SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

THOMASTON WWTP CLARIFIER
THOMASTON, GEORGIA
GEC JOB NO. HN195799

PREPARED FOR

MR. TREY GAVIN
ESG ENGINEERING, INC.
6400 PEAKE ROAD
MACON, GA 31210

PREPARED BY

GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS, INC.
514 HILLCREST INDUSTRIAL BLVD.
MACON, GEORGIA 31204-3472
478-757-1606

OCTOBER 18, 2019

GEC

GEC GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS, INC
A Terracon COMPANY

October 18, 2019

Mr. Trey Gavin
ESG Engineering, Inc.
6400 Peake Road
Macon, GA 31210

SUBJECT: Subsurface Exploration and Geotechnical Engineering Evaluation
Thomaston WWTP Clarifier
Thomaston, Georgia
GEC Project No. HN195799

Dear Mr. Gavin:

Geotechnical & Environmental Consultants, Inc. (GEC) is pleased to present this report of our subsurface exploration and geotechnical engineering evaluation for the above site. The purpose of the exploration was to obtain data to evaluate the site and subsurface conditions in order to provide recommendations relative to the geotechnical aspects of the project.

We greatly appreciate the opportunity to provide these services to you. If you have any questions, or if we can be of further assistance, please do not hesitate to call.

Sincerely,

GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS, INC.

Brad Thigpen, EIT
Project Engineer

Richard L. Curtis, P.E., D.GE
Chief Geotechnical Engineer
Ga. Reg. #16617

TABLE OF CONTENTS
THOMASTON WWTP CLARIFIER
THOMASTON, GEORGIA
GEC PROJECT NO. HN195799

1.0 EXECUTIVE SUMMARY ... 1
2.0 PROJECT INFORMATION ... 1
3.0 METHOD OF EXPLORATION ... 2
  3.1 Site Reconnaissance and Boring Layout ... 2
  3.2 Soil Test Borings ... 2
4.0 SITE AND SUBSURFACE CONDITIONS ... 2
  4.1 Site Description ... 2
  4.2 Local Geology ... 2
  4.3 Subsurface Conditions ... 3
5.0 CONCLUSIONS AND RECOMMENDATIONS ... 4
  5.1 Site and Subgrade Preparation ... 4
  5.2 Earthwork ... 5
  5.3 Difficult Excavation ... 6
  5.4 Foundations ... 7
  5.5 Slopes ... 7
  5.7 Seismic Design Criteria ... 8
  5.8 Geotechnical Controls ... 10
  5.9 Limitations ... 10

APPENDIX

SITE LOCATION MAP

BORING LOCATION PLAN

SOIL TEST BORING PROCEDURES

SOIL BORING RECORDS

SOIL CLASSIFICATION CHART

GEC

1.0 EXECUTIVE SUMMARY

The following summary highlights our pertinent findings and recommendations concerning this project.

- In general, the on-site materials appear to be suitable for use as structural fill.
- Groundwater was encountered at a depth of 11 feet at the time of boring. Groundwater levels may be expected to fluctuate with changes in temperature, rainfall and other seasonal factors, and may at other times differ from those reported herein. To reach the proposed grades for the clarifier base slab and foundations, we anticipate the need to install temporary groundwater control measures.
- We recommend using conventional shallow foundations for support of the proposed structure. An allowable soil bearing pressure of 2,500 psf may be used for design of shallow foundations bearing on competent existing soils or engineered fill.

This executive summary has been prepared solely to provide a general overview of the report. The executive summary should not be relied upon for any purpose except for a general overview. Please rely on the full report for information concerning the findings, recommendations and other concerns at the site.

2.0 PROJECT INFORMATION

The proposed site is located at an existing wastewater treatment plant located off Goshen Road in Thomaston, Upson County, Georgia. The property is bordered by rural residential and wooded properties in all directions. The site is currently developed with associated wastewater treatment plant structures. The site is generally flat and level. A *Site Location Map* is included in the Appendix.

Our understanding of the project comes from correspondence with ESG Engineering, Inc. The proposed development consists of a new clarifier approximately 60 feet in diameter and 25 feet tall.

No structural loads were provided for the clarifier. The clarifier contents will weigh approximately 4,410,000 pounds. The bottom of the clarifier foundation will bear approximately 25 feet to 30 feet below the existing ground surface. We assume the maximum cuts and fills to develop the site will be 30 feet or less.

The recommendations provided in this report are based in part on the project information described above. If any of the noted information is incorrect or has changed, please inform GEC so that we may amend the recommendations presented in this report, if appropriate.

3.0 METHOD OF EXPLORATION

3.1 Site Reconnaissance and Boring Layout

GEC performed a general review of the proposed project site and surrounding areas prior to the performance of our subsurface exploration activities. The review was performed to evaluate surface conditions that could impact our exploration techniques or the proposed construction.

The locations and depths of the borings were selected by GEC based on the site plans provided. Borings were field-located using a hand-held GPS device and coordinates established by overlaying the provided site plan onto internet-based aerial photography. Boring elevations were determined using the topographic information provided. Since the borings were not located by survey, the locations and boring elevations should be considered approximate.

3.2 Soil Test Borings

A total of two (2) soil test borings were performed at the project site. Boring designated B-1 was performed in the proposed clarifier area and was extended to a depth of 50 feet below the existing ground surface. Boring designated B-2 was performed in a future structure area and was planned to extend to a depth of 20 feet; however, the upper 5 feet was hand augered due to utilities in the area and refusal was encountered at 6 feet below the existing ground surface. The approximate locations of the borings are presented on the *Boring Location Plan* located in the Appendix.

All borings were backfilled with the auger cuttings prior to site demobilization. The split-spoon samples were returned to our laboratory and were manually and visually examined and classified. The samples were classified according to the Unified Soil Classification System (USCS). Detailed records of the soil test borings, indicating the N-values (blow counts) obtained from the Standard Penetration Testing (SPT) and a more detailed description of the drilling and sampling processes, are presented in the Appendix.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 Site Description

The proposed site consists of an existing wastewater treatment plant located off Goshen Road in Thomaston, Upson County, Georgia. The property is bordered by rural residential and wooded properties in all directions. The site is currently developed with associated wastewater treatment plant structures. The site is generally flat and level.

4.2 Local Geology

The site is located in the Piedmont Physiographic Province of Georgia. The Piedmont is composed of igneous and metamorphic rocks, most commonly granites, granitic gneiss, and schists. These rocks have undergone extensive alterations, folding and faulting during the mountain building episodes, which produced the Appalachian Mountains and have since experienced a long period of stability. Chemical and physical weathering have produced the present topography. The depth of weathering can vary greatly. The general Piedmont subsurface profile consists of clayey soils near the surface, which grade into silty sands and sandy silts with depth. Soils beneath the upper clayey zones often retain and exhibit the relic structure (banding, foliation) of the parent rock and are termed saprolite. A zone of weathered rock often separates saprolite from hard relatively un-weathered bedrock. The various rock types resist weathering in different degrees depending on their chemical composition, fracturing, jointing, and bedding, so the depth to bedrock is often quite erratic and can vary over a short distance. Also, it is not unusual to find lenses of partially weathered rock and hard rock boulders within the saprolite. Alluvial, or water deposited, soils are present in association with rivers and streams. These soils consist of interlayered sands, silts and clays with varying amounts of organic materials.

Naturally occurring soils can be covered by fill that resulted from man's activities during construction, farming, waste disposal, or other ground disturbing activities. Fill materials can be highly variable and can contain debris. The engineering properties of fill depend primarily on composition, moisture content, and density. No density test reports or quality assurance reports were provided for any previous construction at the site. Where density tests or other construction-related testing reports are not provided, fill materials are designated as undocumented.

4.3 Subsurface Conditions

Details of the subsurface conditions encountered by the soil test borings are shown on the *Soil Boring Records* in the Appendix of this report. These records represent an estimate of the subsurface conditions based on our interpretation of the boring data using normally accepted engineering judgment. Stratification lines on the *Soil Boring Records* represent approximate boundaries between soil types. However, the in-situ transition is typically more gradual. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of the subsurface conditions at other locations or at other times. The general soil conditions and their pertinent characteristics are discussed in the following paragraphs.

General Stratigraphy

The general subsurface stratigraphy of the site consisted of fill materials underlain by Piedmont residual soils and partially weathered rock extending to the maximum depth explored.

Fill

Fill soils were encountered in the borings and extended to a depth of 17 feet below existing ground surface in boring B-1. The fill generally consisted of silty clay (CL), sandy silts (ML), and silty sands (SM). The standard penetration test (SPT) N-values in these soils were generally low and ranged from 3 to 6 blows per foot (bpf).

It should be noted that determining fill is often ambiguous as there are not necessarily any obvious characteristics of fill material. Deciphering fill materials from native soils is based on visual observation, site characteristics, and N-values. Fill could be present in other areas of the site and to greater depths than observed.

Residual Soils

The residual soils encountered in boring B-1 generally consisted of silty sands (SM). The standard penetration test (SPT) N-values in these soils ranged from 11 to 83 blows per foot (bpf).

Partially Weathered Rock (PWR)

Partially weathered rock (PWR), locally defined as residual material that exhibits standard penetration resistance of at least 100 blows per foot that can still be penetrated with augers, was noted in boring B-1. PWR was encountered in boring B-1 at a depth of 42 feet extending to boring termination at 50 feet. The PWR encountered generally consisted of silty sands (SM).

Auger Refusal

Auger refusal is defined as material that can no longer be penetrated by the soil augers. Refusal to the auger process was encountered in boring B-2 at a depth of 6 feet below existing ground surface. Due to the location of the boring near existing utilities, no offset was performed. Since the refusal was encountered within existing fill material, refusal was likely due to an existing underground structure or utility.

Groundwater

Groundwater was encountered in boring B-1 at a depth of 11 feet at the time of boring. After 2 hours, groundwater was measured at a depth of 12 feet. Groundwater levels may be expected to fluctuate with changes in temperature, rainfall and other seasonal factors, and may at other times differ from those reported herein.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Site and Subgrade Preparation

The initial step in site preparation should consist of the removal of any debris, vegetation and root systems, concrete, existing structures, and any soft/loose near-surface soils in the planned construction areas. Any utility lines in the project area should be removed and relocated. Excavations or holes resulting from the removal of trees or utilities should be backfilled with structural fill to the compaction requirements presented in Section 5.2, *Earthwork*. All debris should be stripped from construction areas.

Depending on the condition of the subgrade after dewatering and excavation, some placement of stone may be required prior to construction of bottom slab and foundations. This is best determined at the time of construction.

5.2 Earthwork

The soil test borings indicate the near-surface soils at the site can be graded with conventional earthmoving equipment such as self-loading or pusher-assisted pans and tracked dozers or excavators. Very dense soils were encountered at a depth of about 32 feet and partially weathered rock (PWR) was encountered at a depth of 42 feet. The near-surface soils appear to be suitable for use as fill material. Wetting or drying of the soils at the site may be necessary to achieve the required compaction criteria. The contractor should be required to have equipment available on site for both wetting and drying of the soils.

In general, all fill placed at the site, including on-site soils, should not contain rocks or lumps larger than four (4) inches in greatest dimension and contain no more than 15 percent larger than 2.5 inches. Structural fill soils should have a liquid limit less than 50, plastic index less than 30 and a standard Proctor maximum dry density (ASTM D698) greater than 90 pcf. Generally, soils classified as SP, SM, SC, ML or CL according to the Unified Soil Classification System are considered suitable for fill providing they meet the above criteria.

Structural fill should be moisture-conditioned to slightly above the optimum moisture content, spread in relatively thin lifts (8-inch maximum loose lifts) and methodically compacted with heavy compaction equipment to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). The upper one-foot of fill material should be compacted to a 98 percent compaction criterion. Additionally, the upper one-foot of material in areas at-grade or cut surfaces should be scarified and compacted to the 98 percent criteria. Structural fill criteria should be utilized beneath proposed and future structural areas. Due to the silty nature of the on-site soils, we recommend that the moisture content of the fill soils be maintained within 3% of the optimum moisture content during compaction. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without pumping when proofrolled.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Any accumulated surface water should be removed as promptly as possible. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction. As noted previously some of the fine-grained soils at this site will be susceptible to degradation from weather and construction activities. Therefore, some remediation of exposed subgrade should be expected.

Structural fill should extend horizontally beyond the outer edge of the structure foundations at least ten feet or a distance equal to the height of the fill to be placed, whichever is greater. In paved areas, fill slopes should extend horizontally at least five feet beyond the edge of pavement prior to sloping.

5.3 Difficult Excavation

Partially weathered rock (PWR) was encountered in boring B-1 at a depth of 42 feet. PWR may be encountered during construction of foundations and utilities. Therefore, lenses of difficult excavation may be encountered in utility or foundation areas.

Our experience indicates that PWR that has a standard penetration resistance of 50 blows for 3 inches or less of penetration will require a significant amount of effort to be removed by ripping and can most effectively be removed by blasting.

Heavy, tracked excavating equipment with single tooth ripping tools will be required to remove the PWR during mass grading. Confined excavations in PWR may require pneumatic hammers or blasting. Blasting may be necessary to efficiently remove more resistant rock and large boulders that could be present within the PWR. The ease of excavation of PWR cannot be specifically quantified and depends on the quality of grading equipment, skill of the equipment operators, and geologic structure of the material itself, such as the direction of bedding, planes of weakness and spacing between discontinuities.

In a large, open excavation, a particularly resistant area could be approached from any direction with the ripper and thus align with a plane of weakness. PWR that is excavated by ripping may be removed in large slabs or boulders, which are difficult to move and/or break into smaller pieces for use in the fill.

For general excavation, we recommend that rock be defined as material that cannot be excavated with a single tooth-ripper drawn by a Caterpillar D-8K or equivalent bulldozer. For trench excavation, we recommend that rock be defined as material that cannot be excavated by a Caterpillar 225 or equivalent track-hoe. We recommend that the requirement for blasting be defined in terms of equipment performance.

PWR or blast rock may be used as structural fill provided they meet the requirements presented in Section 5.2, *Earthwork*. In addition, we recommend that sufficient quantities of soil be mixed with the PWR or blast rock materials to prevent voids and consequently to meet the compaction requirements for structural fill. If voids are present, soil fines will migrate into the voids as a result of percolation of surface water or changes in ground water levels that could eventually result in a depression at the surface. Cobbles and boulders should not be placed in fill closer than 10 feet from the perimeter of the structures. Large cobbles and boulders may be incorporated in non-structural fill areas, such as the parking and drive areas. However, they should not be allowed to "nest" which would result in large voids. The maximum dimension of boulders and cobbles incorporated into non-structural fill areas should be progressively smaller as the fill approaches finished grade. Depending on the application, the upper five feet of the fill should consist of soil without boulders or cobbles.

5.4 Foundations

The proposed clarifier can be constructed on conventional shallow foundations bearing on the in-place soils, reworked soils, or structural fill meeting the compaction requirements of Section 5.2, *Earthwork*. Based on the soils encountered during our exploration, we recommend a uniform net allowable soil bearing pressure of 2,500 psf be used for design of the proposed structure foundations. Exterior foundations should bear at a minimum of 18 inches below external grades to preclude damage due to frost penetration.

Using assumed structural loads, we estimate that total post-construction settlement of up to one (1) inch will occur. Differential settlement should be approximately 50% of the total settlement over a distance of 30 feet. Individual spread footings should have a minimum dimension of 24 inches and strip footings should have a minimum lateral dimension of 20 inches.

A Geotechnical Engineer or his representative should examine footing subgrades immediately prior to rebar placement to confirm that the foundation conditions are as anticipated, and the design bearing pressure is available. Auger and hand-held dynamic cone penetrometer testing, augmented by hand probing, should be used to determine whether conditions within these areas are consistent with those encountered by the borings.

5.5 Slopes

Based on our experience with soils similar to those encountered during our exploration, we recommend excavated slopes less than 10 feet high be laid back at least to a 2H:1V (Horizontal to Vertical) slope. Permanent fill slopes up to 10 feet high that are placed on suitable subgrade may be constructed at 2.5:1 or flatter. All fill slopes should be adequately compacted as recommended in this report. Permanent slopes of 3:1 or flatter may be used to facilitate mowing. All sloped surfaces should be protected from erosion by grassing or other means. Structures should be set back at least 10 feet from the crest of slopes or as required by regulatory authorities. Pavements should be set back at least 5 feet from the crest edge. All temporary slopes and confined excavations should conform to the latest OSHA Regulations.

5.6 Groundwater Control

To reach the proposed grades for the clarifier base slab and foundations, we anticipate the need to install temporary groundwater control measures. If not properly controlled in the construction process, groundwater can cause otherwise suitable soils to lose substantial strength. In order to prevent that occurrence, it will be necessary to temporarily lower groundwater well in advance of any excavation such that no excavation extends to within three feet of groundwater levels. If groundwater is lowered and maintained at levels more than three feet below any excavated grade, then the presence of groundwater itself is typically negligible. This does not resolve the condition where the subgrade will consist of nearly saturated soils but is merely an aid to prevent groundwater from causing those saturated soils to become excessively disturbed and lose the majority of their strength.

In a situation where groundwater is at an elevation to impact soils immediately below footings or slabs, additional precautions are warranted. We recommend that all footing or bottom slab excavations be made only with a geotechnical engineer present on site. Excavations should be extended one foot below the proposed footing or slab subgrade. The geotechnical engineer should immediately evaluate those footing/slab subgrades and, presuming that the exposed soils have not become destabilized due to the presence of groundwater, will allow the contractor to backfill those excavations with a foot of #57 stone and place concrete within a short time frame.

It is probable that the temporary dewatering system will require that well points or cased wells be installed during initial grading activities once excavations have reached an elevation approximately 5 feet above the bottom slab/foundation elevation. The temporary groundwater control system should be installed and functioning a minimum of two weeks prior to the beginning of foundation construction. We do not anticipate the lowering of groundwater during construction to adversely impact the surrounding developments. The temporary groundwater control system will need to operate 24 hours a day, 7 days a week until the construction has been completed.

We recommend that the contract documents indicate that the design and implementation of the temporary dewatering system is the contractor’s responsibility, and that these documents establish performance criteria for assessing the effectiveness of the dewatering system actually installed. The performance criteria should require that the dewatering system successfully lower the prevailing groundwater levels at least three feet below the lowest anticipated subgrade levels in advance of excavation. The project specifications should require that the contractor submit a detailed dewatering plan for the engineers' review prior to implementation. These plans should be provided early in the overall construction process to allow adequate time for review, re-submittals if necessary, and implementation of the plans in a timely fashion so as not to impact the contractor’s schedule. Any dewatering system implemented must also be properly abandoned.

5.7 Lateral Earth Pressures

Based on the results of our exploration performed for the subject project and the testing of similar soils on other projects, the following earth pressure coefficients are recommended for using the soils encountered in our borings as compacted structural fill.

Active Earth Pressure (Ka)	At-Rest Earth Pressure (Ko)	Passive Earth Pressure (Kp)	Frictional Sliding Resistance (fs)
0.36	**0.53**	**2.77**	**0.35**

The earth pressure coefficients presented in the preceding table are based on our experience with similar projects having similar soil conditions. These coefficients were estimated based on an assumed angle of internal friction of approximately 28°. Triaxial shear testing, which was beyond the scope of this exploration, would be required to determine the actual strength properties of the soils at this site. A moist unit weight of 115 pounds per cubic foot (pcf) should be used for design calculations.

Buried structures will be required to resist lateral forces imposed by the adjacent backfill, any adjacent surcharge loads from structures and possible groundwater and uplift forces resulting from submergence. The walls will be nonyielding; therefore, at-rest pressures should be considered in design. At-rest pressures should be estimated considering equivalent fluid unit weights of 61 pcf and 90 pcf above and below the groundwater level, respectively. The lateral uniform pressure resulting from adjacent surcharge loads should be taken as 50 percent of the applied load.

5.8 Seismic Design Criteria

The seismic site classification for the proposed project was evaluated using the criteria given in the 2015 International Building Code (IBC 2015). Based on the project information and soil test borings, it is our opinion that the subsurface conditions within the site are consistent with the characteristics of Site Class "D". The associated USGS-NEHRP probabilistic ground motion values for the general site area were obtained from the USGS geohazards web page and are presented in the table below:

Period (sec)	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S_s	0.140	F_a	1.600	S_{Ms}	0.225	S_{Ds}	0.150
1.0	S_1	0.078	F_v	2.400	S_{M1}	0.187	S_{D1}	0.124

The Site Coefficients, Fa and Fv presented in the above table were also obtained from the noted USGS web page, as a function of the site classification and mapped spectral response acceleration at the short (SS) and 1-second (S1) periods but can also be interpolated from IBC Tables 1613.3.3(1) and 1613.3.3(2).

For Seismic Design Category designations of C, D, E or F, which are contingent on the structure "Occupancy Category", the code also requires an assessment of slope stability and surface rupture due to faulting or lateral spreading. Detailed evaluations of these factors were beyond the scope of this study. However, the table below presents a qualitative assessment of these issues considering the site class, the subsurface soil properties, the groundwater elevation and probabilistic ground motions:

Hazard	Relative Risk	Comments
Liquefaction	Low	The subsurface silty sand materials typically contain sufficient fines to limit the potential for liquefaction.
Slope Stability	Low	The probabilistic ground accelerations are low and site grades are relatively flat.
Surface Rupture	Low	No active faults underlie the site.

5.9 Geotechnical Controls

1. The Geotechnical Engineer should be provided the opportunity for a general review of the final design documents in order to assess proper interpretation of the earthwork and foundation recommendations.

2. The Geotechnical Engineer, or his qualified representative, should observe undercutting and proofrolling operations.

3. A qualified engineering technician, under the supervision of the Geotechnical Engineer, should observe fill operations and perform a minimum of one field density test per 2,500 square feet of area for each one-foot thickness of fill.

4. The Geotechnical Engineer, or his qualified representative, should check each foundation excavation utilizing hand probing and auger and dynamic cone penetrometer testing. This will reduce the risk of unsuitable or soft materials directly underlying the footings, which may be detrimental to the integrity of the structures.

5.10 Limitations

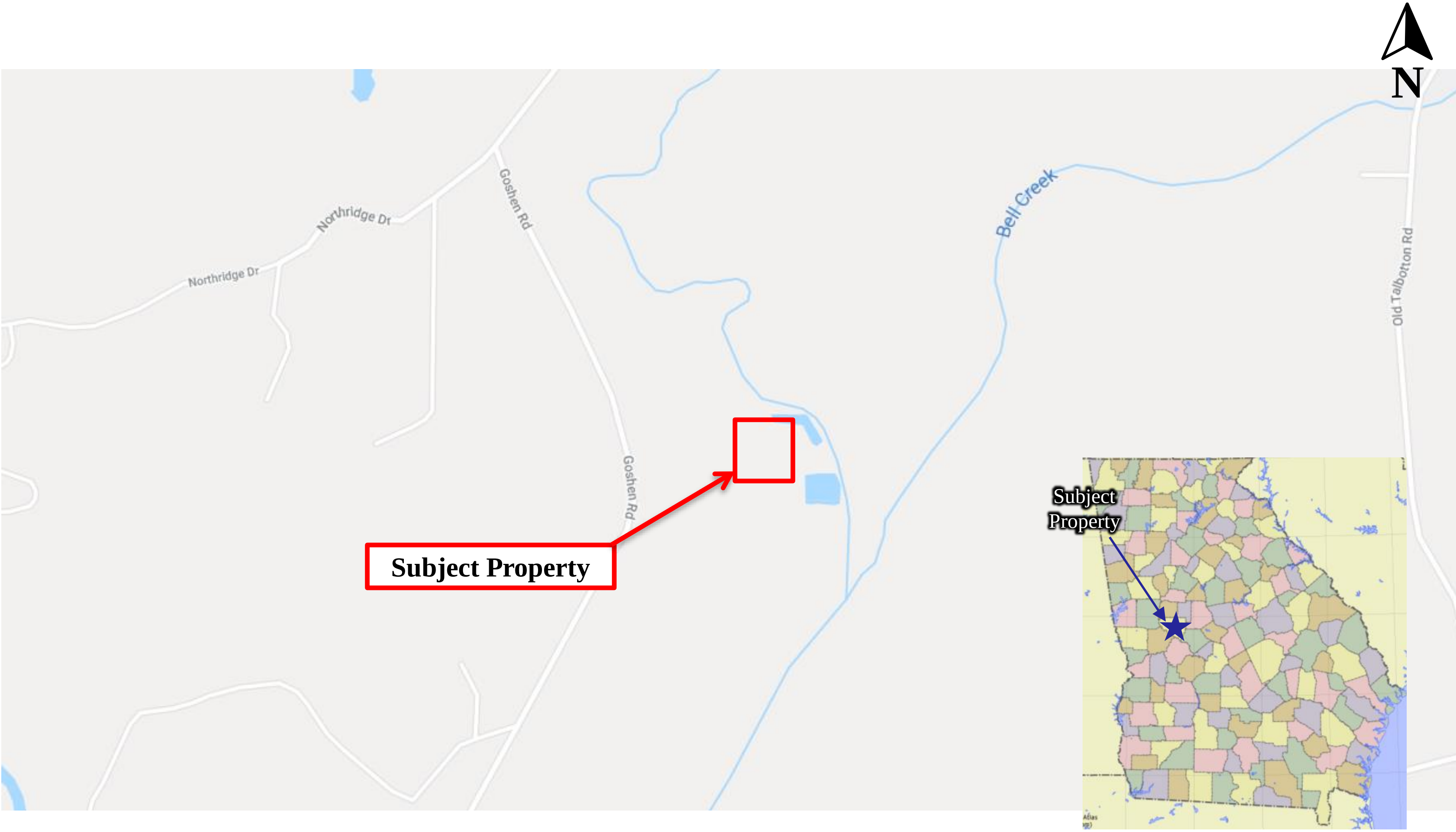
This report is for the exclusive use of ESG Engineering, Inc., the engineers, owners, and subcontractors for the project described herein, and may only be applied to this specific project. The analyses, conclusions and recommendations presented in this report are based on the preceding project information, and the results of this evaluation. Conditions may vary from those observed in the borings.

If it becomes apparent during construction that soil conditions differing from those discussed in this report are encountered, Geotechnical and Environmental Consultants, Inc. should be notified at once so that the effects may be determined and any remedial measures necessary may be prescribed.

This report has been prepared in accordance with generally accepted standards of geotechnical engineering practice in the State of Georgia. No other warranty is expressed or implied. Our firm is not responsible for conclusions, opinions or recommendations of others.

The right to rely upon this report and the data within may not be assigned without the written permission of Geotechnical and Environmental Consultants, Inc. If the design or location of the structure is changed, the recommendations contained herein must be considered invalid, unless our firm reviews changes and our recommendations are either verified or modified in writing. When design is complete, we should be given the opportunity to review the foundation plans, grading plans and applicable portions of the specifications to determine if they are consistent with the intent of our recommendations.

APPENDIX

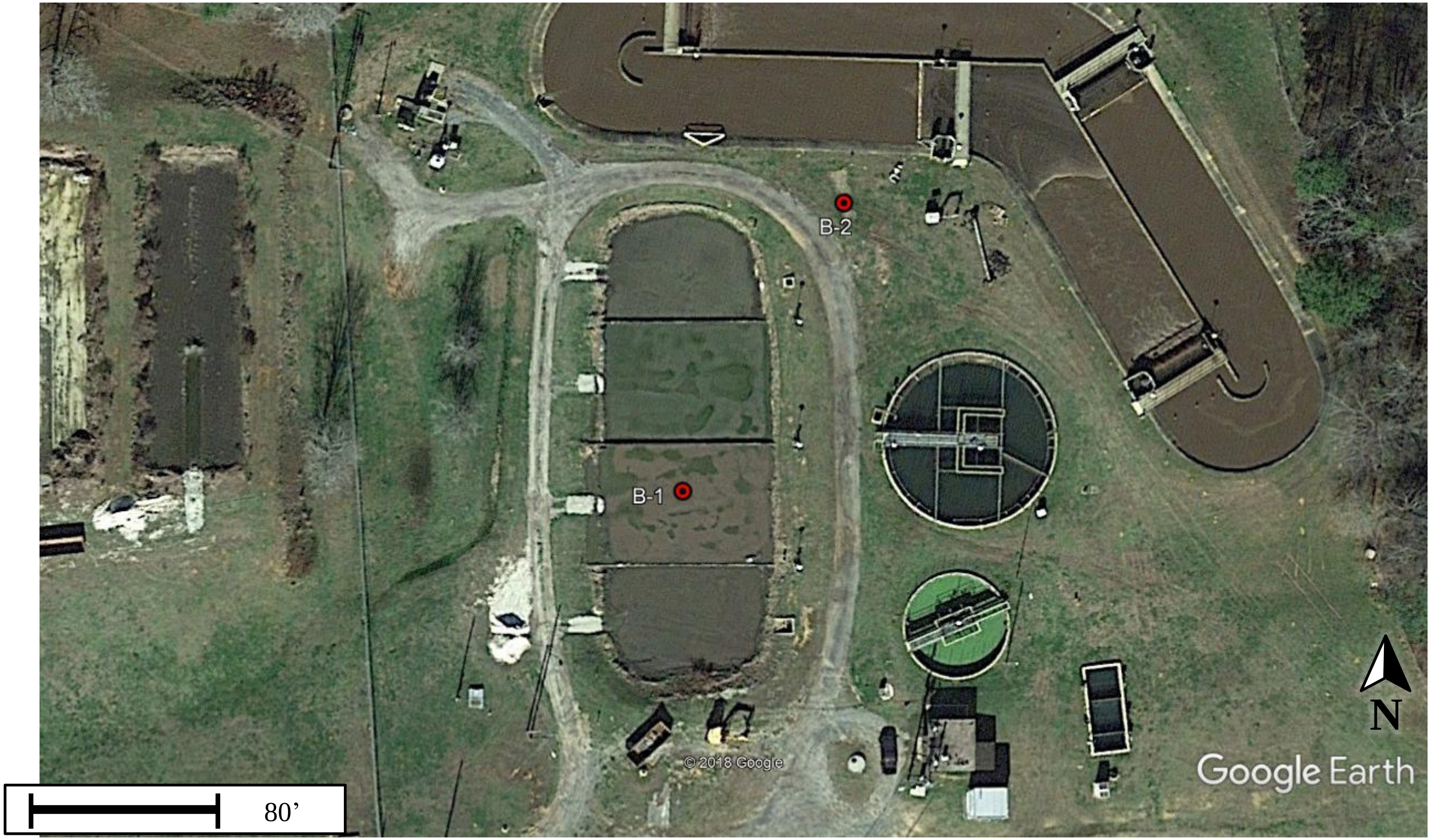


Site Location Map
Thomaston WWTP Clarifier
ESG Engineering, Inc.
Thomaston, Upson County, Georgia
GEC Project No. HN195799
Source: Google Maps

GEC Geotechnical & Environmental Consultants, Inc
A Terracon Company

514 Hillcrest Industrial Boulevard, Macon, GA 31204 • Phone: (478) 757-1606 • Fax: (478) 757-1608

5031 Milgen Court, Columbus, GA 31907 • Phone: (706) 569-0008 • Fax: (706) 569-0940



Boring Location Plan
Thomaston WWTP Clarifier
ESG Engineering, Inc.
Thomaston, Upson County, Georgia
GEC Project No. HN195799
Source: Google Maps

GEC Geotechnical & Environmental Consultants, Inc
A Terracon Company
514 Hillcrest Industrial Boulevard, Macon, GA 31204 • Phone: (478) 757-1606 • Fax: (478) 757-1608
5031 Milgen Court, Columbus, GA 31907 • Phone: (706) 569-0008 • Fax: (706) 569-0940

SOIL TEST BORING PROCEDURES

The borings were advanced by a hollow-stem auger process. At the desired depth in all borings, the borehole was cleaned out and the sample tools inserted through the auger stems. At assigned intervals, soil samples were obtained with a standard 1.4-inch inside diameter, 2-inch outside diameter split tube sampler. The sampler was first seated six inches to penetrate any loose cuttings; then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final foot was recorded and is designated as the standard penetration resistance (N-value). The penetration resistance, when properly evaluated, may be used as an index to the soil strength and foundation support capability. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586.

The drilling method is not capable of penetrating material designated as “refusal materials.” Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core boring procedures are required to determine the character and continuity of refusal materials.

Representative portions of the split tube samples were placed in sample containers and transported to our laboratory. In the laboratory, the samples were examined and the visual classification was confirmed by a geotechnical engineer or geologist.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and testing of selected field samples. These records depict subsurface conditions at the specific locations and at the particular time drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in changes in the ground water conditions at these boring locations. The lines designating the interface between strata on the re3cords and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report.

A record of the sampling operations and the descriptions of the soils encountered in each boring are shown on the following Soil Boring Record sheets.

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

SOIL TYPE	BLOWS PER FOOT (bpf)[1]	RELATIVE DENSITY / CONSISTENCY DESCRIPTION
SANDS and GRAVELS	0 – 4	Very Loose
	5 - 10	Loose
	11 - 20	Firm
	21 - 30	Very Firm
	31-50	Dense
	Over 50	Very Dense
SILTS and CLAYS	0 – 1	Very Soft
	2 – 4	Soft
	5 – 8	Firm
	9 - 15	Stiff
	16-30	Very Stiff
	31-50	Hard
	Over 50	Very Hard

[1] Standard Penetration Resistance blow count, N, which is equal to the sum of the second and third six-inch increments of the SPT test.

GEC

LABORATORY TESTING PROCEDURES

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our evaluations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer or geologist. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our “Soil Boring” records.

The classification system discussed above is primarily qualitative. For detailed soil classification, two laboratory tests are routinely performed: grain size tests and Atterberg limits tests. Using these test results, the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in the report.

WATER LEVEL READINGS

Water table readings are normally taken in conjunction with borings and are recorded on the "Soil Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. Where relatively impervious soils (clayey soils) are encountered, the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring (TOB) water level reported on the boring records is determined by field crews immediately after drilling. Additional water table readings may be obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

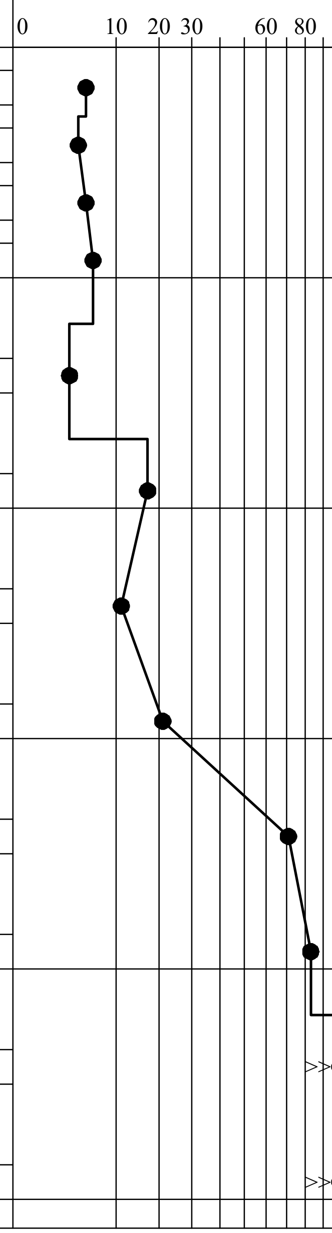
Occasionally, the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is often measured and recorded on the boring records.

SOIL BORING RECORD

Project: **Thomaston WWTP Clarifier** Thomaston, Upson County, Georgia	Boring No: **B-1** Project No: HN195799
Location: **See Boring Location Plan**	GS Elevation:
Driller/Equipment: C. Shubert/ CME 55, 2.25" HSA	Drilling Date: September 26, 2019
Water Level: 11.0 ft at time of boring; 12.0 ft after 2 hours	Engineer/Geologist:

Water Level (ft)	Depth (ft)	Soil Symbol	Soil Description	Sample Type	N-Value
			FILL		
			loose, brown-black, coarse to fine; **SAND;** SM ;	SS-1	5
			soft, tan-red, medium to fine; **SILT;** ML ;	SS-2	4
				SS-3	5
			firm, brown-gray, fine; **CLAY;** CL ;	SS-4	6
▽ ▼	10		firm, tan-gray, medium to fine; **SILT;** ML ;		
			soft, tan-gray, fine; **SAND;** SM ;	SS-5	3
			RESIDUUM		
	20		firm, tan, coarse to fine; **SAND;** SM ;	SS-6	17
			firm, tan, fine; **SAND;** SM ;	SS-7	11
	30		very firm, tan-brown, coarse to fine; **SAND;** SM ;	SS-8	21
			very dense, tan-gray, fine; **SAND;** SM ;	SS-9	71
	40		;	SS-10	83
			PARTIALLY WEATHERED ROCK		
			very dense, tan, coarse to fine; **SAND;** SM ;	SS-11	50/5
	50		;	SS-12	50/4
			BORING TERMINATED AT 50.0 ft		

Standard Penetration Test Data (blows/ft)



- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

514 Hillcrest Industrial Blvd, Macon, GA 31204
5031 Milgen Court, Columbus , GA 31907

GEC
GEOTECHNICAL & ENVIRONMENTAL
CONSULTANTS

SOIL BORING RECORD

Project: **Thomaston WWTP Clarifier** Thomaston, Upson County, Georgia	Boring No: **B-2** Project No: HN195799
Location: **See Boring Location Plan**	GS Elevation:
Driller/Equipment: C. Shubert/ CME 55, 2.25" HSA	Drilling Date: September 26, 2019
Water Level: NGWE at time of boring; NGWE after hours	Engineer/Geologist:

Depth (ft)	Soil Symbol	Soil Description	Sample Type	Standard Penetration Test Data (blows/ft) 0 10 20 30 60 80	N-Value
		FILL brown, coarse to fine; **SAND;** SM			
5		tan, coarse to fine; **SAND;** SM			
		AUGER REFUSAL ENCOUNTERED AT 6.0 ft			

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES: Hand augered for first 5 feet due to potential utilities. Began drilling at 5 feet and encountered refusal at 6 feet below existing ground surface.

514 Hillcrest Industrial Blvd, Macon, GA 31204
5031 Milgen Court, Columbus , GA 31907

GEC
GEOTECHNICAL & ENVIRONMENTAL
CONSULTANTS

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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