

GEOTECHNICAL BASELINE REPORT

AT

Norris Reserve Lift Station Force Main Re-Route Project DeKalb County, Georgia

Final Report

Submitted to

DeKalb County Department of Watershed Management
1580 Roadhaven Drive
Stone Mountain, Georgia 30083

PROJECT NUMBER: MEG 291087.215
January 2020





**Matrix
Engineering
Group, Inc.**

engineers | special inspectors | construction consultants

January 24, 2020

Mr. Kerry Williams, PE, PMP
Engineering Manager
DeKalb County Department of Watershed Management
1580 Roadhaven Drive
Stone Mountain, Georgia 30083

**Re: *Geotechnical Baseline Report – Draft No. 1
Norris Reserve Lift Station Force Main Re-Route Project
DeKalb County, Georgia
Matrix Engineering Group Project Number MEG-291087.215***

Dear Mr. Williams:

Matrix Engineering Group, Inc. has completed the authorized Geotechnical Baseline Report for the proposed Norris Reserve Lift Station Force Main Re-Route project located in DeKalb County, Georgia. The scope of this work consisted of performing a geotechnical study including field and laboratory testing and the preparation of this Geotechnical Baseline Report.

This report provides site specific information for use in the design and construction of the proposed project.

Matrix Engineering Group, Inc. appreciates the opportunity to have worked with the DeKalb County Department of Watershed Management on this project and looks forward to our continued association. If you have any questions or need further assistance, please do not hesitate to call.

Best Regards,

MATRIX ENGINEERING GROUP, INC.

Sulemana Alhassan
Project Manager
sulemana@matrixengineeringstaff.com



Sam Alyateem, PE
Senior Geotechnical Engineer
Principal
sam@matrixengineeringgroup.com

Distribution (email .PDF): Mr. Kerry Williams, PE – DeKalb County Dept of Watershed Management

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1.0 INTRODUCTION

Matrix Engineering Group, Inc. (Matrix) was engaged by the DeKalb County Watershed Management to perform a Geotechnical Base Line Report (GBR) for the proposed Norris Reserve Lift Station Force Main Re-Route project. A total of twelve (12) test boring locations were designated by ATKINS to explore the subsurface conditions and collect samples for laboratory testing. The test borings were designated as B2+00, B4+60, B 6+17, B 9+68, B13+00, B14+00, B14+17, B16+00, B17+00, B75+36, B77+00, and B83+00).

This work was performed in general accordance with our proposal dated December 03, 2019 approved with Task Order issued on December 6, 2019 in accordance with our Annual Contract with DeKalb County.

This project consists of the construction of a sewer pipeline designed by ATKINS who provided the design drawings including the alignment of the pipeline and cross section profiles. The project starts at the intersection of Olivia Drive and Dennis Spring Road (Station 0+00) to the intersection of Rockbridge Road and Stonebridge Park Circle (Station 83+04) in DeKalb County, Georgia.

The objective of this work was to explore the subsurface conditions at a total of twelve (12) pre-designated locations, collect representative soil and rock samples up to the planned depths of the borings, perform laboratory testing to determine the general engineering characteristics of the subsurface conditions, and provide recommendations regarding the design and construction of the proposed sewer line. The data obtained from the field and the laboratory testing form the basis of this GBR. The data are provided in Appendix B of this report.

1.1 Limitations

This GBR has been prepared specifically for the segments of the project at Stations 2+00, 4+60, 6+17, 9+68, 13+00, 14+00, 14+17, 16+00, 17+00, 75+36, 77+00, and 83+00 as shown on the Figures provided in Appendix A.

The results presented herein are not applicable to unexplored areas at the time of this study, specifically the areas represented by segments from approximately Station 17+50 to approximately Station 75+00. These segments were not included in our study.

The opinions and conclusions presented here are interpretations of conditions at discrete sampling locations and experience-based interpolations between those points. If the location of the sewer line is

altered after the submission of this report, then the need for further boreholes must be reviewed to ensure that the information provided is still applicable to the revised segment.

No amount of investigation and analysis can exactly predict the material properties, 3-dimensional distribution, and behavior during construction throughout the project area. The performance of materials during construction is greatly influenced by the means and methods of construction. This GBR presents a definition of the anticipated materials and their engineering properties that are expected to be encountered while carrying out the project work as defined by the plans and specifications. Interpretation of the geotechnical data used to prepare this report assumes that the contractor will implement construction methods that result in conformance with the project plans and specifications. This GBR was produced in accordance with generally accepted practices for geotechnical baseline reports within the limitations of scope, access, and budget of this project.

Testing of groundwater and soil for hazardous materials/contaminants was beyond the scope of work.

1.2 Differing Site Conditions Claims

For a “Differing Site Conditions Claim” to be considered, the following must all be true:

- There must be a difference between reasonably anticipated and encountered conditions.
- There must be a difference between reasonably anticipated and encountered construction performance.
- There must be a demonstrable cause-and-effect relationship between the different conditions and construction performance.
- There must be a definitive impact on time and costs.
- All contract conditions must be fulfilled, including reliance, notice, and mitigation.
- No other factors (self-inflicted) can have caused the difference between anticipated and encountered.

1.3 Sources of Information

This report is based on the data collected from test borings B2+00 to B83+00 as shown on Figures 3 to 6 included in the Appendix of this report. Laboratory testing was performed on representative samples taken at various depths to determine the engineering properties. The test results and data obtained from the test boring form the basis of this GBR. All other sources relied upon as part of the issuance of this report are documented in the respective sections of this report. All of the field data collected are presented in the test boring logs and included in Appendix B. Additionally all laboratory test results are included in Appendix B. The field and laboratory testing formed the basis of this report.

2.0 PROJECT DESCRIPTION

- The project will consist of force main relocation with 8-inch Ductile Iron Pipe Class 350 through open cut and trenchless methods.
- A 30' x 15' Bore Pit and a 10' x 10' Receiving Pit are planned from Stations 04+50 and 06+19 to allow for the installation of trenchless pipe. A 160 L.F of 18-in diameter steel casing with 0.250" Wall Thickness is proposed between these stations.
- A 15' x 30' Bore Pit and a 15' x 15' Receiving Pit are planned from Stations 14+00 and 16+00 to allow for the installation of trenchless pipe. A 180 L.F of 18-in diameter steel casing with 0.50" Wall Thickness is proposed at the Yellow River crossing.
- A 15' x 30' Bore Pits and a 15' x 15' Receiving Pit are planned from Stations 75+00 and 77+25 to allow for the installation of trenchless pipe across Rock Chapel Road (State Route 124). A 160 L.F of 18-in diameter steel casing with 0.25" Wall Thickness is proposed between these stations.

3.0 EXISTING SITE CONDITIONS

3.1 Geologic Setting of the Site

The project is located in the Piedmont Geologic Province, a complex region of mostly crystalline rock (igneous and metamorphic) reflecting several discrete episodes of large scale tectonic (mountain building) activity that occurred over hundreds of millions of years during the Paleozoic Era. The most widely accepted characterization of the rock units and structural make-up of the region are presented in the works of McConnell and Abrams (Georgia Geologic Survey, Bul. 96, 1984) and Higgins et al. (U.S Geological Survey Professional Paper 1475, 1988). According to the interpretation of Higgins et al., the Piedmont province is comprised of "slivers" of the earth's crust (actually thousands of feet thick) that are bounded above and below by low angle faults referred to as "thrust faults". These "fault slices" include remnants of volcanic terrains and sedimentary formations that originated in both marine and continental settings. The formations comprising the different fault slices are often unrelated in geographic origin and time of development. Based on prevailing Plate Tectonic theory, these remnants of ancient terrains were subjected to intense deformation (folding, faulting and metamorphosis, i.e. mineralogical change due to heat and pressure) in the process of literally being pushed up on to the North American continent. during episodes of tectonic plate collision.

The rocks in the area of the project are classified as part of the Big Cotton Indian Formation by McConnell and Abrams and by Higgins et al. The rocks of the Big Cotton Indian formation are described as biotite-plagioclase gneisses, hornblende-plagioclase-amphibolites, and biotite-muscovite schists. The Big Cotton Indian Formation and other formations in the thrust slice that includes this formation are considered by the authors to be mostly

metamorphosed marine shales and manganiferous chemical sediments, with a large component of metamorphosed volcanoclastic rocks of presumably ocean island arc origin. Both sources recognize the location of the region along a complex fold structure, contributing to the pronounced northeast strike and west dip observed in the project area. Bold outcrops of gneissic rock are exposed in stream cuts and along slopes in the project area.

The development of soils in the Piedmont province is mainly the result of in-place weathering of original igneous and metamorphic schist and gneiss parent rock. The derived soils are typically clayey to sandy silts and silty sands, in many cases with a relatively high mica content. Soil consistency generally increases fairly quickly and regularly with depth, and in most cases, partially weathered rock, with SPT values in excess of 100 blows per foot, occurs gradationally between the distinct near-surface soil-like materials and intact parent rock encountered at depth. The residual soil and partially weathered rock cover generally encountered in the Piedmont Province were encountered in all borings for this project.

The soils observed during our investigation were primarily silty sands. In many cases, alluvial soils, as the stream deposited soils are termed, were in direct contact with extremely hard, intact rock. Soils deposited by man, referred to as fill, also occur in the project area. Alluvial soils and fill material are characteristically variable in composition and consistency, and as such, are unpredictable. The occurrence of these soils, which often have a high organic content, is of potential concern in most construction projects.

3.2 Topography

The site begins from the intersection of Olivia Drive & Dennis Springs Road in Snellville and ends at the intersection of Stonebridge Park Circle and Rock Bridge Road SW in Lithonia. According to notes from the Cover of the Plan and Profile drawings prepared by ATKINS, the overall project area is approximately 7.03 acres.

Test locations B2+00 to B6+17 are in residential area. Based on the Plans and Profiles provided by ATKINS the elevations at this segment begins at approximately 792 feet MSL (Station 2+00) to elevation 786 feet MSL (Station 06+17). Test locations B9+68 to B16+00 starts from near a driveway of a house on Riverlake Way in Snellville through a wooded area and across Yellow River. Based on the Plans and Profiles provided by ATKINS the elevations at this segment begins at approximately 773 feet MSL (Station 09+68) to elevation 734 feet MSL (Station 16+00).

Test locations B75+36 to B83+00 start from the eastern right of way of Rock Chapel Road (at the intersection of Rock Chapel Road & Rock Bridge Road SW. in Lithonia), runs in a westerly direction across Rock Chapel Road through the southern right of way of Rock Bridge Road SW, and ends at the

intersection of Stonebridge Park Circle & Rock Bridge Road SW. Based on the Plans and Profiles provided by ATKINS the elevations at this segment begins at approximately 771 feet MSL (Station 75+36) to elevation 767 feet MSL (Station 83+00).

4.0 EXPLORATION AND TESTING PROGRAM

4.1 Subsurface Exploration

4.1.1 Soil Test Borings

The drilling exploration was performed on December 18, 2019. The test borings were located in the field by Matrix staff utilizing coordinates obtained from Google Earth, tape measurements, and relying on existing features including existing structures shown on the design drawings provided by ATKINS.

The subsurface exploration was performed using an All-Terrain Vehicle (ATV) equipped with CME 550X drill rig equipped with automatic hammer in general accordance with ASTM D1586 standards. Borings were advanced by augering through the soils with continuous flights of 3-inch ID augers. At regular intervals, soil samples were obtained through the center of the auger flights with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler is first seated 6 inches to penetrate any loose cuttings, and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot; blows per foot (bpf); is recorded and is designated as the Standard Penetration Resistance (N-Value). The penetration resistance, when properly evaluated, is an index of the soil strength, consistency and ability to support structures.

Soil samples were taken continuously within the top 10 feet and every 5 feet thereafter up to the termination depth of the test borings. Undisturbed sample was collected at Test Location B4+60 between 9 to 11 feet to allow for geotechnical laboratory testing to determine the engineering characteristics of the encountered materials. Rock was encountered within the borings at test locations, B9+68, B13+00, B14+00, B14+17, and B16+00. However, the encountered rock at B9+68, B13+00, and B16+00 were below the anticipated depth of pipe, therefore rock coring was not performed at these locations. Rock coring was performed at test locations B14+17 to the anticipated depth of pipe invert elevation in order to determine the type and strength of the encountered rock.

The data obtained from the test borings, as well as the field test data are provided in the boring logs in Appendix B of this report.

4.2 Rock Coring

Due to rock encountered within the limits of the exploration, rock coring was performed in general accordance with ASTM D2113 – “Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation” at test boring B14+17 utilizing a standard NQ-size diamond encrusted drill bit to a maximum depth of 26.3 feet below the existing ground surface. In this process, a core barrel is advanced through rock by the application of downward pressure during rotation. Circulating water removes ground-up material from the hole while also cooling the bit. The rate of advance is controlled so as to obtain the maximum possible core recovery.

4.3 Laboratory Testing

4.3.1 Soil Classifications

The laboratory testing program for the encountered soils for this project consisted of performing soil classifications in accordance with ASTM D2488 (Visual-Manual Method for Identification of Soils), sieve analysis in accordance with ASTM D6913, Atterberg limits in accordance with ASTM D4318, unconfined compressive strength testing of rock in general accordance with ASTM D7012 Method C and moisture contents in accordance with ASTM D2216. The soil samples were examined in the laboratory by a geotechnical engineer and visually classified based on texture and plasticity in accordance with the Unified Soil Classification System (ASTM D2487).

4.3.2 Rock Quality Designation (RQD)

The cored rock samples were collected in the field and then preserved and transported to our laboratory in general accordance with ASTM D5079. Once in the laboratory, the rock was classified by a project geologist in accordance with ASTM STP984.

The percent core recovery and Rock Quality Designation (RQD) of the rock core samples were determined in accordance with ASTM D2113 and D6032, respectively, and are shown on the respective core logs together with estimated hardness and degree of weathering.

4.3.3 Rock Compressive Strength

The uniaxial compressive strength of the rock cores was determined in general accordance with ASTM D7012, utilizing Method C.

5.0 GEOTECHNICAL BASELINE CONDITIONS

The following conditions were determined from the subsurface exploration, which was performed on December 18, 2019 and December 19, 2019.

5.1 Surface Layer

Grass and topsoil cover were encountered at most of the test boring locations. The grass and topsoil measured approximately 6 inches in thickness. Asphalt and GAB measuring approximately 5-inches each were measured at three locations.

5.2 Man-Made Fill

Man-Made Fill was encountered at each of the test boring locations below the surface layers. The depths of man-made fill ranged from approximately 3 feet to 7 feet. The fill consisted of very loose to medium dense, silty sand (SM) and stiff to very stiff sandy /clayey silt (ML), and stiff silty clay (CL). The consistency of the fill material generally ranged between 2 bpf and 22 bpf.

5.3 Residual Material

Residual soils are those which have weathered in place from the parent rock. Residual soils were encountered at all the soil borings below the encountered fill materials. The residual soils generally consisted of very loose to dense Silty Sands (SM) and firm to very stiff sandy/clayey silt (ML). The residual material generally exhibited N-values ranging from 4 to 37 bpf.

5.4 Partially Weathered Rock and Bedrock

Partially Weathered Rock (PWR) is a regionally used term for residual material with a Standard Penetration Resistance (N-values) of 100 bpf or more, but which can be penetrated by the soil drilling equipment. PWR was encountered at B9+68, B14+00, B16+00 and B77+00 at depth ranging from 5.0 feet and 18.5 feet BGS.

5.5 Groundwater

Groundwater was encountered at B16+00 at approximately 10.0 BGS during drilling. Due to the restrictions from the homeowner, the borehole was backfilled at the conclusion of the drilling process. Test boring B14+17 encountered rock auger refusal at 5 feet BGS. Rock coring was performed up to approximately 26.3 feet. Groundwater could not be measured during the coring due to the use of water during the drilling operation. Groundwater measurement was attempted several days after coring and found that the water level was 2 feet BGS. It is our opinion that the depth of groundwater

at this location has been impacted by the depth of rock as well as the lack of drainage within the borehole to allow the stabilized groundwater elevation to be realized.

The subsurface soil conditions were also classified based on the general guideline of Terzaghi Tunnelman's Classification System to describe the potential soil behavior during excavation or tunneling. Based on the soil test borings at the drilled locations, the subsurface conditions are classified as follows:

Running: All man-made fills and residual and partially weathered rock will exhibit running behavior when excavated or tunneled through. The soils at all of the test locations up to the depth of the proposed pipe should be considered to have running behavior with the exception of test boring B16+00 near the existing creek due to the presence of groundwater within the excavation depth.

Flowing: Saturated soils and soils under groundwater will exhibit flowing behavior. We anticipate that the soils between Station 14+00 to Station 16+00 to have a flowing behavior below groundwater elevations encountered at approximately 10 feet below the surface.

Firm: All excavations below the auger refusal levels and bedrock that was encountered at boring B14+00 and B16+00 should exhibit firm behavior.

Tables 1 to 3 below present a summary of the test borings, laboratory test results, and soil parameters. For a complete field and laboratory test results and data, refer to Appendix B of this report.

Table 1: Summary of Test Boring Records.

Boring No.	Drilled /Cored Depth (ft)	Existing Elevation (ft MSL)	Bottom of Pipe/Manhole Elevation (ft MSL)	Groundwater Elevation (ft MSL)	Top of PWR Elevation (ft MSL)	Auger Refusal (Top of Rock) Elevation (ft MSL)
B2+00	10	792	785.6	N/E	N/E ¹	N/E
B4+60	20	794	785.6	N/E	N/E	N/E
B6+17	15	786	780.6	N/E	N/E	N/E
B9+68	11	775	770.6	N/E	N/E	N/E
B13+00	13.5	752	739.6	N/E	738.5	738.5
B14+00	5.0	740	715.6	N/E	735	735
B14+17	26.4	738	715.6	2 ²	734	733
B16+00	20	734	715.6	10	714	714
B17+00	10	735	728	N/E	N/E	N/E
B75+36	20	771	764.6	N/E	N/E	N/E
B77+00	15	771	763.6	N/E	N/E	N/E
B83+00	15	767	757.6	N/E	N/E	N/E

¹N/E: Not Encountered. ²Shallow rock may have impacted the stabilized groundwater elevation.

Table 2: Summary of Laboratory Test Results

Boring ID	Depth (ft BGS)	MC (%)	% Finer than #200	LL	PL	PI	USCS
B2+00	1-3	21.1	37.9	-	-	-	SM
B2+00	8-10	8.2	27.6	-	-	-	SM
B4+60	1-3	47.6	-	56	32	24	ML
B4+60	18.5-20	12.1	31.8	-	-	-	SM
B6+17	8-10	35.3	-	49	34	15	ML
B6+17	13.5-15	10.2	30.9	-	-	-	SM
B9+68	3-5	36.5	45.6	-	-	NP	SM
B9+68	5-7	35.5	53.6	-	-	-	ML
B14+00	1-3	6.6	36.7	-	-	-	SM
B14+00	3-5	6.9	27.5	-	-	-	SM
B14+17	1-3	14.9	22.1	-	-	-	SM
B16+00	7-9	22.5	27.5	-	NP	-	SM
B16+00	15-17	22.0	9.4	-	-	-	SM
B75+36	13.5-15	7.4	19.3	-	-	-	SM
B77+00	1-3	19.4	26.6	-	-	-	SM
B83+00	3-5	24.1	43.3	-	-	-	SM

Table 3: Unit Weight and Strength Parameters

Boring ID	Depth (ft BGS)	MC (%)	Wet Unit Weight(pcf)	Compressive Strength of Rock (psi)
B4+60	9.5	20.1	108.3	-
B4+60	10	21.2	109.7	-
B4+60	10.5	23.4	115.8	-
B14+17	16.3-16.9	-	-	11,310
B14+17	16.9-19.4	-	-	15,510
B14+17	21.3-21.8	-	-	8,630
B14+17	21.8-22.3	-	-	12,010
B14+17	22.3-23.6	-	-	7,410
B14+17	23.6-26.3	-	-	7,740

6.0 CONSTRUCTION CONSIDERATIONS

The design and construction of the proposed sewer line should be based on the field and laboratory data collected and presented in Section 5.0 and Appendix B. Based on the field and laboratory testing performed, the following Geotechnical Base Line Conditions should be considered:

6.1 Hydrological and Geologic Considerations

Groundwater at the test boring B16+00 was encountered above the proposed excavation elevations for the proposed Receiving Pit as well as the pipe crossing the Yellow River. It is also assumed that the same condition will be encountered at the proposed Bore Pit (at B14+00). Since stabilized groundwater measurements (after 24-hours of drilling) was not possible as discussed in section 5.5, the design should use a stabilized groundwater elevation on the order of 8 feet GBS to account for groundwater fluctuation. Based on the data collected, it appears only the section between Station 14+00 and 16+00 will be affected by groundwater, especially during rain events. Therefore, measures for groundwater control should be carefully planned to minimize hydrostatic pressures against shoring systems.

Slug testing was not performed to estimate the hydraulic conductivity for base line consideration. Therefore, we recommend that testing is performed to determine the hydraulic conductivity for the purpose of determining groundwater inflow and dewatering design.

6.2 Site Preparation, Bearing Capacity, and Stabilization Considerations

Site preparation will consist of removal of the topsoil and the overburden soils up to the proposed finished elevations. Although the fill and residual soils encountered in the test borings generally did not contain unsuitable materials and are considered suitable for structural fill. The suitability of excavated materials should be evaluated by the soil's engineer prior to their use on the field. Refer to Section 7.0 for Structural Fill recommendations.

For base line conditions, we recommend that an allowable soil bearing capacity of 2,500 pounds per square foot (psf) be used. Unsuitable materials at the subgrade elevations should be removed and replaced with structural fill or crushed stone to a depth necessary to establish a firm base. Due to the presence of groundwater near the proposed excavation elevations at the Yellow River crossing, we recommend that stabilization be included in the base line conditions to include geotextile fabric (TerraTex HD or equivalent), and 12 inches of crushed stone #57 bedding under the pipe. We also recommend that a 6-inch thick mud mat be used at each of the entry and exit bore pits to protect the bearing materials. Additionally, we recommend the use of pipes with sealed flexible joints in order to prevent the ingress of groundwater and the associated soil loss.

6.3 Lateral Earth Pressures and Shoring, and Excavation Considerations

We recommend that slopes be excavated at a minimum of of 2.0(H) to 1.0(V) or flatter. Excavation for the slopes should be monitored by a geotechnical engineer to ensure that soil conditions are similar to those we have encountered. Potential planes of weakness will be more visible at depth as the excavation proceeds. If weak conditions are evident, the engineer can then recommend any necessary remedial actions.

Vertical cuts will be required to accommodate the installation of the proposed pipe as well as the entry and exits prior to the tunneling process. Vertical cuts that exceed 4 feet should be braced or shored as required by OSHA regulations for safety. Additionally, stairways, ladders, ramps or other means of safe access should be made available for any trenches deeper than 4 feet. The slopes of excavations deeper than 20 feet must be designed by a professional engineer licensed in the State of GA.

Lateral earth pressures are a function of the retained soils properties and the structural design of the "thrust" wall used during the 'Jack and Bore' process. As a result, a shoring or shielding system will be required in order to support the trench faces at the launch and exit pits. It will be at the discretion of the contractor to determine which type of shoring system to be implemented. For the entry and exit pits, we recommend that interlocking sheet piling or steel soldier piles with timber lagging be driven

prior to excavation in order to protect nearby structures. Shoring with trench boxes or similar devices at the entry and exit shafts is not acceptable. After construction and backfilling, sheet piling within the shafts (pits) should be cut-off 18 inches below final grade and left in place. The selected system will have to be designed by a registered professional engineer in the state of Georgia and comply with all local and/or federal guidelines and requirements. Additional testing may be commissioned by the contractor depending on the type of design selected in order to determine specific soil parameters that are relevant to that system. Based on our experience with similar soils, we recommend that an effective angle of internal friction (Φ') = 28° and a cohesion $c' = 0$ psf be used as design strength parameters for the soils encountered at the site. These strength parameters result in the following earth pressures coefficients and equivalent fluid pressure per foot of depth for compacted fill (based on a total (wet) unit weight (γ_w) of 120 pcf). A coefficient of friction of 0.40 could be used between the wall foundations and the underlying soil, which includes a factor of safety of 1.5. We recommend that the following soil parameters be used for design of the shoring systems:

<i>Earth Pressure Condition</i>	<i>Coefficient</i>	<i>Recommended Equivalent Earth Pressure (pcf)¹</i>
Active	(K_a) 0.36	43.3
At-Rest	(K_o) 0.53	63.7
Passive	(K_p) 2.77	166 ²

¹ Assumes a constantly functional drainage system.

² The total calculated passive pressure should be reduced by 1/2 to 2/3rd for design purposes.

Open Trench Installation:

Based on the test boring records, the fill and residual was encountered within the drilled depth except in the area near test boring B14+00. Excavation of the fill and residual soils can be accomplished by conventional construction equipment.

Based on the subsurface conditions encountered, vertical cuts over 5 feet in depth will require shoring or adequate trench boxes be used during excavation. Alternatively, sloped excavation can be used with a minimum of 2H:1V.

Shafts Excavation

Test borings (B4+60-B6+17) and (B75+36-B77+00) were drilled within the footprint of the proposed Bore Pits and Receiving Pits locations. Soils with relatively high consistencies were encountered and

can be excavated with conventional construction equipment. Appropriate shoring system should be used at these locations.

However, Bore/Receiving Pits locations at Stations 14+00 and 16+00, near the Yellow River will require more attention due to the presence of groundwater and rock within the excavation depth of the proposed sewer line.

Partially Weathered Rock (PWR) and rock was encountered in the vicinity of test borings B14+00 (at 5.0 BGS) and B16+00 (at 18.5 ft BGS). Therefore, rock removal will be required to facilitate the construction of the proposed sewer line. Refer to Section 6.6 for rock removal and rock blast monitoring. The following general specifications for rock excavation, or a variation thereof, be incorporated into the contract documents:

(1) General Excavation: Any material occupying an original volume of more than one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds (caterpillar D-8 or larger)

(2) Trench Excavation: Any material occupying an original volume of more than one cubic yard which cannot be excavated with a backhoe having a bucket curling force rated at not less than 40,000 pounds, using a rock bucket and rock teeth (a John Deere 790 or larger).

Rock quantification should be based on a surveyed profile of exposed rock that is verified as unrippable. Relying on rock blasting drill logs should not be permitted. Decomposed rock and partially-weathered rock that can be removed by tractor-drawn ripper or power machinery, as previously defined, will be classified as earth excavation, and should be billed as such.

We recommend that shoring utilizing interlocking sheet piling or steel soldier piles with timber lagging be used at the Receiving Pit at Station 16+00. Provisions for ground water control should be undertaken to prevent from softening of the bearing materials. Refer to Section 6.4 for groundwater control and Section 6.5 for settlement considerations.

Trenchless Pipe Installation:

The materials at the proposed pipe elevation at the bore and receiving pits for borings B14+00 and B16+00 (at the Yellow River Crossing) consisted of rock and partially weathered rock (PWR). Groundwater was encountered at several feet above the bottom of the pipe elevation. Refer to Section

6.4 for groundwater and dewatering recommendations and Section 6.5 for settlements, rock removal, and blast vibration monitoring.

Based on the boring logs and the length of the tunnel, Pilot Tube and other Guided Boring Methods as means and methods for installing the carrier pipe shall be used. Additionally, based on the subsurface condition encountered, only closed face tunneling methods like Guided Jack and Bore is recommended for boring below the groundwater table.

Contractor should test the pH of the water prior to construction and seek permitting to discharge groundwater from dewatering operations into the sanitary sewer system as warranted.

Trenchless pipe installation with Jack or Bore methods should follow the Georgia DOT Standard Specifications, latest edition. Provisions for use of fluids with bentonite to consolidate excavated material, seal the walls of the hole, and lubricate subsequent removal of materials and immediate pipe installation. Refer to Section 6.5 for settlement and settlement monitoring.

6.4 Groundwater Control and Dewatering

The Groundwater table was encountered above the proposed excavation and pipe at borings B14+00 and B16+00 (at the Yellow River Crossing). Groundwater elevations may fluctuate in dry and wet seasons and substantially be different from the current stabilized elevations. Groundwater control will be required during the construction for the J&B pipe installation only at borings B14+00 and B16+00 (at the Yellow River Crossing). Groundwater is not anticipated to impact the project at any other location. In order to minimize softening of the bearing soils, we recommend that elevations of the groundwater to be a minimum of 2 feet below the bottom of excavations.

Monitoring of the stabilized groundwater elevations prior to the beginning of the construction should be performed to determine the potential maximum fluctuation of the groundwater during the construction at borings B14+00 and B16+00 (at the Yellow River Crossing).

Surface drainage should always be diverted away from the trench and pits excavations. Installation of sandbags, berms or diversion channels shall be used to divert water surface run-off from the excavation.

If dewatering for the open cut sections are needed, it can be accomplished by well point system or sump and pump system. If sloped excavation is employed, we recommend that a pump and sump

system be used to lower the groundwater table to a minimum of 2 feet below the bottom of the excavation. At areas where groundwater is above the bottom of the excavation, we recommend the following criterion be implemented for dewatering:

- Excavation 12 inches of soils beneath the pipe elevation and place crushed stone number #57
- Excavate pits (minimum of 5 feet deep and 5 feet long for the full width of the trench) at a maximum spacing of 50 feet
- Place crushed stone #57 in the pit and place a sump and pump system. The crushed stone at the pits should be connected to the crushed stone bed along under the pipe to allow for proper drainage.
- Dewater continuously until pipe is installed and backfilled in accordance with the project specifications.
- Structural fill should be placed and compacted to a minimum of 5 feet above the pipe before dewatering is stopped to avoid hydrostatic impact on the pipe as well as softening of the fill.

Dewatering for the entry and exit shafts can be accomplished as follows:

- Excavate 12 inches beneath the proposed bottom of the excavation to allow for placement of crushed stone #57 layer.
- Excavate two trenches; one at each edge of the shaft (minimum of 3 feet wide 3 feet deep) for the entire length of the shaft.
- Install french drains in the excavated trenches (a minimum of 8-inch perforated pvc pipe wrapped with filter non-woven, needle punched fabric should be used to facilitate dewatering). The bottom of the shaft should also be wrapped prior to placement of the crushed stone. The crushed stone at the pits should be connected to the crushed stone layer at the bottom of the shaft. The bottom of the shaft and trenches should be graded to have a positive drainage towards the trenches.
- Place a sump and pump system at the edge of each trench.
- Dewater continuously to maintain the groundwater to a minimum of 2 feet below the bottom of the shaft.
- A 6-inch mud mat consisting of 2,000 psi concrete should be placed at the bottom of the shaft to protect the soil bearing and allow proper working conditions.

Additional measures may be required at localized areas as warranted by the field conditions.

6.5 Settlements

Excavation and dewatering within the fill and saturated soils may impact the overall behavior of the existing fill in the areas surrounding the excavation. The increase of the soil unit weight as a result of dewatering will consolidate the soft soils encountered near the alluvium soils and the groundwater table resulting in settlements at the surface. The magnitude of the settlement is directly related to the water table draw down elevations as well as the soil conditions. Additionally, excavation of the fill may allow soils to laterally mobilize if shoring is not installed immediately. Therefore, we recommend that vertical cuts are immediately shored upon excavation.

The contractor should protect all existing facilities, pavements, and underground structures from movement or settlement. Monitoring should be performed during construction including, but not limited to, visual inspections, and settlement monitoring

We recommend that a pre-construction survey be performed at structures within 50 feet of excavation and/or tunneling. The survey should include written and photographic documentation of the existing conditions. Settlement monitoring points should be installed at select points along the trench and tunnel alignment. Monitoring points for the tunnel should be located at 20 feet at the center (minimum 3 points) and at 10-foot offset of the centerline in each direction.

The contractor should engage a registered land surveyor and survey existing conditions. A minimum of 2 readings should be taken prior to beginning of any construction activities to establish base line measurements.

The monitoring points should be measured daily during the excavation and tunneling and then once a week until all excavation, dewatering, and backfilling has been completed.

The maximum allowable settlement should be 2 inches landscaped areas, 1.0 inches for pavements, and less than 0.25 for structures. The contractor should notify the owner when one-half of the maximum allowable settlement is measured. If the maximum allowable settlement is measured, the contractor must stop all work until a plan of action is submitted to the owner describing additional measures to prevent further movements.

6.6 Rock Removal and Blast Vibration Monitoring

Rock removal can be accomplished by blasting or mechanical means. Prior to any blasting, a pre-construction survey shall be conducted on all structures within the influence range of the blast with a

minimum of 500 feet of the blast area. The survey shall include a visual inspection and photographic documentation with notes should to record any existing cracks or structural damage previously sustained. The survey shall be performed by qualified personnel furnished by the contractor's insurance underwriter. A copy of all notes and photographs shall be submitted to the Owner prior to beginning of the blasting operation. In the event damage claims occur, a report shall be prepared by the Contractor as requested by the Owner.

The blasting operation should be executed in strict conformance with the local County, State, and Federal regulations relating to the transportation, storage, handling and use of explosives.

The contractor shall submit a detailed blasting plan for approval prior to blasting. The plan shall include, but not limited to, drawings, safety procedures, permitting, notification to authorities and to neighbors affected by the blast. Seismic monitoring of vibrations at nearby structures shall be performed by a qualified third party contractor/consultant and approved by the Owner. A plan shall be prepared by the seismic monitoring consultant showing the structures to be monitored and provide reports after each blast. Ground motion shall not exceed maximum allowed by DeKalb County and State Guidelines.

7.0 CONSTRUCTION RECOMMENDATIONS

7.1 Structural Fill

Staged, methodical and well-planned grading is key to avoiding unnecessary costs and time delays. Areas should not be stripped or disturbed if the grading contractor is unable to properly seal the subgrade prior to departure each day. Exposure of soils to moisture from direct rainfall or runoff usually renders these soils un-usable for several days. This usually gets mischaracterized as an unsuitable soils condition which is inaccurate. Unsuitable soils are defined as those containing deleterious matter (such as organics, alluvium, debris and/or trash). Moisture related problems should be avoided by employing best management practices (BMPs) that involve maintaining positive drainage, placing berms, diversion channels, and/or sealing the subgrade to avoid water infiltration. Other measures involve covering all stockpiled soils with heavy tarps or plastic to avoid saturating the soils in the event of rainfall. Means and methods of construction are certainly the contractor's jurisdiction; however, exposing otherwise suitable soils to excessive moisture or softening of existing subgrades as a result of unscrupulous construction traffic should be avoided and planned for.

We recommend that the following criteria be used for structural fill:

1. Adequate laboratory proctor density tests should be performed on representative samples of the proposed fill materials to provide data necessary for the quality control. The moisture content at the time of compaction should be within 3 percentage points of the optimum moisture content. In addition, we recommend that the fill soils be free of organics and rock boulder/cobbles larger than 2 inches in nominal size and relatively non-plastic with plasticity indices less than 20.
2. Suitable fill material should be placed in thin lifts (lift thickness depends on type of equipment used, but generally lifts of 8 inches loose measurements are recommended). The soils should be compacted by mechanical means such as sheepsfoot rollers.
3. We recommend that the fill be compacted to a minimum of 98% of the Standard Proctor Maximum Dry Density (ASTM Specifications D 698). The top 2 feet under pavements or structural areas should be compacted to a minimum of 100% of the Standard Proctor Test.
4. An experienced soil engineering inspector should take adequate density tests throughout the fill placement operation to ensure that the specified compaction is being achieved.

7.2 Construction Monitoring and Testing

During construction, it is advisable that Matrix Engineering Group monitor the site preparation and excavations to confirm removal of unsuitable or unstable soils and materials as encountered. The placement of any compacted fill should be inspected and tested. The utilization of acceptable on-site borrow materials, as well as adequate off-site selected fill must be verified. Monitor and document the placement of the pipes. Document subsurface conditions encountered during the construction that are different from those encountered during preparation of the GBR and provide response as warranted.

Prior to placement of pipes, the subgrade should be inspected in order to verify the availability of the required bearing pressure and to determine any special procedures required. At a minimum, Hand Auger and Dynamic Cone Penetrometer testing in accordance with ASTM STP 399 should be performed at every 25 linear feet, or as directed by the geotechnical engineer.

APPENDIX A

FIGURE 1: Project Limits Plan

FIGURE 2: Street and Geologic Map

FIGURE 3: Approximate Soil Boring Location Plan with Profile-B2+00-B6+17

FIGURE 4: Approximate Soil Borings Locations Plan with Profile-B9+68-B16+00

FIGURE 5: Approximate Soil Boring Location Plan with Profile-B17+00

FIGURE 6: Approximate Soil Boring Location Plan with Profile-B75+36-B83+00

APPENDIX B

Correlation of Standard Penetration Resistance with
Relative Compactness and Consistency
Soil Boring Logs
Laboratory Test Results



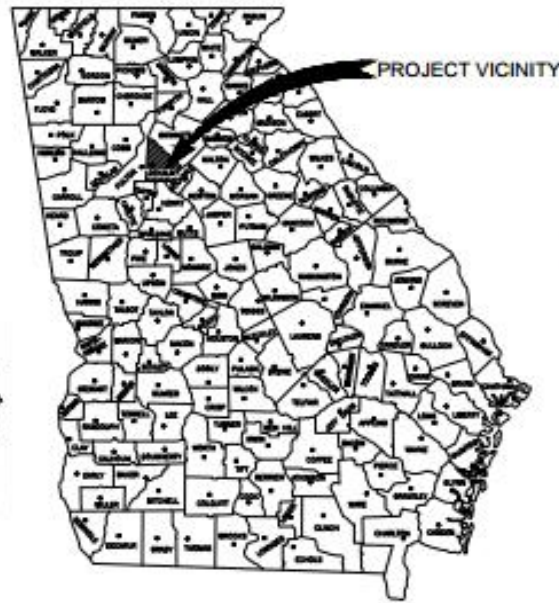
DEKALB COUNTY

DEPARTMENT OF WATERSHED MANAGEMENT

NORRIS RESERVE LIFT STATION FORCE MAIN RE-ROUTE

SEPTEMBER 2018

SITE LOCATION:
FROM THE INTERSECTION OF OLIVA DR. & DENNIS SPRINGS RD. TO STONEBRIDGE PARK CIRCLE AND ROCK BRIDGE ROAD SW, DEKALB COUNTY, GEORGIA.



SITE LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

WATER AND SEWER NOTES

- ALL DESIGN AND CONSTRUCTION SHALL COMPLY WITH DEKALB COUNTY DEPARTMENT OF WATERSHED MANAGEMENT DESIGN STANDARDS 2017 EDITION, VERSION 1.0.
- THE DESIGN STANDARDS 2017 EDITION IS PROVIDED ON THE DWM CIMS WEBSITE.
- www.dekalbcountyga.gov/departments/watershed-management/for-external-use/departmental-services
- CONTRACTOR SHALL PROVIDE RECORD DRAWINGS "AS-BUILT PLANS" AND "FINAL PLANS" (IF APPLICABLE) IN HARD COPY AND ELECTRONIC FORMAT (AUTOCAD OR MICROSTATION).
- FIELD CHANGES DURING CONSTRUCTION MUST BE SUBMITTED FOR REVIEW AND APPROVAL TO THE DWM CONSTRUCTION MANAGER.
- CONTRACTOR MUST NOTIFY WATER AND SEWER CONSTRUCTION INSPECTOR 72 HOURS PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES.

DISTRICT 12:	LOVINE KELLEY	(404) 371-2149
DISTRICT 16:	DAVID OSERBY	(404) 687-4550
DISTRICT 18 (NW):	DANIEL TUCKER	(404) 750-6411
DISTRICT 18 (MIDDLE):	MICO FAVORS	(404) 371-2126
DISTRICT 18 (EAST):	MARCELIN DENIS	(404) 371-2110

OWNER

DEKALB COUNTY DEPARTMENT OF WATERSHED MANAGEMENT
4572 MEMORIAL DRIVE
DECATUR, GEORGIA 30032
CONTACT: TINA STRICKLAND,
PHONE: (770) 414-2385

OFFICERS

CHIEF EXECUTIVE OFFICER: MICHAEL THURMOND

DEKALB COUNTY BOARD OF COMMISSIONERS

DISTRICT 1:	NANCY JESTER
DISTRICT 2:	JEFF RADER
DISTRICT 3:	LARRY JOHNSON
DISTRICT 4:	STEVE BRADSHAW
DISTRICT 5:	MEREDA DAVIS JOHNSON
DISTRICT 6:	KATHIE GANNON
DISTRICT 7:	GREGORY ADAMS

DEPARTMENT OF WATERSHED MANAGEMENT

INTERIM DIRECTOR: REGINALD WELLS

DESIGNER

ATKINS, NORTH AMERICA
1600 RIVEREDGE PARKWAY, SUITE 700
ATLANTA, GEORGIA 30328

Borings should extend one pipe diameter below the invert or to auger refusal.

NOTES

1. ALL EROSION AND SEDIMENTATION CONTROLS AND ALL TREE PROTECTION MEASURES SHALL BE INSTALLED PRIOR TO GRADING.
2. CONTACTS:
DEKALB WATERSHED MANAGEMENT:
TINA STRICKLAND, PHONE: (770) 414-2385
GDOT DISTRICT ACCESS MANAGEMENT ENGINEER:
CHRISTOPHER MCKINNEY, PHONE (770) 986-7870
GDOT AREA 1 OFFICE, PHONE (404) 293-4361
3. NECESSARY BARRICADES, SUFFICIENT LIGHTS, SIGNS AND OTHER TRAFFIC CONTROL METHODS AS MAY BE NECESSARY FOR THE PROTECTION AND SAFETY OF THE PUBLIC SHALL BE PROVIDED AND MAINTAINED THROUGHOUT WORKING OF AND CONSTRUCTION ON DEKALB COUNTY ROADS.
4. BEGIN CONSTRUCTION: 12 23 46 05:00 16 04 03 24:00
END CONSTRUCTION: 12 23 46 27:00 16 04 04 43:14
5. PROJECT AREA= 7.03 ACRES
DISTURBED AREA= 7.03 ACRES
NPDES FEES= 7.03 x \$46.00 = \$323.20
PAID TO DEKALB COUNTY AND \$281.20
PAID TO EPA.
6. PROJECT INCLUDES 8 PROPOSED ACCESS MANHOLES.



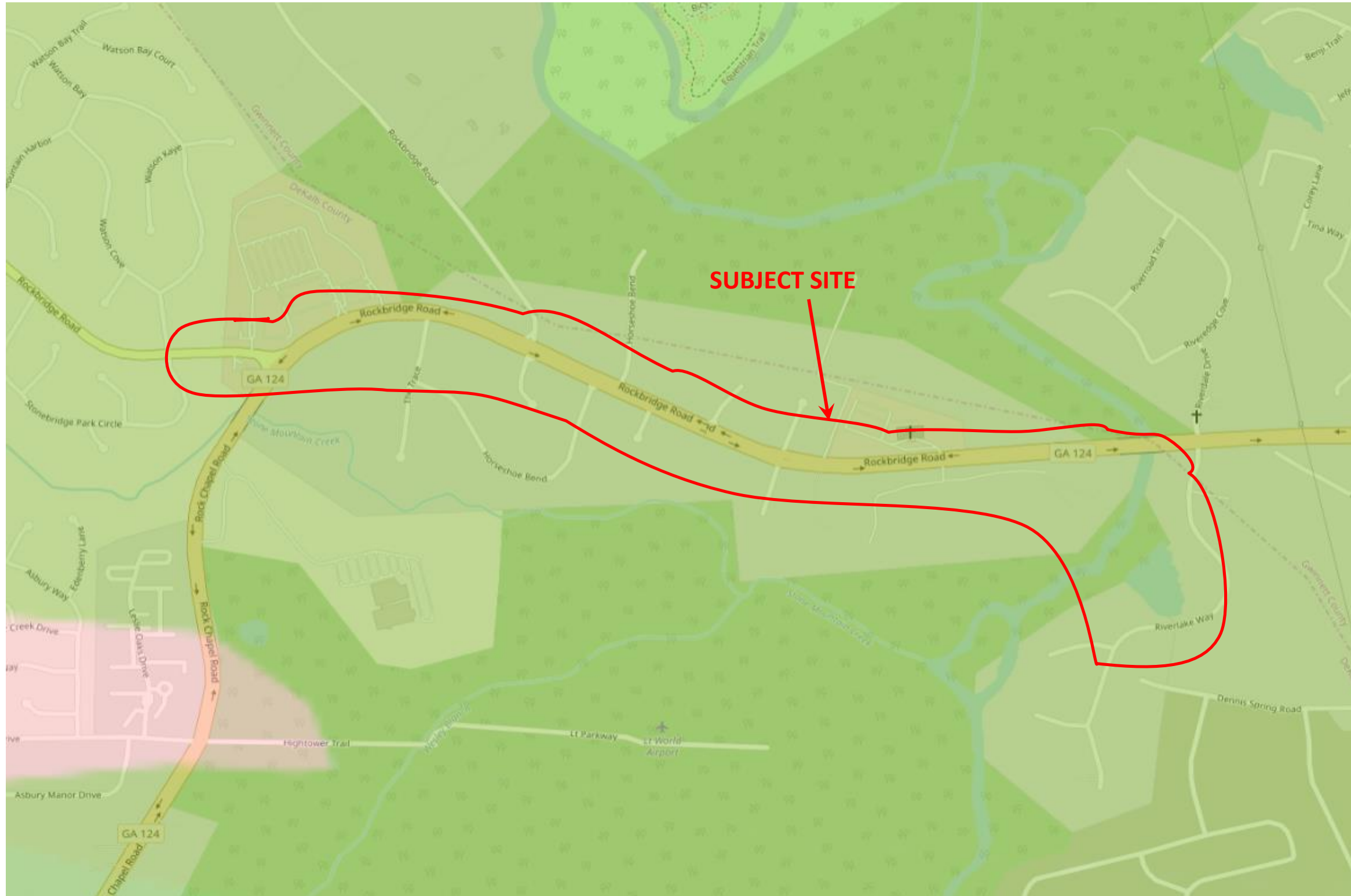
Know what's below
Call before you dig
100% SUBMITTAL



Matrix Engineering Group, Inc.

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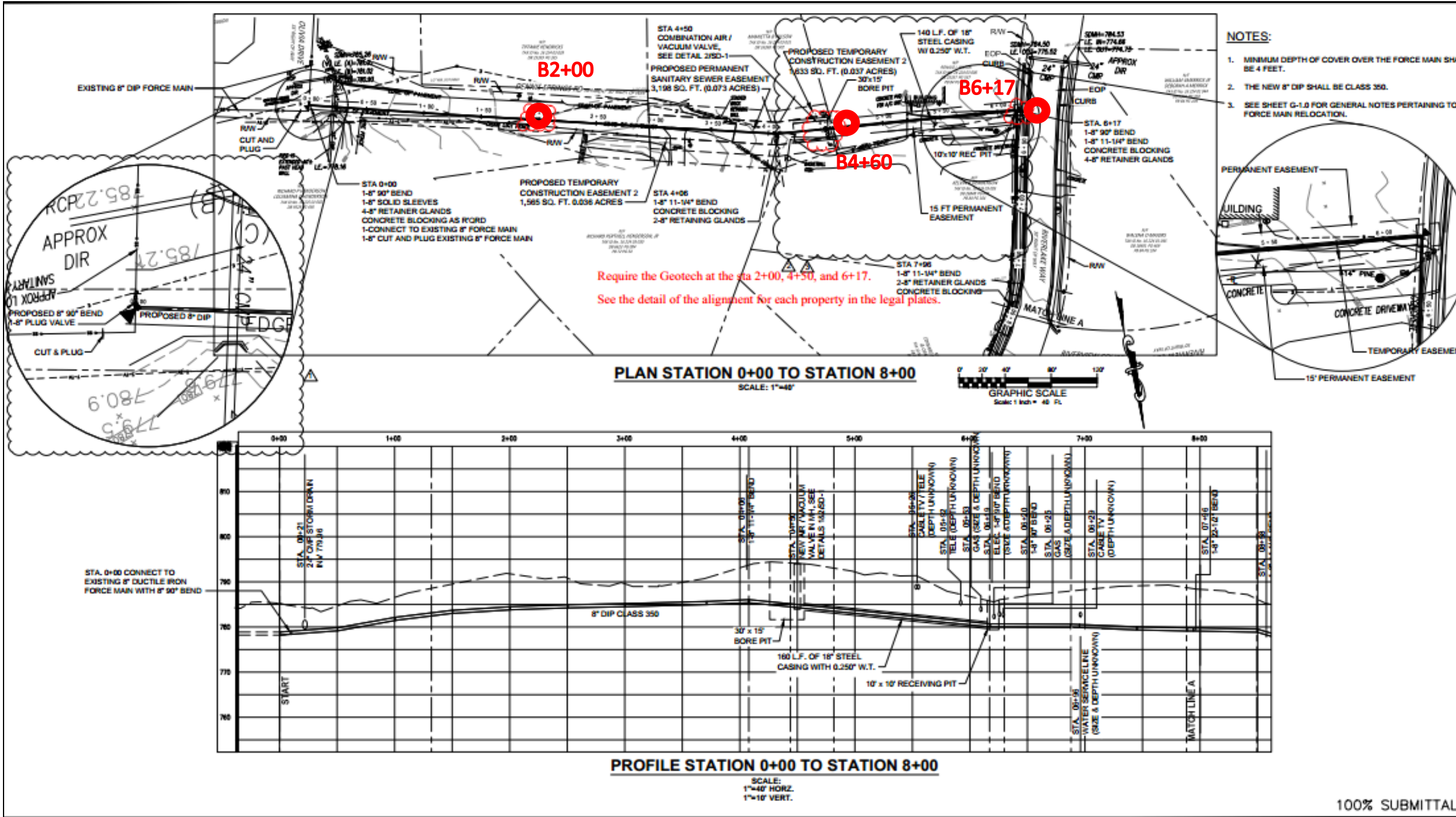
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PROJECT	Norris Reserve Lift Station Force Main Re-Route
PROJECT #	MEG 291087.215
CLIENT	DeKalb County
	Not to Scale
PREPARED BY	DeKalb County
REVIEWED BY	Sam Alyateem, PE
DATE	1/24/2020
FIGURE	1
LEGEND	




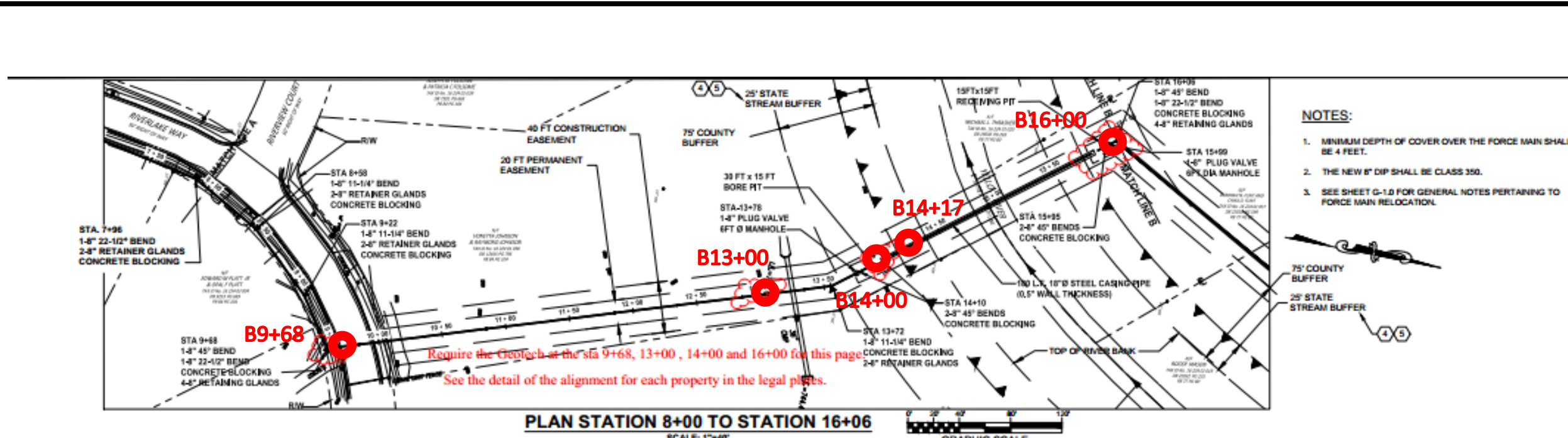
**Matrix
Engineering
Group, Inc.**

engineers | special inspectors | construction consultants

TITLE	
	Street & Geologic Map
PROJECT	
	Norris Reserve Lift Station Force Main Reroute
PROJECT #	
	MEG 291087.215
CLIENT	
	DeKalb County
	Not to Scale
PREPARED BY	
	Sulemana Alhassan
REVIEWED BY	
	Sam Alyateem, PE
DATE	
	1/24/2020
ADDRESS	
	Norris Reserve Lift Station Force Main Reroute
FIGURE	
	2
LEGEND	
	Quartzite /Mica Schist/Amphibolite Granite Gneiss/Amphibolite



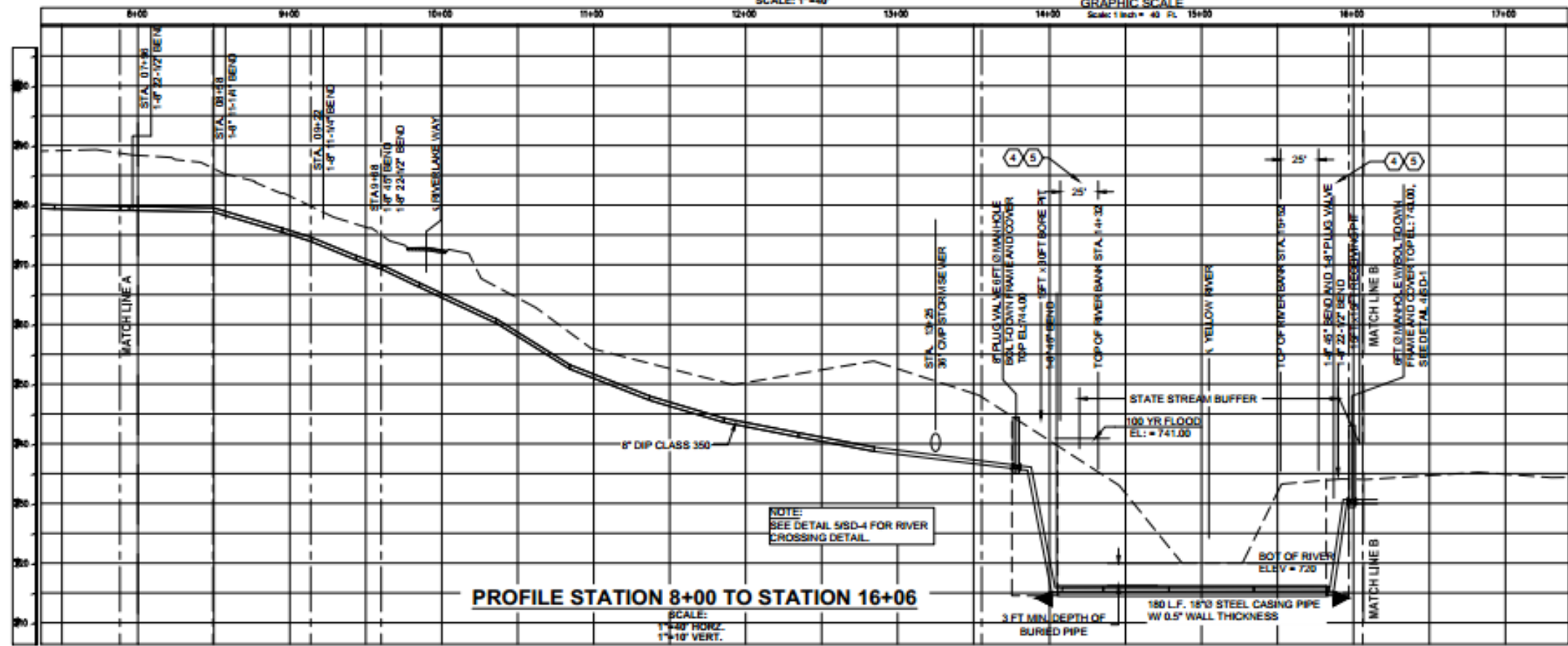
TITLE	Approximate Boring Location Plan with Profile
PROJECT	Norris Reserve Lift Station Force Main Re-Route
PROJECT #	MEG 291087.215
CLIENT	DeKalb County
	Not to Scale
PREPARED BY	DeKalb County
REVIEWED BY	Sam Alyateem, PE
DATE	1/24/2020
FIGURE	3
LEGEND	<p> Approximate Boring Location</p>



- NOTES:**
1. MINIMUM DEPTH OF COVER OVER THE FORCE MAIN SHALL BE 4 FEET.
 2. THE NEW 8\" DIP SHALL BE CLASS 350.
 3. SEE SHEET G-10 FOR GENERAL NOTES PERTAINING TO FORCE MAIN RELOCATION.

Require the Geotech at the sta 9+68, 13+00, 14+00 and 16+00 for this page.
See the detail of the alignment for each property in the legal plots.

PLAN STATION 8+00 TO STATION 16+06
SCALE: 1"=40'
GRAPHIC SCALE



PROFILE STATION 8+00 TO STATION 16+06
SCALE:
1"=40' HORIZ.
1"=10' VERT.

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TITLE
Approximate Boring Location Plan with Profile

PROJECT
Norris Reserve Lift Station Force Main Re-Route

PROJECT #
MEG 291087.215

CLIENT
DeKalb County

Not to Scale

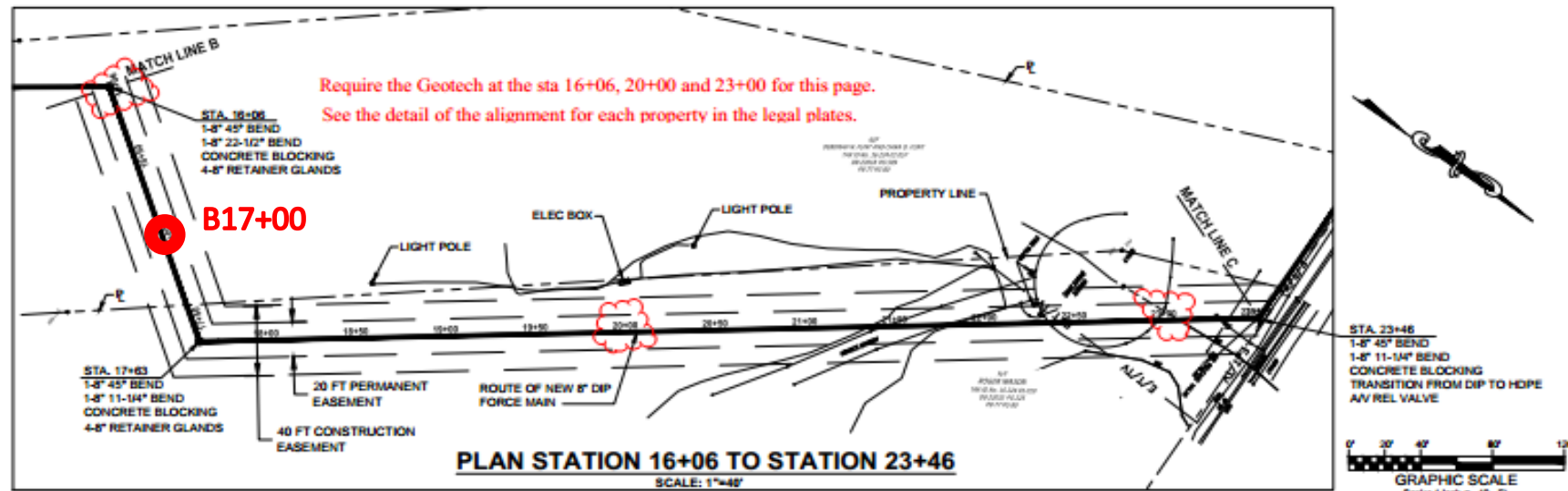
PREPARED BY
DeKalb County

REVIEWED BY
Sam Alyateem, PE

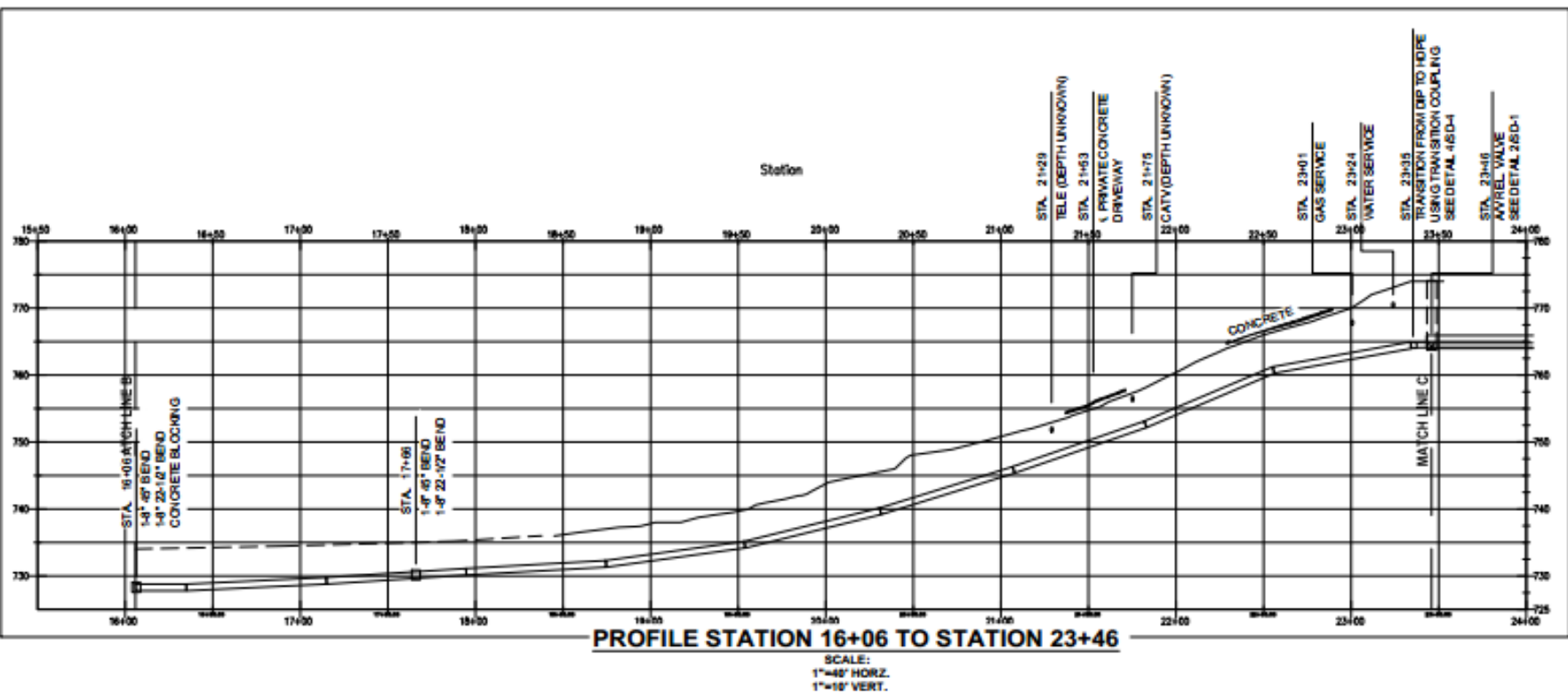
DATE
1/24/2020

FIGURE
4


LEGEND
 Approximate Boring Location

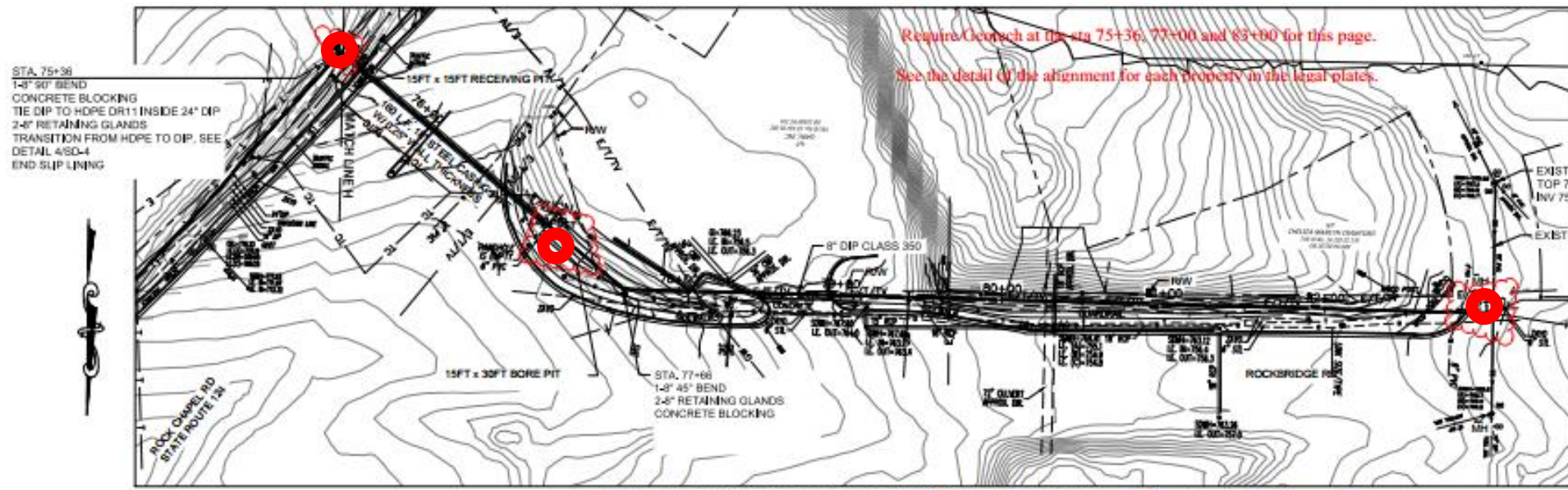


- NOTES:**
1. MINIMUM DEPTH OF COVER OVER THE FORCE MAIN SHALL BE 4 FEET.
 2. THE NEW 8" DIP SHALL BE CLASS 350.
 3. SEE SHEET G-1.0 FOR GENERAL NOTES PERTAINING TO FORCE MAIN RELOCATION.



100% SUBMITTAL

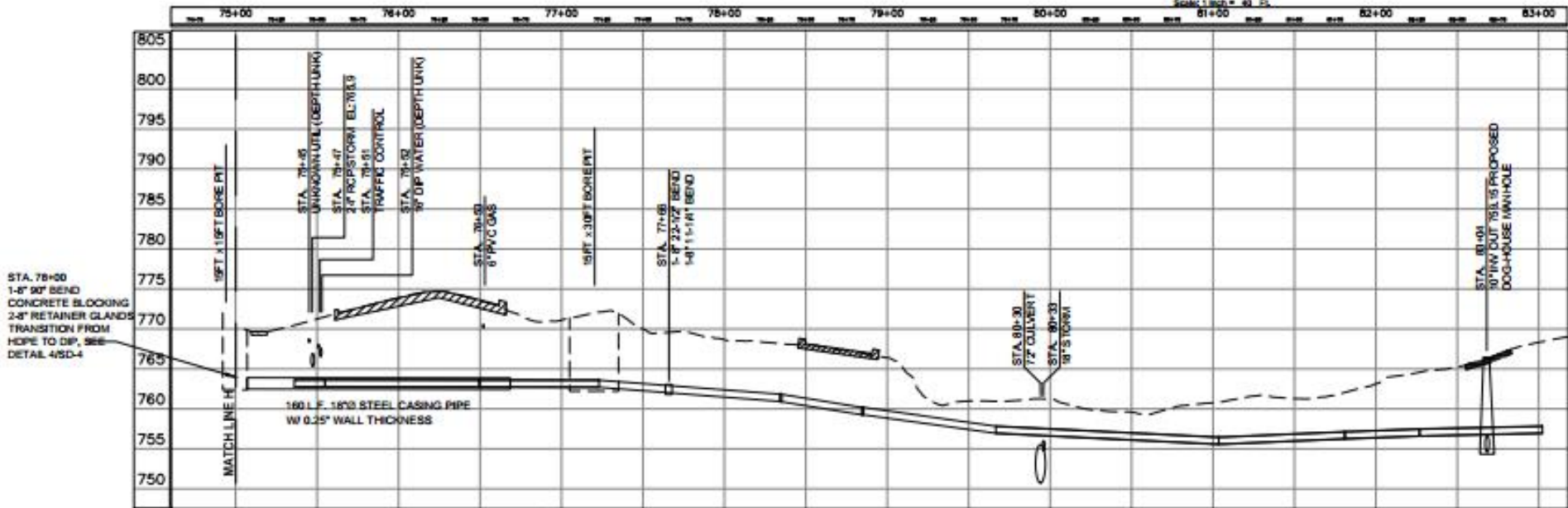
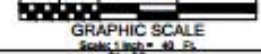
TITLE	Approximate Boring Location Plan with Profile
PROJECT	Norris Reserve Lift Station Force Main Re-Route
PROJECT #	MEG 291087.215
CLIENT	DeKalb County
	Not to Scale
PREPARED BY	DeKalb County
REVIEWED BY	Sam Alyateem, PE
DATE	1/24/2020
FIGURE	5
LEGEND	<p> Approximate Boring Location</p>



Requires Coverch at the sta 75+36, 77+00 and 83+00 for this page.
See the detail of the alignment for each property in the legal plates.

- NOTES:**
1. MINIMUM DEPTH OF COVER OVER THE FORCE MAIN SHALL BE 4 FEET.
 2. THE NEW 8" DIP SHALL BE CLASS 350.
 3. SEE SHEET G-1.0 FOR GENERAL NOTES PERTAINING TO FORCE MAIN RELOCATION.

PLAN STATION 75+36 TO END STATION 83+04
SCALE: 1"=40'



PROFILE STATION 75+36 TO END STATION 83+04
SCALE:
1"=40' HORIZ.
1"=10' VERT.

100% SUBMITTAL



TITLE	Approximate Boring Location Plan with Profile
PROJECT	Norris Reserve Lift Station Force Main Re-Route
PROJECT #	MEG 291087.215
CLIENT	DeKalb County
	Not to Scale
PREPARED BY	DeKalb County
REVIEWED BY	Sam Alyateem, PE
DATE	1/24/2020
FIGURE	6
LEGEND	Approximate Boring Location

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (More Than 1/2 of Soil > #200 Sieve)	GRAVELS (More Than 1/2 of Coarse Fraction > #4 Sieve)	GW	Well Graded Gravels or Gravel-Sand Mixtures; Little or no fines
		GP	Poorly Graded Gravels or Gravel-Sand Mixtures; Little or no fines
		GM	Silty Gravels, Gravel-Sand-Silt Mixtures
		GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS (MORE Than 1/2 of Coarse Fraction < #4 Sieve)	SW	Well Graded Sands or Gravelly Sands; Little or no fines
		SP	Poorly Graded Sands or Gravelly Sands; Little or no fines
		SM	Silty Sands, Sand-Silt Mixtures
		SC	Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS (More Than 1/2 of Soil < #200 Sieve)	SILTS & CLAYS Liquid Limit Less Than 50	ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
		CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
		OL	Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS & CLAYS Liquid Limit Greater Than 50	MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts
		CH	Inorganic Clays of High Plasticity, Fat Clays
		OH	Organic Clays or Medium to High Plasticity, Organic Silty Clays, Organic Silts
HIGHLY ORGANIC SOILS	PT	Peat and Other Highly Organic Soils	

CLASSIFICATION CHART

Relative Density of Cohesionless Soils from Standard Penetration Test	
Very Loose	≤ 4 bpf
Loose	5-10 bpf
Medium Dense	11-30 bpf
Dense	31-50 bpf
Very Dense	> 50 bpf
(bpf=blows per foot; ASTM D1586)	

Consistency of Cohesive Soils	
Very Soft	≤ 2 bpf
Soft	3-4 bpf
Firm	5-8 bpf
Stiff	9-15 bpf
Very Stiff	16-30 bpf
Hard	30-50 bpf
Very Hard	> 50 bpf

Relative Hardness of Rock	
Very Soft	Hard rock disintegrates or easily compresses to touch; can be hard to very hard soil
Soft	May be broken with fingers
Moderately Soft	May be scratched with a nail, corners and edges may be broken with fingers
Moderately Hard	Light Blow of hammer required to break samples
Hard	Hard blow of hammer required to break sample

Particle Size Identification	
Boulders	Larger than 12"
Cobbles	3"-12"
Gravel	
Coarse	3/4"-3"
Fine	4.76mm-3/4"
Sand	
Coarse	2.0-4.76 mm
Medium	0.42-2.00 mm
Fine	0.42-0.074 mm
Fines (Silt or Clay)	Smaller than 0.074 mm

Rock Continuity	
RECOVERY (%) = $\frac{\text{Total Length of Core} \times 100}{\text{Length of Core Run}}$	
Description	Core Recovery (%)
Incompetent	Less than 40
Competent	40-70
Fairly Continuous	71-90
Continuous	91-100

Relative Quality of Rocks	
RQD (%) = $\frac{(\text{Total core, counting only pieces } > 4" \text{ long})}{(\text{Length of Core Run})} \times 100$	
Description	RQD (%)
Very Poor	0-25
Poor	25-50
Fair	50-75
Good	75-90
Excellent	90-100



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Correlation of Penetration Resistance with Relative Density and Consistency Sheet and Soil Classification Chart



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 3 **ELEVATION:** 792 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

BORING NO. B2+00

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS		N-Values Blows/ft (ASTM D1586)	
						Natural Moisture Content (%) ▲	Penetration - ●		
792	0	Approximately 6-inches Grass and Topsoil.							
791	1	Fill - Medium Dense, Reddish Brown, Micaceous, Silty Sand.	Fill					20	
790	2								
789	3								
788	4	Residual - Medium Dense, Reddish Brown, Micaceous, Silty SAND.	SM					15	
787	5								
786	6					Medium Dense, Reddish Brown, Micaceous, with Rock Fragments.			
785	7								
784	8	Color Changes to Light Tan.						18	
783	9								
782	10	Boring was Terminated at 10.0' BGS.						29	
781	11								
780	12								
779	13								
778	14								
777	15								
776	16								
775	17								
774	18								
773	19								
772	20								
771	21								
770	22								
769	23								
768	24								
767	25								
766	26								
765	27								
764	28								
763	29								

Elevation was Interpolated from Profile Station 0+00 to Station 8+00 prepared by ATKINS.



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 3 **ELEVATION:** 794 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

BORING NO. B4+60

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS					N-Values Blows/ft (ASTM D1586)			
						Natural Moisture Content (%). ▲ Penetration - ●								
794	0	Approximately 6-inches Grass and Topsoil.												
793	1	Fill - Stiff, Reddish Brown, Clayey Silt.	Fill	[Symbol]	[Symbol]									
792	2													12
791	3	Residual - Very Stiff, Reddish Brown, Clayey SILT. Becomes Sandy SILT. Changes to Stiff and Tan.	ML	[Symbol]	[Symbol]									
790	4													18
789	5													18
788	6													18
787	7													11
786	8													11
785	9	[UNDISTURBED SAMPLE COLLECTED]												
784	10													
783	11													
782	12													
781	13													
780	14	Very Stiff, Brown, Sandy SILT.												
779	15													
778	16													
777	17													
776	18													
775	19	Becomes Dense Mottled (Dark Gray and Brown), Silty SAND.	SM	[Symbol]	[Symbol]									
774	20	Boring was Terminated at 20.0' BGS.												
773	21													
772	22													
771	23													
770	24													
769	25													
768	26													
767	27													
766	28													
765	29													

Elevation was Interpolated from Profile Station 0+00 to Station 8+00 prepared by ATKINS.



DRILL HOLE LOG

BORING NO. B6+17

PROJECT: Norris Reserve Lift Station Force Main Re-Route PROJECT NO.: MEG291087-215
 CLIENT: DeKalb County Department of Watershed Management DATE: 12/18/2019
 LOCATION: Refer to Figure 3 ELEVATION: 786 Feet MSL
 DRILLER: Kilman Brothers LOGGED BY: Sulemana Alhassan
 DRILLING METHOD: ASTM D1586 with Automatic Hammer STATION: _____
 DEPTH TO - WATER> INITIAL: ∅ After 48+ Hours: ∅ CAVING> C

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS				N-Values Blows/ft (ASTM D1586)	
						Natural Moisture Content (%) ▲	Penetration - ●				
						10	20	30	40	50	
786	0										
785	1	Approximately 5-inches Asphalt.									
785	1	Approximately 5-inches GAB.	GW/SW								
784	2	Fill - Stiff, Reddish Brown, Clayey Silt.	Fill								12
783	3										
782	4										9
781	5	Residual - Stiff, Dark Brown, Clayey SILT.	ML								9
780	6										
779	7										
778	8	Becomes Firm.									
777	9										8
776	10										
775	11										
774	12										
773	13										
772	14	Loose, Light Brown, Silty SAND.	SM								9
771	15	Boring was Terminated at 15.0 BGS.									
770	16										
769	17										
768	18										
767	19										
766	20										
765	21										
764	22										
763	23										
762	24										
761	25										
760	26										
759	27										
758	28										
757	29										

Elevation was Interpolated from Profile Station 0+00 to Station 8+00 prepared by ATKINS.



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 4 **ELEVATION:** 773 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

BORING NO. B9+68

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS		N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%) ▲	Penetration - ●	
773	0	Approximately 5-inches Asphalt.						
772	1	Approximately 5-inches GAB.	GW/SW					
771	2	Fill - Very Stiff, Light Brown, Sandy Silt.	Fill					22
770	3	Residual - Dense, Reddish Brown, Silty SAND with Clay.	SM					33
769	4							
768	5	Very Stiff, Dark Brown, Sandy SILT.	ML					32
767	6							
766	7	Becomes Medium Dense.						23
765	8							
764	9	Partially Weathered Rock (PWR), Sampled as Very Dense, Mottled (Light Brown and Gray), Silty SAND.	PWR					50/1"
763	10							
762	11	Auger Refusal was encountered at 11.0' BGS.						
761	12							
760	13							
759	14							
758	15							
757	16							
756	17							
755	18							
754	19							
753	20							
752	21							
751	22							
750	23							
749	24							
748	25							
747	26							
746	27							
745	28							
744	29							

Elevation was Interpolated from Profile Station 8+00 to Station 16+06 prepared by ATKINS.



DRILL HOLE LOG

BORING NO. B13+00

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 4 **ELEVATION:** 752 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS				N-Values Blows/ft (ASTM D1586)	
						Natural Moisture Content (%) ▲	Penetration - ●	10	20		30
752	0	Boring was Augered through to the depth of 13.5, where auger refusal was encountered. The encountered soil was residual Silty Sand.	SM	[Soil Symbol]	[Samplers]						
751	1										
750	2										
749	3										
748	4										
747	5										
746	6										
745	7										
744	8										
743	9										
742	10										
741	11										
740	12										
739	13	Auger refusal was encountered at 13.5 ft BGS.									
738	14										
737	15										
736	16										
735	17										
734	18										
733	19										
732	20										
731	21										
730	22										
729	23										
728	24										
727	25										
726	26										
725	27										
724	28										
723	29										

Elevation was Interpolated from Profile Station 8+00 to Station 16+06 prepared by ATKINS. Boring was Augered through to depth of 13.5 ft before rock was encountered.



DRILL HOLE LOG

BORING NO. B14+00

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 4 **ELEVATION:** 740 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∅ **After 48+ Hours:** ∅ **CAVING>** C

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS		N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%) ▲	Penetration - ●	
740	0	Approximately 6-inches Grass and Topsoil.						
739	1	Residual - Medium Dense, Light Brown, Silty SAND.	SM					
738	2							22
737	3							50/1"
736	4	Partially Weathered Rock (PWR), Sampled as Very Dense, Light Brown, Silty SAND.	PWR					
735	5	Auger Refusal was encountered at 5.0' BGS.						
734	6							
733	7							
732	8							
731	9							
730	10							
729	11							
728	12							
727	13							
726	14							
725	15							
724	16							
723	17							
722	18							
721	19							
720	20							
719	21							
718	22							
717	23							
716	24							
715	25							
714	26							
713	27							
712	28							
711	29							

Elevation was Interpolated from Profile Station 8+00 to Station 16+06 prepared by ATKINS. Auger Refusal was encountered at 5.0 ft BGS. Two offset borings within 5.0' and 10.0' of B14+00 also encountered auger refusal at 5.5' and 11.0', respectively.



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 4 **ELEVATION:** 738 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

BORING NO. B14+17

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS		N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%) ▲	Penetration - ●	
738	0	Approximately 6-inches Grass and Topsoil.						14 50/1"
737	1	Residual - Medium Dense, Mottled (Brown and Yellowish Brown), Silty SAND.	SM					
736	2							
735	3	Partially Weathered Rock (PWR), Sampled as Very Dense, Light Gray, Silty SAND.	PWR					
734	4							
733	5							
732	6							
731	7							
730	8							
729	9							
728	10							
727	11							
726	12							
725	13							
724	14							
723	15							
722	16							
721	17							
720	18							
719	19							
718	20							
717	21							
716	22							
715	23							
714	24							
713	25							
712	26							
711	27	Boring was Terminated at 26.33' BGS.						
710	28							
709	29							

Elevation was Interpolated from Profile Station 8+00 to Station 16+06 prepared by ATKINS.



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 4 **ELEVATION:** 734 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: 10 **After 48+ Hours:** 10 **CAVING>** C

BORING NO. B16+00

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS		N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%) ▲	Penetration - ●	
734	0	Approximately 6-inches Grass and Topsoil.						
733	1	Fill - Very Loose, Light Brown, Silty Sand.	Fill	[Cross-hatched symbol]	[Sampler symbols]			
732	2							
731	3	Medium Dense, Light Brown, Silty Sand.						
730	4							
729	5	Becomes Loose.						
728	6							
727	7	Residual - Loose, Light Brown, Moist, Silty SAND.	SM	[Vertical lines symbol]	[Sampler symbols]			
726	8							
725	9	Becomes wet.						
724	10							
723	11							
722	12							
721	13	Loose, Light Gray, Coarse SAND.	SW	[Dotted symbol]	[Sampler symbols]			
720	14							
719	15	Becomes Medium Dense and Light Brown.						
718	16							
717	17							
716	18							
715	19	Partially Weathered Rock (PWR), Sampled as Very Dense, Tan, Silty SAND.	PWR	[Diagonal lines symbol]	[Sampler symbols]			
714	20	Boring was Terminated at 20.0 BGS.						
713	21							
712	22							
711	23							
710	24							
709	25							
708	26							
707	27							
706	28							
705	29							

Elevation was Interpolated from Profile Station 8+00 to Station 16+06 prepared by ATKINS.



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 5 **ELEVATION:** 735 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

BORING NO. B17+00

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS				N-Values Blows/ft (ASTM D1586)	
						Natural Moisture Content (%) ▲	Penetration - ●				
						10	20	30	40	50	
735	0	Approximately 6-inches Grass and Topsoil.									
734	1	Residual - Very Loose, Light Brown, Coarse SAND.	SW								4
733	2										
732	3	Stiff, Light Brown, Silty CLAY.	CL								10
731	4										
730	5										
729	6	Medium Dense, Light Brown, Silty SAND.	SM								11
728	7										
727	8										
726	9										
725	10	Boring was Terminated at 10.0' BGS.									
724	11										
723	12										
722	13										
721	14										
720	15										
719	16										
718	17										
717	18										
716	19										
715	20										
714	21										
713	22										
712	23										
711	24										
710	25										
709	26										
708	27										
707	28										
706	29										

Elevation was Interpolated from Profile Station 16+06 to Station 23+46 prepared by ATKINS.



DRILL HOLE LOG

BORING NO. B75+36

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 6 **ELEVATION:** 771 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∅ **After 48+ Hours:** ∅ **CAVING>** C

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS				N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%). ▲ Penetration - ●				
771	0	Approximately 6-inches Grass and Topsoil.								
770	1	Fill - Loose, Dark Brown, Silty Sand.	Fill							
769	2									5
768	3	Stiff, Mottled (Tan and Brown), Micaceous, Sandy Silt.								
767	4									10
766	5	Residual - Stiff, Tan, Micaceous, Sandy SILT.	ML							
765	6									12
764	7									
763	8									
762	9									10
761	10									
760	11									
759	12									
758	13									
757	14	Color Changes to Mottled (Tan and Brown)								
756	15									14
755	16									
754	17									
753	18									
752	19	Medium Dense, Mottled (Tan and Brown), Micaceous, Silty SAND with Rock Fragments.	SM							
751	20	Boring was Terminated at 20.0 BGS.								
750	21									23
749	22									
748	23									
747	24									
746	25									
745	26									
744	27									
743	28									
742	29									

Elevation was Interpolated from Profile Station 75+36 to Station 83+04 prepared by ATKINS.



DRILL HOLE LOG

BORING NO. B77+00

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 6 **ELEVATION:** 771 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∞ **After 48+ Hours:** ∞ **CAVING>** C

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS		N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%) ▲	Penetration - ●	
771	0	Approximately 6-inches Grass and Topsoil.						
770	1	Fill - Medium Dense, Mottled (Brown and Gray), Silty Sand with Gravel.	Fill	[Cross-hatch symbol]	[Sampler symbol]			17
769	2							
768	3	Residual - Medium Dense, Brown, Silty SAND with Rock Fragments. Color Changes to Mottled (Dark Gray and Brown).	ML	[Vertical lines symbol]	[Sampler symbol]			12
767	4							
766	5							
765	6							
764	7							
763	8							
762	9							
761	10							
760	11	Partially Weathered Rock (PWR). Sampled as Very Dense, Silty SAND with Rock Fragments.	PWR	[Diagonal lines symbol]	[Sampler symbol]			50/5"
759	12							
758	13							
757	14							
756	15	Boring was Terminated at 15.0 BGS.						
755	16							
754	17							
753	18							
752	19							
751	20							
750	21							
749	22							
748	23							
747	24							
746	25							
745	26							
744	27							
743	28							
742	29							

Elevation was Interpolated from Profile Station 75+36 to Station 83+04 prepared by ATKINS.



DRILL HOLE LOG

PROJECT: Norris Reserve Lift Station Force Main Re-Route **PROJECT NO.:** MEG291087-215
CLIENT: DeKalb County Department of Watershed Management **DATE:** 12/18/2019
LOCATION: Refer to Figure 6 **ELEVATION:** 767 Feet MSL
DRILLER: Kilman Brothers **LOGGED BY:** Sulemana Alhassan
DRILLING METHOD: ASTM D1586 with Automatic Hammer **STATION:** _____
DEPTH TO - WATER> INITIAL: ∅ **After 48+ Hours:** ∅ **CAVING>** C

BORING NO. B83+00

File: Borings

Date Printed: 1/17/2020

This information pertains only to this boring and should not be interpreted as being indicative of the site.

ELEVATION (feet)	DEPTH (FEET)	Description	SOIL TYPE	SOIL SYMBOL	SAMPLERS	TEST RESULTS				N-Values Blows/ft (ASTM D1586)
						Natural Moisture Content (%) ▲	Penetration - ●			
767	0									
766	1	Approximately 4-inches Asphalt.	GW-SW							
766	1	Approximately 7-inches GAB.								
765	2	Fill - Medium Dense, Tan, Silty Sand with Clay and Rock Fragments.	Fill							22
764	3	Stiff, Reddish Brown, Sandy Silt.								
763	4									10
762	5	Becomes Firm.								
761	6									6
760	7									
759	8	Residual - Firm, Tan, Sandy SILT with some Clay.	ML							6
758	9									
757	10									
756	11									
755	12									
754	13									
753	14									7
752	15	Boring was Terminated at 15.0 BGS.								
751	16									
750	17									
749	18									
748	19									
747	20									
746	21									
745	22									
744	23									
743	24									
742	25									
741	26									
740	27									
739	28									
738	29									

Elevation was Interpolated from Profile Station 75+36 to Station 83+04 prepared by ATKINS.

LOG OF TEST CORING

CORING NO. B14+17 Rock

PROJECT: Norris Reserve Lift Station Force Main Re-Route
CLIENT: DeKalb County Department of Watershed Management
LOCATION: Refer to Figure 4
DRILLER: Kilman Brothers
DRILLING METHOD: ASTM D2113

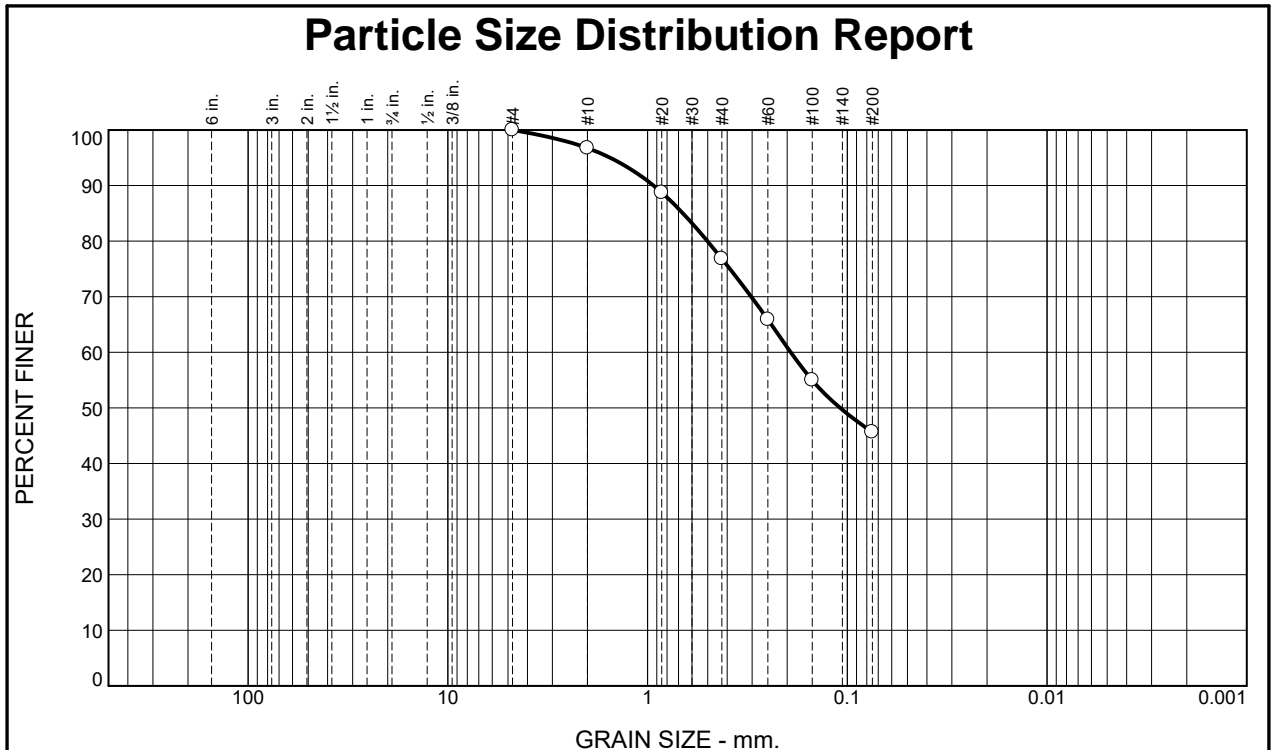
PROJECT NO.: MEG291087-215
DATE: 12/19/2019
ELEVATION: 738 Feet MSL
LOGGED BY: Sulemana Alhassan

DEPTH TO WATER>

ELEVATION/ DEPTH	GRAPHIC LOG	DESCRIPTION	CORE RUN	REC (%)	RQD (%)					FRACTURES PER FOOT	HARDNESS				WEATHERING							
					0	25	50	75	100		VS	S	H	VHEH	Fr	SW	MW	HW _{EW}				
732		Slightly weathered granulite, biotite, plagioclase, quartz. small quartz banding, very hard	1	44						1												
8		Slightly weathered to fresh granulite; biotite, plagioclase, quartz; small quartz banding, some weathered fracture planes; very hard	2	97											2							
728																						
12		Fresh granulite; biotite, plagioclase, quartz; small quartz banding, some slightly weathered fracture planes; very hard	3	90											1							
724																						
16		Fresh granulite; biotite, plagioclase, quartz; fresh granulite; biotite, plagioclase, quartz; small quartz banding, some slightly weathered fracture planes, 3' of weathered plagioclase/quartz material; very hard	4	98						2												
720																						
20																						
716		Fresh granulite; biotite, plagioclase, quartz; small quartz banding, some slightly weathered fracture planes; very hard	5	100						2												
24																						
712																						
28		Boring was Terminated at 26.33' BGS.																				
708																						
32																						

Auger Refusal Encountered at 5.0', Rock Coring from 5.0' to 26.33' BGS. Groundwater level was not determined during the coring process. Matrix visited the site after several days and the water level was at 2.0 feet BGS.





% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	3.3	19.9	31.2	45.6	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	96.7		
#20	88.7		
#40	76.8		
#60	65.9		
#100	55.0		
#200	45.6		

* (no specification provided)

Material Description

Reddish Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D₉₀= 0.9348 D₈₅= 0.6655 D₆₀= 0.1920
D₅₀= 0.1088 D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Nat. Moisture=36.5%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: 9+08 (3-5)

Date Sampled: 12/24/19

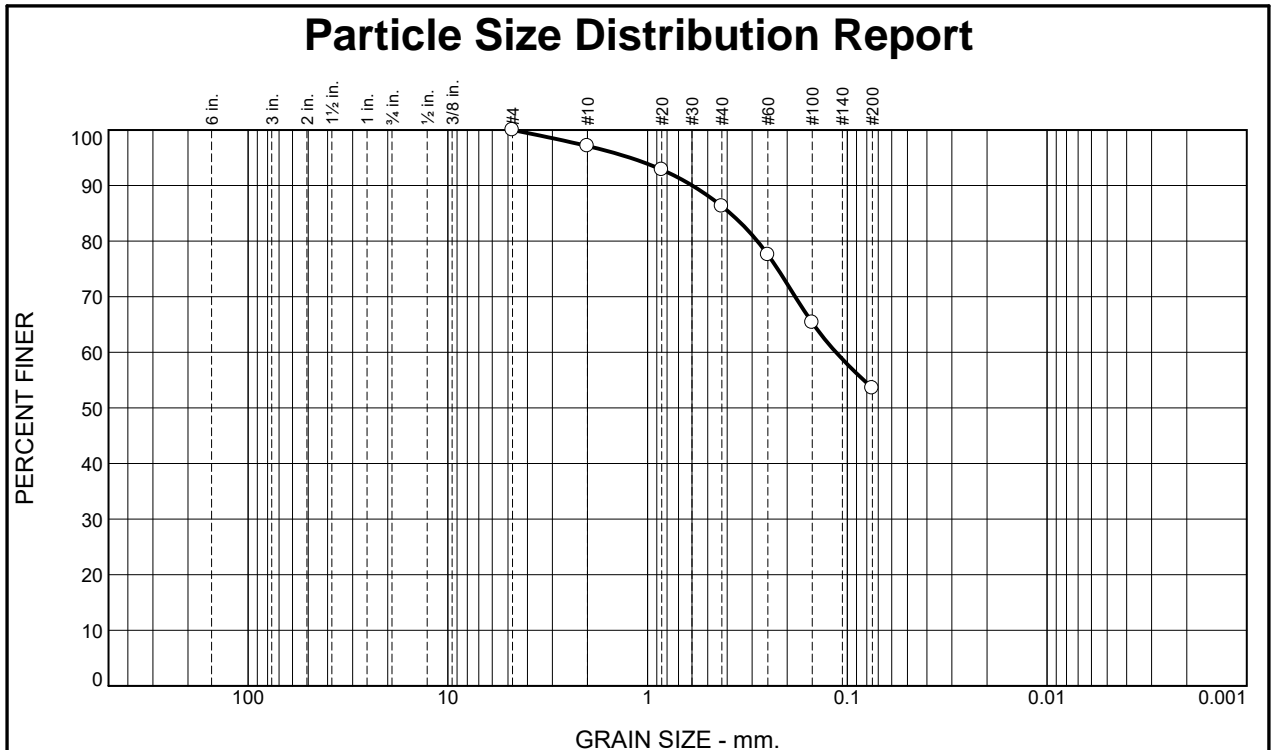


MATRIX ENGINEERING GROUP, INC.
 Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	2.9	10.8	32.7	53.6	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.1		
#20	92.9		
#40	86.3		
#60	77.6		
#100	65.4		
#200	53.6		

* (no specification provided)

Material Description

Dark Orangish Brown Soil

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= _____ AASHTO (M 145)= _____

Coefficients

D₉₀= 0.5978 D₈₅= 0.3853 D₆₀= 0.1140
 D₅₀= _____ D₃₀= _____ D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=35.5%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: 9+60 (5-7)

Date Sampled: 12/24/19

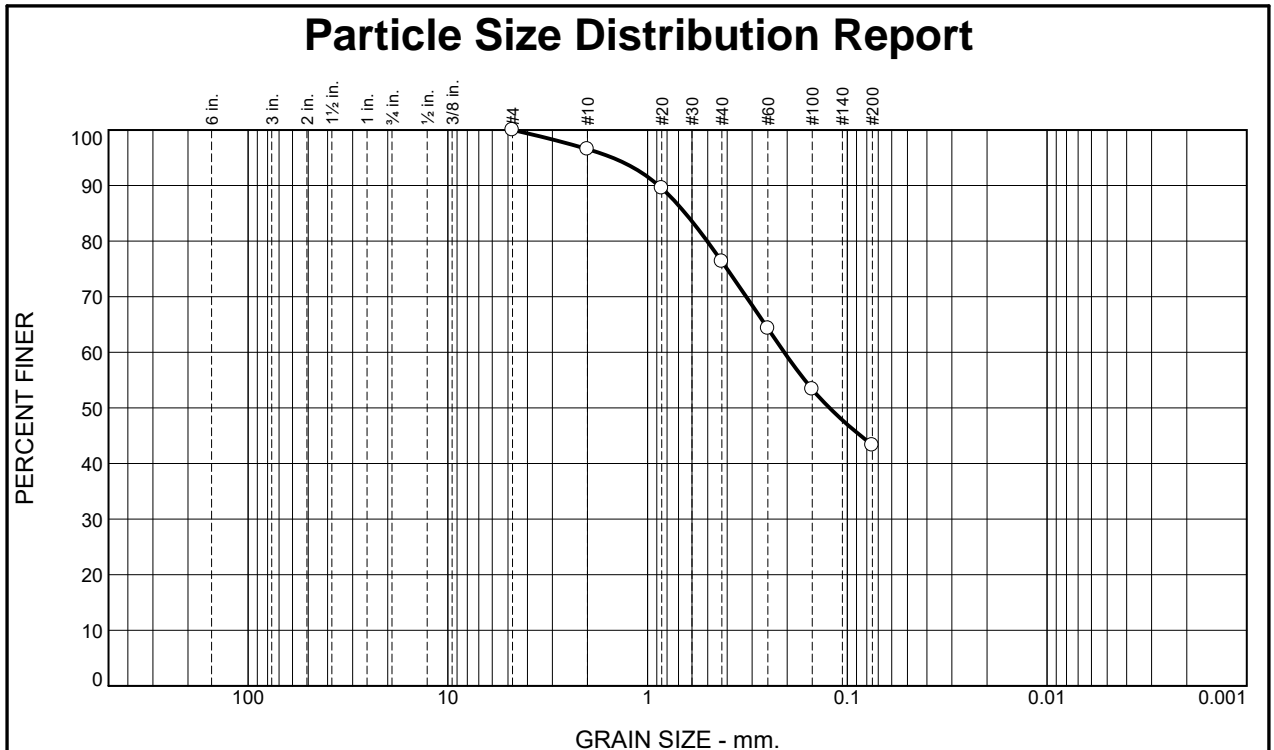


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Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	3.4	20.3	33.0	43.3	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	96.6		
#20	89.5		
#40	76.3		
#60	64.3		
#100	53.4		
#200	43.3		

* (no specification provided)

Material Description

Reddish Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.8805 D₈₅= 0.6464 D₆₀= 0.2070
 D₅₀= 0.1229 D₃₀= _____ D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=24.1%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: 83+00 (3-5)

Date Sampled: 12/24/19

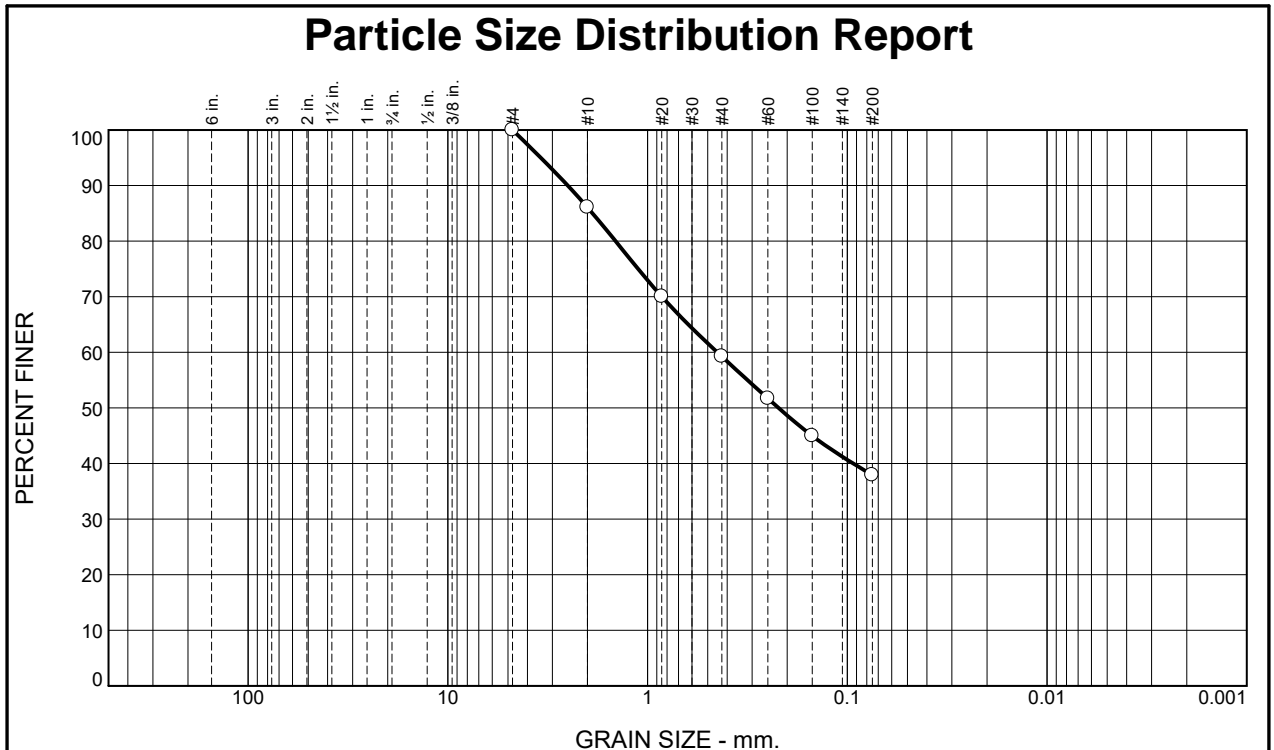


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Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	13.9	26.9	21.3	37.9	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	86.1		
#20	70.0		
#40	59.2		
#60	51.7		
#100	45.0		
#200	37.9		

* (no specification provided)

Material Description

Reddish Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 2.5104 D₈₅= 1.8863 D₆₀= 0.4476
 D₅₀= 0.2211 D₃₀= _____ D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=21.1%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B2+00 (1-3)

Date Sampled: 12/24/19



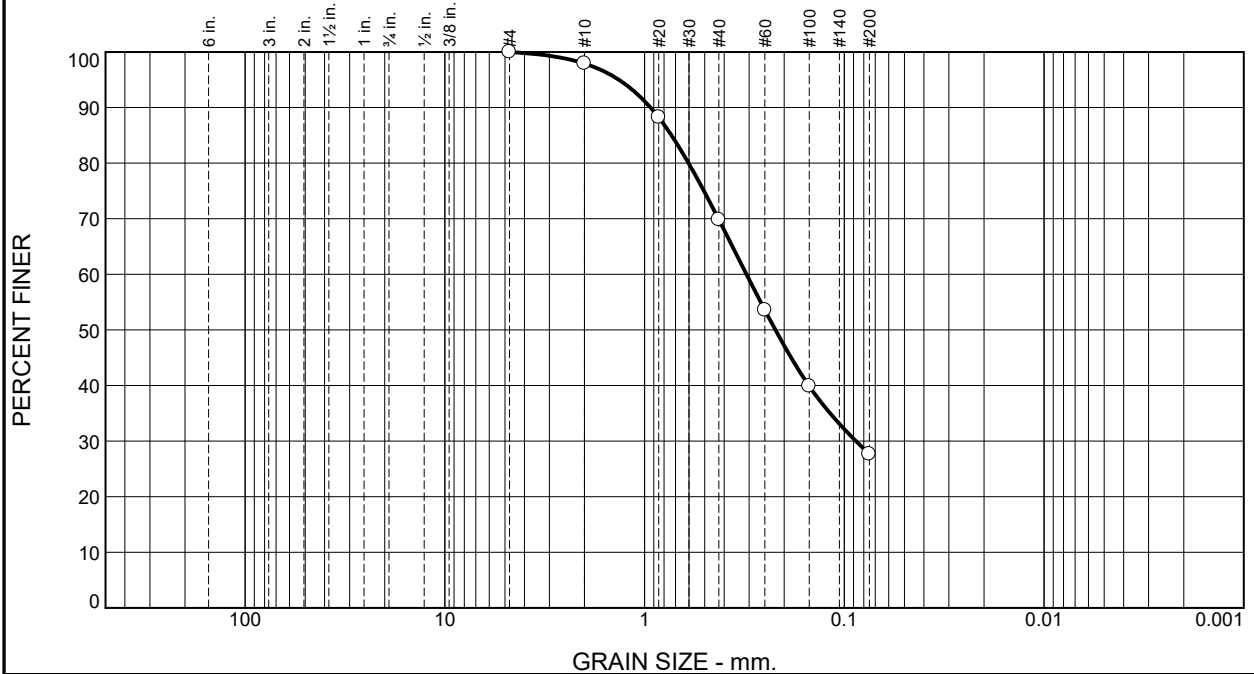
MATRIX ENGINEERING GROUP, INC.
 Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
 Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	2.1	28.1	42.2	27.6	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.9		
#20	88.2		
#40	69.8		
#60	53.6		
#100	39.9		
#200	27.6		

* (no specification provided)

Material Description

Light Tan Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.9340 D₈₅= 0.7333 D₆₀= 0.3091
 D₅₀= 0.2214 D₃₀= 0.0875 D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=8.2%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B2+00 (8-10)

Date Sampled: 12/24/19



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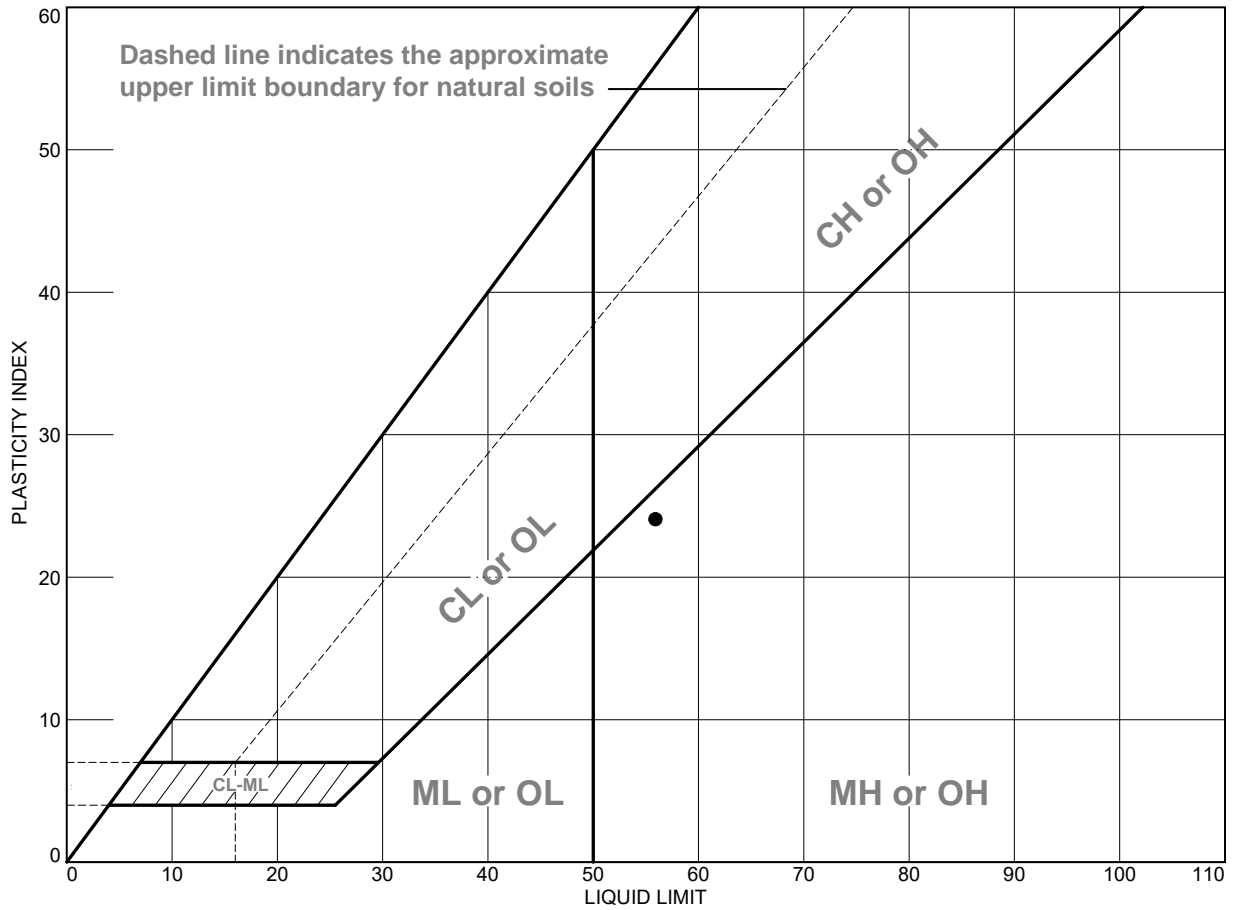
Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

LIQUID AND PLASTIC LIMITS TEST REPORT



These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Reddish Brown Clayey Fine Sand	56	32	24			ML

Project No. 291087.215 **Client:** DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route
● Source of Sample: B4+60 (1-3)

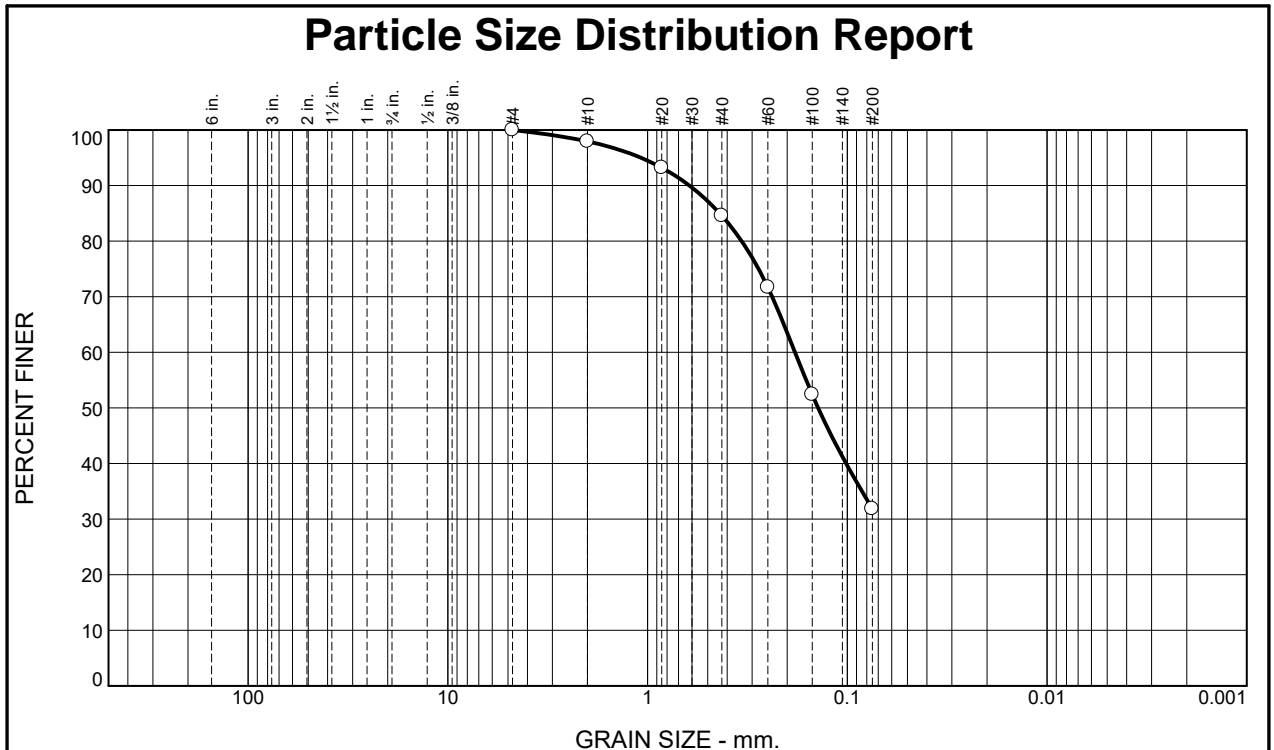
Remarks:
 ● Nat. Moisture 47.6%



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Figure

Tested By: Lekendrick King **Checked By:** Eric Taylor, ICC



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	2.1	13.3	52.8	31.8	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.9		
#20	93.2		
#40	84.6		
#60	71.7		
#100	52.4		
#200	31.8		

* (no specification provided)

Material Description

Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.6176 D₈₅= 0.4358 D₆₀= 0.1829
 D₅₀= 0.1401 D₃₀= _____ D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=12.1%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B4+60 (18.5-20)

Date Sampled: 12/24/19



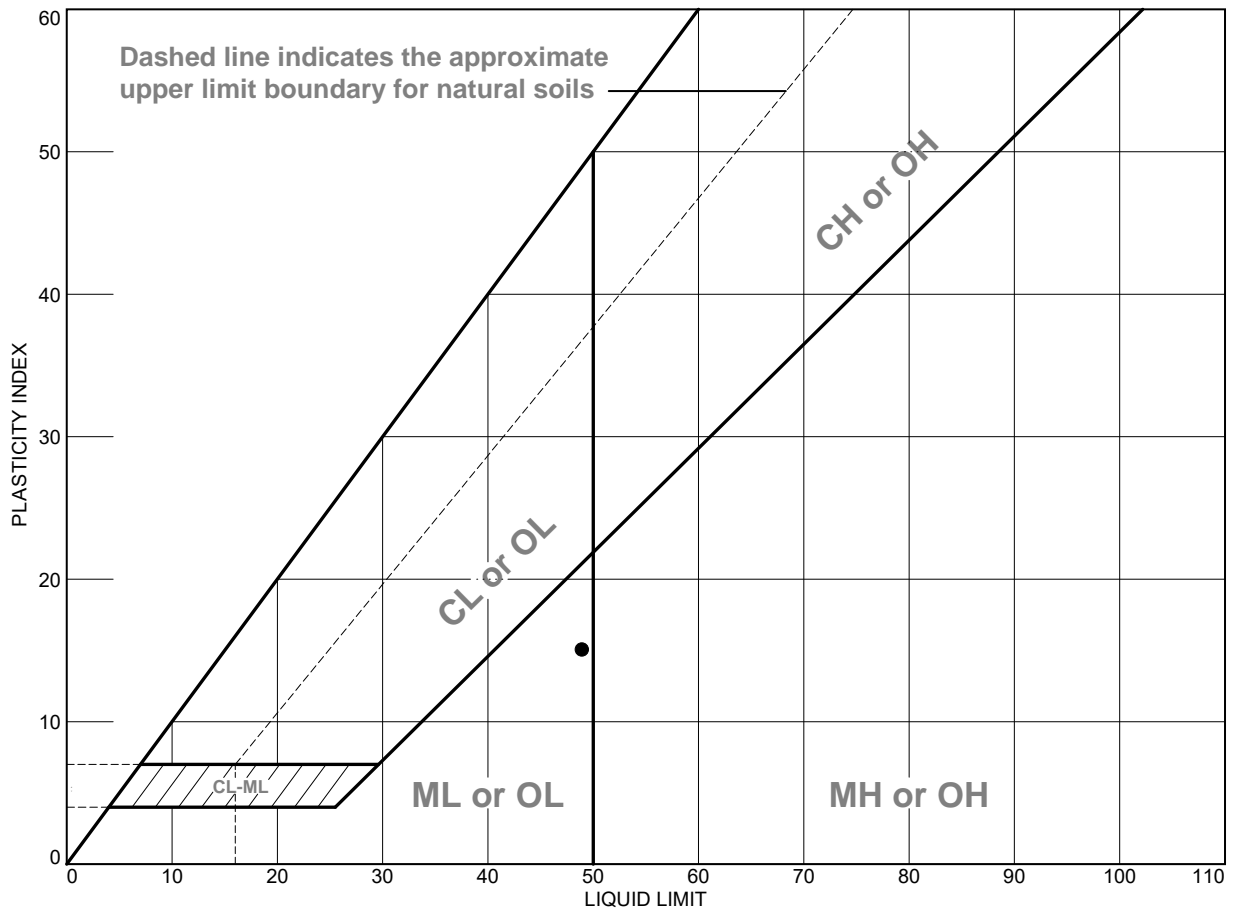
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Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Reddish Brown Clayey Fine Sand	49	34	15			ML

Project No. 291087.215 **Client:** DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route
● Source of Sample: B6+17 (8-10)

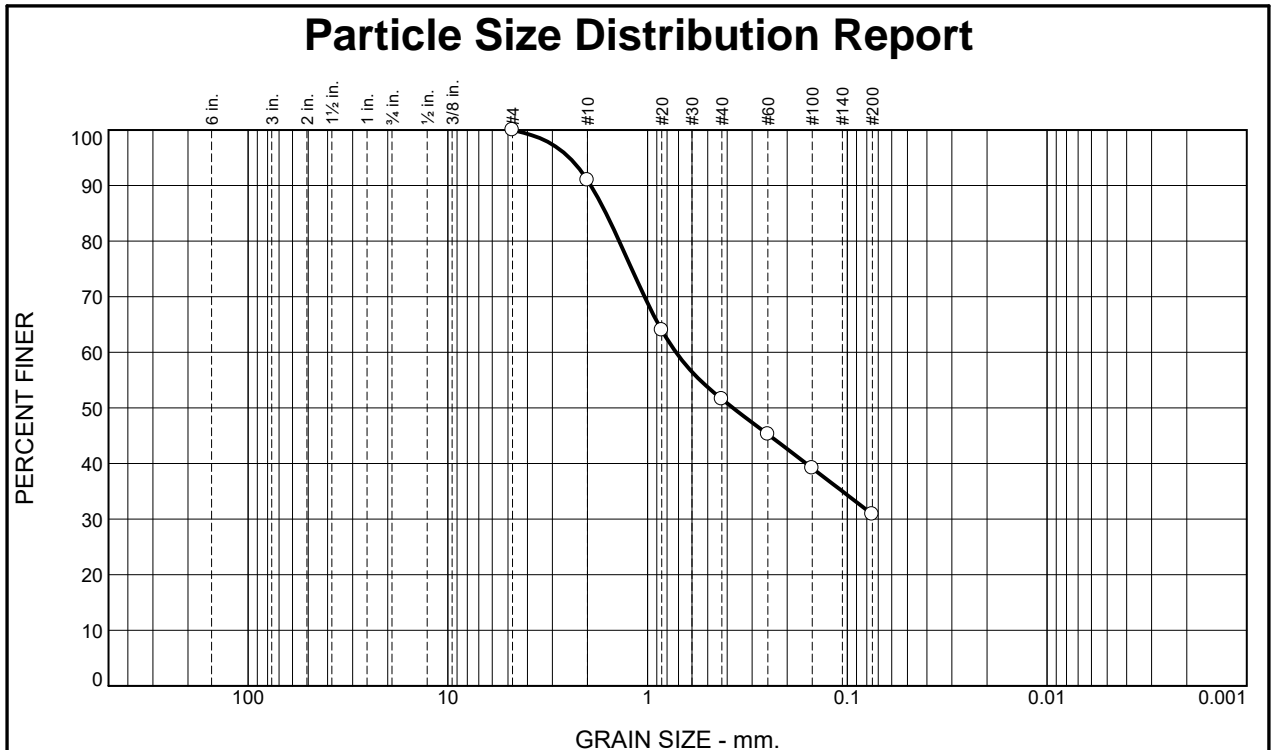
Remarks:
 ● Nat. Moisture 35.3%



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Figure

Tested By: Lekendrick King **Checked By:** Eric Taylor, ICC



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	9.0	39.4	20.7	30.9	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	91.0		
#20	64.0		
#40	51.6		
#60	45.2		
#100	39.2		
#200	30.9		

* (no specification provided)

Material Description

Light Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 1.9230 D₈₅= 1.6158 D₆₀= 0.7213
 D₅₀= 0.3740 D₃₀= _____ D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=10.2%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B6+17 (13.5-15)

Date Sampled: 12/24/19

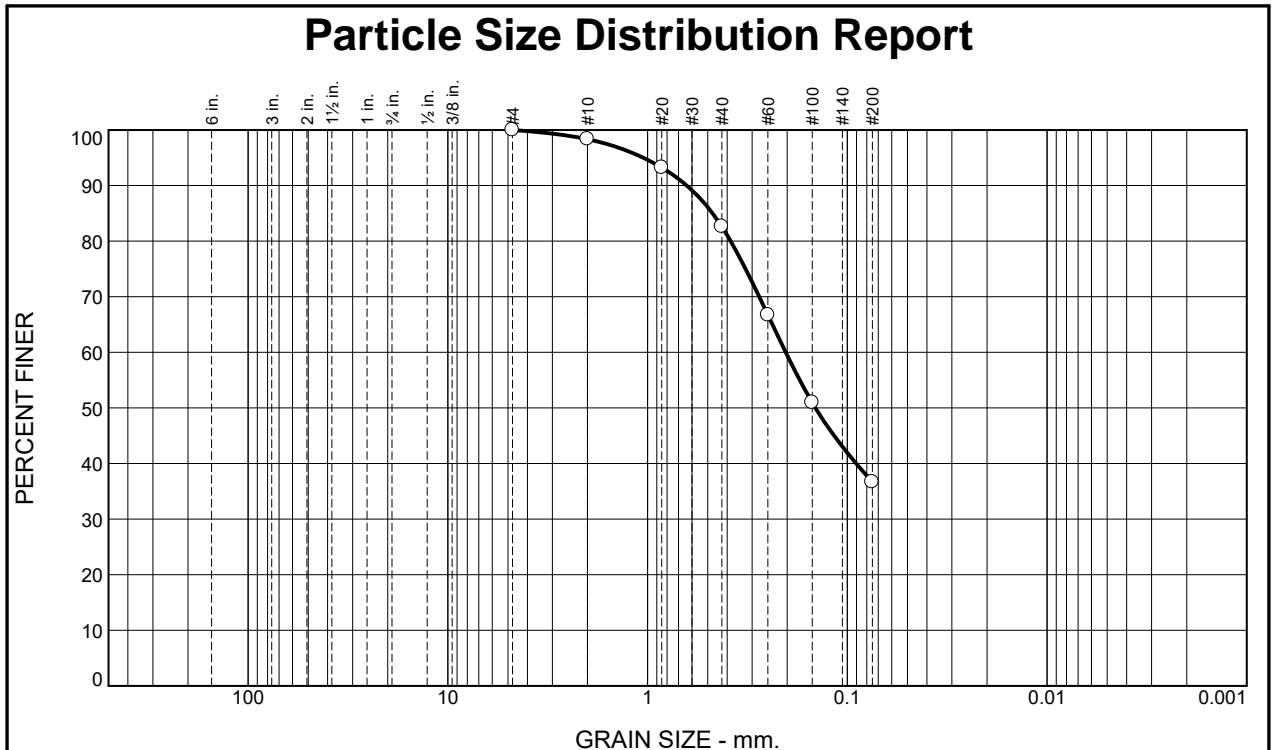


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Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	1.7	15.7	45.9	36.7	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	98.3		
#20	93.2		
#40	82.6		
#60	66.7		
#100	51.0		
#200	36.7		

Material Description

Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.6366 D₈₅= 0.4731 D₆₀= 0.2035
 D₅₀= 0.1445 D₃₀= _____ D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=6.6%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

* (no specification provided)

Source of Sample: B14+00 (1-3)

Date Sampled: 12/24/19

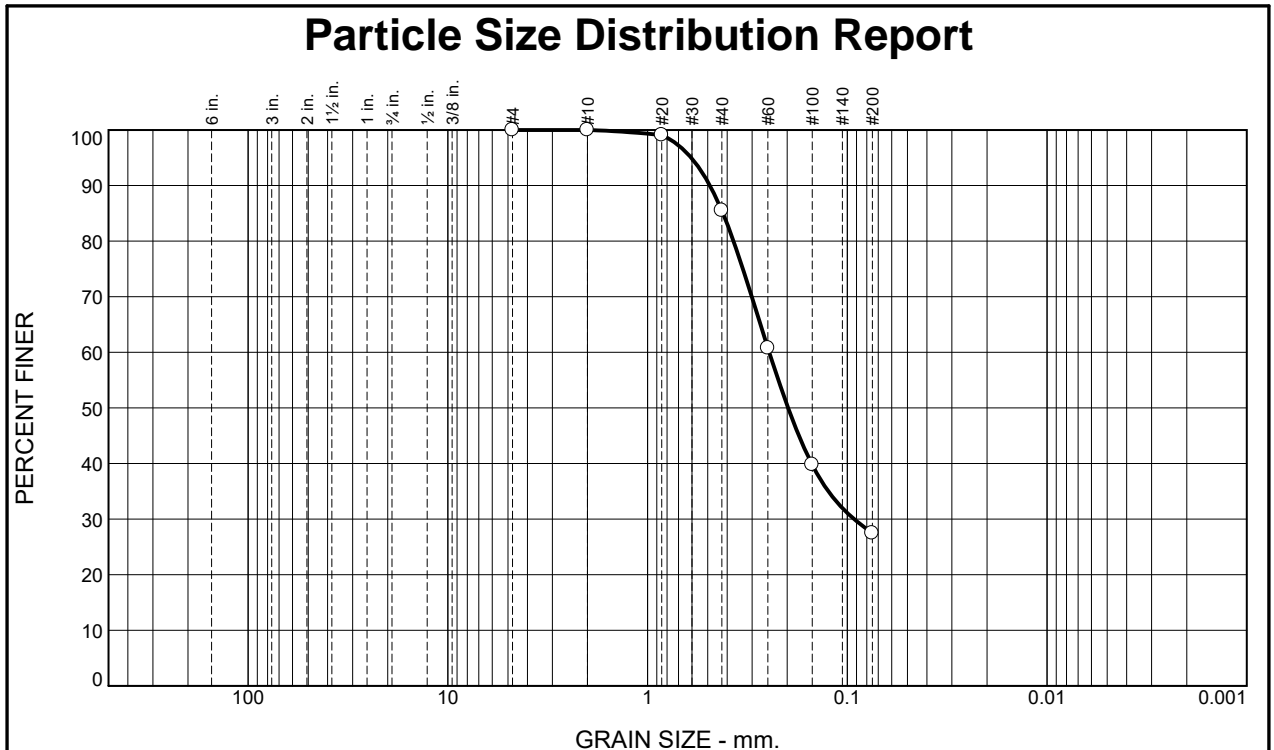


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Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	0.0	14.5	58.0	27.5	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	99.1		
#40	85.5		
#60	60.8		
#100	39.8		
#200	27.5		

* (no specification provided)

Material Description

Light Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.4877 D₈₅= 0.4195 D₆₀= 0.2462
 D₅₀= 0.1979 D₃₀= 0.0925 D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=6.9%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B14+00 (3-5)

Date Sampled: 12/24/19

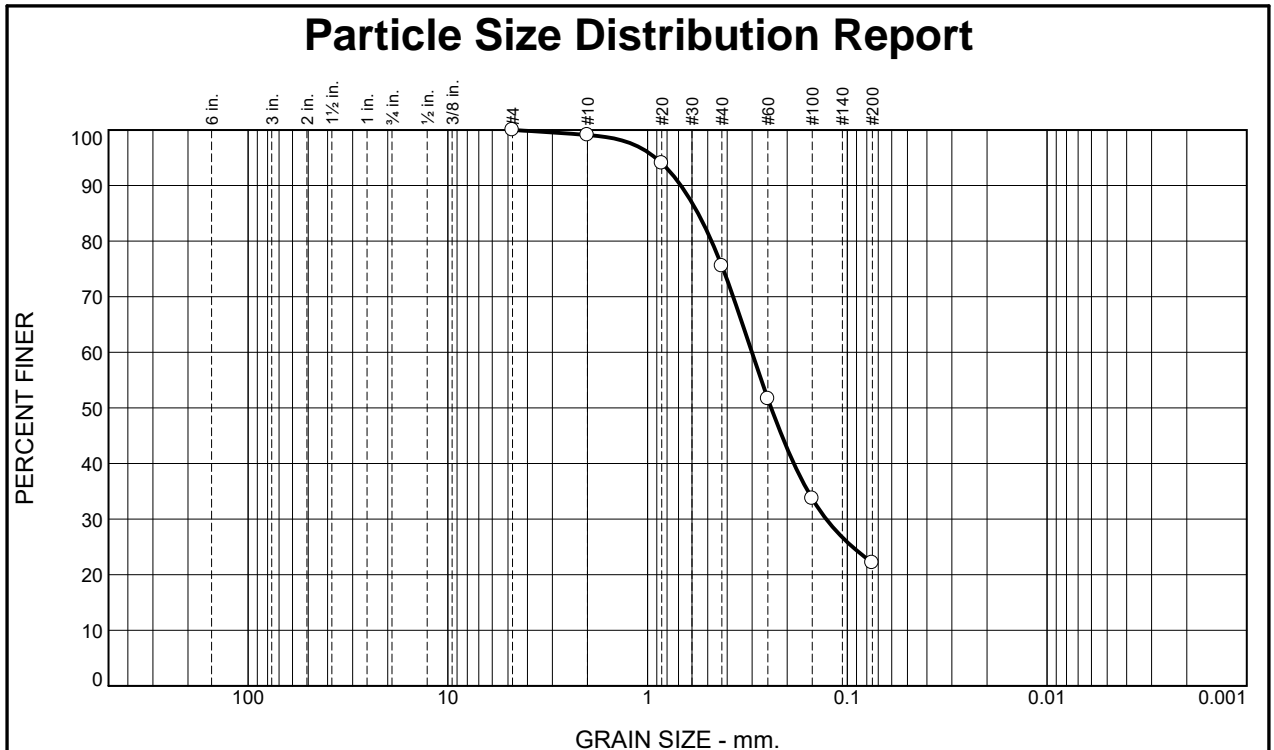


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Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	0.9	23.6	53.4	22.1	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.1		
#20	94.0		
#40	75.5		
#60	51.6		
#100	33.7		
#200	22.1		

* (no specification provided)

Material Description

Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.6814 D₈₅= 0.5593 D₆₀= 0.3005
 D₅₀= 0.2408 D₃₀= 0.1277 D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=14.9%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B14+17 (1-3)

Date Sampled: 12/24/19



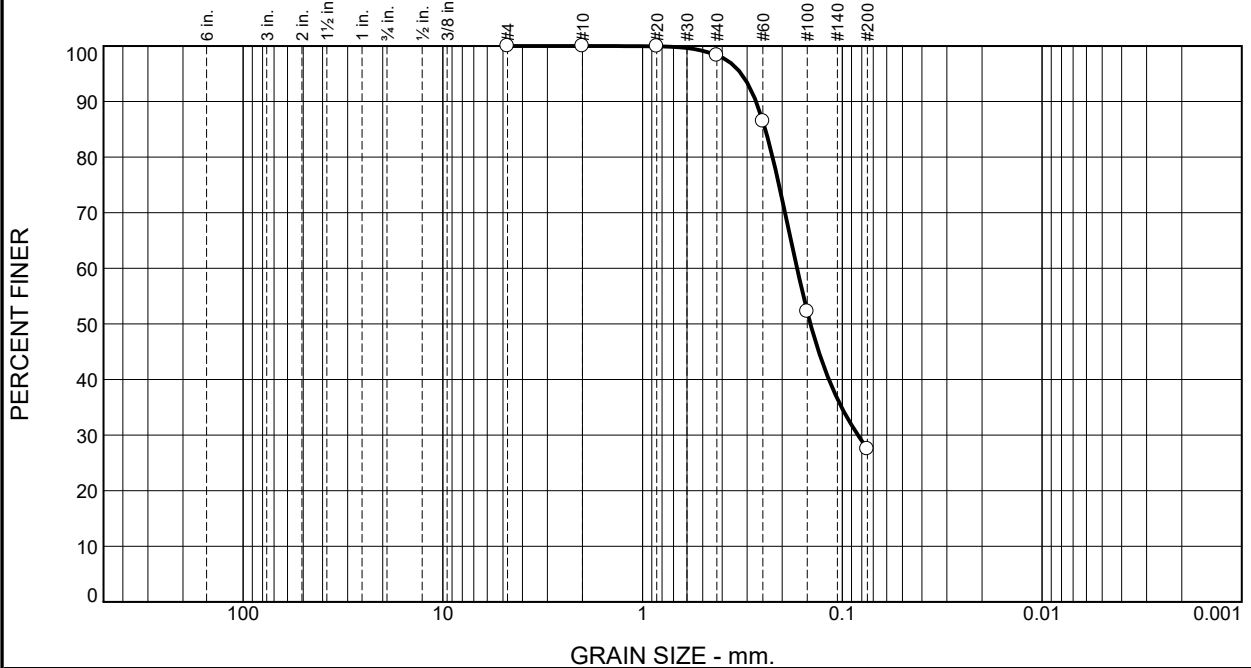
MATRIX ENGINEERING GROUP, INC.
 Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	0.0	1.7	70.8	27.5	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	99.9		
#40	98.3		
#60	86.5		
#100	52.2		
#200	27.5		

* (no specification provided)

Material Description
Light Brown Silty Sand

Atterberg Limits (ASTM D 4318)
 PL= NP LL= PI=

Classification
 USCS (D 2487)= SM AASHTO (M 145)=

Coefficients
 D₉₀= 0.2705 D₈₅= 0.2431 D₆₀= 0.1686
 D₅₀= 0.1444 D₃₀= 0.0835 D₁₅=
 D₁₀= C_u= C_c=

Remarks
Nat. Moisture=22.5%

Date Received: 12/24/19 Date Tested: 1/4/20
 Tested By: Lekendrick King
 Checked By: Eric Taylor, ICC
 Title: Lab Manager

Source of Sample: B16+00 (7-9)

Date Sampled: 12/24/19

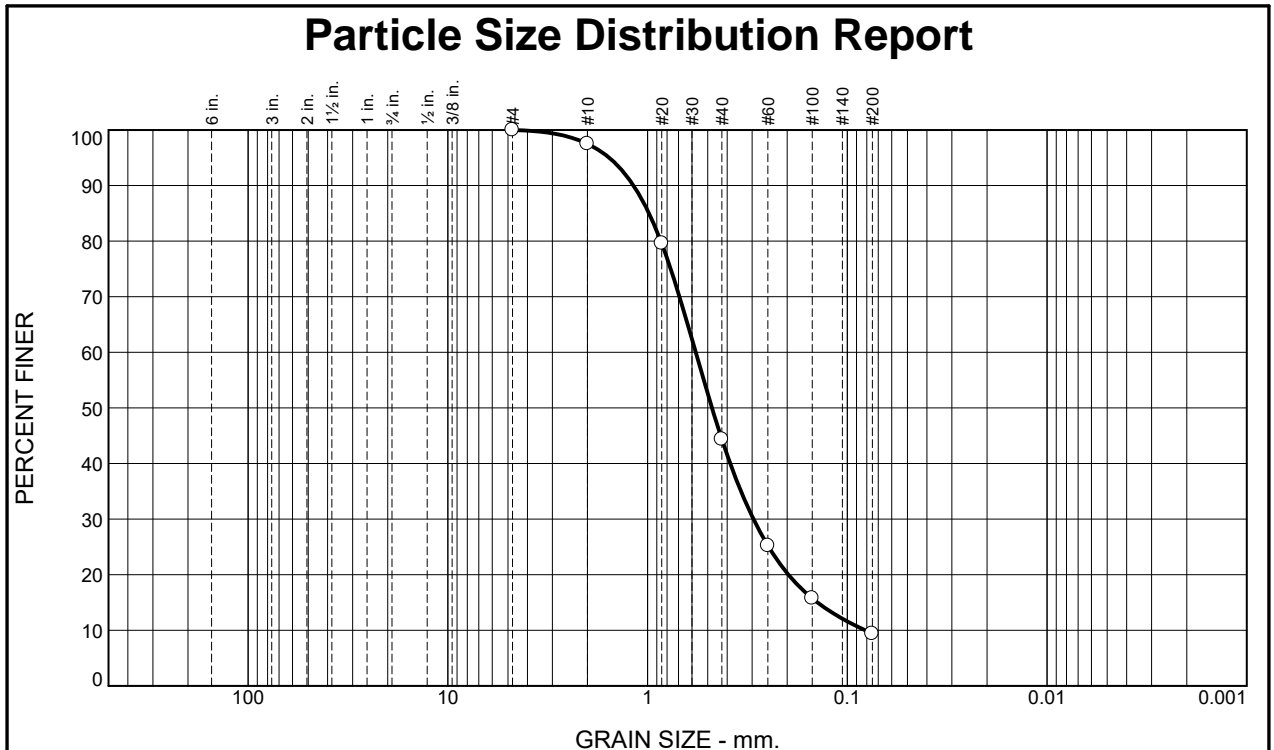


MATRIX ENGINEERING GROUP, INC.
Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	2.5	53.2	34.9	9.4	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.5		
#20	79.6		
#40	44.3		
#60	25.2		
#100	15.8		
#200	9.4		

* (no specification provided)

Material Description

Light Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 1.1767 D₈₅= 0.9840 D₆₀= 0.5741
 D₅₀= 0.4762 D₃₀= 0.2953 D₁₅= 0.1412
 D₁₀= 0.0815 C_u= 7.04 C_c= 1.86

Remarks

Nat. Moisture=22.0%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B16+00 (15-17)

Date Sampled: 12/24/19

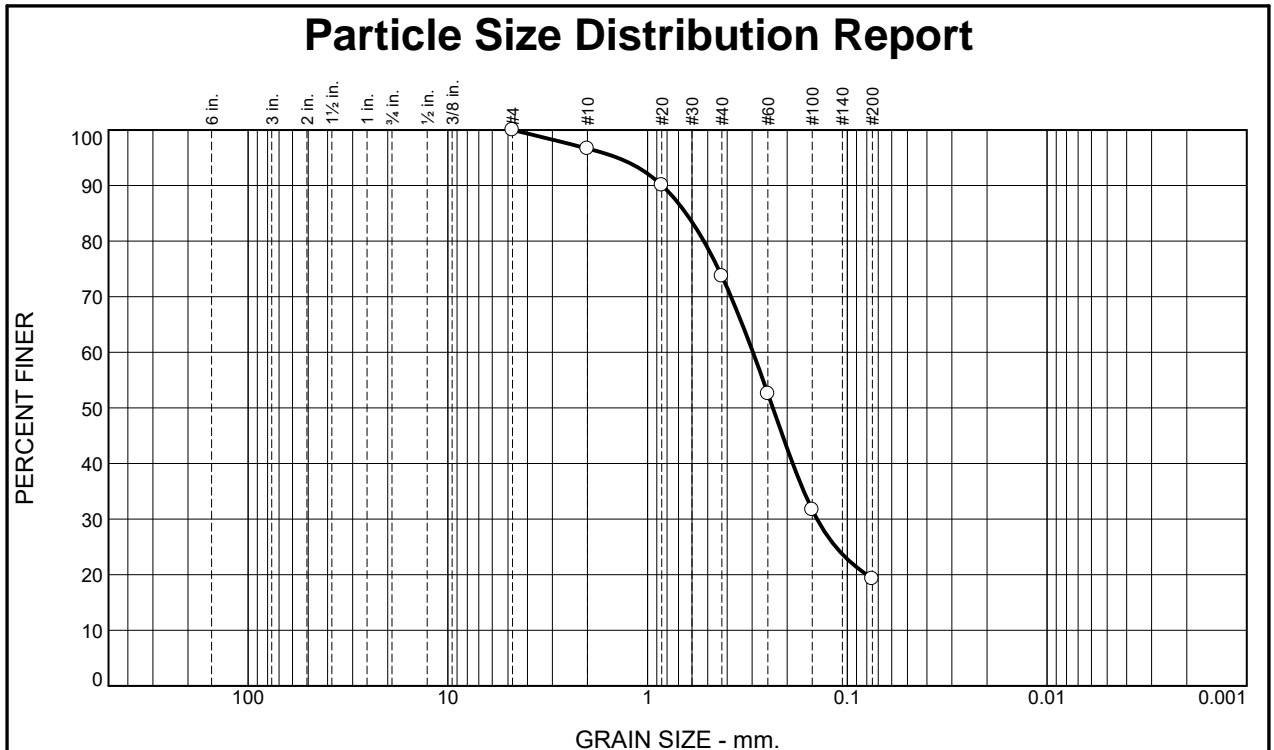


MATRIX ENGINEERING GROUP, INC.
 Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	3.3	23.0	54.4	19.3	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	96.7		
#20	90.1		
#40	73.7		
#60	52.6		
#100	31.7		
#200	19.3		

* (no specification provided)

Material Description

Grayish Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.8459 D₈₅= 0.6418 D₆₀= 0.2970
 D₅₀= 0.2361 D₃₀= 0.1419 D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=7.4%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B75+36 (13.5-15)

Date Sampled: 12/24/19

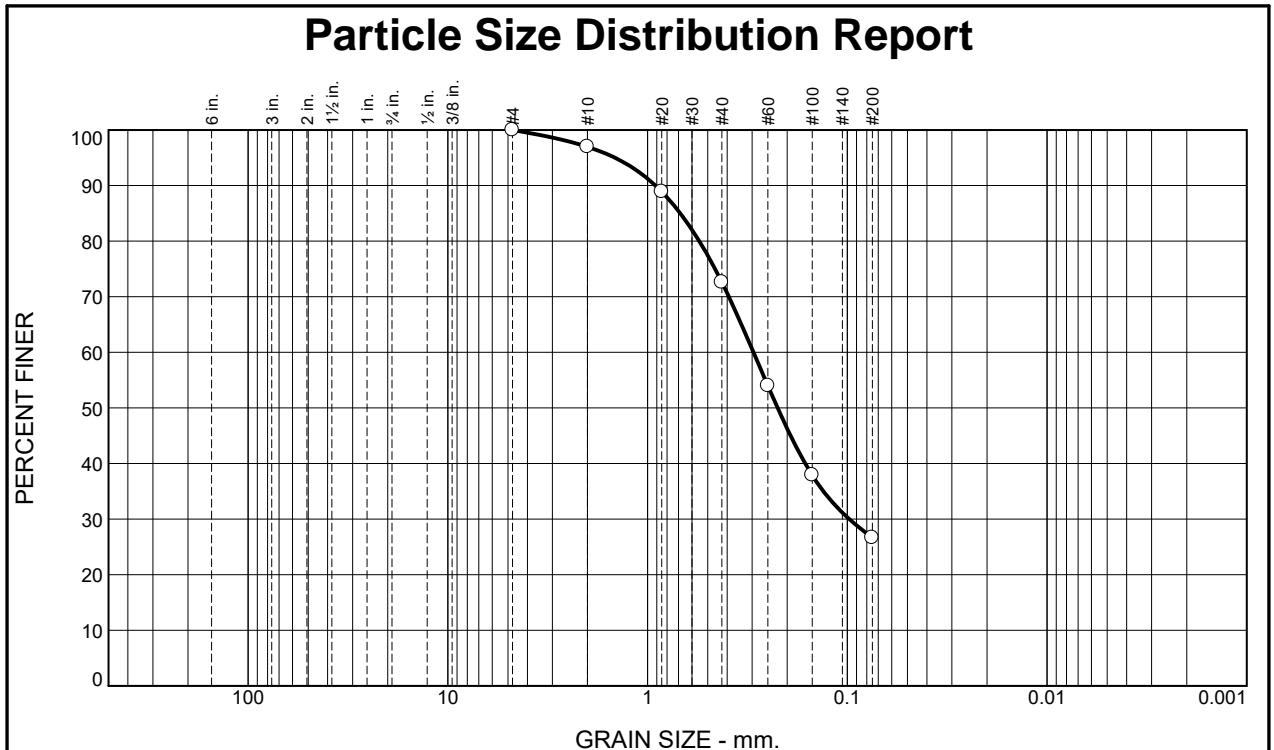


MATRIX ENGINEERING GROUP, INC.
 Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
 Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	3.0	24.4	46.0	26.6	

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.0		
#20	88.9		
#40	72.6		
#60	54.0		
#100	37.9		
#200	26.6		

* (no specification provided)

Material Description

Light Grayish Brown Silty Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SM AASHTO (M 145)= _____

Coefficients

D₉₀= 0.9145 D₈₅= 0.6864 D₆₀= 0.2952
 D₅₀= 0.2234 D₃₀= 0.0978 D₁₅= _____
 D₁₀= _____ C_u= _____ C_c= _____

Remarks

Nat. Moisture=19.4%

Date Received: 12/24/19 Date Tested: 1/4/20

Tested By: Lekendrick King

Checked By: Eric Taylor, ICC

Title: Lab Manager

Source of Sample: B77+00 (1-3)

Date Sampled: 12/24/19



MATRIX ENGINEERING GROUP, INC.
 Geotechnical, Environmental & Construction Materials Consultants

Client: DeKalb County
Project: Norris Reserve Lift Station Force Main Re-Route

Project No: 291087.215

Figure