ADDENDUM NO. 1

LOWER POPLAR WATER RECLAMATION FACILITY
INFLUENT PUMP STATION IMPROVEMENTS

MACON WATER AUTHORITY
MACON, GEORGIA

ADDITIONAL INFORMATION DOCUMENTS

The following documents:

- Questions and Responses No. 1
- Geotechnical Investigation Report

are being provided with this addendum for informational purposes only. The documents listed above are not, and will not, be considered as part of the Contract Documents.

SPECIFICATIONS

INDEX, ADD, 40 05 31.13B Polyvinyl Chloride Process Piping

03 64 00 Concrete Repair Crack Injection,
Delete Section in its entirety and replace it with Section 03 64 00 included with this addendum.

ADD, Specification Section 40 05 31.13B Polyvinyl Chloride Process Piping, included with this addendum.

01 35 00 3, Article 1.5, A.7, Delete paragraph A.7 in its entirety.

DRAWINGS

Drawing 00-G001, VALVE SCHEDULE, PV-12,
Delete Row for 24” valve PV-12 in its entirety.

Drawing 09-D302,
Delete Text “ 24” X 20” FM-DI/SSTL ECCENTRIC REDUCER. TYP”.
and
Replace with “ 24” X 20” FM-DI/SSTL ECCENTRIC REDUCER, TYP 4,
16” X 14” FM-DI/SSTL ECCENTIRC REDUCER, TYP 2 ”.

Drawing 09-D302,
Delete Text “ 24” DI/SSTL 11.25 DEGREE BEND, TYP ”.
and
Replace with “ 24” DI/SSTL 11.25 DEGREE BEND, TYP 8,
16” DI/SSTL 11.25 DEGREE BEND, TYP 4 ”.

Drawing 09-D303, Delete Graphic Scale Bar in Section Titles.

Delete Drawing 99-D501 and replace with Drawing 99-D501 attached.

<u>Bidder Must Acknowledge Receipt of this Addendum on Bid Form</u>

August 5, 2024
Barge Design Solutions, Inc.
6525 The Corners Parkway, Suite 450
Peachtree Corners, Georgia 30092
(678) 515-9411

QUESTIONS AND RESPONSES NO. 1

LOWER POPLAR WATER RECLAMATION FACILITY
INFLUENT PUMP STATION IMPROVEMENTS

MACON WATER AUTHORITY
MACON, GEORGIA

1.	Q:	Is there a Geo Tech report that will be made available to the bidders?
	R:	See Addendum No.1 Additional Information Documents
2.	Q:	Are there existing underground pipes and or utilities in the work area that are to remain?
	R:	See contract documents
3.	Q:	Are there any equipment access restrictions we need to be made aware of that would prevent the use of a standard size steer machine or small to mid-size excavator?
	R:	No
4.	Q:	Confirm there are no AIS or Domestic requirements for the project.
	R:	There are no AIS or Domestic Requirements.
5.	Q:	What type of PVC is required for the 1-1/2" NPW line called out on Sheet 09-D103?
	R:	See Addendum No. 1
6.	Q:	What size reducers are on the 16" discharge line?
	R:	16" x 14" See Addendum No. 1
7.	Q:	Are there offset fittings on 16" similar to the 24" discharge piping shown on 09-D302?
	R:	Yes
8.	Q:	Graphic Scale Bar on Sheet 09-D303 is off.
	R:	Drawings are to Scale. Removing Graphic Bar Scale, See Addendum 1
9.	Q:	Detail 2 09-D101 will not work. Everything will have to be threaded because of the location of the ARVs and what they are connecting to.
	R:	No Action Necessary
10.	Q:	Please clarify pipe support detail on Sheet 09-D103 is adjustable or non adjustable. D103
	R:	Adjustable – See Addendum No. 1

August 5 , 2024

Barge Design Solutions, Inc.
6525 The Corners Parkway, Suite 450
Peachtree Corners, Georgia 30092
(678) 515-9411

Lower Poplar WRF Improvements

Geotechnical Engineering Report

October 4, 2023 | Terracon Project No. HN235137

Prepared for:

Barge Design Solutions
6525 The Corners Parkway, Suite 450
Peachtree Corners, GA 30092

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October 4, 2023

Barge Design Solutions
6525 The Corners Parkway, Suite 450
Peachtree Corners, GA 30092

Attn: Raymond Cordon, P.E.
P: (678) 515-9411
E: Raymond.Cordon@bargedesign.com

Re: Geotechnical Engineering Report
Lower Poplar WRF Improvements
Lower Poplar Street
Macon, Georgia
Terracon Project No. HN235137

Dear Mr. Cordon:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PHN235137 (Revised) dated August 22, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

Stephen Boltja
Senior Engineer

Thomas E. Driver, P.E.
Regional Manager

Table of Contents

Figures

Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Report Summary

Topic [1]	Overview Statement [2]
Project Description	The project includes the design of improvements to the Influent Pump Station at the Lower Poplar WRF. The plans are to retrofit the existing Dry Pit Pump station to a wetwell configuration with submersible pumps, as well as other support buildings, piping, and valves, etc.
Geotechnical Characterization	Very loose to medium dense sands were encountered to depths ranging from 28 to 73 feet. Beneath the sand, very soft to very hard layers of sandy elastic silts were encountered at depths ranging from 28 to 73 feet. Existing fill was encountered in the area of the influent pumping station to depths of 10 feet in the new electrical enclosures and to the maximum depths explored of 15 feet adjacent to the influent pumping station. Our borings were terminated at 15 feet as we were drilling above a wet well structure located at approximately 21.4 feet below the exterior grade at the influent pumping station. Groundwater was not encountered in our shallow borings that were advanced to a depth of 15 feet. Because of the anticipated soil conditions, the deep borings were advanced utilizing mud rotary drilling techniques therefore we were unable to check ground water elevations. Based on historical knowledge of this site, we anticipate that groundwater will be a concern for some of the excavations at this site.
Shallow Foundations	Not recommended for this site.
Deep Foundations	Deep foundations are recommended for the site. We recommend utilizing helical piers to support the valves, pipes, and the electrical room structures. We recommend that pulldown helical piles be utilized for foundation support in the area adjacent to the influent pumping station due to installation depth restrictions. Pulldown piles provide more capacity than traditional helical piers installed to the same depth. Helical piles should not be installed beneath an elevation of 279' to minimize any additional loads placed on the roof of the wet well located at an elevation of 273.7'. A structural engineer should review the wet well roof ability to carry any additional loads from the helical piles. Alternatively, we have provided recommendations for auger cast piles for structures other than the pipe foundation adjacent to the influent pumping station.

Topic [1]	Overview Statement [2]
Below-Grade Structures	The plans for the force main valve installations call for excavations of up 21 feet with steel shoring. Our recommendations for lateral earth pressures are presented in the lateral earth pressure section of this report. Due to the potential for ground water fluctuations at this site we recommend using the presented submerged values for shoring design. Dewatering of the shored excavation may be required and should be anticipated. It is our understanding that hydro compacted sand will be utilized to backfill the excavation.
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed improvements to be located at Lower Poplar Street in Macon, Georgia. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction
- Lateral earth pressure

The geotechnical engineering Scope of Services for this project included the advancement of test borings, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	An email request for proposal was submitted by Raymond Cordon to Tom Driver on July 26, 2023. The request included a site narrative and two drawings: ▪ Combined BOD Drawings 7.13.23 ▪ Macon Lower Poplar IPS BOD 7.13.23
Project Description	The project includes the design of improvements to the Influent Pump Station at the Lower Poplar WRF. The plans are to retrofit the existing Dry Pit Pump station to a wetwell configuration with submersible pumps, as well as other support buildings, piping, and valves, etc.

Item	Description
Proposed Structure	Structures to be designed and constructed include, but may not be limited to, the following: ▪ Discharge Piping foundations ▪ Pre-Engineered Electrical Building (2) ▪ Yard Piping Isolation Valves (2) ▪ Force Main Isolation Valves (1)
Finished Floor Elevation	The buildings will be constructed at or near existing grade.
Maximum Loads	Not provided
Below-Grade Structures	Several of the valves and piping will be constructed below grade.
Free-Standing Retaining Walls	Not anticipated.

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at Lower Poplar Street in Macon, Georgia. Latitude/Longitude (approx.) 33°54'34.94"N; 83°23'25.17"W See **Site Location**
Existing Improvements	Existing Lower Poplar Street WRF and associated structures.
Current Ground Cover	Earth and pavement.
Existing Topography	Fairly flat across the site.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Sand**	Poorly graded silty sand to various depths
2	**Elastic Silt**	Sandy elastic silt at various depths

Groundwater was not encountered in our shallow borings that were advanced to a depth of 15 feet. Because of the anticipated soil conditions, the deep borings were advanced utilizing mud rotary drilling techniques. Therefore, we were unable to check ground water elevations. Based on historical knowledge of this site, we anticipate that groundwater will be a concern for some of the excavations at this site. Groundwater conditions may be different at the time of construction. Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project.

Site Geology

Based on a review of the Geologic Map of Georgia, dated 1976, as published by the Georgia Geological Survey, the subject site is located within the Coastal Plain Physiographic Province of Georgia. The Coastal Plain Province is a wedge-shaped deposit of Cretaceous and younger sediments which range in thickness from near zero at the contact with the Piedmont Physiographic Province (Fall Line) along its northwest edge, to thousands of feet at the coast. Coastal Plain soils are marine deposits which range in age from as old as 130 million years near the “Fall Line” contact with ancient continental rocks to recent deposits near the coast. They contain various materials including interbedded gravels, sands, silts and clays, soft to hard limestone and organic materials such as peat.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is that a **Seismic Site Classification of E** should be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 75 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

The subsurface materials generally consisted of very loose to medium dense sands to depths ranging from 28 to 73 feet. Beneath the sand, very soft to very hard layers of sandy elastic silts were encountered at depths ranging from 28 to 73 feet. Existing fill consisting of very loose to medium dense poorly graded silty sand was encountered around the influent pumping station to the maximum depths explored of 15 feet. Our borings were terminated at 15 feet as we were drilling above a wet well structure located at approximately 21.4 feet below the exterior grade at influent pumping station.

Based on the conditions encountered and estimated load-settlement relationships, the proposed structures can be supported on helical piers.

Groundwater was not encountered in our shallow borings that were advanced to a depth of 15 feet. Because of the anticipated soil conditions the deep borings were advanced utilizing mud rotary drilling techniques therefore we were unable to check ground water elevations. Based on historical knowledge of this site, we anticipate that groundwater will be a concern for some of the excavations at this site.

The recommendations contained in this report are based upon the results of field testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Subgrade Preparation

Subgrade preparation will be required for the electrical enclosures. The subgrade should be proof rolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proof rolling should be performed under the observation of the Geotechnical Engineer or representative. Areas excessively deflecting under the proof roll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted. We anticipate that, based on the SPT values in the soil borings, some undercutting or reworking of the near surface soils will be required. Undercut soils may be reused for fill after moisture conditioning.

All exposed areas which will receive fill, once properly stripped, should be scarified to a minimum depth of 10 inches, moisture conditioned as necessary, and compacted per the compaction requirements in this report. This is very important on this site due to the loose near surface soils encountered to provide a consistent subgrade across the site. Compacted structural fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation or pavement construction.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable; however, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements, or constructed slopes. General fill is material used to achieve grade outside of these areas.

Reuse of On-Site Soil: Excavated on-site soil may be selectively reused as fill based on the subsurface exploration. Actual material suitability should be determined in the field at time of construction. Moisture conditioning will likely be required prior to reuse as fill.

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity Cohesive	CL, CL-ML ML, SM, SC	Liquid Limit less than 45 Plasticity index less than 25 Less than 25% retained on No. 200 sieve
Granular	GW, GP, GM, GC, SW, SP, SM, SC	Less than 50% passing No. 200 sieve

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Additional geotechnical consultation should be provided prior to use of uniformly graded gravel on the site.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e., jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements [1,2]	98% of max. below foundations and within 1 foot of finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below finished pavement subgrade	92% of max.
Water Content Range [1]	-3% to +3% of optimum	As required to achieve min. compaction requirements

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. High plasticity cohesive fill should not be compacted to more than 100% of standard Proctor maximum dry density.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Deep Foundations

Specialty Foundations

Helical Piles

Deep foundations are recommended for the site. We recommend utilizing helical piers to support the valves, pipes, and the electrical room structures. We recommend that pulldown helical piles be utilized for foundation support in the area adjacent to the influent pumping station due to installation depth restrictions. Pulldown piles provide more capacity than traditional helical piers installed to the same depth. Helical piles in these areas should not be installed beneath an elevation of 279' to minimize any additional loads placed on the roof of the wet well located at an elevation of 273.7'. A structural engineer should review the wet well roof ability to carry any additional loads from the helical piles.

Helical pile systems are typically installed by design-build contractors who will provide sealed construction drawings based on geotechnical information provided by others. The critical aspect of helical pile installation is achieving the design torque required to install each pile, which correlates to the capacity for a given pile type and size as determined by the pile manufacturer. Minimum embedment depths should also be anticipated based on the subsurface information. In general, helical pile systems can be designed to achieve total settlement on the order of 1 inch or less and differential settlement on the order of ½ inch or less. Based on the boring data for this project, we anticipate that the helical piles would need to be extended to depths on the order of 15 to 25 feet (except in the area of the wet well), depending on required capacities. Increased capacities can be achieved by installing pull down helical piles by injecting grout and to develop skin friction capacity along the length of the pile.

We recommend that you contact helical pile contractors to review and analyze the subsurface data in this report, as well as the proposed structural loads for the project, and to obtain a cost estimate for helical pile installation. We also recommend that the helical pile installation be monitored full time by the Owner's geotechnical consultant. The QC program should include observation of pile spacing, pile types installed, embedment depths and torque achieved upon installation. Terracon is available to provide assistance as needed during the design process.

Augered and Cast-in-Place (ACIP) Pile Design Parameters

Alternatively, we have provided recommendations for auger cast piles, if desired, for structures other than the pipe foundation adjacent to the influent pumping station.

The following table can be used to estimate capacities for individual, continuous flight auger piles, commonly referred to as Augered and Cast-in-Place (ACIP) piles. The values are considered adequate for estimation of allowable (safety factor applied) load carrying capacity for ACIP piles ranging in diameter from 14 inches to 20 inches and ranging in depth from 20 to 60 feet.

ACIP piles should be spaced at least three pile diameters apart (center-to-center) if side friction is used for compressive loads.

ACIP Design Summary [1]

Depth (feet)	Stratigraphy [2]		Allowable Skin Friction (psf) [3]	Allowable End Bearing Pressure (psf) [4]
	No.	Material		
0 to 5	1	--	0	0
5 to 10	1	Loose Sand	300	0
10 to Varies	1	Loose Sand	600	0
Varies	3	Medium Dense Sand to Very Stiff Silt	750	6000

1. Design capacities are dependent upon the method of installation and quality control parameters. The values provided are estimates and should be verified after finalization of installation protocol.
2. See Subsurface Profile in **Geotechnical Characterization** for more details on stratigraphy.
3. Applicable for compressive loading only. Reduce to 2/3 of values shown for uplift loading. The effective weight of the pile can be added to uplift load capacity to the extent permitted by IBC.
4. Piles should extend 5 feet into the bearing stratum for end bearing to be considered.

ACIP Pile Construction Considerations

Installation of adjacent piles with a clear distance spacing of less than ten pile diameters should be delayed until grout in the initial pile has set to avoid possible grout intrusion between the piles which could jeopardize pile integrity.

Proper ACIP pile installation is highly operator-dependent and requires a greater than average dependence on quality workmanship and quality control monitoring. In addition, the successful ACIP pile completion largely depends on the equipment and installation procedures. The auger should be withdrawn in a controlled manner and a sufficient head of grout should always be maintained in the augers to prevent necking of fluid grout due to hydrostatic pressures.

If practical drilling refusal is experienced above the planned termination depth, then a boulder or other obstruction may be present, and a replacement pile should be installed. The situation should be evaluated by the Geotechnical Engineer and the Structural Engineer during the pile driving operations. Continued "hard" drilling to attempt to extend through an obstruction should not be performed due to the possibility of excessive soil removal.

The ACIP pile installation process should be performed under observation of the Geotechnical Engineer. The Geotechnical Engineer should document the pile installation process including soil/rock and groundwater conditions observed, consistency with expected conditions, and details of the installed pile.

Floor Slabs

A subgrade prepared and tested as recommended in this report should provide adequate support for lightly loaded floor slabs. Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks in pavement areas that develop should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments. If these are to be any moisture sensitive floor coverings, a vapor retarder or barrier should be used beneath the concrete floor slab on grade. The slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base rock and concrete and corrective action may be required. We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and placement of base rock. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the base rock and concrete.

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Minimum 12 inches of approved on-site or imported soils placed and compacted in accordance with the recommendations in **Earthwork**
Estimated Modulus of Subgrade Reaction [2]	100 pounds per square inch per inch (psi/in) for point loads
Subbase	6 inches granular material

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams, and/or post-tensioned elements.

Floor Slab Construction Considerations

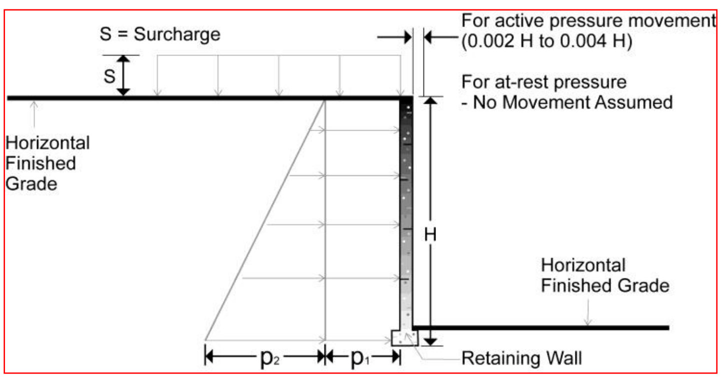
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4]	
			Unsaturated [5]	Submerged [5]
Active (Ka)	Granular - 0.31 Fine Grained - 0.41	(0.31)S (0.41)S	(40)H (50)H	(80)H (85)H
At-Rest (Ko)	Granular - 0.47 Fine Grained - 0.58	(0.47)S (0.58)S	(55)H (70)H	(90)H (95)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, with a maximum unit weight of 115 pcf for cohesive soils and 125 pcf for granular soils.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. To achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case.

Footings, floor slabs or other loads bearing on backfill behind walls may have a significant influence on the lateral earth pressure. Placing footings within wall backfill and in the zone of active soil influence on the wall should be avoided unless structural analyses indicate the wall can safely withstand the increased pressure.

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls). Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop a proposal for evaluation and design of such wall systems upon request.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

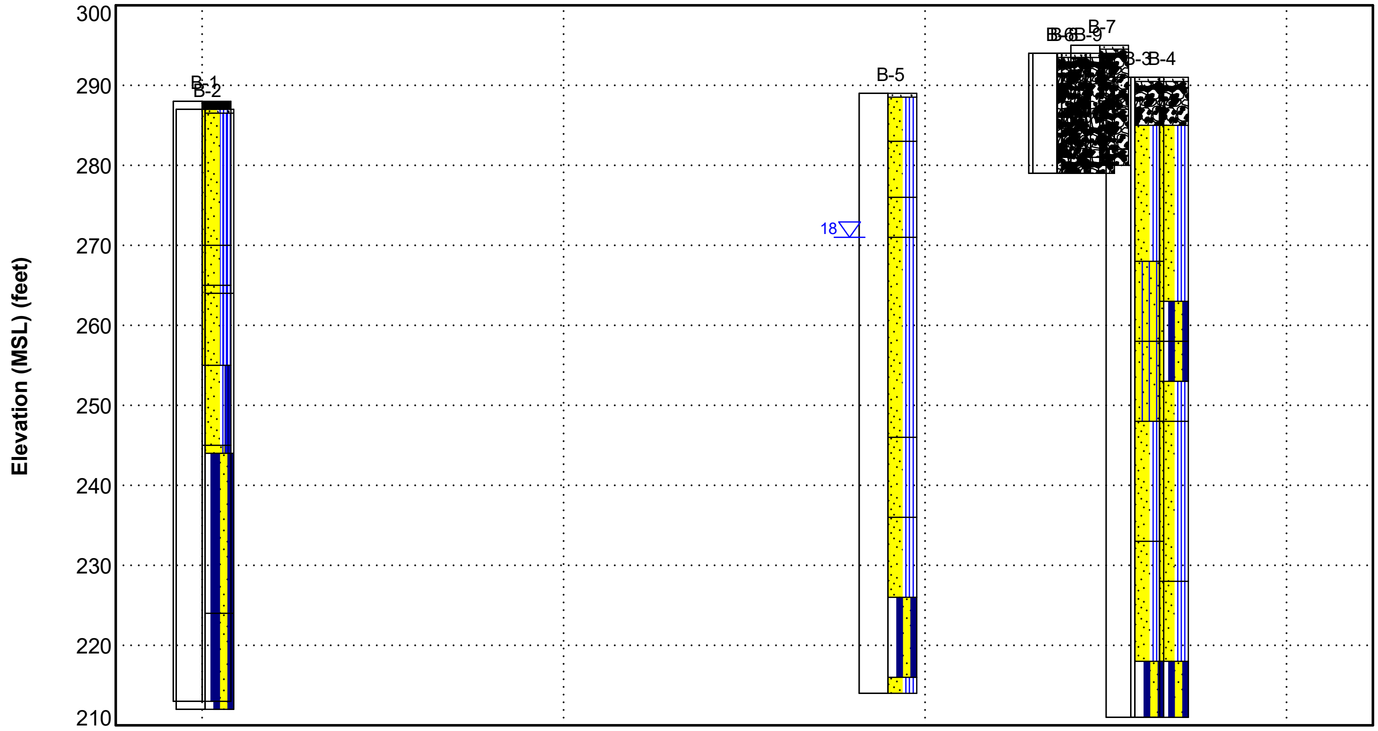
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

Contents:

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

LEGEND

- Asphalt
- Poorly-graded Sand with Silt
- Elastic Silt
- Elastic Silt with Sand
- Topsoil
- Fill
- Silty Sand

First Water Observation

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

The groundwater levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
5	75 to 80	utilities / buildings
4	15	utilities / buildings

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted rotary drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. Where possible, we observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion. Pavements were patched with cold-mix asphalt and/or pre-mixed concrete, as appropriate.

Due to the use of mud rotary drilling techniques, we were unable to measure ground water levels in Borings B-1 through B-5. Borings B-6 through B-9 were advanced using conventional drilling to a depth of 15 feet. Groundwater was not observed at these times in the 15 feet boreholes. However, ground water levels fluctuate, and historical data shows the potential for shallow groundwater at this site.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our office for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our office.

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

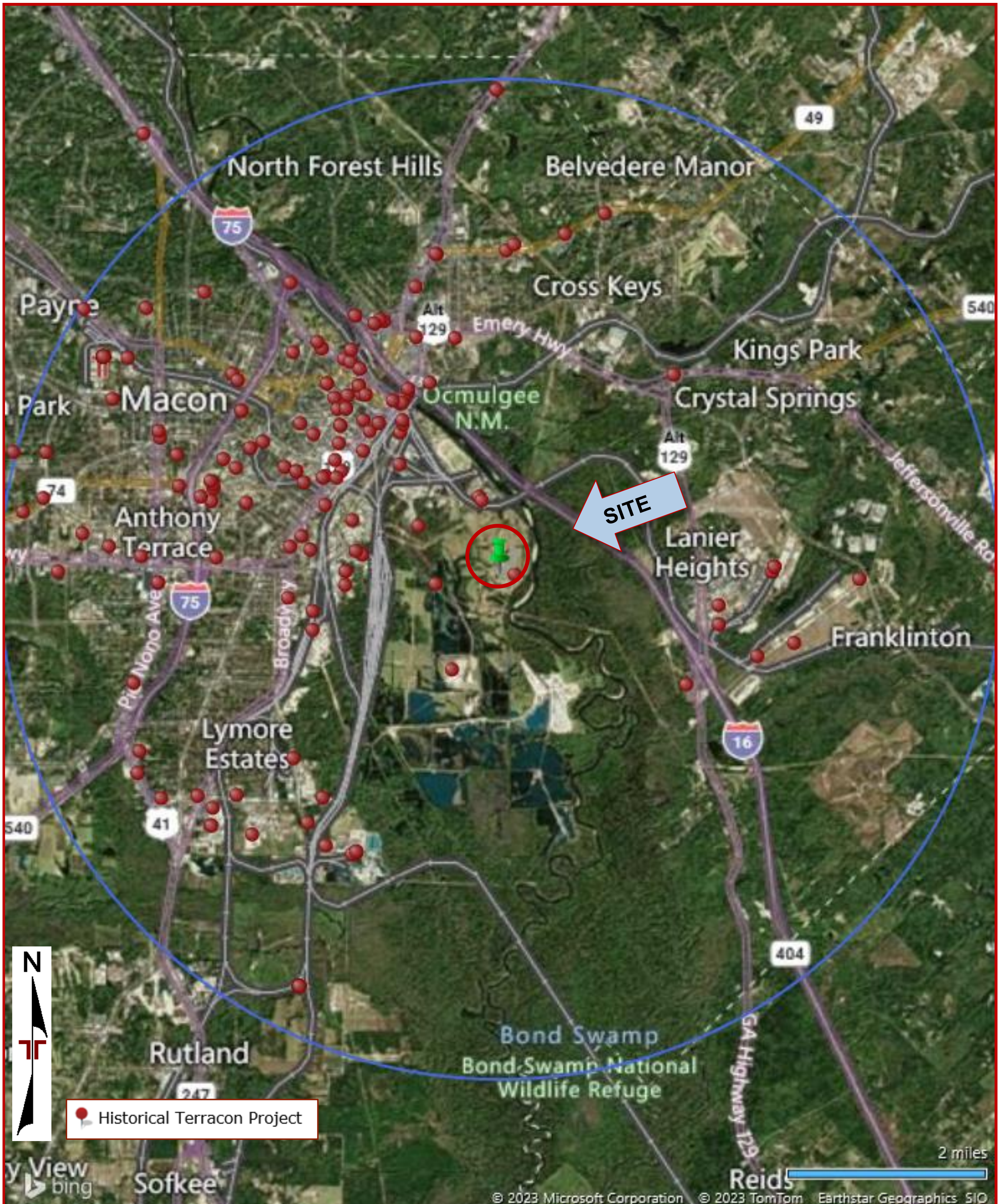


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

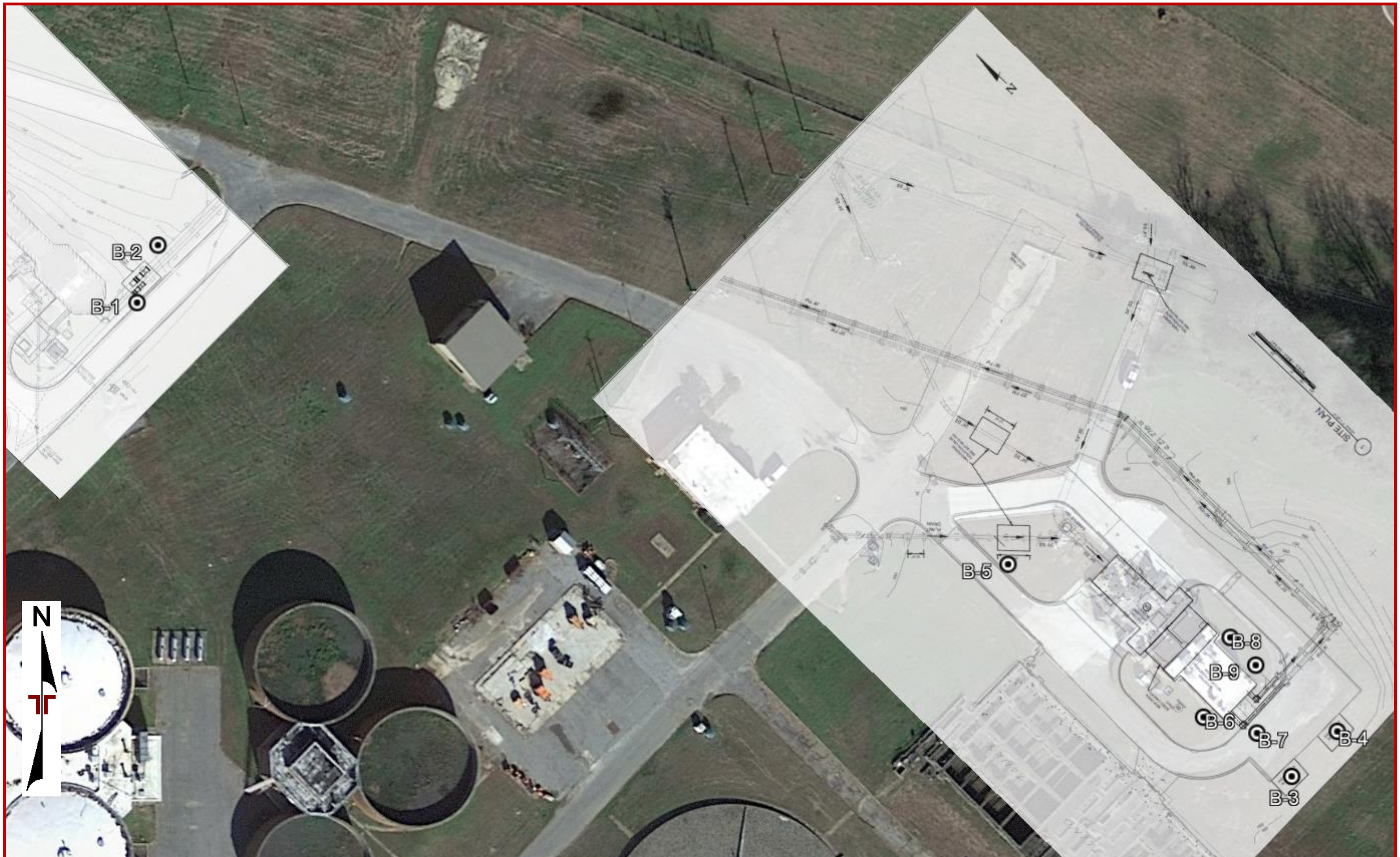


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-9)

Note: All attachments are one page unless noted above.

514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 32.8133° Longitude: -83.6035°

Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results
1.0	**ASPHALT**, 6 inches asphalt/6 inches graded aggregate base				
18.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose to loose			X	6-5-4 N=9
				X	1-4-2 N=6
				X	2-2-3 N=5
		10		X	2-2-2 N=4
				X	1-1-2 N=3
23.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense	20		X	6-6-7 N=13
33.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, reddish tan, loose			X	4-4-4 N=8
		30		X	2-3-4 N=7
43.0	**ELASTIC SILT (MH)**, fine grained, light gray, medium stiff to stiff			X	4-3-3 N=6
		40		X	4-6-6 N=12
75.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, light gray and tan, very stiff to hard			X	6-11-12 N=23
		50		X	8-14-15 N=29
				X	10-12-18 N=30
		60		X	16-24-25 N=49
				X	18-25-27 N=52
		70		X	20-22-29 N=51
				X	23-24-29 N=53

Boring Terminated at 75 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-06-2023

Boring Completed
09-06-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 32.8134° Longitude: -83.6034°

Depth (Ft.)	Material Description	Sample Depth (Ft.)	Field Test Results
0.5	**TOPSOIL**, 5 inches		
23.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose to loose		5-5-6 N=11
			1-1-2 N=3
			1-1-1 N=2
			1-1-2 N=3
			1-2-2 N=4
			1-1-1 N=2
43.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, reddish tan, loose to medium dense		2-3-3 N=6
			3-3-5 N=8
			6-5-7 N=12
			7-4-6 N=10
63.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, light gray, hard		50/6" N=100
			50/4" N=100
			20-31-40 N=71
			22-33-37 N=70
75.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, light gray and tan, stiff to very stiff		2-4-6 N=10
			3-5-7 N=12
			6-8-11 N=19

Boring Terminated at 75 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations

Notes

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-06-2023

Boring Completed
09-06-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 32.8125° Longitude: -83.6010°

Depth (Ft.)	Material Description	Field Test Results
0.5	**TOPSOIL**, 4 inches	
6.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense	3-4-7 N=11; 6-6-12 N=18
23.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose	2-1-2 N=3; 1-1-2 N=3; 1-2-1 N=3; 1-1-3 N=4
33.0	**SILTY SAND (SM)**, fine to coarse grained, light brown, medium dense	4-5-6 N=11; 7-7-6 N=13
43.0	**SILTY SAND (SM)**, fine to coarse grained, light brown, very loose to loose	2-3-2 N=5; 1-2-1 N=3
58.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, gray, loose to medium dense	3-3-5 N=8; 4-5-8 N=13; 6-8-10 N=18
73.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, light gray, medium dense	8-11-12 N=23; 11-11-12 N=23; 13-14-15 N=29
80.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, tan, very stiff	11-10-12 N=22; 10-12-14 N=26

Boring Terminated at 80 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations

Notes

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-08-2023

Boring Completed
09-08-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 32.8126° Longitude: -83.6009°

Depth (Ft.)	Description	Sample Depth (Ft.)	Field Test Results
0.5	**TOPSOIL**, 4 inches		
6.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense		6-8-7 N=15
			6-9-10 N=19
28.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, loose to medium dense		5-8-8 N=16
		10	6-6-14 N=20
			2-3-4 N=7
		20	3-5-4 N=9
			2-3-3 N=6
33.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, dark gray, very soft	30	1-1-1 N=2
38.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, dark gray, very stiff		4-5-7 N=12
43.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, gray and tan, loose	40	3-4-4 N=8
63.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light gray, medium dense to dense		11-17-12 N=29
		50	11-11-14 N=25
			10-12-19 N=31
		60	14-21-24 N=45
73.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, light gray, dense		11-15-22 N=37
		70	12-17-19 N=36
80.0	**ELASTIC SILT WITH SAND (MH)**, medium grained, grayish tan, very stiff		10-8-17 N=25
		80	7-9-21 N=30

Boring Terminated at 80 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-11-2023

Boring Completed
09-11-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-5

Location: See Exploration Plan

Latitude: 32.8129° Longitude: -83.6016°

Depth (Ft.)	Material Description	Water Level Observations	Field Test Results
0.5	**TOPSOIL**, 4 inches		
6.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, loose to medium dense		3-3-5 N=8; 6-6-10 N=16
13.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose		2-2-2 N=4; 2-1-3 N=4
18.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense	▽ (approx. 17.5 ft)	5-6-8 N=14
43.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose to loose		5-6-7 N=13; 1-2-3 N=5; 3-3-5 N=8; 3-2-4 N=6; 2-2-2 N=4
53.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, gray, loose		2-3-2 N=5; 2-3-4 N=7
63.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light gray, loose		3-2-4 N=6; 3-4-3 N=7
73.0	**ELASTIC SILT WITH SAND (MH)**, fine to coarse grained, light gray, very stiff		8-9-8 N=17; 12-12-12 N=24
75.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, light gray, medium dense		7-7-8 N=15

Boring Terminated at 75 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽

Notes

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-25-2023

Boring Completed
09-25-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-6

Location: See Exploration Plan

Latitude: 32.8126° Longitude: -83.6012°

Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results
0.5	**TOPSOIL**, 3 inches				
8.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose to loose			X	1-2-2 N=4
				X	2-2-3 N=5
				X	3-5-5 N=10
15.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense	10		X	6-9-7 N=16
				X	4-4-7 N=11
	Boring Terminated at 15 Feet				

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-11-2023

Boring Completed
09-11-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-7

Location: See Exploration Plan

Latitude: 32.8126° Longitude: -83.6011°

Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results
0.5	**TOPSOIL**, 3 inches				
	FILL - POORLY GRADED SAND WITH SILT (SP-SM), fine to medium grained, light brown, very loose			X	2-2-2 N=4
				X	1-2-3 N=5
8.0				X	4-5-6 N=11
	FILL - POORLY GRADED SAND WITH SILT (SP-SM), fine to medium grained, light brown, medium dense	10		X	7-7-9 N=16
13.0					
15.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, loose, with organics (wood)			X	5-4-6 N=10
	Boring Terminated at 15 Feet				

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations

Notes

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-11-2023

Boring Completed
09-11-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-8

Location: See Exploration Plan

Latitude: 32.8127° Longitude: -83.6011°

Graphic Log Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results
0.5	**TOPSOIL**, 4 inches				
	FILL - POORLY GRADED SAND WITH SILT (SP-SM), fine to medium grained, light brown, very loose			X	1-1-2 N=3
				X	2-2-2 N=4
				X	W.O.H. N=0
		10		X	0-1-1 N=2
13.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense				
15.0				X	2-8-4 N=12
	Boring Terminated at 15 Feet				

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-11-2023

Boring Completed
09-11-2023

Terracon
514 Hillcrest Indust. Blvd
Macon, GA

Boring Log No. B-9

Location: See Exploration Plan

Latitude: 32.8127° Longitude: -83.6011°

Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results
0.5	**TOPSOIL**, 4 inches				
13.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, very loose				1-1-2 N=3
					2-2-2 N=4
					1-1-1 N=2
		10			1-1-2 N=3
15.0	**FILL - POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, light brown, medium dense				3-5-7 N=12
	Boring Terminated at 15 Feet				

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations

Advancement Method
2.25" HSA

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME-550

Hammer Type
Automatic

Driller
CS

Logged by

Boring Started
09-11-2023

Boring Completed
09-11-2023

Supporting Information

Contents:

Note: All attachments are one page unless noted above.

General Notes

Sampling	Water Level		Field Tests	
Grab Sample		Water Initially Encountered	N	Standard Penetration Test Resistance (Blows/Ft.)
Split Spoon		Water Level After a Specified Period of Time	(HP)	Hand Penetrometer
		Water Level After a Specified Period of Time	(T)	Torvane
		Cave In Encountered	(DCP)	Dynamic Cone Penetrometer
	Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.		UC	Unconfined Compressive Strength
			(PID)	Photo-Ionization Detector
			(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**Consistency of Fine-Grained Soils** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

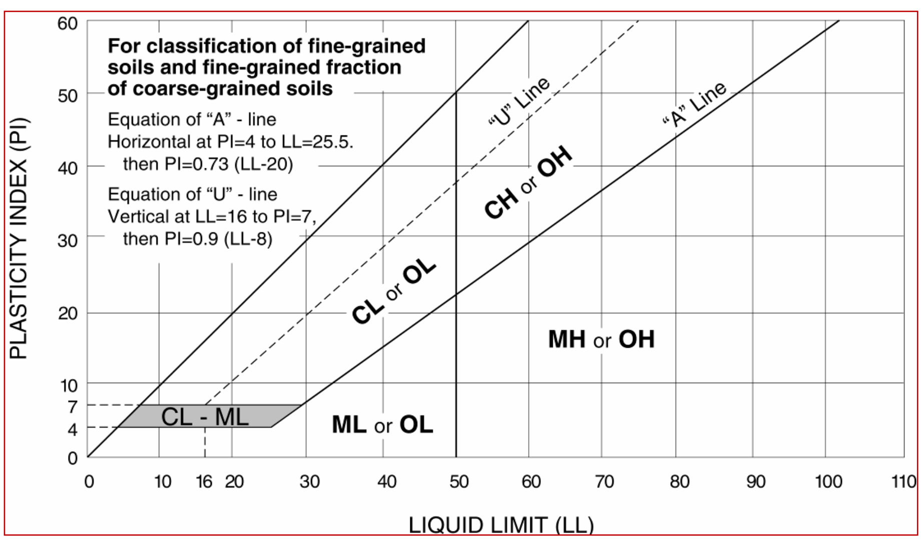
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	**Group Name** [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



Part 1 General

1.1 Summary

A. Section Includes:

1. Epoxy/polyurethane injection system.

B. Related Sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.2 References

A. ASTM International (ASTM):

1. D 638, Standard Test Method for Tensile Properties of Plastics.

2. D 648, Standard Test Method for Deflection of Plastics under Flexural Load.

3. D 695, Standard Test Method for Compressive Properties of Rigid Plastics.

4. D 790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.3 Definitions

A. Epoxy/polyurethane Injection Repair Areas: Areas deemed to be defective and requiring large crack repair.

B. Defective Areas: Surface defects that include honeycomb, rock pockets, and indentations greater than 3/16"; cracks 0.010" wide and larger, as well as any crack that leaks, for hydraulic structures and below grade habitable spaces; cracks 0.015" wide and larger in non-hydraulic structures; spalls; chips; air bubbles greater than ¾" in diameter; pinholes; bug holes; embedded debris; fins and other projections; form pop-outs; texture irregularities; and stains that cannot be removed by cleaning.

C. Large Cracks: Wider than 0.015".

D. Small Cracks: Width greater than or equal to 0.010" and less than or equal to 0.015", as well as any smaller cracks that leak.

1.4 Submittals

A. Information Submittals:

1. Manufacturer’s recommended surface preparation procedures and application instructions for epoxy or polyurethane injection system.

2. Manufacturer’s product data for epoxy/polyurethane injection system.

3. Statements of Qualification for Epoxy/Polyurethane Injection Material:

   a. Manufacturer’s site representative.

   b. Injection applicator.

   c. Injection pump operating technician.

1.5 Quality Assurance

A. Qualifications for Epoxy/Polyurethane Injection Staff:

1. Manufacturer’s Site Representative:

   a. Capable of instructing successful methods for restoring concrete structures utilizing injection process.

   b. Understands and is capable of explaining technical aspects of correct material selection and use.

   c. Experienced in the operation, maintenance, and troubleshooting of application equipment.

2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:

   a. Licensed and certified by epoxy/polyurethane Manufacturer.

   b. Minimum 3 years’ experience in successful epoxy/polyurethane injection for at least 10,000 linear feet of successful crack injection including 2,000 linear feet of wet crack injection to stop water leakage.

1.6 Delivery, Storage, And Handling

A. Packing and Shipping: Package adhesive material in new sealed containers and label with following information:

1. Manufacturer’s name.

2. Product name and lot number.

3. ANSI Hazard Classification (formerly SPI Classification).

4. ANSI recommended precautions for handling.

5. Mix ratio by volume.

B. Storage and Protection: Store adhesive containers at ambient temperatures below 120 °F and above 32 °F.

Part 2 Products

2.1 Manufacturers

A. Epoxy Injection Material equal to:

1. Sika Corp., Lyndhurst, NJ; Sikadur-52 N/LP (or approved equal).

B. Polyurethane Injection Material equal to:

1. Sika Corp., Lyndhurst, NJ; Sika Injection-215 (or approved equal).

2. Sika Corp., Lyndhurst, NJ; Sika Injection-304 (or approved equal).

3. Sika Corp., Lyndhurst, NJ; Sika Injection-307 (or approved equal).

2.2 Surface Seal

A. Sufficient strength and adhesion for holding injection fittings firmly in-place, and to resist pressures preventing leakage during injection.

B. Capable of removal after injection adhesive has cured.

Part 3 Execution

3.1 General

A. Large Cracks: Repair by injection of epoxy or polyurethane as noted on drawings.

B. Small Cracks: Repair according to 03 01 00 - Concrete Surface Repair Systems.

3.2 Preparation

A. Clean cracks in accordance with epoxy/polyurethane manufacturer’s instructions.

B. Clean surfaces adjacent to cracks from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system.

C. Do not use acids and corrosives for cleaning, unless neutralized prior to injecting epoxy/polyurethane.

3.3 Application

A. Sealing: Apply surface seal in accordance with Manufacturer's instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy/polyurethane.

B. Entry Ports:

1. Determine space between entry ports equal to thickness of concrete member to allow epoxy/polyurethane to penetrate to the full thickness of the wall.

2. Clean entry ports after drilling.

3. Space entry ports close together to allow adjustment of injection pressure to obtain minimum loss of epoxy/polyurethane to soil at locations where:

   a. Cracks extend entirely through wall.

   b. Backfill of walls on one side.

   c. Difficult to excavate behind wall to seal both crack surfaces.

C. Epoxy/polyurethane Injection:

1. Store epoxy/polyurethane at minimum of 70 °F.

2. Start injection into each crack at lowest elevation entry port.

3. Continue injection at first port until adhesive begins to flow out of port at next highest elevation.

4. Plug first port and start injection at second port until adhesive flows from next port.

5. Inject entire crack with same sequence.

D. Finishing:

1. Cure epoxy/polyurethane adhesive after cracks have been completely filled to allow surface seal removal without draining or runback of epoxy/polyurethane material from cracks.

2. Remove surface seal from cured injection adhesive.

3. Finish crack face flush with adjacent concrete.

4. Indentations or protrusions caused by placement of entry ports are not acceptable.

5. Remove surface seal material and injection adhesive runs and spills from concrete surfaces.

3.4 Equipment

A. Portable, positive displacement type pumps with in-line metering to mix two adhesive components, and inject mixture into crack, and as required by injection system manufacturer.

3.5 Field Quality Control

A. Epoxy/Polyurethane Adhesive Two Component Ratio Tests:

1. Disconnect mixing head and pump two adhesive components simultaneously through ratio check device.

2. Adjust discharge pressure to 160 psi for both adhesive components.

3. Simultaneously discharge both adhesive components into separate calibrated containers.

4. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.

5. Complete test at 160 psi discharge pressure and repeat procedure for 0 psi discharge pressure.

6. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work has stopped for more than 1-hour.

7. Document and maintain complete accurate records of ratios and pressure checks.

B. Injection Pressure Test:

1. Disconnect mixing head of injection equipment and connect two adhesive component delivery lines to pressure check device.

2. Pressure Check Device:

a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.

b. Pressure gauge capable of sensing pressure buildup behind each valve.

3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 psi.

4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 psi within 3 minutes.

5. Run pressure test for each injection equipment unit:

    a. Beginning and end of each injection work day.

    b. When injection work has stopped for more than 1-hour.

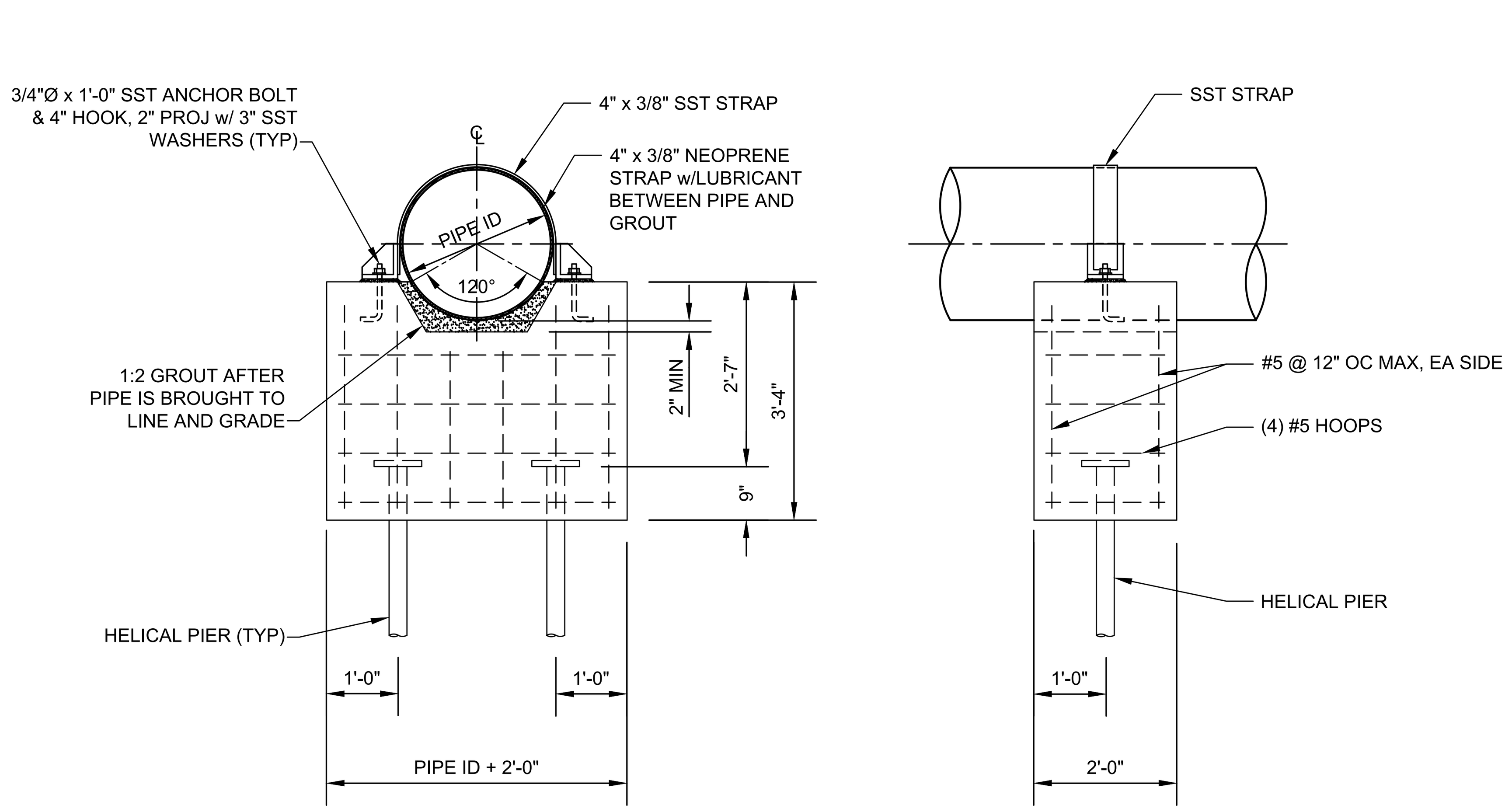
6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

END OF SECTION

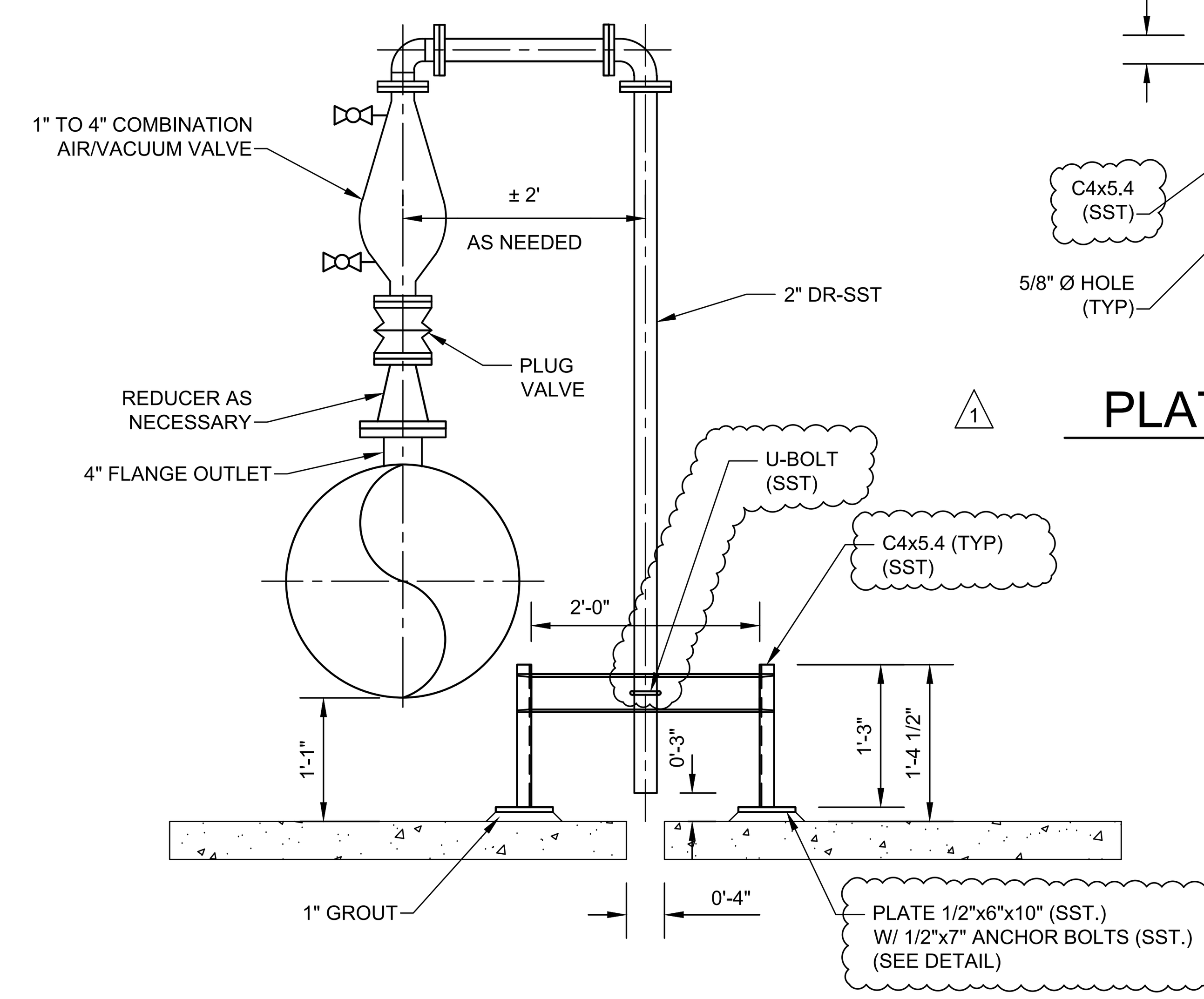
Item	Size	Description
General		A. Pipe fittings shall be compatible with the applicable pipe materials. B. Identification and Tagging: Each piece of pipe shall bear the ASTM designation and all other markings required for that designation. C. All materials in contact with potable water shall be certified to NSF Standard 61 and Standard 372. D. PVC Pipe shall be colored, with the entire pipe being cast in a uniform color. The pipe colors shall be as follows: 1. Potable Water – Blue 2. Sewer – Green 3. Effluent Reuse – Purple 4. Other Liquids - White E. Pipe shall be handled during manufacture and shipped without nesting (i.e., insertion of one pipe inside another). F. Pipe shall be manufactured with titanium dioxide for UV protection.
Pipe	3” and smaller	ASTM D1784, minimum cell classification 12454. Pipe shall be Schedule 80 conforming to D1785. Threaded nipples: Schedule 80 PVC.
Fittings	3” and smaller	Schedule to match pipe above. ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide.
Joints	3” and smaller	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	All	One-piece, molded hub type PVC flat face flange in accordance with fittings above. ASME B16.1, 125 # drilling.
Gaskets	All flanges	General: Gaskets in contact with potable water shall be NSF 61 certified. Flat face mating flange: Full faced, 1/8 inch thick Ethylene Polypropylene (EPM) rubber. Raised face mating flange: Flat ring, 1/8 inch thick Ethylene Polypropylene (EPM) rubber, with

		filler gasket between OD of raised face and flange OD to protect flange from bolting moment.
Solvent Cement	All	Socket connections shall be joined with PVC solvent cement conforming to ASTM D2564. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility. Joints shall be prepared with primers conforming to ASTM F656 prior to cementing and assembly.
Thread Lubricant		Polytetrafluoroethylene (PTFE) pipe-thread tape.

END OF SECTION



1 HELICAL PIER
09-D101
SCALE: N.T.S.



2 AIR/VACUUM VALVE
09-D101
SCALE: N.T.S.

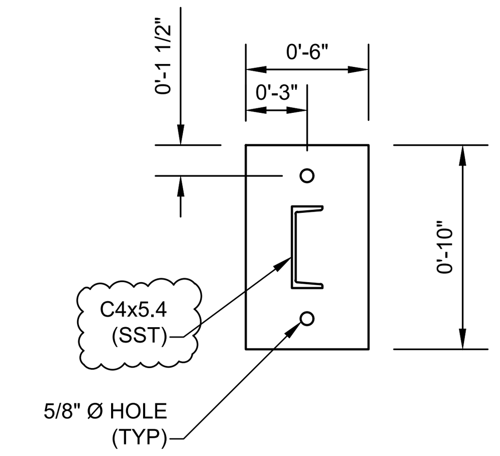
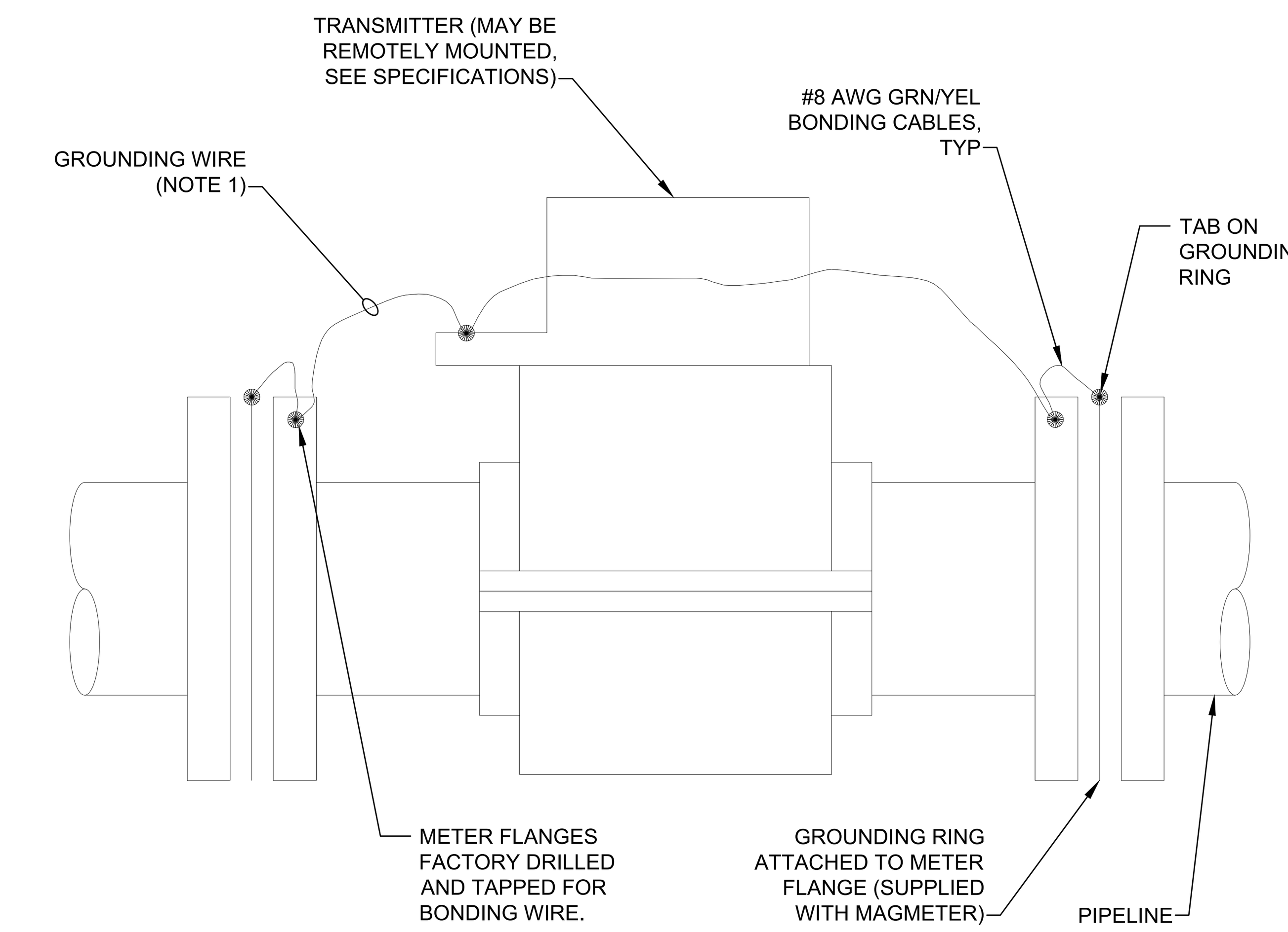


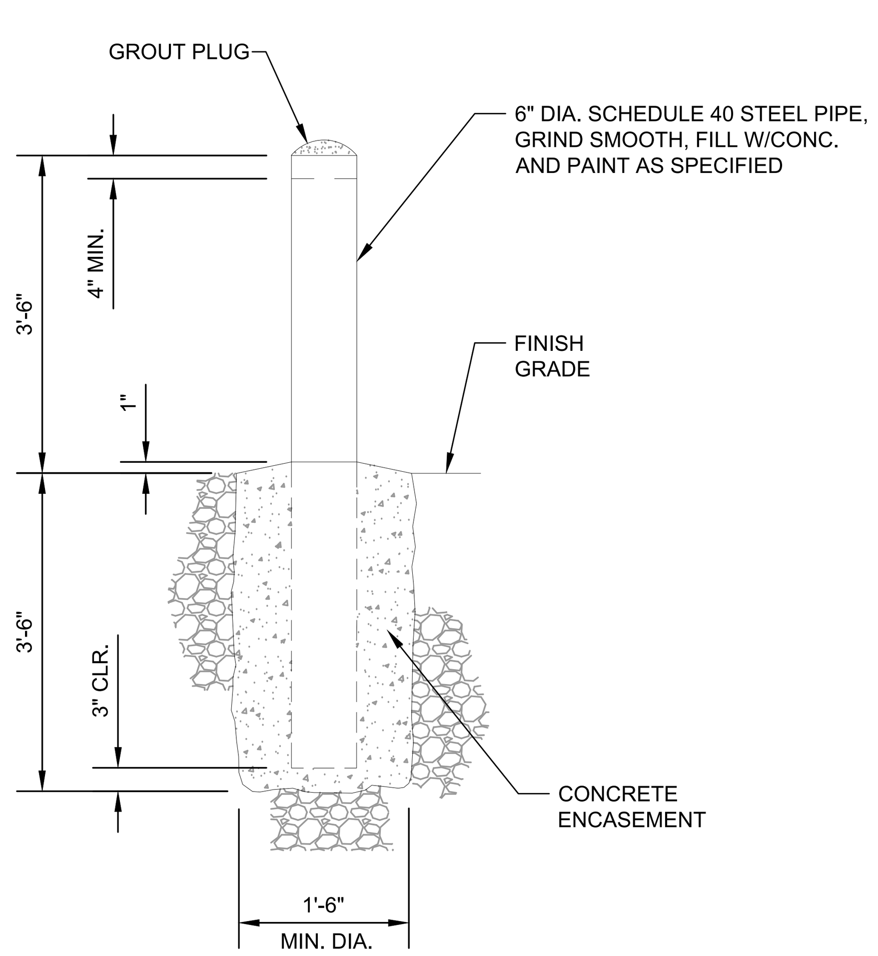
PLATE DETAIL



NOTES:

1. NO. 8 AWG INSULATED IF LENGTH IS LESS THAN 6'. IF MORE THAN 6', INSTALL CONDUCTOR IN 3/4" CONDUIT.
2. BOND MAGMETER TO POWER CIRCUIT GROUND CONDUCTOR AT FLOW ELEMENT.
   A) POWER CIRCUIT GROUND CONDUCTOR AT TRANSMITTER.
   B) NEAREST AVAILABLE EQUIPMENT GROUND CONNECTION POINT.
   C) SEPARATE TAIL FROM EMBEDDED GROUND MAT.

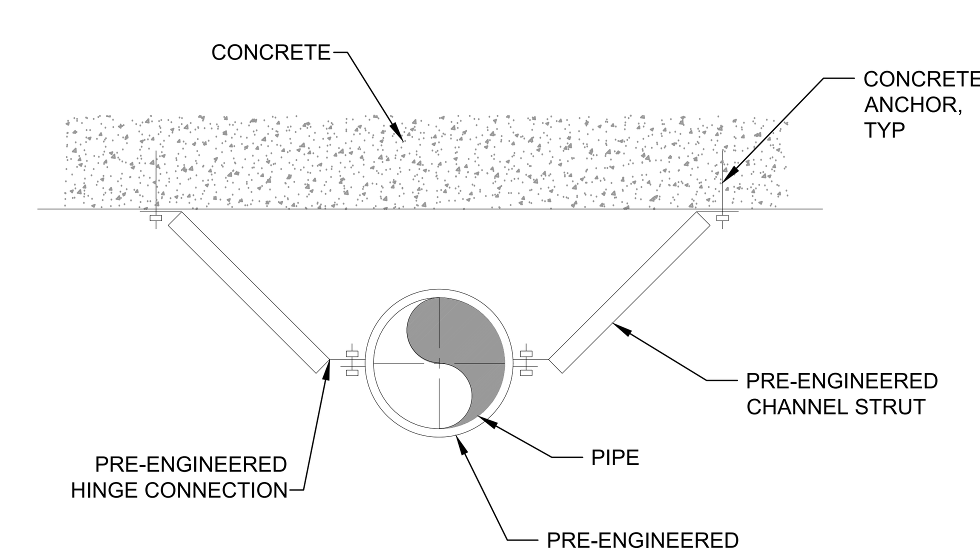
3 MAGNETIC FLOWMETER INSTALLATION
09-D103
SCALE: N.T.S.



NOTES:

1. ALL MATERIALS SHALL BE GALVANIZED

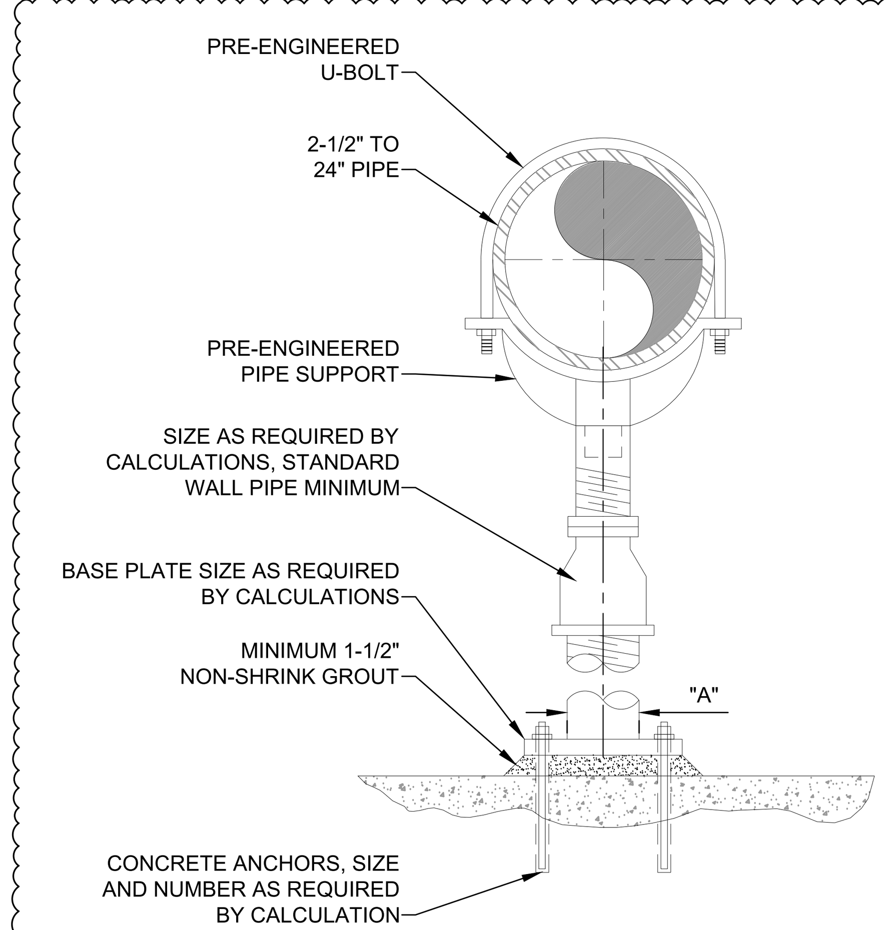
4 BOLLARDS
09-D103
SCALE: N.T.S.



NOTES:

1. ONLY FOR VERTICAL OR FLOOR MOUNTED PIPES.
2. SUBMIT FINAL DESIGN AND CALCULATIONS FOR SUPPORT AND ANCHORAGE AS SPECIFIED.

5 PIPE SUPPORT - VERTICAL PIPE CLAMP
09-D301
SCALE: N.T.S.



DIMENSION TABLE

PIPE SIZE	"A" MINIMUM NOMINAL PIPE SIZE
2-1/2"	2-1/2"
3"	2-1/2"
4"	3"
6"	3"
8"	3"
10"	3"
12"	3"
14"	4"
16"	4"
20"	6"
24"	6"
30"	6"

NOTES:

1. SUBMIT FINAL DESIGN AND CALCULATIONS FOR SUPPORT AND ANCHORAGE AS SPECIFIED

6 PIPE SUPPORT SADDLE - ADJUSTABLE PEDESTAL
09-D301
SCALE: N.T.S.

BARGE DESIGN SOLUTIONS
6525 The Corners Parkway // Suite 450 // Peachtree Corners, Georgia 30092
PHONE (678) 515-9411

GEORGIA REGISTERED No. 24385 PROFESSIONAL ENGINEER MICHAEL LYNN ALEXANDER
Digitally signed by Mike Alexander
Date: 2024.08.05 14:26:20-04'00'

PROCESS DETAILS

LOWER POPLAR WATER RECLAMATION FACILITY
INFLUENT PUMP STATION IMPROVEMENTS
MACON WATER AUTHORITY

REVISION INFORMATION

REV.	DR.	CHK.	DATE	DESCRIPTION
0	BM	MA	07/10/2024	ISSUED FOR BID
1	BM	MA	07/30/2024	ADDENDUM NO. 1

99-D501
FILE NO. 3618121

USER:BEMATHIS
FILE:F:\36\3618121\3618121\04_CAD\WATR\PLOT\3618121D_99501.dwg
SAVED:7/30/2024
PLOTTED:7/30/2024