ST. TAMMANY PARISH

MICHAEL B. COOPER
PARISH PRESIDENT

**October 17, 2024**

Please find the following addendum to the below-mentioned BID.

**Addendum No**.: 3

**Bid#**: 24-53-2

**Project Name**: West St. Tammany Regional Sewer Treatment Facility

**Bid Due Date**: October 22, 2024

## GENERAL INFORMATION:

1. Drawing Sheet GS-1: Add the following to the Structural General Notes:
   7. At the Contractor's option, the influent screen channel and wet well top slab may be constructed using pre-cast concrete. Pre-cast concrete shall be provided by Gainey's or approved equal. The pre-cast concrete design shall be submitted during the submittal phase of construction and shall be stamped by a registered professional engineer.

## QUESTIONS & ANSWERS:

QUESTION 1: Will the geotechnical report and soil borings be provided with the latest addendum? Per plan sheet GS-1, Note E. Foundations, a geotechnical report was prepared by Stratum Engineering LLC but I do not see it in the bid documents.

ANSWER 1: - A copy of the Geotech report is attached.

## ATTACHMENTS:

1. **Geotech Report.pdf**

**End of Addendum #3**

STRATUM ENGINEERING, LLC
Geotechnical Engineering ♦ Testing and Inspection Services

January 19, 2016

Kyle Associates, LLC
638 Village Lane North
Mandeville, Louisiana 70471

Attn: Mr. Phil Nelson, P.E.

Re: Geotechnical Engineering Report
Proposed West St. Tammany Parish
Waste Water Treatment Plant Expansion
Covington, Louisiana
Project No. G15-108

Dear Phil:

Stratum Engineering, LLC (SE) is pleased to submit our Geotechnical Engineering Report for the above referenced project. This report includes the results of our field exploration and laboratory testing, and recommendations for foundation design as well as general site development.

We appreciate the opportunity to perform this geotechnical study and look forward to working with you during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please do not hesitate to call.

Respectfully submitted,
STRATUM ENGINEERING, LLC

William "Dean" McInnis, P.E.
Project Manager

Tony Y. Maroun, P.E.
Principal

STATE OF LOUISIANA
TONY Y. MAROUN
License No. 26198
PROFESSIONAL ENGINEER
1/19/16
CIVIL ENGINEERING

WDM/TYM:nsv

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# PROJECT INFORMATION

## Project Authorization

Stratum Engineering, LLC (SE) has completed a geotechnical exploration for the proposed expansion to the West St. Tammany Regional Waste Water Treatment Plant (WWTP) to be completed for Tammany Utilities in Covington, Louisiana. The exploration was accomplished in general accordance with SE Proposal No. G15-185, dated November 24, 2015.

## Project Description

The project includes the installation of new waste water treatment units consisting of an above ground steel aeration/clarifier tank as well as a steel equalization (EQ) tank. Both tanks will be supported on reinforced concrete mats. The units will have plan areas of approximately 5,000 and 12,000 square feet. The aeration/clarifier tank and equalization tank will each be about 16 ½ feet high with empty weights of approximately 300 kips and 85 kips, respectively. Each tank will exert a slab load of about 1,400 pounds per square foot when filled to capacity.

The geotechnical recommendations presented in this report are based on the available project information, plant location, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform SE in writing so that we may amend the recommendations presented in this report, if appropriate and if desired by the client. SE will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

## Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site to enable an evaluation of cost effective foundation systems for the proposed Waste Water Treatment Plant Expansion. Two (2) borings were drilled at the site to a depth of 30 feet below the existing ground surface. The borings were located in the field by a Stratum Engineering representative using normal taping from existing landmarks. The approximate locations of the borings are indicated on the boring location plan included in the Appendix.

Our scope of services included a reconnaissance of the project site, drilling the soil borings, select laboratory testing, and preparation of this geotechnical report. The report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and presents recommendations regarding the following:

- Foundation type, allowable bearing capacity, and an estimate of settlement;
- Seismic site classification;
- Site preparation, including subgrade preparation and fill compaction requirements;
- Factors influencing construction and performance of the proposed improvements.

# SITE AND SUBSURFACE CONDITIONS

## Site Location and Description

The site encompasses about 1 acre of property currently occupied by an existing aeration/clarifier tank and associated pump house structure. The property is located off LA Highway 1085 just north of Interstate 12 in Covington, Louisiana. Detailed grading information was unavailable at the time of this report. However, based on conversations with Mr. Phil Nelson of Kyle Associates, we understand that the existing ground surface elevation at the tank locations ranges from +23 to +24 feet. Considering a slab finished floor elevation of +26 feet, 2 to 3 feet of fill may be required to achieve the design grades. Furthermore, we understand that about two (2) feet of fill was previously placed during the initial development of the site.

The site is bounded by a wooded area followed by commercial properties to the north, LA Highway 1085 to the south, Windward Drive to the east, and a wooded area followed by residential properties to the west.

## Drilling, Sampling, and Laboratory Testing Procedures

The borings were drilled with an All Terrain Vehicle (ATV) mounted drill rig. Auger and wet rotary drilling techniques were used to advance the borings. Samples were generally obtained continuously from the ground surface to a depth of ten feet and at maximum five foot intervals thereafter. Drilling and sampling techniques were accomplished in general accordance with ASTM Standards.

Undisturbed samples of cohesive soils were generally obtained using thin-wall tube sampling procedures in general accordance with the procedures for "Thin-Walled Tube Geotechnical Sampling of Soils" (ASTM D1587). These samples were extruded in the field with a hydraulic ram and were wrapped in aluminum foil prior to placement in a plastic wrapping to preserve moisture. The samples were transported to the laboratory in containers to prevent disturbance.

For cohesionless soils and semi-cohesive soils, Standard Penetration Tests (SPT) were performed to obtain standard penetration values of the soil. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling 30 inches, required to advance the split-barrel sampler one (1) foot into the soil. Samples of granular soils were obtained utilizing a two (2) inch O.D. split-barrel sampler in general accordance with procedures for "Penetration Test and Split-Barrel Sampling of Soils" (ASTM D1586). To perform the test and obtain a sample, the sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer. The number of blows is recorded for each of three (3) successive increments of six (6) inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density of cohesionless soils and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components. The split spoon samples were identified according to the project number, boring number, and depth, and were also placed in polyethylene plastic wrapping to protect against moisture loss.

The laboratory testing program included supplementary visual classification and water content tests on all of the soil samples. In addition, selected samples were subjected to unconfined compression testing, percent passing the #200 sieve, and Atterberg Limits determination. Additional estimates of unconfined compressive strength were made using a hand penetrometer. The laboratory testing was performed in general accordance with ASTM Standard Procedures.

## Subsurface Conditions

Based on the borings, about 24 inches of previously placed fill consisting of sand and limestone mixture was encountered at the surface of the site. The surficial material was underlain by firm to stiff reddish sandy lean clay to a depth of about 4 feet and was followed by stiff tannish gray lean clay to a depth of about 12 feet. The lean clay was underlain by firm to stiff tannish gray fat clay to a depth of 30 feet, the maximum depth explored.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at the boring locations. These records include soil descriptions, stratification, penetration resistance, and locations of the samples and laboratory test data. The stratification shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected across the site. The stratification represents the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on the boring logs. The samples, which were not altered by laboratory testing, will be retained for 60 days from the date of this report and then will be discarded.

## Groundwater Conditions

Groundwater was encountered at a depth between 9 ½ and 10 feet during the drilling operations. However, it should be noted that groundwater levels will fluctuate with seasonal variations in rainfall, extended periods of drought and surface runoff. Therefore, it is recommended that the actual groundwater levels at the site be determined by the contractor at the time of the construction activities.

## IBC Site Classification

*The International Building Code (IBC), 2012 edition,* was reviewed to determine the site classification for seismic design. Based on the soils encountered in the boring and our experience in the general vicinity, the site can be classified as Site Class "D", as outlined in Section 1613.3.2 of the Building Code.

# EVALUATION AND RECOMMENDATIONS

## General

The type and depth of foundation suitable for a given structure primarily depends 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 movement which the structure can withstand without damage.

The results of this exploration indicate that the subsurface soils present at the site are fair in bearing quality and suitable to support the structure on a shallow foundation system. Details related to site preparation, foundation design, and construction considerations are presented in subsequent sections of this report.

## Site Preparation

We understand that the area may have been filled some time ago and graded to achieve the current elevations. Since the tank sand pads and underlying sandy clay have been filled without any technical observation, it is recommended that 24 inches of the sandy fill be removed and stockpiled for re-use. The bottom 12 inches of the sandy clay fill should be proofrolled and field density tests conducted to verify the density of the in-situ fill.

The subgrade fill should be proofrolled with a tandem axle dump truck or a similar heavily loaded rubber tired vehicle weighing 20 tons. Soils, which are observed to rut or deflect excessively under the moving load, should be undercut and replaced with properly compacted structural fill. The proofrolling and undercutting activities should be witnessed by a representative of the Geotechnical Engineer and should be performed during a period of dry weather.

The remaining fill should be placed in a relatively uniform horizontal lift and should be adequately keyed into the previous lift. The structural fill may consist of sandy clay or clayey sand having a maximum liquid limit of 40 and a plasticity index of less than 18 percent. The structural fill should be compacted to at least 95 percent of the fill's maximum dry density as determined by ASTM D698 (Standard Proctor).

The structural fill should be placed in maximum lifts of eight (8) inches of loose material and should be compacted within the range of one (1) percentage point below to three (3) percentage points above the optimum moisture content value. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of compacted structural fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts. In-place density measurements should be taken to assure that the above degree of compaction is achieved.

## Mat Foundations

We understand that the proposed waste water treatment plant will be supported on a shallow mat type of foundation bearing at least two (2) feet below the finished grade in the naturally occurring stiff clay or on compacted structural fill. The foundation may be designed for a maximum allowable bearing pressure of 2,500 psf which includes a design factor of safety of three (3).

Estimates of Modulus of Subgrade Reaction (k) for mat foundations will depend on the type and strength of bearing soils, mat size, shape, bearing depth, and magnitude of sustained loads. Since limited information regarding the bearing depth was available at the time the report was prepared, estimates for the subgrade reaction modulus for the soils encountered in the upper 4 feet are tabulated below:

| **Modulus of Subgrade Reaction (k)** | | |
|---|---|---|
| **Soil Type** | **Depth (ft)** | **k (pci)** |
| Silty Clayey Sand with Limestone | 0 to 2 | 250 |
| Sandy Clay | 2 to 4 | 125 |

The Modulus of Subgrade Reaction (k) can be better estimated by plate load tests conducted on the soils in question at the actual bearing depth.

The foundation excavations should be observed by a representative of SE prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of firm soils or adequately compacted fill as directed by the Geotechnical Engineer. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with compacted structural fill or crushed stone, as determined by the Geotechnical Engineer.

Footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond prior to or after concrete placement. The foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

### Settlement

Differential settlements of mat foundations depend on the rigidity of the mat. Differential settlements for mats with a rigidity factor greater that 0.5 will be negligible. For mat foundations with rigidity factors less than 0.5, differential settlements will generally be on the order of 50 percent of the total settlement.

Analyses were made to estimate the settlement under a loaded area roughly about 130 feet by 130 feet. Based on a loading condition exerted by a uniform load of 1,400 psf, long term settlement at the center of the loaded area was estimated to be about one (1) to 1 ½ inches. Settlement at the edge and corner of the mat were estimated to be about ¾ inch and ½ inch, respectively.

## CONSTRUCTION CONSIDERATIONS

It is recommended that SE be retained to provide observation and testing of construction activities involved in the foundations and related activities of this project. SE cannot accept any responsibility for any conditions which deviate from those described in this report, nor for the performance of the foundations, if not engaged to also provide construction observation and testing for this project.

## Moisture Sensitive Soils/Weather Related Concerns

The upper soils encountered at this site are relatively sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, an increase in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

## Drainage and Groundwater Concerns

Water should not be allowed to collect in the foundation excavations or on the prepared subgrade in the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the foundation elements.

Groundwater was encountered at a depth between 9 ½ and 10 feet during the drilling operations. However, it is possible that seasonal variations will cause fluctuations of the water table. Additionally, perched water may be encountered in discontinuous zones within the overburden soils. Any water accumulation should be removed from the excavations by pumping. If excessive and uncontrolled amounts of seepage occur, the Geotechnical Engineer should be consulted.

## Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1928, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavation, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR, Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. SE does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

## REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by SE and design details furnished by Kyle Associates, LLC. 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, SE should be notified immediately to determine if changes in the foundation or pavement recommendations are required. If SE is not notified of such changes, SE will not be responsible for the impact of those changes on the project.

The Geotechnical Engineer 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.

The scope of services does not include an environmental or biological assessment of the site. Any statements in the report or supplementary documentation concerning odors or other suspicious observations are for information purposes only. If there are contamination or environmental concerns with the site, the owner should have further investigations conducted by others.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated in to the design documents. At that time, it may be necessary to submit supplementary recommendations. If SE is not retained to perform these functions, SE will not be responsible for the impact of those conditions on the project. This report has been prepared for the exclusive use of Kyle Associates, LLC for the specific application to the proposed West St. Tammany Parish Waste Water Treatment Plant Expansion to be constructed in Covington, Louisiana.

# APPENDIX

STRATUM ENGINEERING, LLC


⊕ = BORING LOCATION

STRATUM ENGINEERING, LLC

## BORING LOCATION PLAN

GEOTECHNICAL ENGINEERING SERVICES
**PROPOSED WEST ST. TAMMANY PARISH**
**WASTE WATER TREATMENT PLANT EXPANSION**
COVINGTON, LOUISIANA

STRATUM ENGINEERING, LLC

# LOG OF BORING B-1

**PROPOSED WEST ST. TAMMANY PARISH**
**WASTE WATER TREATMENT PLANT EXPASION**
**COVINGTON, LOUISIANA**

**TYPE OF BORING:** WET ROTARY **LOCATION:** TREATMENT PLANT AREA **PROJECT NO.:** G15-108

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Reddish tan Clayey Sand with limestone - Fill | | | | | | 13 | | | |
| | | | Firm to stiff reddish Sandy Lean Clay | | 0.41 | 1.00 | | 106 | 21 | 31 | 14 | 66 |
| 5 | | | Stiff tannish gray Lean Clay with silt seams and sand lenses | | | 1.50 | | | 20 | | | |
| | | | | | 1.45 | 1.50 | | 110 | 21 | | | |
| 10 | | | ▽ | | | 1.50 | | | 23 | 41 | 25 | |
| | | | Firm to stiff tannish gray Fat Clay | | 0.87 | 1.00 | | 90 | 33 | | | |
| 15 | | | | | | | | | | | | |
| 20 | | | | | | 1.50 | | | 31 | | | |
| 25 | | | -becomes gray at 23' | | 0.93 | 1.00 | | 82 | 41 | | | |
| 30 | | | -stiff to very stiff at 28' | | | 2.00 | | | 36 | | | |
| | | | Boring Terminated at 30 Feet | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

**DEPTH OF BORING:** 30 Feet **GROUNDWATER:** Encountered at 9 ½ Feet During Drilling
**DATE:** 12/14/2015

STRATUM ENGINEERING, LLC

# LOG OF BORING B-2

**PROPOSED WEST ST. TAMMANY PARISH**
**WASTE WATER TREATMENT PLANT EXPASION**
**COVINGTON, LOUISIANA**

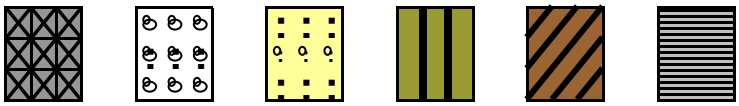
**TYPE OF BORING:** WET ROTARY **LOCATION:** TREATMENT PLANT AREA **PROJECT NO.:** G15-108

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Reddish tan Poorly Graded Sand with limestone | | | | | | 6 | | | |
| | | | Stiff gray Silty Sandy Clay | 12 | | | | | 19 | | | 78 |
| 5 | | | Stiff to very stiff tannish gray Lean Clay with sand | | | 2.00 | | | 21 | | | |
| | | | | | 1.32 | 1.50 | | 112 | 19 | 40 | 24 | 83 |
| | | | | | | 1.50 | | | 23 | | | |
| 10 | | | ▽ | | | | | | | | | |
| | | | -firm to stiff at 13' | | 0.93 | 1.00 | | 106 | 25 | | | |
| 15 | | | | | | | | | | | | |
| | | | Stiff tannish gray Fat Clay | | | 1.50 | | | 42 | | | |
| 20 | | | | | | | | | | | | |
| | | | -becomes gray at 23' | | 1.23 | 1.25 | | 88 | 36 | | | |
| 25 | | | | | | | | | | | | |
| | | | | | | 1.50 | | | 33 | | | |
| 30 | | | | | | | | | | | | |
| | | | Boring Terminated at 30 Feet | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

**DEPTH OF BORING:** 30 Feet **GROUNDWATER:** Encountered at 10 Feet During Drilling
**DATE:** 12/14/2015

# KEY TO TERMS AND SYMBOLS USED ON LOGS

## SOIL TYPE

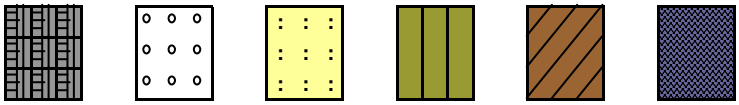


ROCK | GRAVEL | SAND | SILT | CLAY | PEAT

## SAMPLER TYPE

NO SAMPLE | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

## MODIFIERS



STONE | GRAVELY | SANDY | SILTY | CLAYEY | FILL

NO RECOVERY | ROCK CORE | 2" SHELBY TUBE | TXDOT CONE

## UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

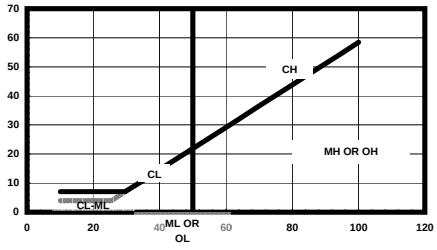
| MAJOR DIVISIONS | | | LETTER SYMBOL | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|
| COARSE GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE | GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING NO. 4 SIEVE | CLEAN GRAVEL (LITTLE OR NO FINES | GW | WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | | GP | POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | W/ 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 FINES | SW | WELL GRADED SAND, GRAVELY SAND (LITTLE FINES) |
| | | | SP | POORLY GRADED SANDS, GRAVELY SAND (L.FINES) |
| | | SANDS WITH APPREA. FINES | SM | SILTY SANDS, SAND-SILT MIXTURES |
| | | | SC | CLAYEY SANDS,SAND-CLAY MIXTURES |
| FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/ LOW PI |
| | | | CL | INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS |
| | | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI |
| | SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 | | 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 MED TO HIGH PI, ORGANIC SILT |
| 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 OF 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 0.5 |
| STIFF | 0.5 TO 1.0 |
| VERY STIFF | 1.0 TO 2.0 |
| HARD | > 2.0 OR 2.0+ |

## RELATIVE DENSITY - GRANULAR SOILS

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




## ABBREVIATIONS

HP - HAND PENETROMETER
TV - TORVANE
MV - MINIATURE VANE
UC - UNCONFINED COMPRESSION TEST
UU - UNCONSOLIDATED UNDRAINED TRAIXIAL
CU - CONSOLIDATED UNDRAINED

NOTE: PLOT INDICATES SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS

DELAYED GROUNDWATER LVL

LEVEL GROUNDWATER ENCOUNTERED

## CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

| 6" | 3" | 3/4" | 4 | 10 | 40 | 200 |
|---|---|---|---|---|---|---|

| BOUL--DERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

| 152 | 76.2 | 19.1 | 4.76 | 2.0 | 0.42 | 0.075 | 0.002 |
|---|---|---|---|---|---|---|---|

GRAIN SIZE IN MM

STRATUM ENGINEERING, LLC
Geotechnical Engineering ◆ Testing and Inspection Services

April 26, 2016

Kyle Associates, LLC
638 Village Lane North
Mandeville, Louisiana 70471

Attn: Mr. Phil Nelson, P.E.

Re: Additional Geotechnical Recommendations
Proposed West St. Tammany Parish
Waste Water Treatment Plant Expansion
Covington, Louisiana
SE Project No. G15-108
Addendum No. 1

Dear Phil:

Stratum Engineering (SE) is pleased to submit supplemental foundation recommendations for the above referenced project. SE conducted an initial geotechnical investigation for the project and our recommendations were provided in SE Report No. G15-108, dated January 19, 2016. During the initial investigation, two (2) borings were advanced to a depth of 30 feet below the existing ground surface in the tank areas. The report provided shallow mat foundation recommendations for the proposed new 5,000 and 12,000 square foot waste water treatment plants. Subsequent to the initial investigation, a recent revision to the plans includes the addition of a pump station in the southwest corner of the property.

We understand that the new pump station will consist of a pre-cast concrete wet well with a footprint of approximately 200 square feet installed at a bottom depth of approximately 12 feet below the existing ground surface. Consequently, SE was requested to advance one (1) additional boring to a depth of 30 feet in the pump station area so that design recommendations could be provided for the structure. The approximate location of the boring is indicated on the boring location plan included with this letter. Based on the results of the exploration, the subsurface soil conditions are generally consistent with the material encountered during the initial investigation. The soil appears to be generally fair in bearing quality and suitable for support of the proposed lift station on a shallow foundation system. Details related to the lift station, foundation recommendations, as well as construction consideration are presented in subsequent sections of this letter.

**Lift Station Wet Well**

It is understood that a pre-cast concrete wet well with a plan area of about 200 square feet will be installed at a depth of approximately 12 feet below the existing ground surface. Based on the boring drilled in the wet well area, loose clayey sand was encountered to a depth of about two (2) feet. The clayey sand was underlain by firm to stiff silty sandy clay to a depth of about six (6) feet and was followed by firm to stiff lean clay to a depth of 12 feet. The lean clay was underlain by stiff to very stiff lean clay with sand to a depth of about 22 feet. The boring was terminated in stiff to very stiff lean clay at a depth of 30 feet, the maximum depth explored. The log included with this letter should be reviewed for specific information at the boring location.

Based on the field data and laboratory test results, the soils at the bottom of the wet well elevation are estimated to have an allowable bearing pressure of about 2,000 psf which includes a factor of safety of 3.0.

Since wet conditions may be encountered at the bottom of the excavation, the wet well should bear on a minimum of 18 inches of #57 limestone to distribute the load and minimize the initial subsidence. The wet well excavation should be side bedded and backfilled to the surface with granular fill. The granular fill may consist of sand or an equivalent granular fill approved by the Geotechnical Engineer. The sand should have less than ten (10) percent passing the #200 sieve and be placed in lifts not exceeding 12 inches and compacted to 95 percent of the maximum dry density, as determined by ASTM D698.

Groundwater was encountered at a depth of about 7 ½ feet during the drilling operations. Dewatering of the excavation area may be necessary to allow proper installation of the wet well. Based on the laboratory test results, a coefficient of permeability (K) for the lean clay encountered in the upper 12 feet of the boring was estimated to be on the order of $1 \times 10^{-8}$ cm/sec. Dewatering is anticipated to be accomplished using a sump/pump system due to the low permeability of the clay. However, should dewatering be required, it is recommended that the groundwater be lowered about two (2) feet below the bottom of the excavation. This can be accomplished by well points or other means of forced withdrawal. Braced excavations may be necessary to maintain a safe access to the wet well area. The design of the dewatering system and bulkhead for the wet well braced excavation should be the responsibility of the contractor who should maintain both systems, as necessary, throughout the installation.

Although groundwater was encountered at a depth of 7 ½ at the time of the investigation it may be encountered at shallower depths during construction. Therefore, the design of the wet well should take into consideration any buoyant forces exerted on the structure.

The foundation excavation should be observed by a representative of Stratum Engineering prior to placement of the wet well to assess that the foundation materials are consistent with the materials discussed in this letter. Soft or loose soil zones encountered at the bottom of the excavation should be removed to the level of firm, suitable bearing soils or adequately compacted fill as directed by the Geotechnical Engineer.

The foundation excavation should be observed and the well installed as quickly as possible to avoid exposure of the excavation bottom to wetting and drying. Surface run-off water should be drained away from the excavation and not be allowed to pond. If it is required that the excavation be left open for more than one day, it should be protected to reduce changes in the moisture content of the bearing soils.

**Bedding Material**

The wet well and associated sanitary gravity sewer lines and force mains should be supported on aggregate bedding to distribute the load and minimize initial subsidence. The bedding material below the wet well slab should be at least 18 inches in thickness and should extend at least 2 feet below the edge of the structure. The bedding material below the pipes should be at least 6 inches in thickness and should extend one-half of the pipe diameters beyond the edge of either side of the pipe or a minimum of 12 inches, whichever is greater. The pipes should be side bedded to the mid-height of the pipe. The bedding material should consist of well-graded, free draining aggregate, meeting the requirements of #57 stone.

The trench excavation should be backfilled to the surface with granular fill (sand). The fill should be placed in lifts not exceeding 8 inches and compacted to 95 percent of the maximum dry density, as determined by ASTM D698.

**Report Limitations**

These additional recommendations have been provided for the exclusive use of Kyle Associates, LLC for the specific application to West St. Tammany Parish Waste Water Treatment Plant Expansion in Covington, Louisiana. Site preparation and other recommendations provided in the initial geotechnical report remain in effect. If you should have any questions, please do not hesitate to call.

Respectfully submitted,
STRATUM ENGINEERING, LLC

William "Dean" McInnis, P.E.
Project Manager

Tony Y. Maroun, P.E.
Principal

STATE OF LOUISIANA
TONY Y. MAROUN
License No. 26198
PROFESSIONAL ENGINEER
CIVIL ENGINEERING
4/26/16

WDM/TYM:nsv

# APPENDIX

STRATUM ENGINEERING, LLC


STRATUM ENGINEERING, LLC

**BORING LOCATION PLAN**

GEOTECHNICAL ENGINEERING SERVICES
**PROPOSED WEST ST. TAMMANY PARISH**
**WASTE WATER TREATMENT PLANT EXPANSION**
COVINGTON, LOUISIANA

STRATUM ENGINEERING, LLC

# LOG OF BORING B-3

**PROPOSED WEST ST. TAMMANY PARISH**
**WASTE WATER TREATMENT PLANT EXPASION**
**COVINGTON, LOUISIANA**

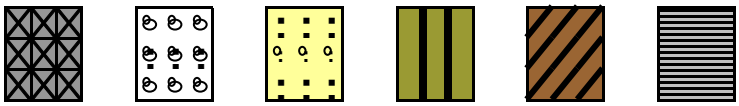
**TYPE OF BORING:** WET ROTARY **LOCATION:** WET WELL AREA **PROJECT NO.:** G15-108

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 6" Silty Sandy Topsoil with organics | | | | | | 17 | | | |
| | | | Reddish tan Clayey Sand | | | | | | | | | |
| | | | Firm to stiff reddish tan Silty Sandy Clay | | 0.36 | 0.75 | | 103 | 22 | 23 | 6 | 55 |
| 5 | | | -becomes gray at 4' | | | 1.75 | | | 20 | | | |
| | | | Firm to stiff gray Lean Clay ▽ | | 0.73 | 0.75 | | 102 | 26 | | | |
| 10 | | | | | | 1.50 | | | 23 | 37 | 20 | |
| | | | Stiff to very stiff tannish gray Lean Clay with sand | | 1.60 | 2.00 | | 104 | 22 | | | |
| 15 | | | | | | | | | | | | |
| 20 | | | | | | 2.25 | | | 22 | | | |
| | | | Stiff to very stiff tannish gray Lean Clay | | 0.85 | 1.25 | | 98 | 25 | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | 2.00 | | | 25 | | | |
| | | | Boring Terminated at 30 Feet | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

**DEPTH OF BORING:** 30 Feet **GROUNDWATER:** Encountered at 7 ½ Feet During Drilling
**DATE:** 4/13/2016

# KEY TO TERMS AND SYMBOLS USED ON LOGS

## SOIL TYPE

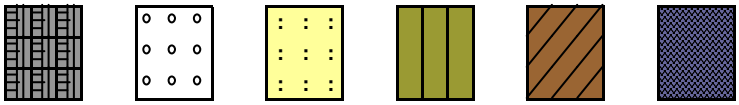


ROCK | GRAVEL | SAND | SILT | CLAY | PEAT

## SAMPLER TYPE

NO SAMPLE | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

## MODIFIERS



STONE | GRAVELY | SANDY | SILTY | CLAYEY | FILL

NO RECOVERY | ROCK CORE | 2" SHELBY TUBE | TXDOT CONE

## UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

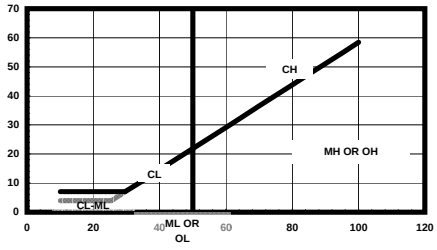
| MAJOR DIVISIONS | | | LETTER SYMBOL | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|
| COARSE GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE | GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING NO. 4 SIEVE | CLEAN GRAVEL (LITTLE OR NO FINES | GW | WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | | GP | POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | W/ 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 FINES | SW | WELL GRADED SAND, GRAVELY SAND (LITTLE FINES) |
| | | | SP | POORLY GRADED SANDS, GRAVELY SAND (L.FINES) |
| | | SANDS WITH APPREA. FINES | SM | SILTY SANDS, SAND-SILT MIXTURES |
| | | | SC | CLAYEY SANDS,SAND-CLAY MIXTURES |
| FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/ LOW PI |
| | | | CL | INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS |
| | | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI |
| | SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 | | 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 MED TO HIGH PI, ORGANIC SILT |
| 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 OF 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 0.5 |
| STIFF | 0.5 TO 1.0 |
| VERY STIFF | 1.0 TO 2.0 |
| HARD | > 2.0 OR 2.0+ |

## RELATIVE DENSITY - GRANULAR SOILS

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




## ABBREVIATIONS

HP - HAND PENETROMETER
TV - TORVANE
MV - MINIATURE VANE
UC - UNCONFINED COMPRESSION TEST
UU - UNCONSOLIDATED UNDRAINED TRAIXIAL
CU - CONSOLIDATED UNDRAINED

NOTE: PLOT INDICATES SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS

DELAYED GROUNDWATER LVL

LEVEL GROUNDWATER ENCOUNTERED

## CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

| 6" | 3" | 3/4" | 4 | 10 | 40 | 200 |
|---|---|---|---|---|---|---|

| BOUL--DERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

| 152 | 76.2 | 19.1 | 4.76 | 2.0 | 0.42 | 0.075 | 0.002 |
|---|---|---|---|---|---|---|---|

GRAIN SIZE IN MM