resistance (blows/ft)	Description	Relative Density
Soft	0.0 to 1.0	0 to 4	Very Loose	0 to 20%
Firm	1.0 to 1.5	4 to 10	Loose	20 to 40%
Stiff	1.5 to 3.0	10 to 30	Medium Dense	40 to 70%
Very Stiff	3.0 to 4.5	30 to 50	Dense	70 to 90%
Hard	4.5+	Over 50	Very Dense	90 to 100%