October 28, 2021

ADDENDUM #1

BID No. 21-134-3330

For: Laurel Springs Gravity Sewer Upgrade

This addendum supersedes and supplements all portions of the bidding documents and becomes part of the contract documents for the above-referenced project.

Where any item called for in the specifications or indicated on the drawings is supplemented hereby, the original requirements shall remain in effect.

Where any original item is amended, voided or superseded hereby, the provision of such item not so specifically amended, voided or superseded shall remain in effect.

Clarification on Bidder Questions and Geotechnical Report attached:

1. **Q: For the NPDES Monitoring, how many points are to be monitored?**
   A: See ESC-102 and ESC-103 for NPDES Sampling requirements

2. **Q: Plans show 6 manholes to be installed, but the bid schedule has a pay quantity of 7 ea. Please clarify which quantity is correct.**
   A: This is a unit price bid item. 6 manholes are shown are the plans and additional one was added if needed.

3. **Q: Which manhole is intended to be raised per pay item 24 "Raise Existing Manhole, 20 VF"? If this is intended to be SSMH 21, would the pay quantity of Manholes then be 5 ea?**
   A: Unit price item to be paid for each MH at owner's discretion.

4. **Q: Regarding permanent seeding/sodding, some drawings have Ds3 called out for the easement and Ds4 called out for the area between the easement and the LOD. Is the entire easement to be seeded permanently?**

A: All areas to be restored to current conditions. Some lots require additional landscaping requirements for sodding.

5. **Q: Is the 15,000 SY of RECP intended to be the entirety of the easement or just areas that have a slope greater than 2.5:1?**
   A: Generally in areas that have a slope greater than 2.5:1 or as directed by the owner or as field conditions warrant.

6. **Q: Is there geotechnical data or are boring logs available for the areas to be open cut for DIP?**
   A: Geotechnical report attached to this Addendum.

7. **Q: Are the existing manholes to be connected to the ones on either end of the DIP to be installed? (i.e. MH 2664 and MH 1953)**
   A: MHs 2664 and 1953 are existing and to be connected to the new DIP. All manholes in between MH 2664 and 195 will be new.

8. **Q: Which service lateral is to be connected? Which manhole is this connection occurring at?**
   A: Survey picked up two cleanouts near MH #20263. All service laterals discovered in the field will be reconnected and paid for on a unit price basis.

9. **Q: Under Spec Section 31 01 30.73 Section 2.03 the client has pneumatic pipe bursting as the method and equipment for the bid. We request static pipe bursting as an alternative method.**
   A: Either method is acceptable.

10. **Q: In the plans, the open cut section is described as DI pipe to replace existing DI pipe. Has there been any mention of the host pipe to be pipe burst as DI pipe as well, assuming all the pipe is the same when originally installed? If not, we would need clarification on the existing host pipe (size and type) to be pipe burst so we can offer a complete proposal.**
    A: Forsyth County's record indicate the existing pipe within the pipe bursting limits is 12"-15" PVC. Contractor shall verify and confirm.

11. **Q: What are allowable working hours and days?**
    A: Normal working hours are 7a.m. to 5p.m. Owner approval required outside normal working hours.

12. **Q: Can there be a pay item included with bid for clearing and grading?**
    A: No

13. **Q: Can a pay items for rock access roads be added to bid?**
    A: No

14. **Q: Can a unit price for Trench Rock be included in bid?**
    A: No

15. **Q: Can a unit price for Rock at Pipe Bursting Access Pits be included in Bid?**
    A: No

16. **Q: Can a unit price for J&B Bore rock be included in Bid?**
    A: No

17. **Q: Can Creek crossing be added as a bid item?**
    A: No

18. **Q: Please clarify Golf Course Restoration and how this gets paid. What is final restoration requirements at golf course?**
    A: Items 13 through 16 cover golf course and landscaping restoration. Golf Course and all landscaping to be returned to existing conditions. Sod for golf course will be paid for out of the Allowance as directed and approved by the owner. Contractor to use landscape subcontractor approved by Laurel Springs Golf Course.

19. **Q: Please clarify any limitations for contractor while maintaining access across golf course. Will holes be closed off?**
    A: Contractor to coordinate his work schedule and efforts with Laurel Springs Golf Course. Golf Course Superintendent has offered to temporarily close holes if needed. Contractor will be limited by the access easement.

20. **Q: Is there any geotechnical bores available to be shared with contractor? Maybe from previous construction.**
    A: Geotechnical report attached to this addendum.

21. **Q: Was existing sewer pipe laid in a trench rock situation, this may interfere with new pipe bursting work?**
    A: See attached geotechnical report.

22. **Q: Can a bid item for a point repair be included in bid in case there is an obstruction / sag in existing line?**
    A: No

23. **Q: Can there be an allowance in bid to restore retaining walls / other private property, if damage is encountered?**

A: No

24. **Q: Please clarify access for Laurel Oak Drive and any requirements.**
    A: Trees within easement along Laurel Oak Drive may be cleared. Access easement to be fenced off from public access. On completion of work, golf course sidewalk and fairways to be restored to existing condition.

25. **Q: Can water level be lowered in Dick Creek by breaking beaver dams?**
    A: Owner is planning to remove beaver dams.

26. **Q: Golf cart access will be cut off between MH 1710 to sta. 11+00, how will this effect golf course?**
    A: Contractor to coordinate his work schedule and efforts with Laurel Springs Golf Course. Golf Course Superintendent has offered to temporarily close holes if needed.

27. **Q: How does engineer propose access in stream from Sta 1+00 to 6+00?**
    A: Access will be from the north along existing easements. Forsyth Co is in process of breaking beaver dams to help with water levels. Dewatering efforts may be required by the contractor.

Geotechnical Report:

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

Laurel Springs Gravity Sewer Replacement
Suwanee, Forsyth County, Georgia

PREPARED FOR:
Forsyth County Procurement
514 West Maple Street
Suite 104
Cumming, Georgia 30040

NOVA Project Number: 6218006

July 27, 2018

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July 27, 2018

FORSYTH COUNTY PROCUREMENT
514 West Maple Street
Suite 104
Cumming, Georgia 30040

Attention: Mrs. Donna H. Kukarola
Procurement Director

Subject: Preliminary Geotechnical Engineering Report
LAUREL SPRINGS GRAVITY SEWER REPLACEMENT PROJECT
Suwanee, Forsyth County, Georgia
NOVA Project Number 6218006

Dear Mrs. Kukarola:

NOVA Engineering and Environmental, LLC (NOVA) has completed the authorized Geotechnical Engineering Report for Laurel Springs Gravity Sewer Replacement Project located along Dick Creek in Suwanee, GA. The proposed project includes the replacement and/or rehabilitation and/or enlargement of the existing gravity sewer lines between Welwyn Court and near Redcliff Court in Forsyth County, Georgia. The work was performed in general accordance with NOVA Proposal Number 003-20184151.1, revised March 29, 2018. This report briefly discusses our understanding of the project at the time of the subsurface exploration, describes the geotechnical consulting services provided by NOVA, and presents our findings, conclusions, and recommendations.

We appreciate your selection of NOVA and the opportunity to be of service on this project. If you have any questions, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,
NOVA Engineering and Environmental, LLC

Kimberly Lyons, Ph.D., E.I.T.
Project Engineer

Marc D. Johnston, P.E.
Regional Manager / Principal
GA P.E. License 027809

Copies Submitted: Addressee (electronic)

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PROJECT INFORMATION

Our understanding of this project is based on discussions with Mrs. Donna H. Kukarola, the provided RFP, a boring site plan, a site reconnaissance during boring layout and our experience with similar projects.

1.1.1 Site Plans and Documents

We were furnished with the following plans and documents:

- Pipe Plan and Profile by Brown and Caldwell, undated

1.2 SCOPE OF WORK

Forsyth County Procurement engaged NOVA to provide geotechnical engineering consulting services for the proposed new pipeline alignment. This report briefly discusses our understanding of the project, describes our exploratory procedures, and presents our findings, conclusions, and recommendations.

The primary objective of this study was to perform a preliminary geotechnical exploration within the area of the proposed construction and to assess these findings as they relate to geotechnical aspects of the proposed pipeline alignment development. The authorized geotechnical engineering services included a site reconnaissance, a soil test boring and sampling program, engineering evaluation of the field and laboratory data, and the preparation of this report.

The services were performed substantially as outlined in our proposal number 003-20184151.1, revised March 29, 2018, and in general accordance with industry standards.

As authorized per the above referenced proposal, the completed geotechnical report was to include:

- A description of the site, fieldwork, laboratory testing and general soil conditions encountered, as well as a Boring Location Plan, and individual Boring Records.
- Description of the site including existing structures, drainage conditions, vegetation and relevant features.
- Geological setting of the site.

- Plot showing the location of the existing pipeline, proposed pipeline and the test borings and/or excavations.
- General description of the subsoil conditions as determined from the recovered soil samples, laboratory tests and standard penetration resistance including depth, thickness and composition of soil and rock strata at boring locations.
- Recorded elevations of the water table, during the drilling, immediately after the drilling completion, and 24 hours after the drilling completion.
- Anticipated groundwater control measures needed at the site during and after construction, including the possibility of buoyancy of empty pipes or manholes.
- Anticipated rock removal effort, as applicable.
- Trench base, backfill material and placement procedure, including compaction requirements.
- Special design and construction provisions for pipe installation trenches and trenchless technologies founded on expansive soils, as applicable.

The assessment of the presence of wetlands, floodplains, or water classified as State Waters of Georgia was beyond the scope of this study. Additionally, the assessment of site environmental conditions, including the detection of pollutants in the soil, rock, or groundwater, at the site was also beyond the scope of this geotechnical study. If desired by the client, NOVA can provide these services.

2.0 SITE DESCRIPTION

2.1 LOCATION AND LEGAL DESCRIPTION

The subject property is the sewer line easement for the Laurel Springs Gravity Sewer in Forsyth County, Georgia. The easement alignment generally runs along Dick Creek within the Laurel Springs Residential Community and Golf Course in Suwanee, Georgia. The alignment begins near the Forsyth County pump station at the end of Welwyn Court, then continues to the north along Dick Creek behind the residential houses of the Laurel Springs Residential Community. The easement alignment ends near the end of Redcliff Court in the Laurel Springs Golf Course.

2.2 CURRENT USE OF THE PROPERTY

The proposed sewer alignment is generally undeveloped land along either side of Dick Creek within the Laurel Springs Community and Golf Course. Much of the alignment is within the existing sewer easement which has been cleared of trees, but other areas are heavily wooded with medium to dense undergrowth.

3.0 FIELD AND LABORATORY PROCEDURES

3.1 FIELD EXPLORATION

The proposed sewer alignment was surveyed and staked prior to our field exploration. Our boring locations were adjusted in the field as required due to site access issues at the time of the field exploration. The approximate locations are shown on Figure 4 in Appendix A. Consequently, referenced boring locations are approximate. If increased accuracy is desired by the client, NOVA recommends that the boring locations and elevations be surveyed.

Our field exploration was conducted on May 29, June 15 and July 2, 2018 and included:

- Thirteen (13) soil test borings (B-1 through B-11) along Dick Creek at the locations indicated on the provided site plan extended to depths of up to 20 feet below the existing ground surface.
- Four (4) hand auger borings (HA-1 through HA-4) along Dick Creek at the locations indicated on the provided site plan extended to depths of up to 4.5 feet below the existing ground surface.

Soil Test Borings: The soil test borings were performed using the guidelines of ASTM Designation D-1586, "Penetration Test and Split-Barrel Sampling of Soils". A hollow-stem auger was used to advance the borings. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler. The sampler was first seated six inches 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 is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density. Representative portions of the soil samples, obtained from the sampler, were placed in glass jars and transported to our laboratory for further evaluation and laboratory testing.

Test Boring Records in Appendix B show the standard penetration test (SPT) resistances, or “N-values”, and present the soil conditions encountered in the borings. These records represent our interpretation of the subsurface conditions based on the field exploration data, visual examination of the split-barrel samples, laboratory test data, and generally accepted geotechnical engineering practices. The stratification lines and depth designations represent approximate boundaries between various subsurface strata. Actual transitions between materials may be gradual.

Hand Auger Borings: The hand auger boring was performed at 4 (HA-1 through HA-4) locations due to access limitations for the drill rig. At regular intervals in each of the hand auger borings, the soil consistency was measured with a portable dynamic cone penetrometer (DCP). After first seating the conical point, the point was driven an additional 1¾ inches with blows of a manually-operated 15-pound hammer falling freely over a 20-inch drop. The number of blows required to achieve this penetration was recorded and is an empirical assessment of the soil's load bearing capacity and density. Please refer to the Hand Auger Boring Logs included in the Appendix B.

Groundwater: The groundwater levels reported on the Test Boring Records represent measurements made at the completion of the soil test borings. The soil test borings were subsequently backfilled with the soil cuttings and patched with asphalt, if necessary.

3.2 LABORATORY TESTING

Split-barrel samples were returned to our testing laboratory, where they were classified using visual/manual methods in accordance with the Unified Soil Classification System (USCS) and ASTM designations. The descriptions presented in the boring logs should be considered approximate. Further laboratory testing was beyond the scope of this exploration.

It should be noted that all soil samples would be properly disposed of 30 days following the submittal of this NOVA subsurface exploration report unless you request otherwise.

4.0 SUBSURFACE CONDITIONS

4.1 GEOLOGY

The site is located in the Piedmont Geologic Region, a broad northeasterly trending province underlain by crystalline rocks up to 600 million years old. The Piedmont is bounded on the northwest by the Blue Ridge Range of the Appalachian Mountains, and on the southeast by the leading edge of Coastal Plain sediments, commonly referred to as the “Fall Line”. Numerous episodes of crystal deformation have produced varying degrees of metamorphism, folding and shearing in the underlying rock. The resulting metamorphic rock types in this area of the Piedmont are predominantly a series of Precambrian age schists and gneisses, with scattered granitic or quartzite intrusions.

Residual soils in the region are primarily the product of in-situ chemical decomposition of the parent rock. The extent of the weathering is influenced by the mineral composition of the rock and defects such as fissures, faults and fractures. The residual profile can generally be divided into three zones:

- An upper zone near the ground surface consisting of red clays and clayey silts which have undergone the most advanced weathering,

- An intermediate zone of less weathered micaceous sandy silts and silty sands, frequently described as “saprolite”, whose mineralogy, texture and banded appearance reflects the structure of the original rock, and

- A transitional zone between soil and rock termed partially weathered rock (PWR). Partially weathered rock is defined locally by standard penetration resistances exceeding 100 blows per foot.

The boundaries between zones of soil, partially weathered rock, and bedrock are erratic and poorly defined. Weathering is often more advanced next to fractures and joints that transmit water, and in mineral bands that are more susceptible to decomposition. Boulders and rock lenses are sometimes encountered within the overlying PWR or soil matrix. Consequently, significant fluctuations in depths to materials requiring difficult excavation techniques may occur over short horizontal distances.

4.2 SOIL AND ROCK CONDITIONS

The following paragraphs provide generalized descriptions of the subsurface profiles and soil conditions encountered by the borings conducted during this study.

The Test Boring Records in Appendix B should be reviewed to provide more detailed descriptions of the subsurface conditions encountered at each boring location. These records represent our interpretation of the subsurface conditions based on the field logs and visual observations of samples by an engineer. The lines designating the interface between various strata on the Boring Logs represent the approximate interface locations and elevation. The actual transition between strata may be gradual. Groundwater levels shown on the Boring Logs represent the conditions at the time of drilling. It should be understood that soil conditions may vary between boring locations.

4.2.1 Surface Materials

Topsoil: A surface layer of topsoil up to 3 inches in thickness at our boring locations. Please note that topsoil thickness is frequently erratic and thicker zones of topsoil should be anticipated, most notably in the wooded portions of the site.

4.2.2 Fill

Existing fill was encountered in all of the borings except B-6 to B-9 and B-11. The fill was variable in consistency and composition, but generally consisted of silty SAND, with some occasional rock fragments and/or trace amounts of organics. Standard penetration resistances in the fill varied from 2 to 30 blows per foot (bpf) but may have been amplified by the presence of rock fragments.

4.2.3 Alluvium

Alluvium (water deposited soil) was encountered in borings B-4, and HA-2 from depths ranging from 3 feet to 10 feet below existing grade. The alluvium generally consisted of silty SAND. Standard penetration resistances in the alluvium varied from 0 to 8 bpf.

4.2.4 Residual Soils

Residual soils were encountered beneath the surface materials and/or near surface fill and/or alluvium in all borings. The residuum generally consisted of silty SAND. Standard penetration resistance values ranged from 0 to 44 bpf, but more typically varied from 7 to 25 bpf.

4.2.5 Partially Weathered Rock

Partially weathered rock (PWR) is a transitional material between soil and the underlying parent rock that is defined locally as materials that exhibit a standard penetration resistance exceeding 100 bpf.

PWR was encountered in borings (B-1 through B-4) and (B-6 through B-10) performed during this study at depths ranging from 3.5 to 18.5 feet below the ground surface. The following table depicts locations and depths where PWR was encountered.

BORING	DEPTH (feet)	ELEVATIONS (FT-MSL)
B-1	5.5	998.5
B-1A	5.5	998.5
B-2	8.5	991.5
B-3	18.5	997.5
B-4	13.5	1002.5
B-6	16.5	1017.5
B-7	18.5	1011.5
B-8	3.5	1030.5
B-8A	3.5	1030.5
B-9	13.5	1014.5
B-10	8.5	1029.5

4.2.6 Auger Refusal Materials

Auger refusal materials are any very hard or very dense material, frequently boulders or the upper surface of bedrock, which cannot be penetrated by a power auger. Auger refusal was encountered in several of the borings at depths ranging from 5 to 20 feet below the existing ground surface. The following table depicts the locations and depths where auger refusal materials were encountered.

BORING	DEPTH (feet)	ELEVATIONS (FT-MSL)
B-1	6	998
B-1A	6	998
B-6	17	1017
B-7	20	1010
B-8	5	1029
B-8A	5	1029
B-9	15	1013
B-10	10	1028

*Rock coring to determine the nature and continuity of refusal materials was beyond the scope of this exploration.

4.3 GROUNDWATER CONDITIONS

4.3.1 General

Groundwater in the Piedmont typically occurs as an unconfined or semi-confined aquifer condition. Recharge is provided by the infiltration of rainfall and surface water through the soil overburden. More permeable zones in the soil matrix, as well as fractures, joints and discontinuities in the underlying bedrock can affect groundwater conditions. The groundwater table in the Piedmont is expected to be a subdued replica of the original surface topography.

Groundwater levels vary with changes in season and rainfall, construction activity, surface water runoff, and other site-specific factors. Groundwater levels in the Alpharetta area are typically lowest in the late summer-early fall and highest in the late winter-early spring, with annual groundwater fluctuations of 4 to 8 feet; consequently, the water table may vary at times.

4.3.2 Soil Test Boring Groundwater Conditions

Groundwater was observed at the time of drilling in several of the borings at depths ranging from 1 to 20 feet below the existing ground surface. The following table depicts the locations and depths where groundwater was encountered during this study.

BORING	DEPTH (feet)	ELEVATIONS (FT-MSL)
B-2	4	996
B-3	20	996
B-4	13	1003
B-6	5	1029
B-7	3	1027
B-9	3	1025
B-11	2	1028
HA-2	4	1013
HA-4	1	1025

5.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction, site observations, our evaluation and interpretation of the field and laboratory data obtained during this exploration, our experience with similar subsurface conditions, and generally accepted geotechnical engineering principles and practices.

Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific boring locations. If such variations are noted during construction, or if project development plans are changed, we request the opportunity to review the changes and amend our recommendations, if necessary.

As previously noted, boring locations were established by estimating distances and angles from site landmarks. If increased accuracy is desired by the client, we recommend that the boring locations and elevations be surveyed.

5.1 SITE PREPARATION

5.1.1 General

General: Prior to proceeding with construction, all vegetation, root systems, topsoil, and other deleterious non-soil materials should be stripped from proposed construction areas. Clean topsoil may be stockpiled and subsequently re-used in landscaped areas. Debris-laden materials should be excavated, transported and disposed of off-site in accordance with appropriate solid waste rules and regulations.

5.1.2 Trench and Pit Excavation

Weak and/or low consistency soils were encountered in several of our borings along the proposed pipeline alignment. These weak soils are likely present at or near the proposed invert elevation of the new pipe in many locations. We anticipate that a 12” thick layer of bedding stone will be utilized beneath the new gravity sewer. In areas that encounter alluvial and/or low consistency soils at the proposed invert elevation, some over-excavation and backfilling with crushed stone to provide a stable bedding platform for the gravity sewer should be anticipated.

Very dense soils, PWR and/or auger refusal materials were encountered in borings in multiple borings along the proposed pipeline alignment. These very dense soils, PWR and/or auger refusal materials are present at or near the proposed invert elevation of the new pipe. We anticipate that materials requiring difficult excavation techniques will be encountered frequently across a majority of the proposed pipeline alignment during trench excavation.

Groundwater was encountered at or near the proposed pipe invert elevation at borings B-2, B-6, B-7, B-9 and B-11 at the time of our field exploration. We believe it would be prudent to schedule construction activities for the drier season of the year, typically late summer, early fall, when groundwater levels and rainfall are usually near their yearly minimum.

Excavations below groundwater table will require the installation of a temporary dewatering system to facilitate trenching. During trench excavations, weak, wet alluvial soils will be unstable and highly susceptible to caving in. The contractor should be prepared to stabilize trench excavations during pipe construction and to ensure safe working conditions for laborers. We expect that the soils excavated during installation of the pipeline will be re-used as trench backfill.

Table 1 – Summary of Subsurface Information is included at the beginning of Appendix B to facilitate review of areas which may require difficult excavation techniques or excavation below the groundwater elevation.

5.1.3 Fill Placement – Trench Backfill

Soil: Fill materials should be low plasticity soil (Plasticity Index less than 30), free of non-soil materials and rock fragments larger than 3 inches in any one dimension. Based on visual examination, the existing soils, which do not contain appreciable amounts of debris, rock organics or other deleterious materials, generally appear suitable for re-use as structural fill. Soils excavated near or below the existing groundwater elevation will be wet and will require extensive aeration and drying prior to reuse as backfill.

Organic and/or debris laden material is not suitable for re-use as structural fill. Topsoil, mulch and similar organic materials can be wasted in architectural areas. Debris-laden materials should be excavated, transported and disposed of off-site in accordance with appropriate solid waste rules and regulations.

Fill should be placed in thin, horizontal loose lifts (maximum 8-inch) and compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D 698). In confined areas, such as utility trenches or behind retaining walls, portable compaction equipment and thinner fill lifts (3 to 4 inches) may be necessary.

Soil moisture content should be maintained within 3 percent of the optimum moisture content. We recommend that the contractor have equipment on site during earthwork for both drying and wetting fill soils. Moisture control may be difficult during rainy weather.

All structural filling operations should be observed by a NOVA soils technician, who can confirm suitability of material used and uniformity and appropriateness of compaction efforts. NOVA can also document compliance with the specifications by performing field density tests using thin-walled tube, nuclear, or sand cone testing methods (ASTM D 2937, D 2922, or D 1556, respectively). One test per 400 cubic yards and every 2 feet of placed fill is recommended, with test locations well distributed throughout the fill mass. When filling in small areas, at least one test per day per area should be performed.

5.1.4 Difficult Excavation

Very dense soils, PWR and/or auger refusal materials were encountered in several borings within 3.5 feet of the existing ground surface. ***Consequently, we anticipate that materials requiring difficult excavation techniques will be encountered frequently during trench excavation, across a majority of proposed pipeline alignment.***

As discussed in the geology section of this report, the weathering process is erratic and variations in the PWR or rock profile can occur in small lateral distances. Therefore, it is likely that very dense soils, PWR, and/or rock pinnacles or ledges requiring difficult excavation techniques may be encountered in site areas intermediate of our boring locations.

Ripping: Mass excavation of very hard or very dense soils ($\geq$ 50 bpf) and PWR will likely require loosening the material with a large single-toothed ripper or track-mounted backhoe before removal with conventional earthmoving equipment. In confined areas, such as utility trenches and foundations, excavations of very hard or very dense soils ($\geq$ 50 bpf) and PWR, may require either the use of pneumatic tools or light blasting.

Rock Definition: The definition of rock can be source of conflict during construction. If a classified excavation contract is selected by the owner, the following definitions have been incorporated into classified excavation specifications on other projects and are provided for your general guidance.

We recommend that the determination and confirmation of difficult excavation materials be performed by the NOVA geotechnical engineer in accordance with the project specifications. Measurement of the quantities of difficult excavation materials should be performed by the project surveyor.

GENERAL EXCAVATION	
Blast Rock	Any material which cannot be excavated with a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent) or by a Caterpillar 977 front-end loader or equivalent, and occupying an original volume of at least one (1) cubic yard.

TRENCH EXCAVATION	
Trench Rock	Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 25,700 pounds (Caterpillar Model 225 or equivalent), and occupying an original volume of at least one-half (1/2) cubic yard.

5.2 GROUNDWATER CONTROL

5.2.1 General

In our borings located within the pipeline easement, depths to groundwater ranged from 1 to 20 feet below the existing ground surface (approximate elevations ranging from approximately 996 to 1029 feet-MSL). Based on anticipated pipeline invert elevations ranging from approximately 984 to 1024 feet-MSL, we anticipate trench excavations will extend near or below groundwater elevations in several areas. Groundwater control will be required during trench excavation and installation of the pipeline.

As previously noted, groundwater levels are subject to seasonal, climatic and other variations and may be different at other times and locations. The extent and nature of any dewatering required during construction will be dependent on the actual groundwater conditions prevalent at the time of construction and the effectiveness of construction drainage to prevent run-off into open excavations.

5.2.2 Temporary Dewatering

Design of a temporary dewatering system is usually the responsibility of the contractor. However, based on our experience with similar conditions, we believe a conventional construction dewatering system of trenches, sumps and pumps should be possible to control both groundwater and rainfall runoff.

At the time of construction, groundwater must be lowered and continuously maintained at a minimum depth of 3 feet below the working elevation to permit pipeline trenching excavations and construction. The dewatering system should be installed and operational prior to excavation beneath the water table. The dewatering system should remain in continuous operation until the pipe joints have been properly sealed.

5.3 DUCTILE- IRON PIPE RECOMMENDATIONS

Laboratory tests to evaluate the potential corrosiveness of the soils in accordance with ANSI/AWWA C105/A21.5-10 were not included in this Scope of Work. These laboratory tests are used to evaluate various factors that are considered when determining the corrosiveness of soil and is measured by a scoring system. When results of these specific tests are available, the assigned points are totaled. According to Table A.1 of AWWA C105, ten points accumulated or greater indicates that soil is corrosive to ductile iron-pipe and protection is required.

Forsyth County DWR may want to consider laboratory and field testing to determine the corrosive potential of the soils present. Once this potential has been determined, NOVA may recommend protective casing or alternatives to selected pipe materials.

APPENDIX A
Figures and Maps

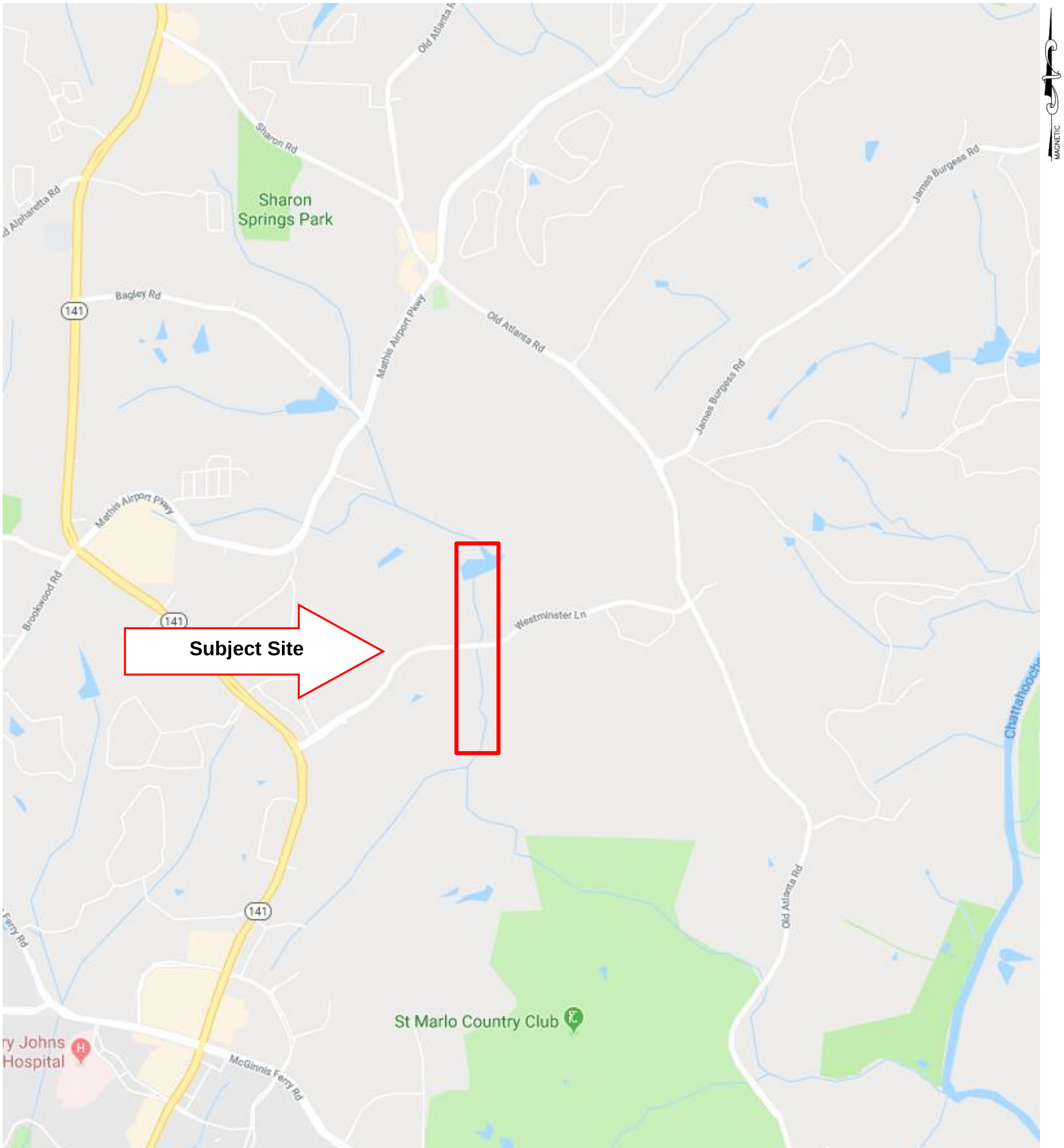

FIGURE 1
SITE LOCATION
Source: Google Maps

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Laurel Springs Gravity Sewer
Suwanee, Georgia
NOVA Project Number 6218006

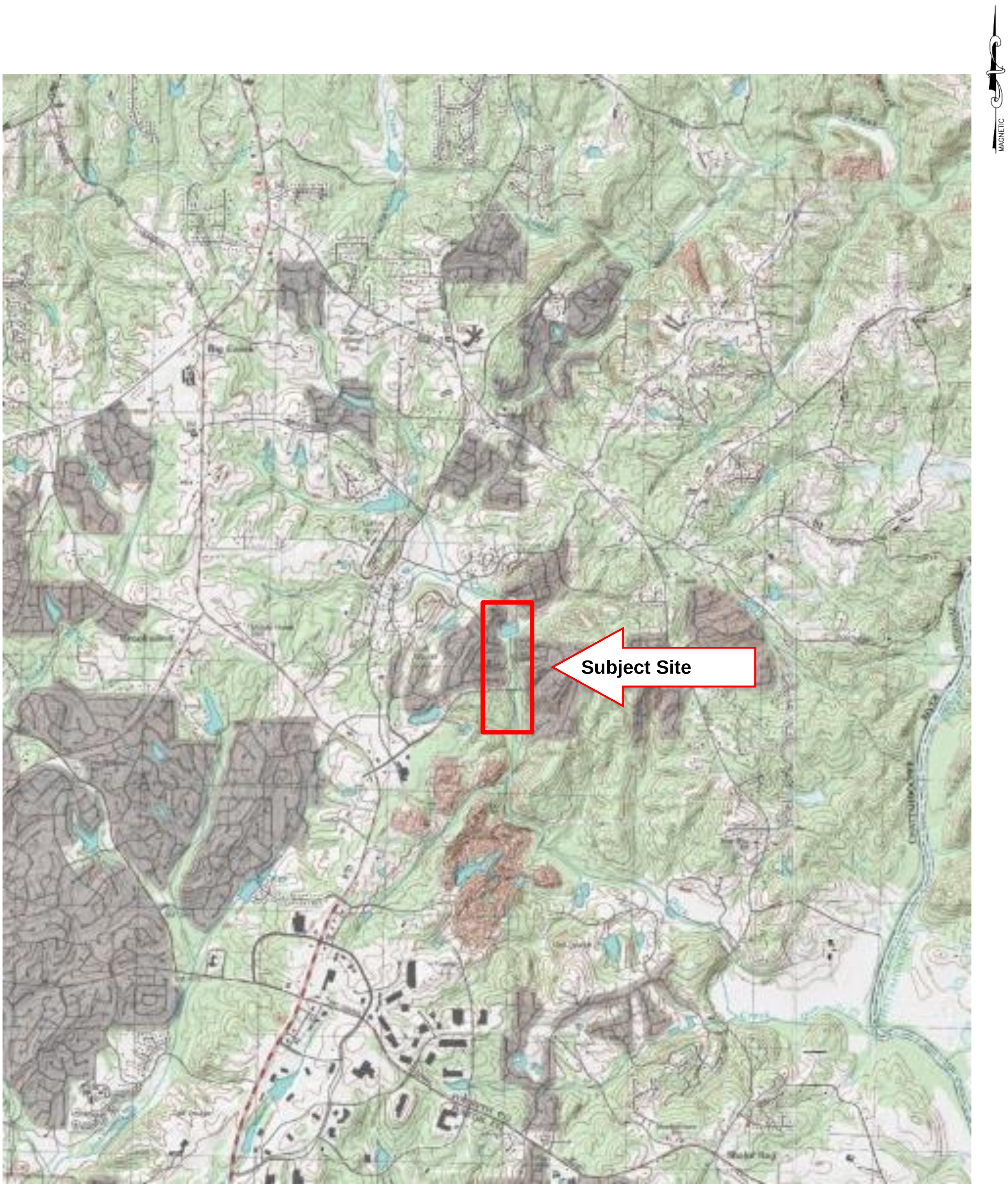

FIGURE 2
TOPOGRAPHIC MAP
Source: http://www.mytopo.com/maps/

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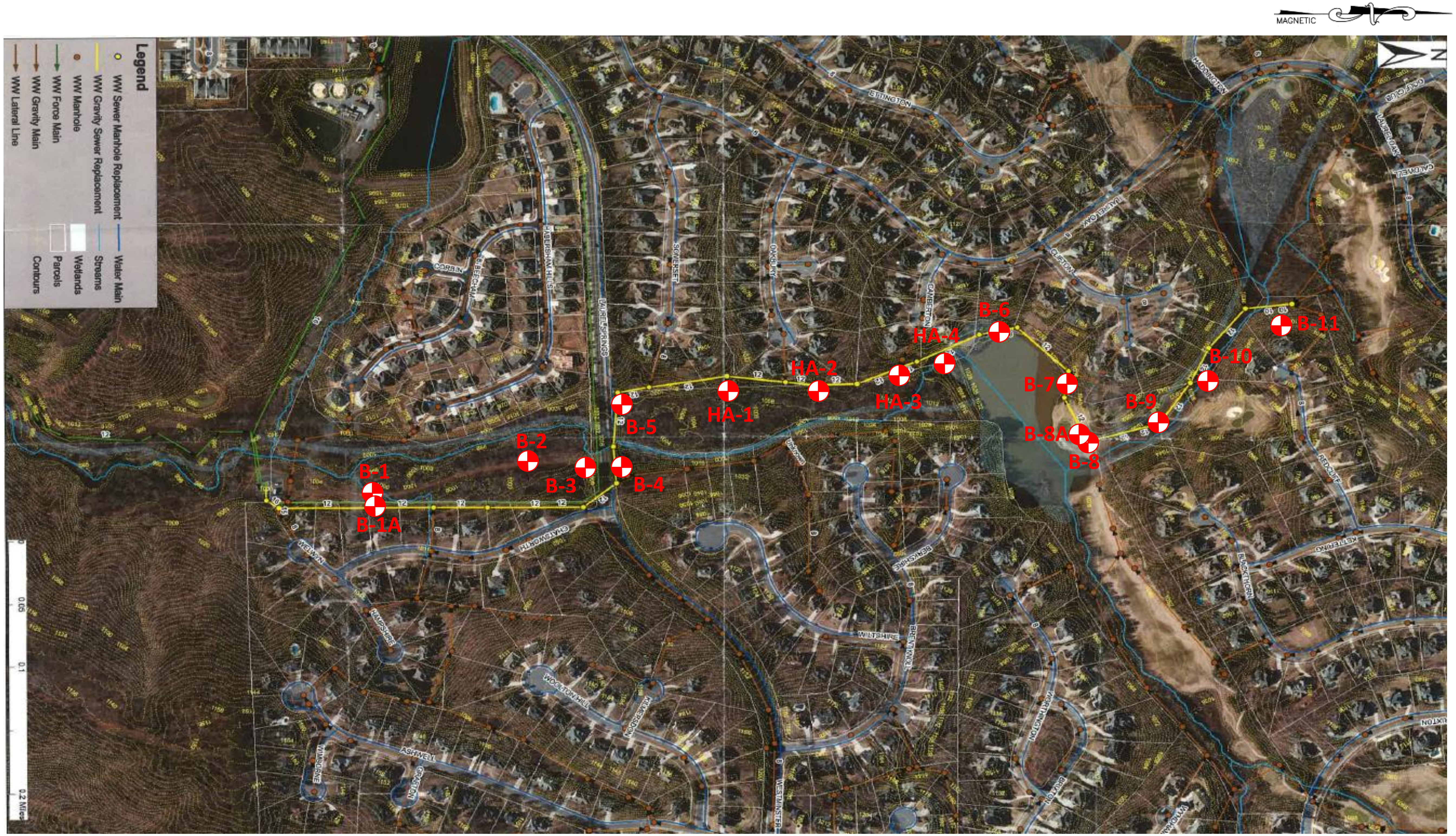
Laurel Springs Gravity Sewer
Suwanee, Georgia
NOVA Project Number 6218006



APPROXIMATE LOCATION OF NOVA SOIL TEST BORINGS

FIGURE 3
BORING SITE LOCATION
Source: Forsyth County Department of Water and Sewer

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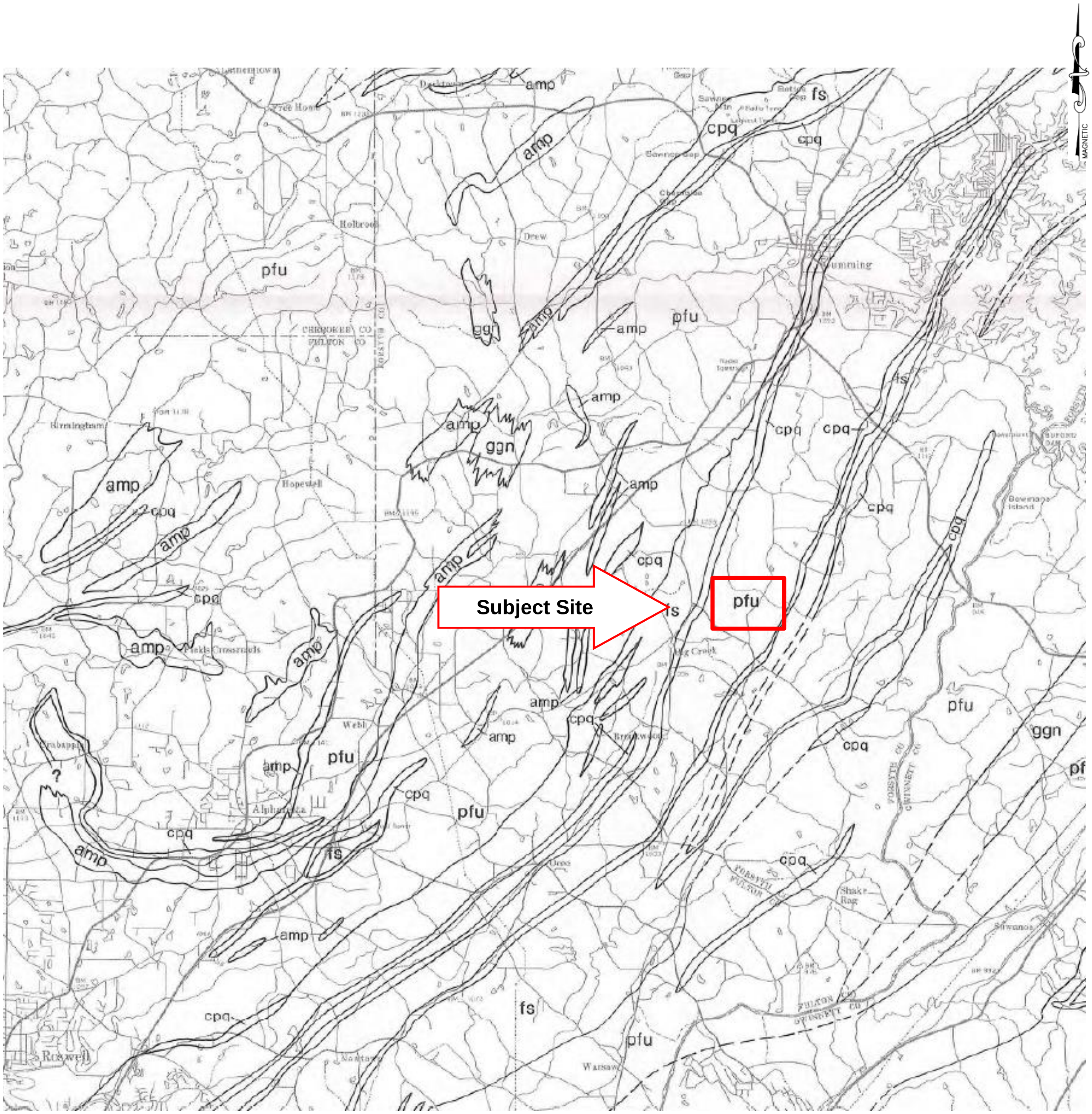
Laurel Springs Gravity Sewer
Suwanee, Georgia
NOVA Project Number 6218006



Powers Ferry Formation (Higgins and McConnell, 1978a; this report): undifferentiated biotite-quartz-plagioclase gneiss (metagraywacke),mica schist and amphibolite (pfu); a mappable mica schist unit (pfs); and banded iron formation (bif). One continuous amphibolite was termed the Mableton amphibolite (rna).

FIGURE 4
REGIONAL GEOLOGY
SOURCE: Geology of The Greater Atlanta Region, GA DNR/EPD/GGS, McConnell and Abrams, Bulletin 96, 1984

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Laurel Springs Gravity Sewer
Suwanee, Georgia
NOVA Project Number 6218006

APPENDIX B
Subsurface Data

TABLE 1 - SUMMARY OF SUBSURFACE INFORMATION

BORING	APPROXIMATE STATION NUMBER	ESTIMATED GROUND SURFACE ELEVATION (ft-MSL)	ESTIMATED INVERT ELEVATION (ft-MSL)	BORING TERMINATION DEPTH (ft)	ESTIMATED ELEVATION TERMINATION DEPTH (ft-MSL)	AUGER REFUSAL DEPTH (ft)	ESTIMATED REFUSAL ELEVATION (ft-MSL)	WATER TABLE DEPTH (ft)	ESTIMATED WATER TABLE ELEVATION (ft-MSL)
B-1	45+75	1004	990	N/A	-	6.0	998	NE	-
B-1A	45+75	1004	990	N/A	-	6.0	998	NE	-
B-2	40+75	1000	992	10.0	990	N/A	-	4.0	996
B-3	35+60	1016	1002	20.0	996	N/A	-	20.0	996
B-4	35+00	1016	1004	15.0	1001	N/A	-	13.0	1003
B-5	32+05	1016	1008	10.0	1006	N/A	-	NE	-
B-6	16+50	1034	1014	N/A	-	17.0	1017	5.0	1029
B-7	13+00	1030	1016	N/A	-	20.0	1010	3.0	1027
B-8	10+50	1034	1016	N/A	-	5.0	1029	NE	-
B-8A	10+50	1034	1016	N/A	-	5.0	1029	NE	-
B-9	8+00	1028	1018	N/A	-	15.0	1013	3.0	1025
B-10	5+50	1038	1018	N/A	-	10.0	1028	NE	-
B-11	0+25	1030	1020	15.0	1015	N/A	-	2.0	1028
HA-1	29+00	1022	1010	N/A	-	1.5	-	NE	-
HA-2	24+60	1017	1010	N/A	-	4.5	1012.5	4.0	1013
HA-3	21+33	1027	1012	N/A	-	1.5	1025.5	NE	-
HA-4	19+50	1026	1014	N/A	-	3.0	1023	1	1025

*Borings HA-1 through HA-4 could not be accessed for machine borings due to steep grades and existing creek.

**Rows highlighted in Blue, the Water Table Depth (ft) is above Invert Elevation of proposed pipeline

***Rows highlighted in Red, the Auger Refusal Depth (ft) is above Invert Elevation of proposed pipeline

****Rows highlighted in Purple, the Water Table Depth (ft) and Auger Refusal Depth (ft) is above Invert Elevation of proposed pipeline

KEY TO SYMBOLS AND CLASSIFICATIONS

DRILLING SYMBOLS

◪	Split Spoon Sample
▯	Undisturbed Sample (UD)
●	Standard Penetration Resistance (ASTM D1586-67)
▼	Water Table at least 24 Hours after Drilling
▽	Water Table 1 Hour or less after Drilling
100/2”	Number of Blows (100) to Drive the Spoon a Number of Inches (2)
NX, NQ	Core Barrel Sizes: 2⅛- and 2-Inch Diameter Rock Core, Respectively
REC	Percentage of Rock Core Recovered
RQD	Rock Quality Designation – Percentage of Recovered Core Segments 4 or more Inches Long
▶	Loss of Drilling Water
MC	Moisture Content Test Performed

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	Number of Blows, “N”	Approximate Relative Density
SANDS	0 – 4	Very Loose
	5 – 10	Loose
	11 – 30	Medium Dense
	31 – 50	Dense
	Over 50	Very Dense

	Number of Blows, “N”	Approximate Consistency
SILTS and CLAYS	0 – 2	Very Soft
	3 – 4	Soft
	5 – 8	Firm
	9 – 15	Stiff
	16 – 30	Very Stiff
	31 – 50	Hard
	Over 50	Very Hard

DRILLING PROCEDURES

Soil sampling and standard penetration testing performed in accordance with ASTM D1586-67. The standard penetration resistance is the number of blows of a 140 pound hammer falling 30 inches to drive a 2-inch O.D., 1⅜-inch I.D. split spoon sampler one foot. Core drilling performed in accordance with ASTM D2113-62T. The undisturbed sampling procedure is described by ASTM D1587-67. Soil and rock samples will be discarded 60 days after the date of the final report unless otherwise directed.

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SOIL CLASSIFICATION CHART

COARSE GRAINED SOILS	**GRAVELS**	Clean Gravel less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with Fines more than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	SANDS	Clean Sand less than 5% fines	SW	Well graded sand
			SP	Poorly graded sand
		Sands with Fines more than 12% fines	SM	Silty sand
			SC	Clayey sand
FINE GRAINED SOILS	**SILTS AND CLAYS** Liquid Limit less than 50	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay and silt
	SILTS AND CLAYS Liquid Limit 50 or more	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic clay and silt
HIGHLY ORGANIC SOILS		Organic matter, dark color, organic odor	PT	Peat

PARTICLE SIZE IDENTIFICATION

GRAVELS	Coarse	¾ inch to 3 inches
	Fine	No. 4 to ¾ inch
SANDS	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
SILTS AND CLAYS		Passing No. 200

NOVA

TEST BORING RECORD B-1

PROJECT: Laurel Springs Gravity Sewer PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 45+75 ELEVATION: 1004 FT-MSL
DRILLER: Betts Environmental Recovery LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger DATE: 5/29/2018
DEPTH TO - WATER> INITIAL: NE AFTER 24 HOURS: CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0		TOPSOIL - 3 Inches	
		FILL - Medium dense tan brown silty medium to fine SAND	16
5	1000	RESIDUUM - Medium dense brown tan micaceous silty medium to fine SAND	29
		PARTIALLY WEATHERED ROCK - Sampled as very dense tan brown slightly micaceous silty medium to fine SAND, with small rock fragments	100/4"
		Auger Refusal at 6 ft.	
10	995		
15	990		
20	985		
25	980		
30	975		
35	970		

Graphic Depiction: BLOW COUNT; NATURAL MOISTURE; PLASTIC LIMIT ├──┤ LIQUID LIMIT; scale 10, 20, 30, 40, 60, 100

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

NOVA

TEST BORING RECORD B-1A

PROJECT: Laurel Springs Gravity Sewer — PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 45+75 — ELEVATION: 1004 FT-MSL
DRILLER: Betts Environmental Recovery — LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger — DATE: 5/29/2018
DEPTH TO - WATER> INITIAL: NE — AFTER 24 HOURS: ___ — CAVING> ___

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

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0	1004	TOPSOIL - 3 Inches	
		FILL - Medium Dense tan brown silty medium to fine SAND	30
		RESIDUUM - Dense brown tan micaceous silty medium to fine SAND	35
		PARTIALLY WEATHERED ROCK - Sampled as very dense brown tan slightly micaceous silty medium to fine SAND, with small rock fragments	100/4"
		Auger Refusal at 6 ft.	

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35. Elevation scale: 1000, 995, 990, 985, 980, 975, 970.

Graphic Depiction: ● BLOW COUNT; ▲ NATURAL MOISTURE; PLASTIC LIMIT |—| LIQUID LIMIT; scale 10, 20, 30, 40, 60, 100

NOVA

TEST BORING RECORD B-2

PROJECT: Laurel Springs Gravity Sewer | PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 40+75 | ELEVATION: 1000 FT-MSL
DRILLER: Betts Environmental Recovery | LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger | DATE: 5/29/2018
DEPTH TO - WATER> INITIAL: 4 | AFTER 24 HOURS: | CAVING>

Graphic Depiction legend: ● BLOW COUNT; ▲ NATURAL MOISTURE; PLASTIC LIMIT |——| LIQUID LIMIT; scale: 10, 20, 30, 40, 60, 100

Depth (feet)	Elevation (ft-MSL)	Description	Groundwater	N-Value
0	1000	TOPSOIL - 3 Inches		
		FILL - Loose brown tan silty medium to fine SAND		6
		RESIDUUM - Very loose black brown slightly micaceous silty medium to fine SAND	▽ (4 ft)	
5	995			2
		Dense brown orange tan micaceous silty medium to fine SAND, with small rock fragments		36
10	990	PARTIALLY WEATHERED ROCK - Sampled as black orange white very dense silty medium to fine SAND, with small rock fragments		100/10"
		Boring Terminated at 10 ft.		
15	985			
20	980			
25	975			
30	970			
35	965			

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

NOVA

TEST BORING RECORD B-3

PROJECT: Laurel Springs Gravity Sewer	PROJECT NO.: 6218006
CLIENT: Forsyth County	
PROJECT LOCATION: Suwanee, GA	
LOCATION: STA 35+60	ELEVATION: 1016 FT-MSL
DRILLER: Betts Environmental Recovery	LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger	DATE: 5/29/2018
DEPTH TO - WATER> INITIAL: 20	AFTER 24 HOURS: CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0	1016	TOPSOIL - 3 Inches	
0.25–3	1015	FILL - Medium dense red brown silty medium to fine SAND, with small rock fragments	20
3–9		RESIDUUM - Loose to medium dense red brown micaceous silty medium to fine SAND	7, 17
9–14		Medium dense red white slightly micaceous medium to fine SAND, with small rock fragments	13
14–19		Very loose red brown micaceous silty medium to fine SAND, with small rock fragments	2
19–20		PARTIALLY WEATHERED ROCK - Sampled as very dense brown white micaceous silty medium to fine SAND, with small rock fragments	100/10"
20		Boring Terminated at 20 ft.	

Groundwater: encountered at 20 ft (initial).

Graphic Depiction: ● BLOW COUNT ▲ NATURAL MOISTURE; PLASTIC LIMIT ├──┤ LIQUID LIMIT; scale 10 20 30 40 60 100

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

TEST BORING RECORD B-4

NOVA

PROJECT: Laurel Springs Gravity Sewer
PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 35+00
ELEVATION: 1016 FT-MSL
DRILLER: Betts Environmental Recovery
LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger
DATE: 5/29/2018
DEPTH TO - WATER> INITIAL: 13 AFTER 24 HOURS: CAVING>

Graphic Depiction: ● BLOW COUNT ▲ NATURAL MOISTURE PLASTIC LIMIT |—| LIQUID LIMIT (scale 10, 20, 30, 40, 60, 100)

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0	1016	TOPSOIL - 3 Inches	
0.25–6		FILL - Loose to medium dense red brown micaceous silty medium to fine SAND, with small rock fragments	18, 10
6–8.5	1010	Very loose red brown micaceous silty medium to fine SAND, with small rock fragments	4
8.5–10		ALLUVIUM - Very loose gray silty fine SAND	WOH
10–13.5		RESIDUMM - Very loose tan silty medium to fine SAND, with small rock fragments	
13.5–15		PARTIALLY WEATHERED ROCK - Sampled as very dense red brown white micaceous silty medium to fine SAND, with small rock fragments	100/10"

Boring Terminated at 15 ft.

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

NOVA

TEST BORING RECORD B-5

PROJECT: Laurel Springs Gravity Sewer — PROJECT NO.: 6218006

CLIENT: Forsyth County

PROJECT LOCATION: Suwanee, GA

LOCATION: STA 32+05 — ELEVATION: 1016 FT-MSL

DRILLER: Betts Environmental Recovery — LOGGED BY: KRL

DRILLING METHOD: Hollow Stem Auger — DATE: 5/29/2018

DEPTH TO - WATER> INITIAL: NE — AFTER 24 HOURS: — CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1016	TOPSOIL - 3 Inches				
0.25–3	1015	FILL - Very loose red tan brown silty medium to fine SAND, with a trace of ORGANICS			Split spoon	2
3–10		RESIDUUM - Medium dense red brown tan micaceous silty medium to fine SAND, with small rock fragments			Split spoon	14
	1010				Split spoon	12
10	1006	Boring Terminated at 10 ft.			Split spoon	16

Graphic Depiction

● BLOW COUNT

▲ NATURAL MOISTURE

PLASTIC LIMIT ├──┤ LIQUID LIMIT

10 20 30 40 60 100

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

NOVA

TEST BORING RECORD B-6

PROJECT: Laurel Springs Gravity Sewer
PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 16+50
ELEVATION: 1034 FT-MSL
DRILLER: Betts Environmental Recovery
LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger
DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: 5 AFTER 24 HOURS: CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL - 3 Inches				
		RESIDUUM - Very loose to loose red tan brown micaceous silty fine to medium SAND, with small rock fragments				6
5	1030			▽		2
						2
10	1025					3
15	1020					6
		PARTIALLY WEATHERED ROCK - No Recovery				100/4"
		Auger Refusal at 17 ft.				
20	1015					
25	1010					
30	1005					
35	1000					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ├──┤ LIQUID LIMIT
10 20 30 40 60 100

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

NOVA

TEST BORING RECORD B-7

PROJECT: Laurel Springs Gravity Sewer
PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 13+00
ELEVATION: 1030 FT-MSL
DRILLER: Betts Environmental Recovery
LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger
DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: 3 AFTER 24 HOURS: CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0	1030	TOPSOIL - 3 Inches	
		RESIDUUM - Very loose to loose red tan brown micaceous silty medium to fine SAND, with small rock fragments	5
5	1025		2
			WOH
10	1020		WOH
15	1015	Medium dense red brown micaceous silty SAND, with small rock fragments	19
20	1010	PARTIALLY WEATHERED ROCK - No Recovery	100/ 20"
		Auger Refusal at 20 ft.	
25	1005		
30	1000		
35	995		

Graphic Depiction: BLOW COUNT, NATURAL MOISTURE, PLASTIC LIMIT, LIQUID LIMIT (scale 10, 20, 30, 40, 60, 100)

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

NOVA

TEST BORING RECORD B-8

PROJECT: Laurel Springs Gravity Sewer	PROJECT NO.: 6218006
CLIENT: Forsyth County	
PROJECT LOCATION: Suwanee, GA	
LOCATION: STA 10+50	ELEVATION: 1034 FT-MSL
DRILLER: Betts Environmental Recovery	LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger	DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: NE	AFTER 24 HOURS:
CAVING>	

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL - 3 Inches				
		RESIDUUM - Very loose to loose red brown micaceous silty fine to medium SAND, with small rock fragments				8
5	1030	PARTIALLY WEATHERED ROCK - Sampled as very dense red tan brown micaceous fine to medium SAND, with small rock fragments				100/6"
		Auger Refusal at 5 ft.				
10	1025					
15	1020					
20	1015					
25	1010					
30	1005					
35	1000					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT |———| LIQUID LIMIT
10 20 30 40 60 100

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

NOVA

TEST BORING RECORD B-8A

PROJECT: Laurel Springs Gravity Sewer | PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 10+50 | ELEVATION: 1034 FT-MSL
DRILLER: Betts Environmental Recovery | LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger | DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: NE | AFTER 24 HOURS: | CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL - 3 Inches				
		RESIDUUM - Loose tan brown micaceous silty fine to medium SAND, with small rock fragments				9
5	1030	PARTIALLY WEATHERED ROCK - Sampled as very dense brown red tan micaceous fine to medium SAND, with small rock fragments				100/2"
		Auger Refusal at 5 ft.				
10	1025					
15	1020					
20	1015					
25	1010					
30	1005					
35	1000					

Graphic Depiction: ● BLOW COUNT; ▲ NATURAL MOISTURE; PLASTIC LIMIT |——| LIQUID LIMIT; scale 10, 20, 30, 40, 60, 100

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

NOVA

TEST BORING RECORD B-9

PROJECT: Laurel Springs Gravity Sewer — PROJECT NO.: 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 8+00 — ELEVATION: 1028 FT-MSL
DRILLER: Betts Environmental Recovery — LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger — DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: 3 — AFTER 24 HOURS: — CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0	1028	TOPSOIL - 3 Inches	
		RESIDUMM - Very loose to loose tan brown micaceous silty medium to fine SAND, with small rock fragments	6
3	1025	(Groundwater, initial)	
5			WOH
			3
8.5	1020	Dense red tan micaceous silty medium to fine SAND, with small rock fragments	44
13.5	1015	PARTIALLY WEATHERED ROCK - Sampled as very dense tan gray micaceous medium to fine SAND, with small rock fragments	100/8"
15		Auger Refusal at 15 ft.	

Graphic Depiction: ● BLOW COUNT; ▲ NATURAL MOISTURE; PLASTIC LIMIT |—| LIQUID LIMIT; scale 10, 20, 30, 40, 60, 100

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

NOVA

TEST BORING RECORD B-10

PROJECT: Laurel Springs Gravity Sewer	PROJECT NO.: 6218006
CLIENT: Forsyth County	
PROJECT LOCATION: Suwanee, GA	
LOCATION: STA 5+50	ELEVATION: 1038 FT-MSL
DRILLER: Betts Environmental Recovery	LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger	DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: NE	AFTER 24 HOURS: CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	N-Value
0		TOPSOIL - 3 Inches	
		FILL - Loose tan brown micaceous silty medium to fine SAND, with small rock fragments	4
5	1035		5
		RESIDUUM - Loose brown red micaceous silty medium to fine SAND	6
10	1030	PARTIALLY WEATHERED ROCK - Sampled as very dense brown red tan micaceous medium to fine SAND, with small rock fragments	100/3"
		Auger Refusal at 10 ft.	
15	1025		
20	1020		
25	1015		
30	1010		
35	1005		

Graphic Depiction: ● BLOW COUNT ▲ NATURAL MOISTURE; PLASTIC LIMIT |—| LIQUID LIMIT; scale 10 20 30 40 60 100

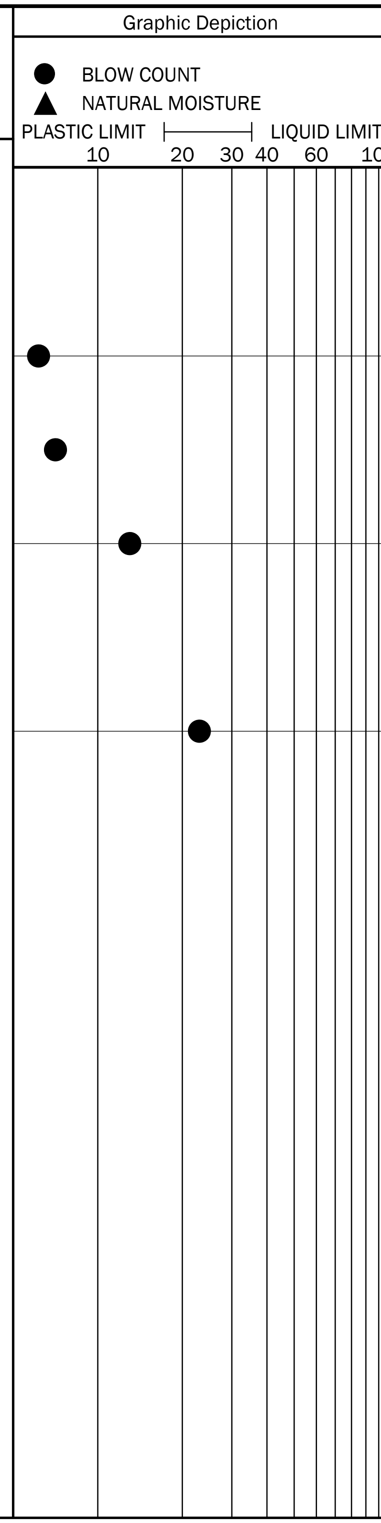
This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD
B-11

PROJECT: Laurel Springs Gravity Sewer	PROJECT NO.: 6218006
CLIENT: Forsyth County	
PROJECT LOCATION: Suwanee, GA	
LOCATION: STA 0+25	ELEVATION: 1030 FT-MSL
DRILLER: Betts Environmental Recovery	LOGGED BY: KRL
DRILLING METHOD: Hollow Stem Auger	DATE: 6/15/2018
DEPTH TO - WATER> INITIAL: 2	AFTER 24 HOURS:
CAVING>	

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0	1030	TOPSOIL - 3 Inches				
		RESIDUUM - Very loose to loose tan brown black micaceous silty medium to fine SAND, with small rock fragments		▽ (2 ft)		WOH
5	1025					3
						5
10	1020	Medium dense orange brown white micaceous silty medium to fine SAND, with small rock fragments				13
15	1015					23
		Boring Terminated at 15 ft.				
20	1010					
25	1005					
30	1000					
35	995					



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

NOVA ENGINEERING AND ENVIRONMENTAL

HAND AUGER BORING RECORD HA-1

PROJECT: Laurel Springs Gravity Sewer **PROJECT NO.:** 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 29+00 **ELEVATION:** 1022 FT-MSL
DRILLER: KRL **LOGGED BY:** KRL
DRILLING METHOD: Hand Auger **DATE:** 7/2/2018
DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:** **CAVING>**

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	DCP Blows per 1-3/4 inches	Graphic Depiction (● BLOW COUNT, ▲ NATURAL MOISTURE, PLASTIC LIMIT ├─┤ LIQUID LIMIT; 10 20 30 40 60 100)
0	1022	TOPSOIL - 3 Inches				5	
		RESIDUUM - Loose brown red slightly micaceous silty medium to fine SAND					
		Medium dense brown red slightly micaceous silty medium to fine SAND, with small rock fragments				25	
2	1020	Hand Auger Refusal at 1.5 ft.					
4	1018						
6	1016						
8	1014						
10	1012						
12	1010						
14	1008						

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

NOVA ENGINEERING AND ENVIRONMENTAL

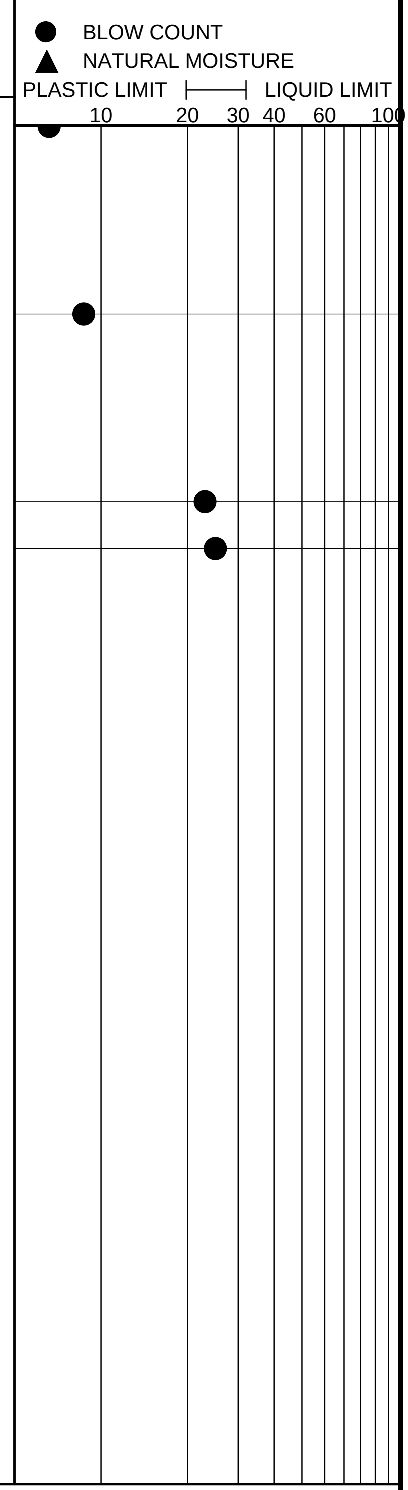
HAND AUGER BORING RECORD HA-2

PROJECT: Laurel Springs Gravity Sewer **PROJECT NO.:** 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 24+60 **ELEVATION:** 1017 FT-MSL
DRILLER: KRL **LOGGED BY:** KRL
DRILLING METHOD: Hand Auger **DATE:** 7/2/2018
DEPTH TO - WATER> INITIAL: 4 **AFTER 24 HOURS:** **CAVING>**

Depth (feet)	Elevation (ft-MSL)	Description	Groundwater	DCP Blows per 1-3/4 inches
0	1017	TOPSOIL - 3 Inches		
		FILL - Very loose to loose brown red tan slightly micaceous silty medium to fine SAND, with a trace of organics		4
2				8
		Medium dense brown tan orange slightly micaceous silty medium to fine SAND, with small rock fragments		
	1014	ALLUVIUM - Medium dense gray silty medium to fine SAND		
4		RESIDUUM - Medium dense tan orange slightly micaceous silty medium to fine SAND, with small rock fragments	▽	23
		Hand Auger Refusal at 4.5 ft.		25

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14. Elevation scale: 1016, 1014, 1012, 1010, 1008, 1006, 1004.

Graphic Depiction



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

NOVA ENGINEERING AND ENVIRONMENTAL

HAND AUGER BORING RECORD HA-3

PROJECT: Laurel Springs Gravity Sewer		**PROJECT NO.:** 6218006	
CLIENT: Forsyth County			
PROJECT LOCATION: Suwanee, GA			
LOCATION: STA 21+33		**ELEVATION:** 1027 FT-MSL	
DRILLER: KRL		**LOGGED BY:** KRL	
DRILLING METHOD: Hand Auger		**DATE:** 7/2/2018	
DEPTH TO - WATER> INITIAL: NE	**AFTER 24 HOURS:**	**CAVING>** C	

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

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	DCP Blows per 1-3/4 inches
0		TOPSOIL - 3 Inches				4
	1026	FILL - Very loose brown red slightly micaceous silty medium to fine SAND				
		RESIDUUM - Medium dense brown red slightly micaceous silty medium to fine SAND, with small rock fragments				25
2		Hand Auger Refusal at 1.5 ft.				
	1024					
4						
	1022					
6						
	1020					
8						
	1018					
10						
	1016					
12						
	1014					
14						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ├───┤ LIQUID LIMIT
10 20 30 40 60 100

NOVA ENGINEERING AND ENVIRONMENTAL

HAND AUGER BORING RECORD HA-4

PROJECT: Laurel Springs Gravity Sewer **PROJECT NO.:** 6218006
CLIENT: Forsyth County
PROJECT LOCATION: Suwanee, GA
LOCATION: STA 19+50 **ELEVATION:** 1026 FT-MSL
DRILLER: KRL **LOGGED BY:** KRL
DRILLING METHOD: Hand Auger **DATE:** 7/2/2018
DEPTH TO - WATER> INITIAL: 1 **AFTER 24 HOURS:** **CAVING>**

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	DCP Blows per 1-3/4 inches
0	1026	TOPSOIL - 3 Inches				14
		RESIDUUM - Medium dense slightly micaceous red brown tan silty medium to fine SAND, with small rock fragments		▽ (1 ft)		
2	1024					24
3		Hand Auger Refusal at 3 ft.				25
4	1022					
6	1020					
8	1018					
10	1016					
12	1014					
14	1012					

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ├──┤ LIQUID LIMIT
10 20 30 40 60 100

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

APPENDIX C
Qualifications of Recommendations

QUALIFICATIONS OF RECOMMENDATIONS

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study and our past experience. If additional information becomes available that might impact our geotechnical opinions, it will be necessary for NOVA to review the information, reassess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between borings will differ from those encountered at specific boring locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process have altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this geotechnical report are not final. Field observations and foundation installation monitoring by the geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and foundation construction, are an extension of this report. Therefore, NOVA should be retained by the owner to observe all earthwork and foundation construction to document that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations. NOVA is not responsible or liable for the conclusions and recommendations presented in this report if NOVA does not perform these observation and testing services.

This report is intended for the sole use of CLIENT only. The scope of work performed during this study was developed for purposes specifically intended by CLIENT and may not satisfy other users' requirements. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. NOVA is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

Our professional services have been performed, our findings obtained, our conclusions derived and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices in the State of Georgia. This warranty is in lieu of all other statements or warranties, either expressed or implied.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

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