Exhibit Y. Double D Site Preliminary Geotechnical Engineering Report

Baton Rouge Area Chamber®

CSRS
IMAGINE SHAPE DELIVER

Professional Service Industries, Inc.
11950 Industriplex Blvd.
Baton Rouge, Louisiana 70809
Phone: (225) 293-8378

June 26, 2019

Baton Rouge Area Chamber
564 Laurel Street
Baton Rouge, LA 70801

Double D Site Preliminary Geotechnical Engineering Report

Attn: Mr. Russell Richardson
Phone: 225.339.1171
Email: russell@brac.org

Re: **General Geotechnical Site Characterization Report**
Addendum Letter #1 – Preliminary Foundation Capacities
Proposed Double D LED Site
Ascension Parish, Louisiana
PSI Project No. 02591524

Dear Mr. Richardson:

Per the request of Mr. Elliott Boudreaux of CSRS Inc., Intertek-PSI is pleased to submit this addendum letter illustrating preliminary shallow and deep foundation capacities for the Proposed Double D LED Site located in Ascension Parish, LA. Please note that this letter should be considered supplementary to PSI's Report No. 02591524 issued on May 23, 2018, therefore, all the information and discussions offered in our original report remain valid.

The foundations suitable for a given structure primarily depend on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation, and the criteria set by the Design Engineer with respect to vertical and differential movements which the structure can withstand without sustaining intolerable damage. Considering the preliminary nature of this study, neither detailed structural loading information nor grading plans were available at this time.

The choice of the type of deep foundation system should be based on the tolerance criteria for the performance of the structures and economics of the construction. Grade supported foundations or surface coverings will likely be governed by the anticipated load and settlement tolerances, particularly where a significant amount of new fill is placed. Driven piles should be viable foundation types considering the subsurface and groundwater conditions encountered, and should be considered to carry the structural loads anticipating that settlement will occur as a result of the self-weight of new fill, and building, and floor loads. Lightly loaded equipment pads may be able to be supported on shallow spread footings or mat foundations, as long as potential for movement is considered in the design. Prior to new fill placement, site preparation should include stripping and removal of surficial topsoil, organic materials, and soft soil or de-mucking of wet areas or drainage conveyances. Proof-rolling should be performed in the presence of the Geotechnical Engineer to assess general stability and firmness prior to fill placement.

SITE PREPARATION

It is our opinion that means, methods, and sequence of the proposed construction, including site preparation, should be the responsibility of the Contractor, who should specialize in this type of work. However, general geotechnical related guidelines are offered herein in this regard for guidance and

consideration. Prior to construction, positive drainage and collection of surface water should be established throughout the construction area and maintained throughout the duration of the construction period.

PSI recommends that any soft or loose near-surface fat clay soils, or other unsuitable materials in the areas to be developed be stripped and removed. In any building areas, an additional depth should be excavated and removed as necessary to provide at least two feet of compacted structural fill material or in situ stiff lean clay materials beneath all soil-supported foundation elements, including footings and floor slabs. Any voids resulting from the removal of unsuitable materials should be backfilled in accordance with the recommendations for structural fill placement provided herein as soon as practical.

Following stripping and removal of unsuitable materials, the exposed soil subgrade should be proof-rolled with a loaded tandem axle dump truck or similar pneumatic-tired vehicle having a minimum gross weight of 20 tons. Soils observed to rut or deflect excessively (i.e., movement greater than one inch) should be undercut and replaced with properly compacted structural fill material as described herein. Proof-rolling and undercutting activities should be performed during a period of dry weather and should be witnessed by a PSI representative.

Once subgrade preparation and observation have been completed, structural fill may be placed as required to reach design grades. Structural fill should be free of organic or other deleterious materials and have a Liquid Limit less than 40 and a Plasticity Index between 10 and 20. The structural fill should be placed in maximum lifts of eight inches of loose material and should be compacted to at least 95 percent of the Standard Proctor (ASTM D698) maximum dry density within the range of -1 to +2 percent of the optimum moisture content. If the fill is too dry, water should be uniformly applied and thoroughly mixed into the soil by disking or scarifying.

Each lift of compacted structural fill should be tested and documented by a PSI representative prior to placement of subsequent lifts. As a guideline, it is recommended that field density tests be performed at a frequency of not less than one test per lift for every 2,500 square feet of fill placed in the building area, or a minimum of four tests per lift, whichever is greater. In parking areas, it is recommended that field density tests be performed at a frequency of not less than one test per lift of every 5,000 square feet of fill placed, or a minimum of four tests per lift, whichever is greater. Tested fill materials not meeting either the required dry density or moisture content range should be recorded, the location noted, and reported to the Contractor and Owner. A retest of that area should be performed after the Contractor performs remedial measures.

A lower degree of compaction within the footprints of the pile-supported structures and floor slabs could be considered. The fill within the structure footprints should be selected and placed so that it does not present high resistance to pile driving. Therefore, the fill within the building footprints could consist of either good quality granular or cohesive material, free from organic, wood, roots, deleterious materials, etc. It should be compacted to a density of about that of the natural subsoils in order to minimize long-term areal settlements. However, controlled-compaction of this portion of the fill is believed to be unwarranted.

SHALLOW FOUNDATION RECOMMENDATIONS

Provided that the site is properly prepared, the proposed industrial structures (tanks, pipe racks, etc.) could be supported on shallow foundation systems using spread footings bearing at least 24 inches below final grade in properly compacted structural fill or stiff to very stiff natural in-situ lean clay. For preliminary analyses purposes only, spread footings bearing in these materials can be designed for a net allowable soil bearing capacities between 1,200 and 1,500 psf for a footing size up to five (5) feet by five (5) feet based on the assumed settlement tolerances of one (1) inch. This allowable bearing capacity value is in consideration of dead loads plus sustained live loads and may be increased by one third (1/3) when accounting for transient live loads, such as wind. To minimize the potential for localized bearing failure, minimum dimensions of 24 inches for spread footings are recommended.

Foundation excavations should be observed and documented by a representative of PSI prior to steel or concrete placement to verify that the foundation materials are consistent with the materials discussed in this report and capable of supporting the design loads. Soft or extremely loose soil zones encountered at the bottom of footing excavations should be removed to a suitable soil level and replaced with compacted structural fill. Fill placed below the foundations where unsuitable materials are removed should extend one foot outside the foundation limits for every one foot in thickness (1H:1V) between the intended bearing surface and the underlying suitable natural soils.

Footing excavations should be observed and concrete placed as quickly as practical to avoid exposure of the bottom of the excavations to wetting and drying. Surface runoff water should be drained away from the excavations and should not be allowed to pond. If possible, the foundation concrete should be placed the same day the excavation is made. If footing excavations are required to be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

SHALLOW FOUNDATION SETTLEMENT

Long-term total settlement due to consolidation under shallow foundations not exceeding the recommended allowable bearing capacities is estimated to be on the order of one (1) inch. Differential settlement is estimated to be about half of the total settlement. Once the final footing sizes and spacing are determined, PSI can provide more representative settlement estimates if required.

Notwithstanding the limited number of soil borings and CPTu soundings with associated field data and laboratory test results, the proposed site is generally feasible for industrial development. The subsurface soils explored are suitable for building foundations and site roadways following proper preparation. The requested estimated allowable bearing capacities for both deep and shallow foundations systems are presented below.

DEEP FOUNDATION RECOMMENDATIONS

Based on the CPT soundings and the laboratory testing, the static method of analysis was used to compute the estimated allowable pile capacities for a precast concrete pile and an open-ended pipe pile for possible use in support of the proposed industrial facility. In Table 1 below, allowable axial capacities are shown for both 14-inch precast concrete piles and 14-inch open-ended pipe piles with an applied design factor if safety of 2.0 in compression and 3.0 in tension.

Table 1: Preliminary Estimated Allowable Pile Capacities

Estimated Allowable Single Pile Capacity (tons)* FS=2.0 in compression; FS= 3.0 in tension				
Pile Length (ft)**	Precast Concrete Pile (PCC)		Open-Ended Pipe Pile (OPP)	
	14-inch Square		14-inch Diameter	
	Compression	Tension	Compression	Tension
40	43	25	26	17
45	49	30	31	21

(*) These are soil-pile related capacities and consideration should be given to the structural integrity of the pile member.

(**) Pile lengths are referenced from the existing ground surface in borings B-1 and CPT-1 at the time of drilling, and additional length should be added to account for fill thickness or a raised floor.

Additional recommendations will have to be provided with regard to pile settlement, drag load, group effect, lateral capacity, and pile driving and monitoring once design of the proposed structures has been finalized or identified with certainty.

As previously stated, PSI's opinions and information presented in this preliminary site characterization report are provided for planning purposes and are strictly preliminary considerations only; they are based on a *very* limited geotechnical exploration and are not to be used for final design and construction.

If you have any questions pertaining to this addendum letter, please contact our office at (504) 733-9411. PSI would be pleased to continue providing geotechnical and construction material testing services throughout the construction of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Ali Hijazi
Geotechnical Department Manager

Reda M. Bakeer, PhD, PE
Chief Engineer

Name: Reda M. Bakeer, Ph.D., P.E.
Date: June 26, 2019
License No.: 27123
THIS PRELIMINARY DOCUMENT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE, SALES, OR AS THE BASIS FOR THE ISSUANCE OF A PERMIT.

Professional Service Industries, Inc.
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May 23, 2018

Baton Rouge Area Chamber
564 Laurel Street
Baton Rouge, LA 70801

Attn: Mr. Russell Richardson
Phone: 225.339.1171
Email: russell@brac.org

Re: **General Geotechnical Site Characterization Report**
Proposed Double D LED Site
Ascension Parish, Louisiana
PSI Project No. 02591524

Dear Mr. Richardson:

Professional Service Industries, Inc. (PSI) is pleased to submit our General Geotechnical Site Characterization Report for the above-referenced project. This report presents the results of our field exploration and laboratory testing and information regarding the compatibility of this site with industrial development, suitability of soils for building foundations and on-site roadways, requirements of soil augmentation for construction of a typical 100,000 square-feet industrial manufacturing building and depth of groundwater.

If you have any questions pertaining to this report, please contact our office at (225) 293-8378. PSI would be pleased to continue providing geotechnical and construction material testing services throughout the construction of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Sarah F. Berman, E.I.
Geotechnical Project Manager

Reda M. Bakeer, PhD, PE
Chief Engineer

GENERAL GEOTECHNICAL SITE CHARACTERIZATION REPORT

Double D LED Site
Gonzales, Ascension Parish, Louisiana
PSI Project No. 02591524

PREPARED FOR

BATON ROUGE AREA CHAMBER
564 LAUREL STREET
BATON ROUGE, LA 70801

May 23, 2018

BY
PROFESSIONAL SERVICE INDUSTRIES, INC.
11950 INDUSTRIPLEX BLVD.
PHONE: 225-293-8378

Name: Reda M. Bakeer, Ph.D., P.E.
Date: May 23, 2018
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PROJECT INFORMATION

PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI) has completed a General Geotechnical Site Characterization Study at the BRAC Double D LED Site located in Ascension Parish, Louisiana. Our services were performed in general accordance with PSI Proposal No. 238249, dated March 12, 2018. Authorization was provided by Mr. Russell Richardson by signing PSI's proposal on April 20, 2018.

PROJECT DESCRIPTION

The primary objective of this preliminary investigation is to provide general information regarding the compatibility of this site with industrial development:

- Sustainability of the naturally occurring soils for building foundations and on-site roadways;
- Requirements of soil augmentation, if any, for construction of a typical 100,000 square-foot industrial manufacturing building; and
- Depth of free groundwater table at the exploration locations during our field operations.

This general geotechnical site characterization report will provide an initial baseline of the site's subsurface conditions that will likely be encountered during future site development. However, as with any geotechnical investigation, particularly given the size of this subject site and the relatively limited number of exploration locations, variations between exploration locations may and should be expected to exist, and there remains a distinct possibility that other conditions may exist at the site that were not encountered within the scope of this preliminary investigation.

The opinions and information to be presented in this preliminary report are general estimates for use by others in feasibility studies and cost-estimating purposes. Thus, the estimates are based on a limited geotechnical exploration, and are not to be used for final design and construction. A detailed geotechnical exploration and analyses should be performed once design and function of the proposed development have been finalized.

PURPOSE AND SCOPE OF SERVICES

The purpose of this site characterization was to explore the subsurface conditions at the site and present preliminary geotechnical related observations for the proposed construction. PSI's contracted scope of services is:

- Perform one (1) Cone Penetrometer Test (CPTu) sounding and one (1) conventional soil boring at the subject site as outlined by the Client;
- Evaluate the general subsurface soil conditions and groundwater depth at the subject site at the exploration locations during our field activities;
- Perform limited geotechnical laboratory testing on selected soil samples recovered from the boring; and,
- Provide a general discussion regarding compatibility of this site for industrial development, suitability of the subgrade soils for building foundations and on-site pavement improvement, and requirements of soil augmentation, if needed, for construction of a typical 100,000 square-foot industrial manufacturing building.

The scope of services did not include an environmental assessment for determining the presence or absence of wetland, or hazardous or toxic materials in the soil, surface water, groundwater, or air on, below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Additionally, PSI's scope of services did not include environmental sampling or performing analytical testing of soil or groundwater samples.

PSI did not provide any service to investigate or detect the presence of moisture, mold, or other biological contaminants within the project area, or any service that was designed or intended to prevent or lower the risk of the occurrence or amplification of the same. The Client should be aware that mold is ubiquitous to the environment, with mold amplification occurring when building materials are impacted by moisture. The Client should also be aware that site conditions are outside of PSI's control, and that mold amplification will likely occur or continue to occur in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

FIELD AND LABORATORY PROCEDURES

The subsurface conditions at the subject site were explored by drilling and recovering soil samples from one (1) soil boring, and through one (1) Cone Penetrometer Test (CPTu) sounding. Soil boring B-1 extended to a depth of approximately 30 feet below the existing ground surface. CPTu sounding CPT-1 extended to a depth of approximately 50 feet below the existing ground surface. The number and depths of the boring and sounding were selected in accordance with the exploration guidelines provided by the Client. Refer to the Boring Location Plan in the Appendix for the approximate exploration locations based on the most recent Google Earth aerial imagery, dated November 13, 2017.

The exploration locations were selected and located in the field by PSI personnel using a furnished site plan and a handheld GPS unit. The soil boring was performed using the Geoprobe 7822DT track-mounted drilling rig using hollow-stem auger and wet rotary drilling techniques. Samples were generally obtained at two (2) foot intervals from the ground surface to a depth of ten (10) feet and then at five (5) foot intervals thereafter to the boring termination depth. Drilling and sampling were both performed in general accordance with ASTM Standard Procedures.

The boring was sampled using the Shelby Tube (ASTM D1587) samplers. The samples were identified according to boring number and depth, placed in polyethylene plastic wrapping to reduce moisture loss, and transported to PSI's laboratory in Baton Rouge, Louisiana. The CPT soundings were performed in general accordance with ASTM D5778. The CPTu sounding was performed using the same Geoprobe 7822DT track-mounted drilling rig and was performed in general accordance with ASTM D5778.

All samples obtained during the field exploration were visually classified and evaluated by experienced geotechnical personnel upon arrival at the laboratory. Selected samples were tested in the laboratory to determine material properties for our evaluation. The geotechnical laboratory testing program included moisture content, Atterberg limits, percent passing the US Standard No. 200 sieve, and unconfined compressive strength testing. Additional estimates of unconfined compressive strength were obtained through the use of a hand penetrometer and torevane.

The geotechnical laboratory testing was conducted in general accordance with applicable ASTM procedures. The results of the laboratory tests are presented in the Boring Logs in the Appendix. The samples which were

not altered by laboratory testing will be retained for 60 days from the date of this report and will then be discarded.

SITE AND SUBSURFACE CONDITIONS

SITE LOCATION AND DESCRIPTION

The Double D LED site is located off of Louisiana Highway 44 (South Burnside Avenue) in Ascension Parish outside of Gonzales, Louisiana. The Latitude and Longitude near the center of the approximately 32 acre site are approximately N 30.20657° and W 90.92484°, respectively. At the time of PSI's field exploration, the subject site area was an undeveloped tract of land with grass and tree groundcover and appeared be relatively consistent in elevation.

Based on a review of historical Google Earth aerial imagery, the site has never been developed based on the earliest available aerial imagery, dated January 30, 1998. Parts of the site were cleared of trees in 2014 However, it should be noted that the available Google Earth aerial imagery for the subject site is of low quality and includes some gaps in coverage; therefore, it may not necessarily be sufficient to reach a conclusion regarding former uses, if any, of the site.

SUBSURFACE CONDITIONS

Based on the field observations and results of the laboratory testing, the soils were classified, and the boring and CPTu logs were developed. The boring and CPTu logs are presented in the Appendix along with a key to the terms and symbols used on the logs. The soil boring generally encountered firm to stiff lean and fat clay strata that extended from the existing ground surface to the maximum explored depth of approximately 30 feet. The CPTu sounding was consistent with the boring stratification. However, consistency of the clay strata varied from soft to stiff. The CPTu encountered lean and fat clays extending from the ground surface to about 35 feet below the existing ground surface, with two small intervals of silty sand or sandy silt materials at about 17 feet and at 31 feet below the existing ground surface. The clay soils are underlain by alternating strata of lean and fat clays with silty sand and sandy silts to the maximum CPTu exploration depth of 50 feet.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring and CPTu logs included in the Appendix should be reviewed for specific information at the individual exploration locations. These records include soil descriptions, stratifications, penetration resistances, and locations of the samples and laboratory test data. The stratifications shown on the logs represent the conditions only at the actual exploration locations. Variations may occur and should be expected between and away from the sample locations. The stratifications represent the approximate boundary between subsurface materials, but the actual transition may be more gradual. This is particularly important considering the site size and the limited number of explorations made at random and accessible locations.

WATER LEVEL MEASUREMENTS

Free groundwater was encountered at a depth of approximately 6 feet below the existing ground surface in soil boring B-1 at the time of our field exploration. However, it should be noted that the groundwater information presented in this report is based on observations made at the time of our field exploration and may not have become fully static at the time of measurement. Groundwater levels at the site can fluctuate

based on variations in rainfall, evaporation, surface runoff, and other hydro-geologic factors. In addition, a perched groundwater condition could develop in parts of the site when rainwater becomes entrapped in the near-surface silty sand and sandy silt strata underlain by less permeable fat clays in sounding CPT-1. Therefore, it is recommended that the Contractor determine the groundwater depth at the time of construction.

EVALUATION AND DISCUSSION

The foundations suitable for a given structure primarily depend on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation, and the criteria set by the Design Engineer with respect to vertical and differential movements which the structure can withstand without damage. Detailed column loads for a typical 100,000 sq. ft industrial manufacturing building were not provided at the time of this study; however, the structural column loads are assumed to be on the order of 100 kips, with wall loads on the order of about 5 kips per linear foot or less. Grading plans are also not available at this time, but for the purpose of this preliminary analysis, we assume that about 3 feet of fill or less will be needed to achieve the final design grade.

The choice of the type of a deep foundation system should be based on the tolerance criteria for the performance of the structures and economics of the construction. Grade supported foundations or surface coverings will likely be governed by the anticipated load and settlement tolerances, particularly where a significant amount of new fill is placed. Driven piles should be viable foundation types considering the subsurface and groundwater conditions encountered and should be considered to carry the structural loads anticipating that settlement will occur as a result of the self-weight of new fill, and building, and floor loads. Lightly loaded equipment pads may be able to be supported on shallow spread footings, or mat foundations, as long as the potential vertical rise (PVR) issues described below are mitigated and the potential for movement is considered in the design. Prior to new fill placement, site preparation should include stripping and removal of surficial topsoil, organic materials, and soft soil or de-mucking of wet areas or drainage conveyances. Proof-rolling should be performed in the presence of the Geotechnical Engineer to assess general stability and firmness prior to fill placement.

Notwithstanding the limited number of soil borings and CPTu soundings with associated field data and laboratory test results, the proposed site is generally feasible for industrial development. The subsurface soils explored are suitable for building foundations and site roadways following proper preparation.

The near surface soils encountered at the exploration location B-1 are moderately to highly susceptible to experiencing volumetric changes (shrinking and swelling) with variations in their moisture content. Potential Vertical Rise (PVR) should be further evaluated considering the actual fill thickness needed to raise the site to achieve the final design grades. PVR in portions of the site could be mitigated by undercutting the clay soils to a predetermined depth and replacing it with moisture-conditioned, properly compacted lean clay (CL) soils, or with the addition of chemical treatment such as lime mixing. Based on the site location, and PSI's previous experience with projects in the general Gonzales area, it is anticipated that the amount of fill that will be needed on this site will be on the order of around two (2) to four (4) feet, and PVR is not anticipated to adversely impact the project site with great significance. The effects of PVR should be considered if lesser amounts of fill are planned/required. The suitability of re-using excavated soils (e.g., ponds, etc.) as structural fill material may require the use of lime treatment or soil mixing, as well.

Site pavements should be underlain by at least 12 inches of properly compacted low plasticity engineered structural fill material or otherwise the existing material be chemically treated with lime prior to base material placement due to the near surface fat clay soils. At this time, we assume that the pavement areas will receive less than three (3) feet of fill material to achieve the final grades.

As previously stated, PSI's opinions and information presented in this preliminary site characterization report are provided for planning purposes and are strictly preliminary considerations only; they are based on a *very* limited geotechnical exploration and are not to be used for final design and construction.

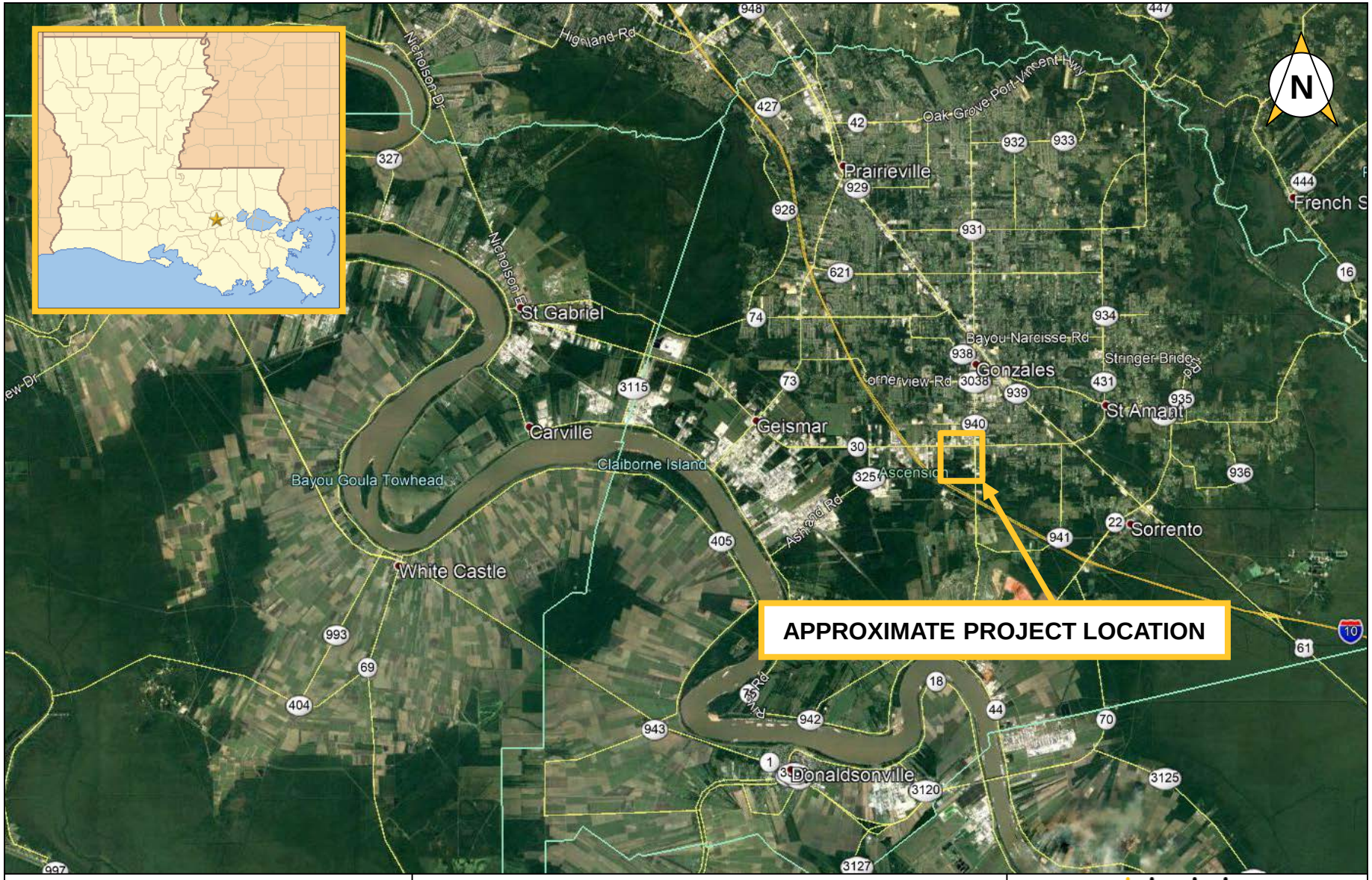
REPORT LIMITATIONS

The preliminary recommendations provided in this site characterization report are based on the available subsurface information obtained by PSI and design details furnished by the Client for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in our recommendations are required. If PSI is not notified of such changes, we will not be responsible for the impact of those changes on the project.

PSI warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

This report has been prepared for the exclusive use the Baton Rouge Area Chamber for the specific purpose of determining general site characterization information at the LED Double D Site located in Ascension Parish, Louisiana.

APPENDIX



GEOTECHNICAL ENGINEERING SERVICES

LED DOUBLE D SITE

BRAC

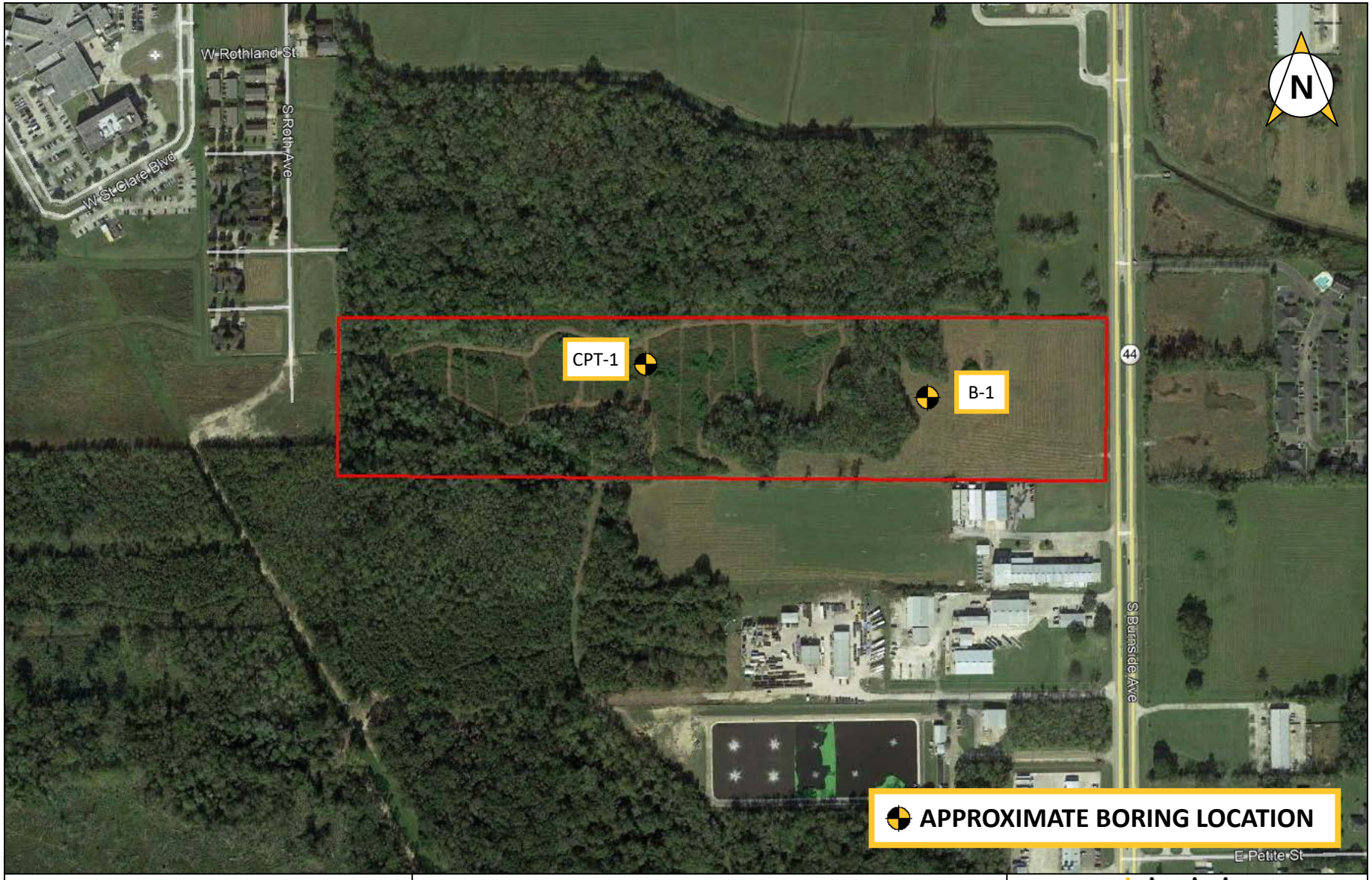
ASCENSION PARISH, LOUISIANA

SITE VICINITY MAP

PSI PROJECT NO.: 02591524

GOOGLE EARTH IMAGERY DATE: 11/13/2017

intertek psi



GEOTECHNICAL ENGINEERING SERVICES

LED DOUBLE D SITE

BRAC

ASCENSION PARISH, LOUISIANA

BORING LOCATION PLAN

PSI PROJECT NO.: 02591524

GOOGLE EARTH IMAGERY DATE: 11/13/2017

intertek psi

CPT: CPT-1

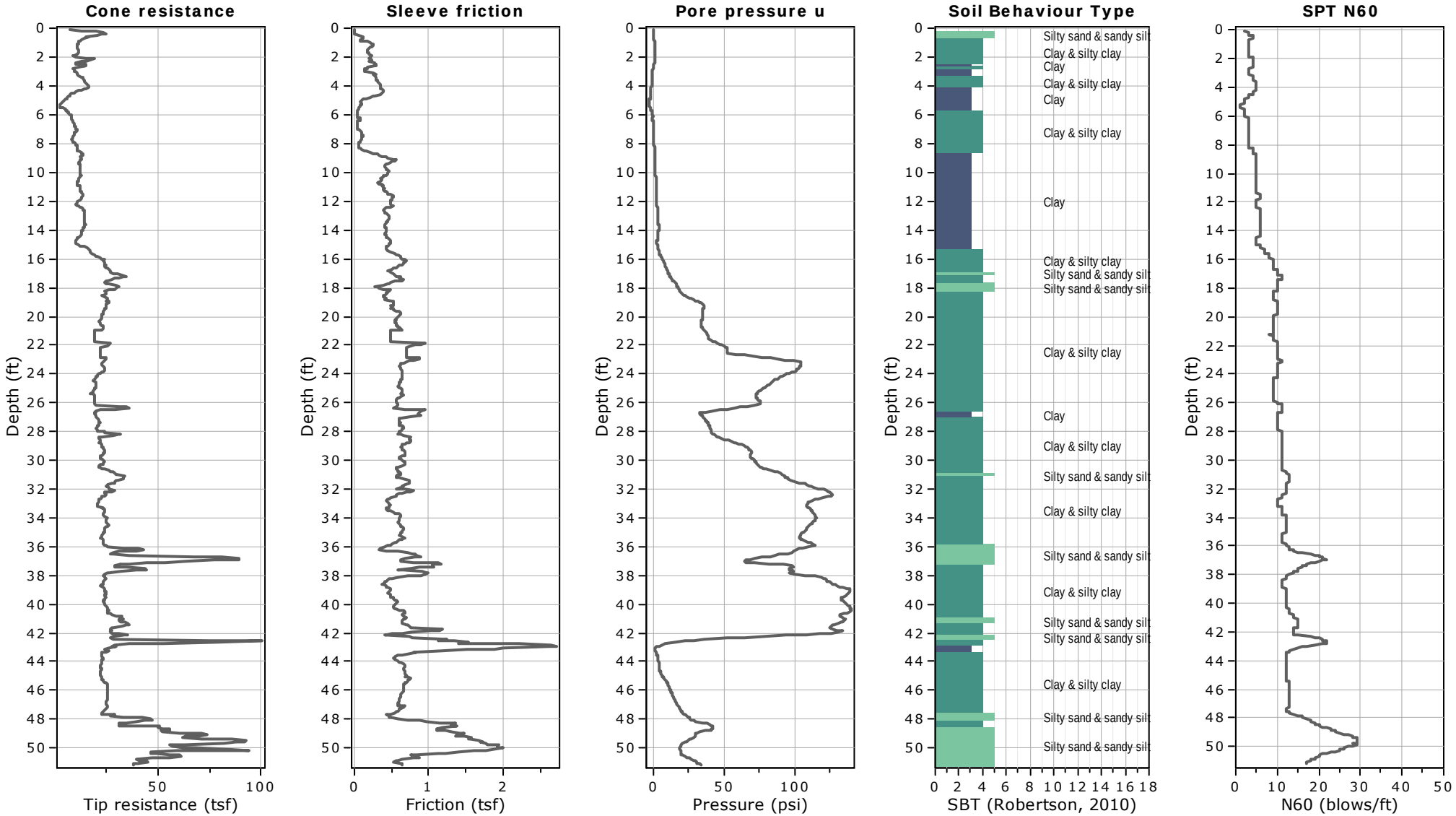
Total depth: 51.18 ft, Date: 5/4/2018

Cone Type: 60° 1.4" Diam. Type 2 Electric Cone Penetrometer

Cone Operator: Bill Penick

Project: **02591524 - BRAC Double D LED Site**

Location: **Highway 44, Gonzales, Louisiana**



Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236 \right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \leq 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: N_{SPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a} \right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c\_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$ (applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c\_cutoff}$)

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Peak drained friction angle, φ (°) ::

$$\varphi = 17.60 + 11 \cdot \log(Q_{tn})$$

(applicable only to SBT_n: 5, 6, 7 and 8)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$

$\alpha = 14$ for $Q_{tn} > 14$

$\alpha = Q_{tn}$ for $Q_{tn} \leq 14$

$M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \leq 2.20$

$$M_{CPT} = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho} \right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot +7 \cdot \log(F_r))} \right]^{1.25}$$ or user defined

$OCR = k_{OCR} \cdot Q_{tn}$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = (1 - \sin\varphi') \cdot OCR^{\sin\varphi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Effective Stress Friction Angle, φ<sun>'

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

• Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012

• Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)

LOG OF BORING B-1

BRAC DOUBLE D LED SITE
LA HIGHWAY 44
ASCENSION PARISH, LOUISIANA

TYPE OF BORING: Hollow Stem Auger | LOCATION: | PSI Project No.: 02591524

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HAND PEN (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TORVANE (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
0		CH		Firm dark gray **FAT CLAY** with roots			53	16	37			0.33				
2.5		CL		Stiff gray and tan **LEAN CLAY** with ferrous nodules								0.58	0.53			100
5.0				▽			42	23	19			0.42		0.55		
7.5												0.42		0.60		
		CH		Stiff tan **FAT CLAY**			53	15	38			0.50	0.57			102
10.0																
12.5																
15.0				- Red and light gray								0.50		0.60		
17.5																
20.0												1.00				
22.5																
25.0				- Brown								0.75	0.61			83
27.5																
30.0				- Light gray								0.75				
32.5																
35.0																
37.5																
40.0																
42.5																
45.0																
47.5																
50.0																

DEPTH OF BORING: 30 FEET
DATE DRILLED: 5/4/18
NOTE:

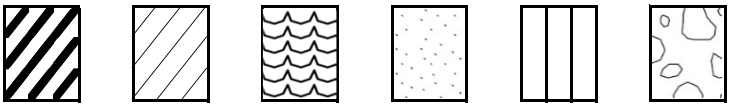
▽ GROUNDWATER DURING DRILLING: 6 feet
▼ GROUNDWATER UPON COMPLETION: N/ A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_BATONROUGE - PSIHOUSTON.GDT - 5/21/18 10:43 - 0254

intertek psi
Professional Service Industries, Inc.
11950 Industriplex Boulevard
Baton Rouge, Louisiana 70809
(225) 293-8378

KEY TO TERMS AND SYMBOLS USED ON LOGS

SOIL TYPE



FAT CLAY | LEAN CLAY | ORGANIC CLAY | SAND | SILT | GRAVEL

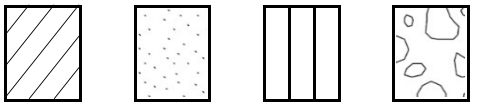
SAMPLER TYPE

NO RECOVERY | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

SOIL TYPE

TOPSOIL | FILL

MODIFIERS



CLAYEY | SANDY | SILTY | GRAVELY

GROUNDWATER DURING DRILLING

GROUNDWATER UPON COMPLETION

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

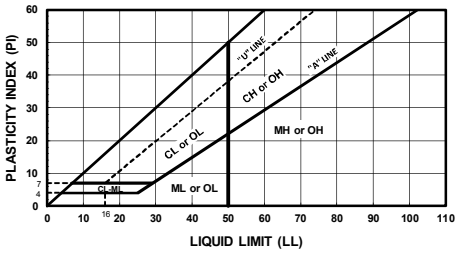
MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE	GRAVEL & GRAVELLY SOILS LESS THAN 50% PASSING NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		WITH APPRECIABLE FINES	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN 50% PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SAND
			SP	POORLY-GRADED SANDS
		WITH APPRECIABLE FINES	SM	SILTY SANDS
			SC	CLAYEY SANDS
FINE-GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT < 50		ML	INORGANIC SILTS & VERY FINE SANDS, CLAYEY SILT W/ LOW PLASTICITY INDEX
			CL	INORGANIC LEAN CLAYS GRAVELLY, SANDY, OR SILTY LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS W/LOW PLASTICITY INDEX
	SILTS AND CLAYS LIQUID LIMIT ≥ 50		MH	INORGANIC SILTS W/ HIGH PLASTICITY INDEX, ELASTIC SILTS
			CH	INORGANIC FAT CLAYS GRAVELLY, SANDY, OR SILTY FAT CLAYS
			OH	ORGANIC CLAYS OF MED TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOIL			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS
UNCLASSIFIED FILL MATERIALS			ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS AND MAN-MADE SOIL MIXTURES	

CONSISTENCY - COHESIVE SOILS

CONSISTENCY	SHEAR STRENGTH IN TONS/FT^2
VERY SOFT	0 TO 0.125
SOFT	0.125 TO 0.25
FIRM	0.25 TO .50
STIFF	0.50 TO 1.00
VERY STIFF	1.00 TO 2.00
HARD	> 2.00 OR 2.00+

RELATIVE DENSITY - GRANULAR SOILS

DENSITY	N-VALUE (BLOWS/FT)
VERY LOOSE	0-4
LOOSE	4-9
MEDIUM DENSE	10-29
DENSE	30-49
VERY DENSE	> 50 OR 50+



ABBREVIATIONS

HP - HAND PENETROMETER

TV - MINIATURE TORVANE

UC - UNCONFINED COMPRESSION TEST

UU - UNCONSOLIDATED UNDRAINED TRAIXIAL

NOTE: BORING LOGS INDICATE SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS

CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

12"	3"	3/4"	4	10	40	200

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

300	75	19	4.75	2.0	0.42	0.075	0.005

GRAIN SIZE IN MM

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