Exhibit Z. Calhoun Technology Park - North Site Preliminary Geotechnical Engineering Report

north louisiana
economic partnership

CSRS
IMAGINE SHAPE DELIVER

Calhoun Technology Park - North Site
Preliminary Geotechnical Engineering Report

LIMITED SUBSURFACE EXPLORATION
AND
PRELIMINARY GEOTECHNICAL ENGINEERING
EVALUATION FOR
CALHOUN TECHNOLOGY PARK – NORTH
321 U.S. HIGHWAY 80
OUACHITA PARISH, LOUISIANA

Ardaman & Associates, Inc.

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Florida Institute of Consulting Engineers

PREPARED
FOR:
OUACHITA PARISH POLICE JURY
C/O LAZENBY & ASSOCIATES, INC.
2000 NORTH 7TH STREET
WEST MONROE, LOUISIANA 71291

PREPARED
BY:
ARDAMAN & ASSOCIATES, INC.
7222 GREENWOOD ROAD
SHREVEPORT, LOUISIANA 71119

ARDAMAN PROJECT NO.: 113-15-94-8547
SHREVEPORT FILE NO.: 15.94.039
February 20, 2017

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

February 20, 2017

Ouachita Parish Police Jury
c/o Lazenby & Associates, Inc.
2000 N. 7th Street
West Monroe, Louisiana 71291

Attention: Kevin E. Crosby, P.E., P.L.S.
Vice President

Reference: Limited subsurface Exploration and
Preliminary Geotechnical Engineering Evaluation
Calhoun Technology Park – North Tract
321 U.S. Highway 80
Ouachita Parish, Louisiana
Ardaman Project No.: 113-15-94-8547
Shreveport File No.: 15.94.039

Gentlemen:

Attached is Ardaman & Associates, Inc. (AAI) Preliminary Geotechnical Investigation Report for the above referenced property parcel. Per your request, AAI's has separated our original investigation report dated June 25, 2015 into two (2) reports; identified herein as the North Tract and the South Tract. This report represents our finding for the portion of the property identified as the *NORTH TRACT.* AAI would be pleased to assist you further by furnishing any subsequent site or client specific geotechnical studies that may be needed on the property in the future. It has been a pleasure to perform this work for you. If we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.

JAMES M. BELT
REG. No. 27126
2-20-17

James M. Belt, P.E.
Branch Manager
Shreveport Area Operations

cc: (3) client

Location: 7222 Greenwood Road, Shreveport, Louisiana 71119 Phone (318) 636-3673 Fax (318) 636-3723
Mailing Address: PO Box 19220, Shreveport, Louisiana 71149-0220
Louisiana: Alexandria, Baton Rouge, Monroe, New Orleans, Shreveport
Florida: Bartow, Cocoa, Fort Myers, Miami, Orlando, Port St. Lucie, Sarasota, Tallahassee, Tampa, West Palm Beach

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LIMITED SUBSURFACE EXPLORATION
AND
PRELIMINARY GEOTECHNICAL ENGINEERING
EVALUATION FOR
CALHOUN TECHNOLOGY PARK – NORTH
321 U.S. HIGHWAY 80
OUACHITA PARISH, LOUISIANA

GENERAL

AAI's proposal P14.26.309, dated August 13, 2014 was approved on behalf of the Police Jury by Lazenby & Associates on March 9, 2013. The purposes of the study were to (1) explore the subsurface conditions present at this site, (2) determine the pertinent engineering properties of the materials encountered, (3) characterize site soil and groundwater conditions, and (4) determine if unfavorable soil conditions exist at the site. Item 4 is general in nature and each boring has brief analysis and conditions presented. Subsequent to this study AAI was requested to separate the study of the property into two (2) separate reports. This additional work was authorized by correspondence receive from Lazenby & Associates dated January 30, 2017.

PROJECT DESCRIPTION

Boundary survey maps provided to AAI indicate the subject property consists of about 241 acres in area and lies north of U.S. Highway 80. The North tract is one of two property parcels previously owned by the Louisiana State University system and operated as the Calhoun Research Station. The facility is on U.S. HWY 80 about one half mile east of the intersection with Louisiana Highway 151 in Calhoun, Louisiana. The Ouachita Parish Police Jury and the North Louisiana Economic Partnership are seeking to have this property certified for the Louisiana Economic Development (LED) "Certified Site" program. This report is, in part, a requirement of the program.

FIELD OPERATIONS

The geotechnical investigation on the North Tract consisted of performing a total of five (5) test borings, more or less randomly located on the property. All test borings were advanced to a depth of approximately twenty (20) feet below the existing ground surface. This investigation was conducted on April 30 and May 1, 2015. Boring locations were pre-selected by the client, but not staked in the field. Our drill crew estimated boring placement using the maps provided, referencing identifiable landmarks, and visually estimating positions on the property. Minor adjustments to the pre-selected map locations may have been made where site access was difficult or obstructions may have existed. Test boring B-5 was relocated about 300 feet west of the pre-selected location due to access restrictions (fenced or gated).

The test borings were advanced utilizing continuous-flight, solid stem augers and samples were obtained for laboratory evaluation in general accordance with provisions of ASTM D1586 and ASTM D1587. Standard, thin-walled, seamless Shelby tube samplers were used to obtain specimens of cohesive materials. These specimens were taken continuously to a depth of ten (10) feet below the existing ground surface. Below this depth, samples were obtained at intervals of five (5) feet as the borings were advanced.

Soils which contained enough cohesionless material or were sufficiently dense to prevent recovery of undisturbed specimens with Shelby Tube samplers were evaluated by means of the Standard Penetration test. This test consists of determining the number of blows required by a 140 pound hammer dropped thirty (30) inches to achieve one foot penetration of the soil. This number or "N" value, is then related to "in situ" density or strength consistency of the soils.

All samples obtained were logged, sealed and packaged in the field to protect them from disturbance and maintain their in situ moisture content during transportation to our laboratory. The results of our boring program (Logs of Boring) are included as Appendix "A" of this report.

LABORATORY TESTING

Upon return to our laboratory selected samples were subjected to standard laboratory tests under the supervision of a soils engineer. The Atterberg Limits, in situ unit weights, percent of material passing a #200 sieve, and moisture contents of the different subsurface soils were determined. These soil properties were used to classify the soils and evaluate their potential for volumetric change. Unconfined compression tests performed on selected undisturbed samples were used to evaluate the shear strength of the different subsurface materials. The results of our testing program are included on the Logs of Boring in Appendix "A" of this report.

SOIL CONDITIONS

Soil conditions described in this section are of a generalized nature and intended to emphasize key features and characteristics. For a more detailed description of the subsurface materials encountered refer to the soil profile on each Log of Boring in Appendix "A". Strata contacts indicated on our Logs are approximate. Actual transitions may be gradual in nature. The soils described are at the specific boring locations within the depths explored. Soils at other locations or depths may be different than those encountered during this exploration. Considering the substantial distances between the boring locations, soil conditions are summarized for each individual test boring location.

Test Boring B-1. Geotechnical laboratory testing performed on selected samples collected from this location indicates moderate to highly plastic clays exist within the upper fifteen (15) feet below the existing ground surface. The clay strata generally classify *lean clay (CL)* per *ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System)*. Strength consistency varies from medium stiff to very stiff with depth. The soils near the surface are sandy and a minor stratum of *fat clay (CH)* exists at about the five (5) foot depth. Below fifteen (15) feet, dense *sand (SP-SM) with silt* is encountered. The boring was terminated in sand at a depth of twenty (20) feet below the existing ground surface.

Test Boring B-2. Geotechnical laboratory testing performed on selected samples collected from this location indicates sandy soils with variable plasticity exist to a depth of about twenty (20) feet below the existing ground surface. The sandy strata generally classify *clayey sand (SC) to sand (SP-SM) with silt per ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System)*. Relative density varies from medium dense to dense with depth. The boring was terminated in sand at a depth of twenty (20) feet below the existing ground surface.

Test Boring B-3. Geotechnical laboratory testing performed on selected samples collected from this location indicates sandy soils with variable plasticity exist to a depth of about twenty (20) feet below the existing ground surface. The sandy strata generally classify *clayey sand (SC) to sand (SP-SM) with silt per ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System)*. Relative density varies from dense to loose with depth. A surficial stratum of *sandy lean clay (CL)* exists within the upper two (2) feet. The boring was terminated in sand at a depth of twenty (20) feet below the existing ground surface.

Test Boring B-4. Geotechnical laboratory testing performed on selected samples collected from this location indicates sandy soils with variable plasticity exist to a depth of about twenty (20) feet below the existing ground surface. The sandy strata generally classify *clayey sand (SC) to sand (SP-SM) with silt per ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).* Relative density varies from dense to medium dense with depth. The boring was terminated in sand at a depth of twenty (20) feet below the existing ground surface.

Test Boring B-5. Geotechnical laboratory testing performed on selected samples collected from this location indicates sandy soils with no plasticity exist to a depth of about twenty (20) feet below the existing ground surface. The sandy strata generally classify *silty sand (SM)* per *ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).* Relative density varies from loose to medium dense with depth. The boring was terminated in sand at a depth of twenty (20) feet below the existing ground surface.

GROUNDWATER

Shallow groundwater was encountered in all but one of the test boring locations during the drilling operations. Our water level observations, in feet below ground surface (bgs), are summarized in Table 1. The test borings were backfilled shortly after completion of sampling activities therefore the observed groundwater levels should not be construed as static or equilibrium levels. Static levels may in fact be higher than our initial observations.

It must be understood shallow groundwater levels will fluctuate with site elevation, climatic conditions/seasons of the year, and the levels of any nearby streams and ponds. Based on the stratigraphy encountered at these sites, shallow groundwater will likely adversely impact excavation operations below a depth of about five (5) feet. If groundwater levels are critical to specific construction actives, the contactor should verify the presence of groundwater at that time.

TABLE 1.

GROUNDWATER OBSERVATIONS

Test Boring	Water Depth (feet bgs)
B-1	7.0
B-2	15.0
B-3	15.5
B-4	>20.0

GENERAL SUBGRADE PREPARATION PROCEDURES

Prior to subsequent construction activity trees, stumps, roots, any existing foundations, pavements, or any other buried structure encountered within proposed construction areas, should be removed and wasted. Abandoned utilities should be completely removed or plugged in-place. Top soil stripping in grassed areas should be expected. The contractor should anticipate stripping and de-grassing will require removal of the upper four (4) to six (6) inches of surface material. The contractor should provide drainage of the exposed subgrade by sloping grades and ditching away from the construction site.

After any required demolition and rough site grading are complete, the exposed surface of areas where fill or paving are to be placed should be proof rolled to identify any weak areas. Proof rolling can be accomplished with a loaded twenty to thirty ton tandem axle dump truck or similarly weighted equipment under the observation of the geotechnical engineer or his designated representative. Weak areas should be investigated, removed, and/or repaired under the supervision of the geotechnical engineer prior to subsequent construction activity.

After verification of a stable subgrade layer, the exposed subgrade should be scarified to a minimum of eight (8) inches, the moisture content adjusted to within one (1) percent below to three (3) percent above optimum and recompacted to ninety (90) percent of the laboratory maximum as determined by *ASTM D1557, Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)* prior to placement of any fill or base materials.

It is imperative the contractor understand the importance of establishing and maintaining proper site drainage to maintain the prepared subgrade's suitability for subsequent construction activity. Failure to follow good site water control practices may result in construction delays and additional costs for reconditioning or replacing saturated materials. Earthwork performed during wet periods of the climatic cycle may warrant special considerations. The use of hydrated lime, fly ash or Portland cement stabilization should be considered to provide a working platform if work is expected to occur during these periods. The need for such techniques is dependent upon earthwork scheduling with respect to weather patterns and good site management of drainage during the construction phase. The suitability of any area left exposed to the elements should be verified by proofroll prior to subsequent construction activity.

FILL MATERIAL CONSIDERATIONS

Where fill materials may be required to achieve the desired finished grade elevations of any future projects, the material should be placed in controlled lifts. Lifts should be placed in thin horizontal layers not exceeding eight (8) inches *compacted* thickness. In steeply sloped areas, horizontal lifts should be benched or stair stepped into the slope as the fill is constructed. Each lift of fill should be moisture conditioned to within two (2) percentage points of optimum moisture and compacted to a minimum of ninety-five (95) percent of the laboratory maximum as determined by *ASTM D1557*.

Onsite soils classifying CL, SC, SC-SM, SM, or SP-SM, free of organic materials or construction debris, are suitable for use as fill with adequate processing and moisture conditioning. Soils classifying ML, CH or those otherwise of suitable classification, but containing organics, construction debris or excessive moisture are not recommended for reuse as fill under structures or pavements.

Where insufficient quantities of suitable onsite soils exist to balance cut/fill site work, off site materials can be imported to the site. All imported fill material should "*select* soil. Select soils classify *clayey sand (SC) or sandy lean clay (CL)* in accordance with ASTM D2487. Select fill materials placed below grade should have liquid limits (LL) no greater than thirty-five (35), plasticity indices (PI) between eight (8) and eighteen (18), and have no more than sixty (60) percent passing the U.S. Standard No. 200 Sieve. Where fills will be drained and erosion can be controlled, the use of non to low plasticity sands classifying (SP), (SP-SM), (SM), or (SC-SM) may be feasible. Where sands are used for fill, minimum density should be increased to ninety-eight (98) percent *ASTM D 1557*.

CONSTRUCTION OUALITY ASSURANCE CONSIDERATIONS

The use of correct fill and/or base materials and their proper placement and compaction are critical for any sitework where subsequent construction of a structure and/or pavements are planned. The project Construction Quality Control Plan should include requirements for construction observations and construction materials testing be performed by the Geotechnical Engineer of Record or his representative to verify suitability of exposed foundation bearing surfaces, that proper site preparation, and compaction have been executed.

PRELIMINARY RECOMMENDATIONS FOR FOUNDATION SUPPORT

The recommendations contained in this section are our opinion based on the limited amount of information available and are intended for preliminary planning purposes only. Prior to any final design, a thorough site/project specific geotechnical study should be made to finalized design parameters for specific areas of the Technology Park North Tract property.

The soils discovered at the test boring locations on this site are of fair to good bearing quality and generally have only slight potential for shrink and swell. These type of soils are not considered expansive. Only a very minor stratum of clay soils that would be considered expansive were encountered. These soils exist in the location of test boring B-1. As such, with attention to the fore mentioned expansive clays, light to moderately loaded future developments could be supported on shallow foundation systems. The Geotechnical Engineer of Record should retained to inspect the exposed subgrade and verify the assumptions of this report before proceeding with fill material placement.

Our preliminary estimate of net allowable bearing capacities for continuous and spread footings placed in the native undisturbed soils at depths of about two (2) feet below the existing ground surface are summarized in Table 2 for each test boring location. Capacities include a minimum safety factor of three (3) against shear failure of the bearing stratum as is recommended for design.

TABLE 2.

ALLOWABLE BEARING CAPACITIES FOR SHALLOW FOUNDATIONS

Test Boring Location	Allowable Net Bearing for Continuous Footings (psf)	Allowable Net Bearing for Spread Footings (psf)
B-1	1,200	1,600
B-2	1,500	1,500
B-3	1,800	2,300
B-4	1,500	1,500
B-5	1,500	1,500

Where the sites are properly prepared and maintained, and allowable bearing capacities are not exceeded, total settlement from consolidation should be limited to an inch or less for typical spread footings with widths less than about five (5) feet and continuous footings with widths less than about (3) feet.

To utilize a conventionally reinforced shallow foundation system, AAI recommends a minimum four (4) feet of density controlled select fill or non-expansive native soil beneath the bottom of all footings and/or grade beams and the underlying expansive clay soil. A minimum of six (6) feet is recommended beneath any *non-load bearing* floor slab. To meet these criteria, the proposed finished floor elevation can be raised, any existing expansive soils can be removed, or a combination of both procedures can be used to achieve an acceptable finished floor elevation with the required thickness of inactive fill beneath it. For the soil profile at B-1, it appears the criteria can be met with the addition of two (2) to three (3) feet of fill materials. However we recommend additional geotechnical investigations be performed to further delineate the aerial extent of expansive soils in this area prior to site development.

For heavy loading, where consolidation settlements may be critical, a deep foundation system would be more suitable. Probably the most economical deep foundation system to support heavily loaded structures is with an auger-cast-in-place (ACIP) pile system. The test boring sites are ideal for utilizing ACIP piles to support heavier loads or to minimize settlement. All areas explored can support heavily loaded structures on an ACIP pile foundation. Although generally less economical, driven timber piles, concrete piles, or steel piles can also be used. For moderate loads, straight sided drilled and cast-in-place concrete caissons (drilled shafts) or helical screw anchor type piers can also be considered. To evaluate load carrying capacity of deep foundations, additional borings advanced to a minimum depth of fifty (5) feet would be required.

A seismic site classification of Class D, as defined in the International Building Code Section 1613, can be assumed for this site due to the lack of specific soil data to a depth of one hundred (100) feet.

PRELIMINARY PAVEMENT INFORMATION

The pavement section recommendations for this site are based upon subsurface conditions implied by the test borings and the assumption use will be limited to commercial or light industrial use. No specific pavement analyses was performed as there is no known specific usage at this time. Recommendations outlined here in are in our opinion, "typical" for the assumed site use and intended for preliminary planning purposes only.

The existing sandy lean clay and clayey sand subgrade soils, prepared and maintained as recommended in the Subgrade Preparation Section of this report should have a laboratory soaked California Bearing Ratio (CBR) values in the order of ten (10) or Modulus of Subgrade Reaction (k_s) in the order of 125 to 150 PCI.

Rigid Pavement - AAI recommends rigid pavement be considered for all heavy duty pavement applications. However we understand the need to make cost effective decisions for the facility. At a minimum turnout aprons, trash collection areas, and any parking aprons adjacent to the truck docks be constructed of rigid pavement.

Minimum flexural strength of the concrete should be 650 pounds per square inch (PSI) at twenty-eight (28) days of age or have compressive strength value of 4,000 PSI. AAI recommends the use of air entrainment chemicals that improve workability of the concrete mix and improve durability of the pavement surface. Control joint spacing should not exceed fifteen (15) feet for un-reinforced pavement of the thicknesses outlined below. All concrete paving should include provisions to mechanically control temperature induced shrinkage cracking and provide for load transfer across construction joints. Rigid pavement sections suggested for this site are summarized in Table 3.

TABLE 3.

RIGID PAVEMENT SECTIONS

Pavement Layer	**Light Duty Auto Parking**	**Medium Duty Channelized Auto Drives**	**Heavy Duty Truck Access Drive, Dumpster Pads, & Turnout Aprons**
Portland Cement Concrete	5.0"	6.0"	8.0"
Base Course Layer	4" crushed stone base material	4" crushed stone base material	8" crushed stone base material
Subbase Course Layer	Density controlled fill per Fill Section of this report	Density controlled fill per Fill Section of this report	Density controlled fill per Fill Section of this report
Subgrade Layer	Density controlled subgrade prepared per the Subgrade Section of this report	Density controlled subgrade prepared per the Subgrade Section of this report	Density controlled subgrade prepared per the Subgrade Section of this report

Flexible Pavement – Flexible paving structurally similar to the above rigid sections are provided for your cost comparison. Hot mixed asphaltic concrete (HMAC) mixtures should meet applicable requirements for materials, production, placement and acceptance as outlined in the *Louisiana Standard Specifications for Roads and Bridges, 2000 Edition,* Section 501 for Marshall mixtures or *LSSRB, 2006,* Section 502 for Level 1 Superpave mixtures. For parking lot and light duty drive applications we recommend utilizing the ½ inch Nominal HMAC mix of either type. This mix produces a more aesthetic surface finish and generally holds up well under automobile parking lot use. Flexible pavement sections suggested for this site are summarized in Table 4.

TABLE 4.

FLEXIBLE PAVEMENT SECTIONS

Pavement Layer	Light Duty Auto Parking	Medium Duty Auto Drives	Heavy Duty Parking
Hot Mixed Asphaltic Concrete Wearing and Binder Course	2.0" WC	1.5" WC 1.5" BC	1.5" WC 3.0" BC
Base Course	8" crushed stone base material or 8" soil-cement base materials	8" crushed stone base material or 8" soil-cement base materials	12" crushed stone base material or 12" soil-cement base materials
Geotechnical Fabric Layer Requirement	Required under aggregate base material	Required under aggregate base material	Required under aggregate base material
Subbase Course	Density controlled fill per Fill Section of this report	Density controlled fill per Fill Section of this report	Density controlled fill per Fill Section of this report
Subgrade Layer	Density controlled subgrade prepared per the Subgrade Section of this report	Density controlled subgrade prepared per the Subgrade Section of this report	Density controlled subgrade prepared per the Subgrade Section of this report

Aggregate base layers recommended herein should meet or exceed material and grading requirements as outlined in the *Louisiana Standard Specifications for Roads and Bridges (LSSRB), 2006 Edition* Section 1003.03 (b) or (c). We recommend aggregate base course layers in excess of four (4) inches in thickness should be compacted to not less than 98% of the laboratory maximum as determined by *ASTM D1557, Method C.* Layers of four (4) inches or less can be compacted under the direction of the geotechnical engineer establishing a rolling pattern that produces the maximum density.

Where a soil-cement sub-base is considered, the type soils recommended for use as *select* fill or the prepared subgrade can be readily stabilized with Type I Portland cement. The cement stabilized soil or "soil-cement" sub-base layer should achieve a minimum unconfined compressive strength of 300 PSI at seven (7) days of age. Eight (8) percent by volume cement can be used for cost estimation for cement stabilization of select soils. The actual quantity required should be verified by the geotechnical engineer during the construction phase of the project in accordance with Louisiana Department of Transportation and Development Test Method TR 432.

Construction of the soil-cement subgrade layer should be in accordance with the provisions outlined in Section 303 of the *Louisiana Standard Specifications for Roads and Bridge, 2006 Edition.* Compaction of the finished subbase layer should not be less than 95% of the maximum laboratory density as determined by LDOTD TR 418. Heavy construction traffic should not utilize cement stabilized areas until the materials have cured sufficiently to obtain minimum specified strength.

If a soil-cement base layer is to be considered, be aware soil-cement materials develop tension cracks during the curing process and these cracks "reflect" through the overlying HMAC paving over time. A general rule of thumb for crack propagation is about one (1) vertical inch per year (takes about 2 years to show up through a 2 inch overlay). Although not initially structurally detrimental to the pavement system, the cracks must be periodically sealed to minimize moisture infiltration into the base system. Failure to preform regular maintenance of the cracks can lead to saturated subgrade soils and premature base failures in the pavement.

Reflective cracking cannot be prevented; however a separation layer can be used to minimize the propagation of reflective cracking. There are commercially available engineered fabrics (underlayment) that claim to reduce crack propagation and a thin layer of crushed aggregate base layer can also be used between the base layer and binder course layers to reduce reflective cracking. Both approaches have pros and cons and the benefit of either must be weighed against installation costs.

CONSTRUCTION CONCERNS

The upper soils at the site are fine-grained materials composed of significant silt and clay fractions. Silty and/or clayey soils are subject to changes in shear strength with varying moisture conditions. If construction is initiated during wetter seasons of the year, it may be difficult to move equipment about the site. Once these type soils become saturated, compaction operations can be hampered by a tendency of the silt to "pump" and the clay to "shear".

Consequently it is recommended, adequate site drainage be established prior to, during, and following construction operations to prevent water ponding on or adjacent to construction areas. Compaction operations may be expedited by using light compaction equipment and thin lifts of soil. Rolling only as necessary to obtain compaction is advisable because further repetitive loading may cause the subgrade to "pump" or fail. Once soils begin to pump, it is usually necessary to either start the moisture conditioning process over or remove and replace the saturated material. AAI can provide experience soils technicians to monitor the contractor's compaction operations and assist in expediting the site work.

Compaction operations and installation of the foundations should be supervised by a qualified soils technician under the supervision of the Geotechnical Engineer. All foundation excavations should be inspected to verify cleanliness and adequate bearing. Concrete should be placed in foundation excavations as soon as practical after forming and final clean-up have been approved, to avoid prolonged exposure of the bearing stratum and possible disturbance due to standing water, desiccation or other construction operations.

LIMITATIONS

This study has been prepared in accordance with generally accepted preliminary geotechnical engineering principles and practices in this area at this time. We make no other warranty either express or implied.

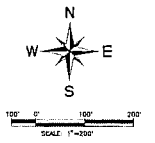
The conclusions and recommendations submitted in this report are based upon the data obtained from the preliminary exploratory borings drilled at the location(s) indicated in Appendix A, the different possible type of construction, and our experience in the area. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory boring(s) and variations in the subsurface conditions may not become evident until excavations are performed.

This study has been prepared for the exclusive use by our client for preliminary purposes only. We are not responsible for technical interpretations by others of our exploratory information, which has not been described or documented in this report. As the site is eventually developed additional borings should be taken. Significant design changes could be required or modifications of the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata by a representative of the geotechnical engineer.

APPENDIX A

SITE MAPS
AND
LOGS OF BORING

LAND DISTRICT NORTH OF RED RIVER
SECTIONS 26 & 27, T-18-N, R-1-E
OUACHITA PARISH, LOUISIANA



SURVEYOR'S NOTES:

1.) THE BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE BASED ON GPS OBSERVATIONS TAKEN AT THE SITE. THE GRID BEARINGS ARE BASED ON THE LOUISIANA COORDINATE SYSTEM OF 1983 NORTH ZONE. THE REFERENCE BEARING WAS TAKEN ALONG THE EAST LINE OF THE WEST 1/2 OF SECTION 26, TOWNSHIP 18 NORTH, RANGE 1 EAST, OUACHITA PARISH, LOUISIANA AS SHOWN HEREON.

2.) BASED ON A LEGAL OPINION PROVIDED BY JAY MITCHELL, ASSISTANT DISTRICT ATTORNEY FOR 4TH JUDICIAL DISTRICT COURT AND LEGAL COUNSEL FOR THE OUACHITA PARISH POLICE JURY, THE AREA LOCATED WITHIN THE RIGHT-OF-WAY OF INTERSTATE-20 WAS OWNED BY LSU, AND IS ONLY SUBJECT TO THE INTERSTATE RIGHT-OF-WAY. APPROXIMATELY 14.744 ACRES IS LOCATED WITHIN THE RIGHT-OF-WAY OF INTERSTATE 20. LSU TRANSFERRED ALL RIGHTS THEY HAD IN THIS PROPERTY TO THE OUACHITA PARISH POLICE JURY AS PER DEED RECORDED IN CONVEYANCE BOOK 2307, PAGE 794 OF THE RECORDS OF OUACHITA PARISH, LOUISIANA.

3.) THERE IS A 0.878 ACRE OVERLAP BETWEEN THE WEST LINE OF THE SUBJECT PROPERTY AND THE EAST LINE OF CURRY CREEK SUBDIVISION UNIT 1 & UNIT 2. THE WEST LINE OF THE SUBJECT PROPERTY FOLLOWS THE QUARTER SECTION LINES. THE EAST LINE OF CURRY CREEK SUBDIVISION IS EAST OF THE QUARTER SECTION LINES. THE DEED TO THE SUBJECT PROPERTY IS SENIOR TO THE CURRY CREEK DEED, HOWEVER CURRY CREEK WAS SUBDIVIDED OVER 10 YEARS AGO. BASED ON A LEGAL OPINION PROVIDED BY JAY MITCHELL, ASSISTANT DISTRICT ATTORNEY FOR 4TH JUDICIAL DISTRICT COURT AND LEGAL COUNSEL FOR THE OUACHITA PARISH POLICE JURY, THE PROPERTY LINE SHOULD FOLLOW THE EAST LINE OF CURRY CREEK SUBDIVISION.

4.) THERE WERE TWO (2) 60D NAILS TIED TOGETHER FOUND AT THE CORNER COMMON TO SECTIONS 26, 27, 34, & 35. THE NAILS WERE REMOVED AND A 1-1/2" IRON PIPE WAS SET IN THE SAME LOCATION THAT THE NAILS WERE FOUND.

5.) NO RIGHT-OF-WAY DOCUMENT FOR THE REGENCY GAS PIPELINE WAS FOUND WHEN PERFORMING THE ABSTRACT ON THE PROPERTY. THE RIGHT-OF-WAY AGENT FOR REGENCY GAS SAID THAT THE RIGHT-OF-WAY WAS 20' WIDE.

6.) THE TITLE ABSTRACT INFORMATION WAS FURNISHED BY JOSH BALDWIN.

7.) LIMITS OF FLOOD ZONE SHOWN WERE GRAPHICALLY PLOTTED FROM FEMA FLOOD MAPS.

8.) THE EXISTING UTILITIES, BOTH ABOVE GROUND AND SUBSURFACE, ARE SHOWN ON THE PLANS AS DETERMINED FROM FIELD SURVEYS AND AVAILABLE FILES AND RECORDS. THE LOCATION, SIZE, EXISTENCE, OR NONEXISTENCE OF UTILITIES IS NOT WARRANTED BY THE SURVEYOR.

FLOOD ZONE DATA:

BASED ON FLOOD INSURANCE RATE MAP NO.22073C0115F (JANUARY 20, 2010), FOR OUACHITA PARISH, LOUISIANA, A PORTION OF THE PROPERTY SHOWN HEREON LIES IN FLOOD ZONE "A", WHICH IS DETERMINED TO BE A SPECIAL FLOOD HAZARD AREA SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD WITH NO BASE FLOOD ELEVATION DETERMINED. THE REMAINDER OF THE PROPERTY LIES IN ZONE "X", WHICH IS DETERMINED TO BE AN AREA OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

REFERENCE PLATS:

1.) STATE OF LOUISIANA DEPARTMENT OF HIGHWAYS RIGHT-OF-WAY MAPS FOR S.P. NO. 740-00-25 & 740-00-26, CHOUDRANT-CALHOUN HIGHWAY, ROUTE I-20, AS PREPARED BY HENRY M. MESSINGER, REGISTERED LAND SURVEYOR, DATED MARCH 12, 1958.

2.) STATE OF LOUISIANA DEPARTMENT OF HIGHWAYS PLAN & PROFILE SHEETS FOR S.P. NO. 740-00-25 & 740-00-26, CHOUDRANT-CALHOUN HIGHWAY, ROUTE I-20, DATED NOVEMBER 1957.

3.) STATE OF LOUISIANA DEPARTMENT OF HIGHWAYS PLAN & PROFILE SHEETS FOR S.P. NO. 4654-A & USWP HWY PROJECT NO. W.P.H. 114-B-(3), ROUTE U.S. HWY 80, DATED MAY 1938.

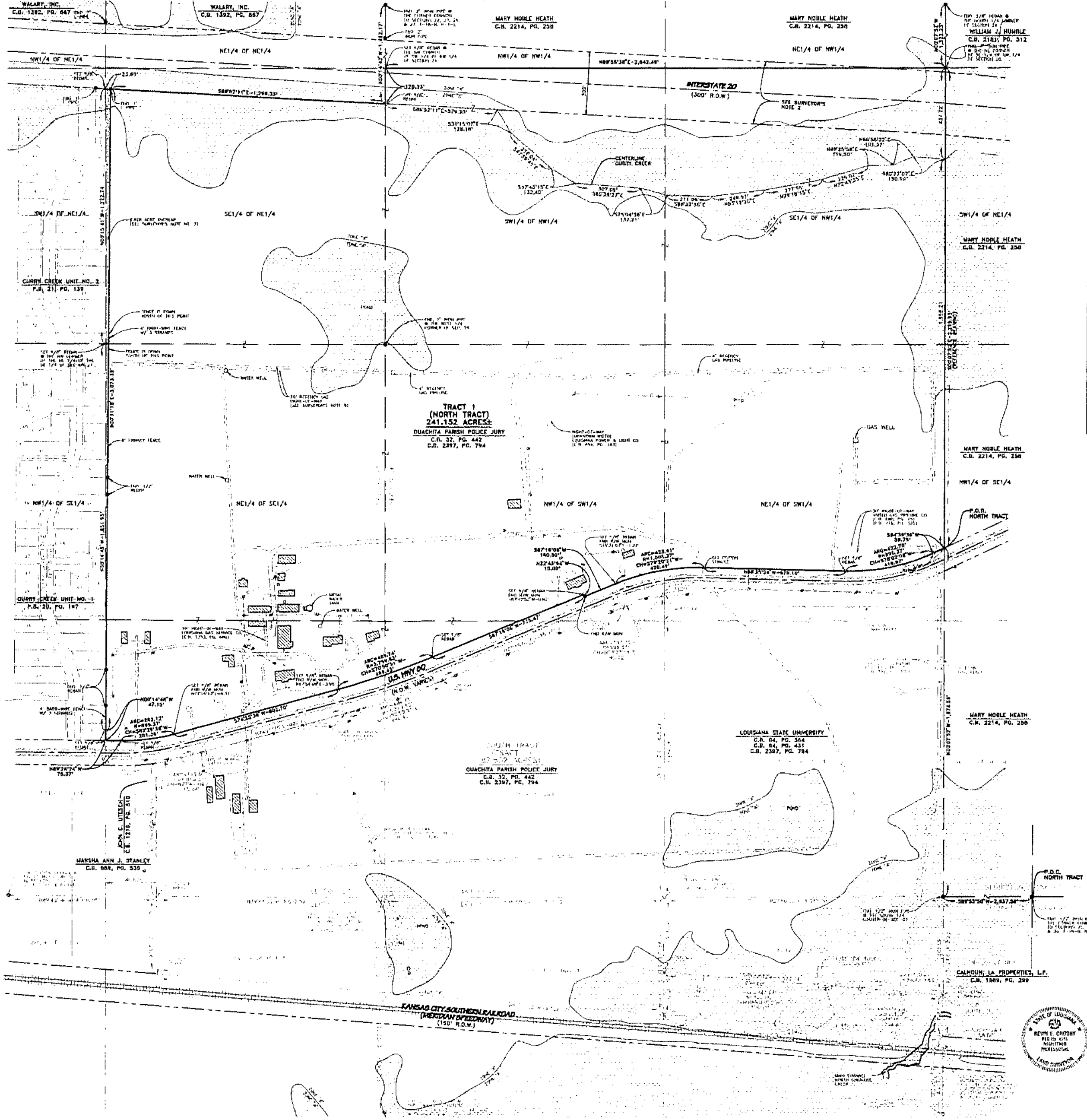
4.) STATE OF LOUISIANA DEPARTMENT OF HIGHWAYS PLAN & PROFILE SHEETS FOR S.P. NO. 4654-B & F.A.P. NO. 114-B(4), ROUTE U.S. HWY 80, DATED AUGUST 1938.

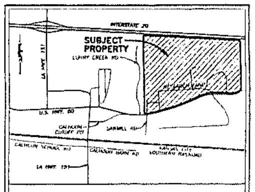
5.) PLAT OF SURVEY OF CURRY CREEK SUBDIVISION UNIT NO. 1, SITUATED IN SECTION 27, TOWNSHIP 18 NORTH, RANGE 1 EAST, OUACHITA PARISH, LOUISIANA AS PREPARED BY DONALD W. KORN, REGISTERED LAND SURVEYOR, DATED AUGUST 2003, AND RECORDED IN PLAT BOOK 20, PAGE 197 OF THE RECORDS OF OUACHITA PARISH, LOUISIANA.

6.) PLAT OF SURVEY OF CURRY CREEK SUBDIVISION UNIT NO. 2, SITUATED IN SECTION 27, TOWNSHIP 18 NORTH, RANGE 1 EAST, OUACHITA PARISH, LOUISIANA AS PREPARED BY DONALD W. KORN, REGISTERED LAND SURVEYOR, DATED AUGUST 2004, AND RECORDED IN PLAT BOOK 21, PAGE 139 OF THE RECORDS OF OUACHITA PARISH, LOUISIANA.

7.) BOUNDARY & TOPOGRAPHIC SURVEY OF CALHOUN MIDDLE SCHOOL, SITUATED IN SECTION 27, TOWNSHIP 18 NORTH, RANGE 1 EAST, OUACHITA PARISH, LOUISIANA, AS PREPARED BY THOMAS A. SEMMES, JR. REGISTERED LAND SURVEYOR, DATED SEPTEMBER 1998.

8.) PLAT OF SURVEY OF BUDDY MILSTEAD'S LAND, SITUATED IN SECTION 27, TOWNSHIP 18 NORTH, RANGE 1 EAST, OUACHITA PARISH, LOUISIANA, AS PREPARED BY Y.A. ROBERTS REGISTERED LAND SURVEYOR, DATED OCTOBER 1994, AND REVISED JANUARY 1995.





VICINITY MAP
N.T.S.

LEGEND

FOUND MONUMENTATION
SET MONUMENTATION
CENTER LINE OF ROAD
RIGHT-OF-WAY LINE
OVERHEAD POWER LINE
GAS LINE
SECTION OR FORTY LINE
DITCH CENTERLINE
SERVITUDE OR EASEMENT
PIPELINE MARKER
POWER POLE
R.O.W. RIGHT-OF-WAY
P.O.B. POINT OF BEGINNING
P.O.C. POINT OF COMMENCING
ASPHALT
CONCRETE
GRAVEL
FLOOD ZONE "A"

CERTIFICATION:

I, KEVIN C. CROSBY, P.L.S., A LICENSED PROFESSIONAL SURVEYOR IN THE STATE OF LOUISIANA, DO HEREBY CERTIFY THAT I HAVE PERFORMED A CLASS "C" SURVEY IN ACCORDANCE WITH THE STANDARDS OF PRACTICE FOR PROPERTY BOUNDARY SURVEYS AS ESTABLISHED BY THE LOUISIANA PROFESSIONAL ENGINEERING AND LAND SURVEYING BOARD AND TO THE BEST OF MY KNOWLEDGE THIS IS A TRUE REPRESENTATION OF THAT SURVEY

Kevin E. Crosby 1/24/17
KEVIN C. CROSBY, P.L.S. NO. 4901 DATE

BOUNDARY SURVEY

CALHOUN TECHNOLOGY PARK
TRACT 1 (NORTH TRACT)
(241.152 ACRES±)
321 HWY 80 EAST
CALHOUN, LA 71225

SITUATED IN SECTIONS 26 & 27, T18N, R1E
LAND DISTRICT NORTH OF RED RIVER
OUACHITA PARISH, LOUISIANA

LAZENBY & ASSOCIATES, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
[illegible] NORTH 7TH STREET WEST MONROE, LOUISIANA [illegible]

1/24/17	DIVIDED TRACTS	K.E.C.
3/9/15	UPDATED OWNERSHIP	K.E.C.
10/1/14	REVISED TRACT 4, 5, 6 & 8	R.J.R.
8/1/14	ADDED TRACT 8 & 200' STRIP	K.E.C.
DATE	DESCRIPTION	BY
REVISIONS		

DESIGNED R.J.R.	CHECKED K.E.C.	CLIENT:
DRAWN R.J.R.	CHECKED K.E.C.	OUACHITA PARISH POLICE JURY
APPROVED	DATE MARCH 7, 2010	
JOB NO. 13E028.02	SCALE 1" = 200'	

PRELIMINARY

THIS DOCUMENT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE, SALES, OR AS THE BASIS FOR THE ISSUANCE OF A PERMIT.

PREPARED BY: KEVIN E. CROSBY, P.L.S. LICENSE NO. 4901
LAZENBY & ASSOCIATES, INC., CONSULTING ENGINEERS & LAND SURVEYORS
2000 NORTH 7TH STREET, WEST MONROE, LA 71291

LOG OF BORING NO. B-1

PROJECT: Calhoun Technology Park

SHEET 1 of 1

CLIENT: Ouachita Parish Police Jury-% Lazenby & Associates

LOCATION: See Remarks

DATE: 4/30/15

SURFACE ELEV: 140' +/-

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at seven (7) feet after 20 minutes stayed at six (6) feet

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
▨		■		24	101	40	19	21	69	1.28	10.3		Medium stiff to stiff red, tan and gray sandy lean clay (CL)
▨		■	P=2.0	23									4.0
▧	5	■	▽	28	94	63	25	38	90	1.49	4.8		Medium stiff red, tan and gray fat clay (CH) with some sand 6.0
▨		■	P=3.0 ▼	26									Stiff tan and gray lean clay (CL)
▨		■		24	94	45	27	18	99	2.59	14.0		
▨	10												
▨		■	P=4.0	25									--Very stiff
▨	15												16.5
⁙		☒	N=39	30									Dense light gray sand with silt (SP-SM) 20.0
	20												Bottom of boring at 20 feet
	25												

■	◨	☒	▯	◣	○
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS: N 32 degrees 31'04.3"
W 92 degrees 20'54.3"

LOG OF BORING NO. B-2

PROJECT: Calhoun Technology Park

SHEET 1 of 1

CLIENT: Ouachita Parish Police Jury-% Lazenby & Associates

LOCATION: See Remarks

DATE: 4/30/15

SURFACE ELEV: 154' +/-

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at fifteen (15) feet depth

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
		■	P=0.75	14					29				Medium dense tan silty sand (SM) 1.5
		■		16	112	23	15	8	44	1.02	9.1		Medium dense red clayey sand (SC) 3.5
		■		10	113					0.86	5.7		Medium dense red clayey silty sand (SC-SM)
	5	■											
		■		17		26	21	5	33				
		■	P=2.75	12									--Dense
	10												11.5
													Medium dense red and gray sand with silt (SP-SM)
		☒	N=23	17		NP	NP	NP	9				
	15		▼										
		☒	N=41	15									--Dense light gray sand with silt (SP-SM) 20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS: N 32 degrees 31'05.8"
W 92 degrees 20'41.7"

LOG OF BORING NO. B-3

PROJECT: Calhoun Technology Park

SHEET 1 of 1

CLIENT: Ouachita Parish Police Jury-% Lazenby & Associates

LOCATION: See Remarks

DATE: 4/30/15

SURFACE ELEV: 175′ +/-

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at fifteen and one-half (15.5) feet after 20 minutes stayed at fifteen (15) feet

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
				16	111	26	14	12	59	2.32	9.5		Stiff red sandy lean clay (CL)
													2.0
			P=1.0	14									Dense red clayey sand (SC)
				16	115	30	13	17	43	1.87	9.4		
	5												
			P=1.25	15									
													8.0
				12	108	27	20	7	28	2.25	12.5		Dense to medium dense red clayey silty sand (SC-SM)
	10												
			N=15	12									
	15		∇ ▼										
													16.5
													Loose light gray sand with silt (SP-SM)
			N=8	24					9				
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS: N 32 degrees 30′53.7″
W 92 degrees 20′56.5″

LOG OF BORING NO. B-4

PROJECT: Calhoun Technology Park

SHEET 1 of 1

CLIENT: Ouachita Parish Police Jury-% Lazenby & Associates

LOCATION: See Remarks

DATE: 4/30/15

SURFACE ELEV: 174′ +/-

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
		■		15	114	27	16	11	46	3.23	13.2		Dense red clayey sand (SC)
		■											2.0
		■	P=1.0	12									Dense reddish tan silty sand (SM)
		■		15	114	21	20	1	28	1.68	6.4		
	5	■											
		■											6.0
		■	P=4.5	17									Dense red clayey sand (SC)
		■		17	110	40	22	18	50	3.94	7.2		
	10												
													11.5
													Medium dense reddish tan silty sand (SM)
		■		17	101					1.28	7.8		
	15												
													16.5
													Medium dense gray sand with silt (SP-SM)
		☒	N=13	10									
	20												20.0
													Bottom of boring at 20 feet
	25												

■	◧	☒	⌶	◣	○
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS: N 32 degrees 30′53.9"
W 92 degrees 20′40.8"

LOG OF BORING NO. B-5

PROJECT: Calhoun Technology Park

SHEET 1 of 1

CLIENT: Ouachita Parish Police Jury-% Lazenby & Associates

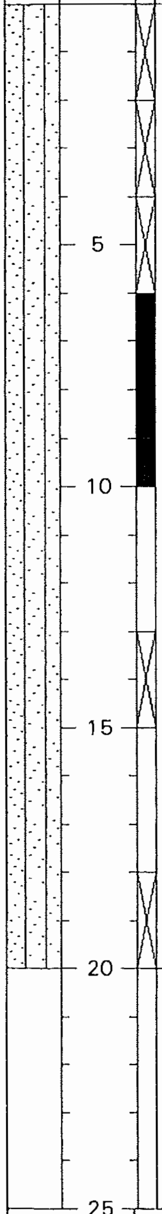
LOCATION: See Remarks

DATE: 5/1/15

SURFACE ELEV: 142' +/-

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at eleven (11) feet after 20 minutes stayed at ten (10) feet



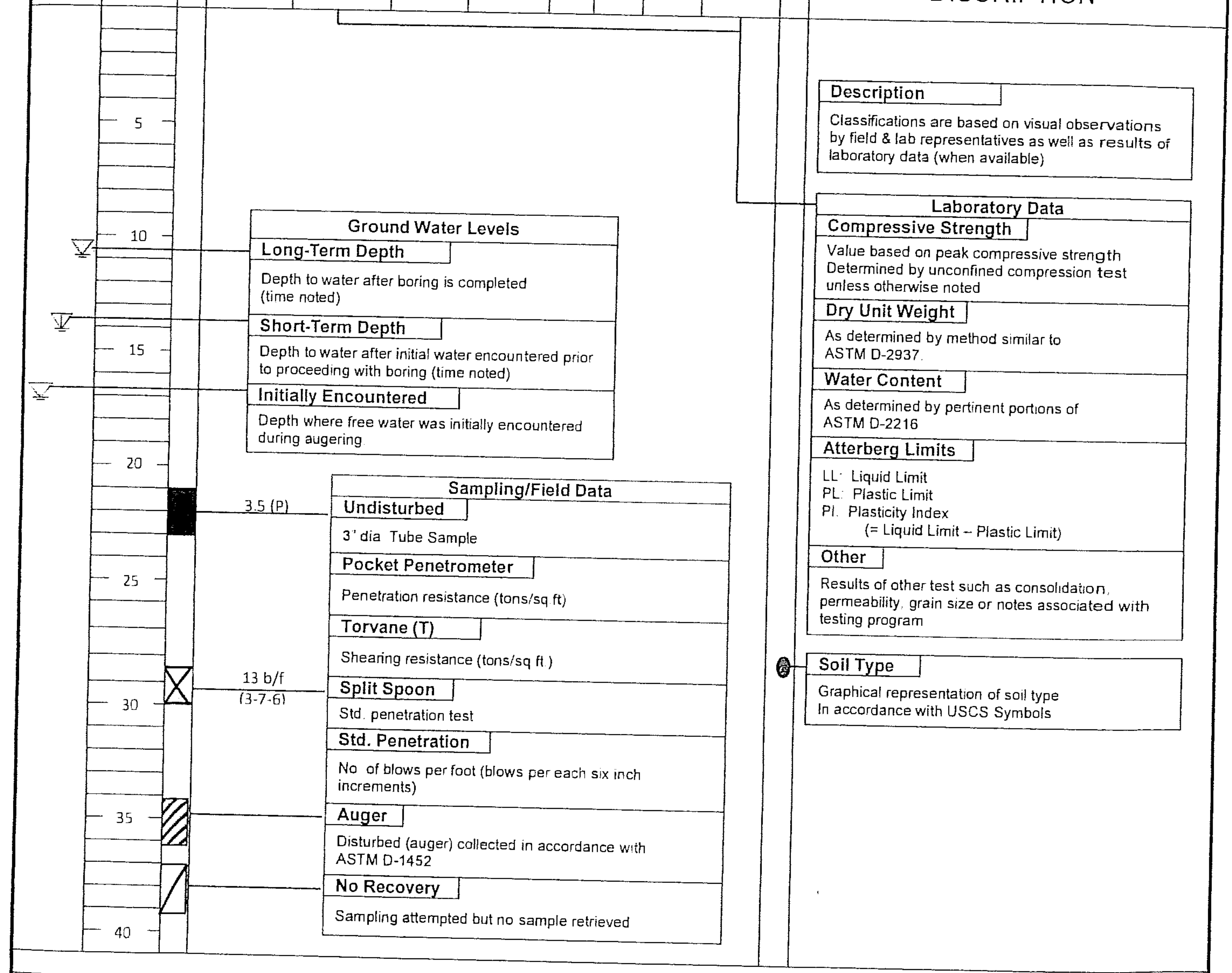
FIELD DATA		LABORATORY DATA									
DEPTH (FT)	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
	N=10	8									Loose to medium dense brown to red silty sand (SM)
	N=11	10					18				
	N=9	7									
5		17	108	22	21	1	25	1.09	8.9		
	P=1.25	18									--Medium dense red silty sand (SM)
10	▽ ▼										
	N=15	25					10				--Gray and tan
15											
	N=17	24					22				--Light gray
20											20.0 Bottom of boring at 20 feet
25											

TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS: N 32 degrees 30'57.8"
W 92 degrees 20'26.3"

DESCRIPTION OF TERMS AND SYMBOLS USED ON SOIL BORING LOGS

FIELD DATA				LABORATORY DATA								
GROUND WATER LEVEL	DEPTH (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits			Other	Soil Type	DISCRIPTION
							LL	PL	PI			



Description

Classifications are based on visual observations by field & lab representatives as well as results of laboratory data (when available)

Laboratory Data

Compressive Strength

Value based on peak compressive strength Determined by unconfined compression test unless otherwise noted

Dry Unit Weight

As determined by method similar to ASTM D-2937.

Water Content

As determined by pertinent portions of ASTM D-2216

Atterberg Limits

LL: Liquid Limit
PL: Plastic Limit
PI. Plasticity Index
(= Liquid Limit – Plastic Limit)

Other

Results of other test such as consolidation, permeability, grain size or notes associated with testing program

Soil Type

Graphical representation of soil type In accordance with USCS Symbols

Ground Water Levels

Long-Term Depth

Depth to water after boring is completed (time noted)

Short-Term Depth

Depth to water after initial water encountered prior to proceeding with boring (time noted)

Initially Encountered

Depth where free water was initially encountered during augering

Sampling/Field Data

Undisturbed

3' dia Tube Sample

Pocket Penetrometer

Penetration resistance (tons/sq ft)

Torvane (T)

Shearing resistance (tons/sq ft.)

Split Spoon

Std. penetration test

Std. Penetration

No. of blows per foot (blows per each six inch increments)

Auger

Disturbed (auger) collected in accordance with ASTM D-1452

No Recovery

Sampling attempted but no sample retrieved

Ground Water Level Data	Boring Advancement Method	Notes
	Boring Abandonment	

Form LOGTERMS

Strats Boundaries May Not Be Exact

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO 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 (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% 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 OR 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 GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

KEY TO SOIL TERMS AND SYMBOLS

CONSISTENCY OF COHESIVE SOILS (MAJOR PORTION PASSING NO. 200 SIEVE)		
CONSISTENCY	RANGE OF SPT RESISTANCE "N" BLOWS/FT	UNDRAINED SHEAR STRENGTH, KSF
Very Soft	< 2	Less than 0.25
Soft	2-4	0.5 TO 1.0
Medium	4-8	1.0 TO 2.0
Stiff	8-15	2.0 TO 4.0
Very Stiff	15-30	4.0 TO 8.0
Hard	>30	Greater than 8.0

RELATIVE DENSITY OF GRANULAR SOILS (MAJOR PORTION RETAINED ON NO. 200 SIEVE)		
DESCRIPTIVE TERM	RANGE OF SPT RESISTANCE "N" BLOWS/FT	RELATIVE DENSITY, %
Very Loose	< 4	Less than 15
Loose	4-10	15 TO 35
Medium Dense	10-30	35 TO 65
Dense	30-50	65 TO 85
Very Dense	>50	Greater than 85

TERMS DESCRIBING SOIL STRUCTURE

Parting:	paper thin in thickness
Seam:	1/8" – 3" in thickness
Layer:	greater than 3" in thickness
Calcareous:	containing appreciable quantities of calcium carbonate
Ferrous:	containing appreciable quantities of iron
Well-graded:	having wide range in grain size and similar proportions of all intermediate sizes
Poorly graded:	predominately one grain size or having a range of sizes with few or no particles of some Intermediate sizes
Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical
Interbedded:	composed of alternate layers of different soil types
Laminated:	composed of thin layers of varying color and texture
Slickensided:	having inclined planes of weakness that are slick and glossy in appearance
NOTE:	Clays possessing slickensided or fissured structure may exhibit lower measured shear strength than indicated by the described consistency. The consistency of such soil is interpreted using the measured shear strength along with pocket penetrometer results.