

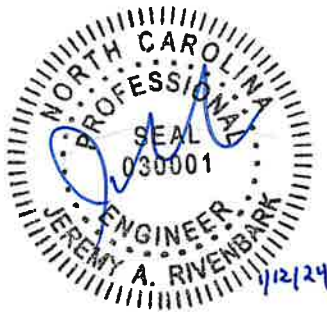
ADDENDUM NUMBER 1

DATE: January 12, 2024  
PROJECT: 2023 WATER MAIN REPLACEMENT  
TOWN OF CARY JOB No. WT3305  
OWNER: TOWN OF CARY, NORTH CAROLINA  
ENGINEER: CJS Conveyance, PLLC  
TO: All Planholders

This Addendum forms a part of the Contract Documents and modifies the Bidding Documents dated March 14, 2022 with amendments and additions noted herein below.

Acknowledge receipt of this Addendum in the space provided in the Bid form. Failure to do so may disqualify the Bidder.

This Addendum consists of 48 pages:



## **CHANGES TO THE SPECIFICATIONS:**

### Section 00300 – BID PROPOSAL

00300-4 to 00300-6

Remove two pages consisting of the bid form and replace with the new bid form provided as Attachment No.1 included with this addendum.

### Section 02651 – CURED-IN-PLACE PIPE LINING (CIPP) FOR MAIN SEWERS

Page 02651-1 to 02651-17

Remove the section entirely and replace it with Attachment No. 2 included in this addendum.

### Section 02651A – CURED-IN-PLACE PIPE LINING (CIPP) FOR MAIN SEWERS ULTRAVIOLET LIGHT CURED CIPP

Page 02651-11

Part 3 – C. Delete the following sentence:

“Refer to Section 01010 for requirements.”

### Section 21000 – SPECIAL CONSTRUCTION

Page 21000-1 to 21000-9

Remove pages consisting of Section 21000 – Special Construction and replace them with the new Section 21000 – Special Construction provided as Attachment No. 3 included with this addendum.

### Appendix 3

Insert Geotechnical Investigation report provided as Attachment No. 4 included with this addendum following Appendix Part 2 – Approved Products

## **QUESTIONS, CLARIFICATIONS, AND ADDITIONAL INFORMATION:**

- *Question – Is there a mandatory Pre-Bid Meeting?* **Answer – No.**
- *Question – Can the Owner please identify a location for the disposal of decanted solids from the pipe cleaning operations?* **Answer – The Town does not have a disposal site for debris/solids removed during cleaning operations. The contractor will need to make arrangements for disposing of the material at an appropriate facility.**

- *Question - Can the tensile strength requirement be removed? Per ASTM F1216 the tensile strength requirement is only for pressure pipes.* **Answer - Tensile strength has been removed.**
- *Question – Please confirm that the 350.2LF of pipe to be CIPP lined on Union Street is in fact 8" diameter and not 6" as identified on Plan C13.* **Answer - The 350.2 LF of pipe to be CIPP lined on Union Street is 6" in diameter, as noted. The bid form with a new line item for 6" CIPP Lining for Addendum #1 has been updated.**
- *Question – Please confirm that the total amount of 8" pipe as shown on Bid Item 33 - 8-inch CIPP Lining is correct.* **Answer - The total quantity of 8-inch CIPP lining (Bid Item 33) has been reduced to 1,390 LF.**
- *Question – Specification Section 01010 pertaining to traffic control is identified in several sections but has not been provided in the Project Manual. Please provide Section 01010.* **Answer - References to Section 01010 have been removed in Sections 02651 and 02651A.**

-END OF DOCUMENT-

**BID PROPOSAL**  
**GENERAL CONSTRUCTION**  
**FOR THE**  
**2023 WATER MAIN REPLACEMENT**  
**TOWN OF CARY PROJECT No. WT3305**  
 (the "Project")

**TOTAL "BID" PRICE** for the construction of the Project complete as indicated by the Contract Documents (in words and figures):

\_\_\_\_\_ Dollars

and \_\_\_\_\_ Cents (\$ \_\_\_\_\_)

Bidder \_\_\_\_\_ (Print)

**ITEMIZED PROPOSAL**

ITEM NO	ITEM DESCRIPTION	SPECIFICATION REFERENCE	UNIT	ESTIMATED QUANTITY	UNIT BID PRICE	AMOUNT BID
<b>SITE PREPARATION</b>						
1	Mobilization (5% Maximum)	700	LS	1		
2	Temporary Traffic Control	20000/21000	LS	1		
3	Construction Staking & Surveying	700	LS	1		
4	Restoration of Lawn Grass	21000	LS	1		
<b>WATER MAIN</b>						
5	4" RJ DI Waterline	10000	LF	250		
6	6" RJ DI Waterline	10000	LF	420		
7	8" RJ DI Waterline	10000	LF	3500		
8	12" RJ DI Waterline	10000	LF	60		
9	Fire Hydrant Assembly	10000	EA	7		
<b>DUCTILE IRON FITTINGS</b>						
10	Ductile Iron Fittings (Restrained)	10000/21000	LBS	5000		
11	6"X6" TS&V	10000	EA	1		
12	8"x8" TS&V	10000	EA	2		
13	20"x8" TS&V	10000	EA	1		
14	4-inch Gate Valve Assembly	10000	EA	1		
15	6- inch Gate Valve Assembly	10000	EA	3		
16	8-inch Gate Valve Assembly	10000	EA	16		
17	Connect to Existing 6" Gate Valve	10000/21000	EA	1		
18	Connect to Existing 8" Gate Valve	10000/21000	EA	1		

19	2" Blow Off Assembly	10000	EA	1		
20	Pipe Crossing/ Concrete Cradle	21000	EA	1		
21	Single 1-inch Water Service Connection	10000/21000	EA	60		
22	Single 1-inch Water Service Connection (SW Maynard Rd)	10000/21000	EA	3		
23	Vacuum Excavation	21000	EA	10		
24	Remove/Abandon Existing Fire Hydrant Assembly	10000	EA	6		
25	Abandon Existing Gate Valve In-Place	10000	EA	15		
26	Abandon Existing 6-inch PVC Water Main (Fill With Grout)	10000	LF	1560		
27	Abandon Existing 6-inch AC Water Main (Fill With Grout)	10000	LF	1000		
28	Abandon Existing 2-inch Galvanized Water Main (Fill With Grout)	10000	LF	1110		
<b>SANITARY SEWER</b>						
29	Remove existing sewer and replace with 8" DIP Sanitary Sewer Pipe (0-6' Deep)	11000	LF	430		
30	Remove existing sewer and replace with 8" DIP Sanitary Sewer Pipe (6-8' Deep)	11000	LF	640		
31	Remove existing sewer and replace with 8" DIP Sanitary Sewer Pipe (8-10' Deep)	11000	LF	60		
32	Remove existing sewer and replace with 8" DIP Sanitary Sewer Pipe (10-12' Deep)	11000	LF	20		
33	8-inch CIPP Lining	02651/02651A	LF	1390		
34	6-inch CIPP Lining	02651/02651A	LF	360		
35	Sewer Cleaning and Television Inspection	02650	LF	1980		
<b>STORM DRAINAGE</b>						
36	Remove and Replace Storm RCP (Allowance if Needed)	11000	LS	1	\$10,000.00	
<b>ROADWAY REPAIR</b>						
37	Pavement Repair Patch- Type S.9.5B	5000/21000	TON	360		
38	Pavement Repair Patch- Type I19.0B	5000/21000	TON	920		
39	Mill (1.5")	5000/21000	SY	950		
40	ABC Including Subgrade Removal	5000/21000	CY	5000		

41	Exploratory Excavation 1/2 Day	21000	EA	4		
42	Thermostriping	21000	LS	1		
<b>CONCRETE WORK</b>						
43	Remove & Replace Concrete Curb	6000	LF	300		
<b>EROSION CONTROL</b>						
44	Curb Inlet Protection (Sack)	16000/21000	EA	20		

**TOTAL BID PRICE** for the construction of the Project complete as indicated by the Contract Documents (in words and figures):

\_\_\_\_\_ Dollars  
and \_\_\_\_\_ Cents (\$\_\_\_\_\_)

Bidder \_\_\_\_\_ (Print)

NOTE: PROPOSAL SIGNATURE REQUIRED ON PAGE 00300-10. ALL PROPOSALS MUST BE PROPERLY EXECUTED TO BE CONSIDERED A VALID BID.

**SECTION 02651**

**CURED-IN-PLACE PIPE LINING (CIPP) FOR MAIN SEWERS**

**PART 1 GENERAL**

**1.1 SCOPE**

A. Work under this section consists of furnishing all materials, labor, and equipment required for the installation of cured-in-place pipe (CIPP) in main sewers.

**1.2 DESIGN AND PERFORMANCE REQUIREMENTS**

A. The CIPP shall be designed for a life of 50 years or greater in accordance with ASTM F1216, Appendix X1, for “fully deteriorated gravity pipe conditions.” The minimum installed, cured liner thickness shall be as listed below when using a standard felt liner. When a fiberglass reinforced felt liner is required, the Contractor shall submit CIPP thickness calculations. The Bid Form and/or Drawings may require the thicknesses for installation based on the Engineer’s decision for specific installations and may list specific thicknesses for larger diameter sewers.

**1.3 A.**

<u>Nominal Sewer Dia.</u>	<u>CIPP Wall Thickness</u>	<u>Sewer Depth</u>
6” sewer:	4.0 mm	(0’ to 20’ deep)
	7.5 mm	(20’ to 28’ deep)
8” sewer:	6.0 mm	(0’ to 20’ deep)
	7.5 mm	(20’ to 28’ deep)
10” sewer:	6.0 mm	(0’ to 14’ deep)
	7.5 mm	(14’ to 25’ deep)
12” sewer:	7.5 mm	(0’ to 16’ deep)
	9.0 mm	(16’ to 24’ deep)
15” sewer:	7.5 mm	(0’ to 10’ deep)
	9.0 mm	(10’ to 16’ deep)
	10.5 mm	(16’ to 24’ deep)
16” sewer:	7.5 mm	(0’ to 8’ deep)
	9.0 mm	(8’ to 13’ deep)
	10.5 mm	(13’ to 18’ deep)
	12.0 mm	(18’ to 24’ deep)

18" sewer:	9.0 mm	(0' to 10' deep)
	10.5 mm	(10' to 14' deep)
	12.0 mm	(14' to 19' deep)
	13.5 mm	(19' to 24' deep)
21" sewer:	10.5 mm	(0'-10' deep)
	12.0 mm	(10' to 13' deep)
	13.5 mm	(13' to 17' deep)
24" sewer:	12.0 mm	(0' to 10' deep)
	13.5 mm	(10' to 13' deep)
	15.0 mm	(13' to 16' deep)
27" sewer:	13.5 mm	(0' to 10' deep)
	15.0 mm	(10' to 12' deep)
	16.5 mm	(12' to 15' deep)
	18.0 mm	(15' to 18' deep)
30" sewer:	15.0 mm	(0' to 10' deep)
	16.5 mm	(10' to 12' deep)
	18.0 mm	(12' to 14' deep)
	19.5 mm	(14' to 17' deep)

C. The cured liner shall have the following minimum structural properties:

Flexural Strength of 4,500 psi in accordance with ASTM D 790  
 Flexural Modulus of 250,000 psi in accordance with ASTM D 790

D. The required structural CIPP wall thickness shall be based on the following design parameters:

Design Safety Factor	2.0
Short-Term Flexural Modulus	250,000 psi
Long-Term Flexural Modulus	125,000 psi
Flexural Strength	4,500 psi.
Creep Retention Factor	50%
Ovality	2%
Soil Modulus	1,000 psi
Soil Density	120 pounds per cubic foot
Soil Coefficient of Friction	0.130 r
Groundwater Depth	Ground Surface Elevation
Live Load	H20 Highway
Poisson's Ratio	0.3
Enhancement Factor, K	7
Service Temperature Range	40 to 140 degrees F
Maximum Long-Term Deflection	5 percent

#### 1.4 SUBMITTALS

- A. Submit a contractor statement of qualifications in accordance with Section 1.6 QUALIFICATIONS of this specification which identifies key personnel and their specific CIPP experience, and recent projects listing the total length installed by host pipe diameter. Work and personnel experience listed must reference projects that used process method and materials to be used on this project. Include project names, references/contacts and phone numbers.
- B. Submit product data for the fabric tube, resin, catalysts, and waterstops demonstrating conformance to the specifications.
- C. Submit manufacturer material certifications for the fabric tube and resin that state conformance to the specifications. The felt tube manufacturer shall provide in their certification a statement identifying how many years they have produced the felt tube. Material certifications shall be current and must reference the project.
- D. Submit manufacturers' shipping, storage and handling recommendations for all components of the CIPP system.
- E. Submit CIPP wet-out information. Wet-out information shall include the identification of the wet-out facility and process description and a sample wet-out form. The wet-out forms shall document, at a minimum, the date and time of wet-out, the wet-out supervisor, the wet-out facility address, the location where the CIPP will be installed (by manhole numbers), the CIPP diameter, the length of wet-tube and dry-tube, the thickness of the CIPP, the roller gap setting for establishing the liner thickness, the felt manufacturer, the resin used (by product name and batch/shipment number) and quantity, the catalyst(s) used (by product name) and quantity, any quality control samples taken, and all else pertinent to the wet-out process.
- F. Installation procedures and curing schedules shall be submitted. Installation procedures shall include acceptable inversion heads and pressures, heating ("cooking") and cool-down procedures and temperatures for varying sewer diameters/lengths/depths, times for each stage of the process, and cure logs for the resin/resin system used. The Contractor shall provide this information without delay or claim to any confidentiality. Testing procedures and quality control procedures shall also be submitted.
- G. Submit a sample CIPP installation report. The report shall include items such as manhole numbers, location, project number, date, time, temperature, curing temperature, curing time, cool down temperature and time, and liner thickness.
- H. With each shipment of CIPP delivered to the jobsite, submit certifications that the CIPP lining was manufactured in accordance with these specifications and the appropriate ASTM standards. The certifications shall include a signed statement by the wet-out manager/supervisor that no fillers were added to the

resin system during manufacture of the CIPP. In addition, wet-out forms documenting the wet-out shall be delivered with each section of CIPP manufactured and delivered to the jobsite.

- I. With each shipment of resin to the wet-out facility, submit certification that the resin was manufactured under ISO 9002 certified procedures and meets these specifications.
- J. Submit a plan for bypassing sewage around the work area and facilities in accordance with Section 02150 Bypass Pumping, where sewage flows must be interrupted to carry the work. The plan shall be reviewed by the Engineer and shall be acknowledged as acceptable before any work is started.
- K. Submit CIPP thickness calculations sealed by a licensed North Carolina professional engineer for fiberglass reinforced felt liner. Any deviations from the design parameters should be clearly noted.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be shipped, stored, and handled in a manner consistent with written recommendations of the CIPP system manufacturer to avoid damage. Damage includes, but is not limited to, gouging, abrasion, flattening, cutting, puncturing, premature curing, or ultra-violet (UV) degradation. The CIPP shall be maintained at a proper temperature in refrigerated facilities prior to installation to prevent premature curing. All damaged materials shall be promptly removed from the project site at the Contractor's expense.

#### 1.6 QUALIFICATIONS

- A. The Contractor performing the CIPP installation shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by the CIPP manufacturer. The Contractor must have successfully installed at least 1,000,000 feet of CIPP for a minimum of 10 years in wastewater collection systems utilizing the products and installation methods specified herein.

In addition, if steam cure is being proposed for the CIPP installation as specified herein, the Contractor must have successfully installed at least 500,000 feet of CIPP via steam cure for at least 5 years in wastewater collection systems utilizing the products specified herein. If the Contractor does not meet this experience requirement, then water cure shall be used for all installations.

The Contractor shall submit detailed references (project names, dates, owner contact names and numbers, project descriptions with lengths installed, etc.) to the Engineer as requested to demonstrate compliance with the above experience requirements. The Engineer's decision on whether the Contractor meets the experience requirements shall be final, and the Contractor shall not be due any additional money if the experience requirements are not met and water cure is

required.

- B. The Contractor's personnel shall have the following experience with the products and installation method to be used on this project.

Project Manager – Shall have a minimum of 5 years managing CIPP projects for wastewater collection systems.

Superintendent - Shall have a minimum of 5 years of on-site supervision of CIPP projects for wastewater collection systems. The superintendent shall have supervised a minimum of 300,000 feet of installed CIPP in wastewater collection systems of the pipe diameters included in the project.

- C. The manufacturer of the felt tube shall have manufactured the product to be used on this project for at least 5 years. The felt material manufacturer and facility shall not change throughout the duration of the contract unless approved by the Engineer in writing.
- D. Approved CIPP products are listed in these specifications. Even though the Contractor's product may be listed as approved, the Contractor shall still meet the experience requirements specified above, or the Contractor will not be approved for this work.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. The use of the product shall not result in the formation or production of any detrimental compounds or by-products at the wastewater treatment plant.

## 1.8 PROJECT ACCESS

- A. The Contractor shall utilize existing road rights-of-way and sanitary sewer easements to perform the work unless notified otherwise. The Contractor shall coordinate with and meet the requirements of North Carolina Department of Transportation, the Owner, or any other agency or municipality that may be impacted by the work.

## 1.9 WARRANTY

- A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The manufacturer shall warrant the liner to be free from defects in raw materials for one (1) year from the date of final acceptance by the Owner.
- B. All installed CIPP systems installed by pipeline segment (manhole/access to manhole/access) shall be guaranteed by the Contractor and manufacturer(s) for a period of two (2) years from the date of acceptance. During this period, any defects discovered in the installed CIPP system, as determined by the Owner through inspection and which may materially affect the integrity, strength,

function and/or operation of the pipe, shall be removed and replaced as recommended by the manufacturer in a satisfactory manner by the Contractor at no cost to the Owner. The Owner may conduct an independent CCTV inspection, at their own expense, of the installed CIPP system prior to the completion of the warranty period. Any defects replaced at that time shall be fully guaranteed by the Contractor and manufacturer for a period of two (2) year(s) from the date the defect was repaired.

#### 1.10 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Contractor shall ensure that the products and work comply with the current version of the following American Society for Testing and Materials (ASTM) standards:

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
2. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
3. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
4. ASTM D5813 - Standard Specification for Cured-in-Place Thermosetting Resin Sewer Pipe
5. ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
6. ASTM F1743 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

### **PART 2 PRODUCTS**

#### 2.1 CURED-IN-PLACE-PIPE LINING

A. Cured-In-Place-Pipe (CIPP) lining shall be one of the following products or approved equal. The products below shall adhere to all requirements specified herein and shall be modified as necessary to meet these requirements.

- CIPP Corporation Liners
- Invert-A-Pipe by IPR Southeast LLC
- National Liner by National EnviroTech Group, LLC
- Inliner by Inliner Technologies, Inc.
- Insituform by Insituform Technologies, Inc.
- Diamond Lining Systems by Daystar Composites LLC
- Premier-Pipe USA by J.W.M. Environmental, Inc.
- Pipenology CIPP for SAK Construction

- B. Depending on location, CIPP can be installed and cured using water, steam, or ultraviolet. See Section 02651A for ultraviolet cured requirements.

The curing method for sewers less than 18 inches may be water, steam, or UV. The curing method for sewers 18 inches and larger shall be water unless otherwise approved. The choice of curing method shall be appropriate for the pipe being lined and must be approved by the Engineer. For example, sewers with heavy active leaks shall be lined using water cure unless the Contractor can prove to the Engineer that the steam can overcome the heat sink and active water stream.

The Engineer will note any concerns with steam curing. Those concerns will be in writing, and the Contractor shall fully address the concerns. If the Engineer's concerns are not fully addressed, the Contractor shall install those specific sewers using water cure.

- C. The liner shall be composed of tubing material consisting of one or more layers of a flexible non-woven polyester felt with or without other additives such as fiberglass or other reinforcing additives. The felt tubing shall be impregnated with a thermosetting isothalic polyester resin and catalyst or vinyl ester and catalyst. The liner material and resin shall be completely compatible. The inside and/or outside layer of the tube shall be coated with an impermeable material compatible with the resin and fabric. The inside layer of the tube shall be resistant to blistering during the curing process. The liner shall cure in the presence of water or steam at the required temperature for the resin system.
- D. The felt material shall be manufactured by companies specializing in felt production for CIPP. The manufacturer shall have manufactured felt material for CIPP for at least 5 years as documented by references. The felt manufacturer, references and location of the manufacturing facility shall be submitted to the Engineer for review and approval. The felt material manufacturer and facility shall not change throughout the duration of the Contract unless specifically approved by the Engineer in writing.
- E. The polyester or vinyl ester resin shall be PREMIUM, NON-RECYCLED resin only. PET resins, or those containing fillers, additives or enhancement agents shall not be used. The resin manufacturer shall not include any old resin or rework in the product shipped to the wet-out facility. The resin shall be manufactured under ISO 9002 certified procedures. Such certification shall be submitted to the Engineer for each shipment of resin to the wet-out facility. The proposed resin shall equal or exceed the published properties of AOC 102NA or Reichhold Polylyte 33420 resin (for isothalic polyester resin) or Reichhold Atlac 580-20 (for vinyl ester resin).
- F. The exact makeup of the resin shall be submitted to the Engineer including chemical resistance information, cure logs and temperatures. Polyester resins shall have a minimum Heat Distortion Temperature of 212 degrees Fahrenheit per ASTM D648. Vinyl ester resins shall have a minimum Heat Distortion Temperature of 220 degrees Fahrenheit per ASTM D648.
- G. The exact mixture ratio of resin and catalyst shall also be submitted. The catalyst system shall be identified by product name. The resin/catalyst ratio shall be approved by the resin

manufacturer in writing. The catalyst system shall be made up of a primary catalyst and a secondary catalyst. The primary catalyst shall be Akzo Perkadox 16 or approved equal and shall be added at a maximum of 1% of the resin volume by weight unless otherwise approved by the Engineer. The secondary catalyst shall be Akzo Trigonox or approved equal and shall be added at a maximum of 0.5% of the resin volume by weight unless otherwise approved by the Engineer. The resin/catalyst system shall be formulated so that the CIPP will cure as specified below. Resins, catalysts and resin/catalysts mixing ratios shall not be changed during this Contract unless specifically approved by the Engineer in writing.

- H. The cure schedules for the CIPP shall be submitted to the Engineer for review. The curing process/schedules shall be approved by the resin manufacturer in writing. The cure schedules shall include specific information on stepping the temperature up to “cooking” temperatures, “cooking” temperatures and durations, and cool-down procedures – all to be approved in writing by the resin manufacturer. The CIPP shall cure in the presence of water or steam. The minimum cure/“cook” time shall be as recommended by the resin manufacturer. The cure time shall be increased as deemed necessary by the Contractor/resin manufacturer, including but not limited to, longer CIPP installations, active ground water infiltration into the existing sewers, pipe type, pipe location, etc.
- I. The resin shall be shipped directly from the resin manufacturer’s facility to the CIPP wet-out facility. The resin shall not be sent to any intermediate mixing facility. Copies of the shipment documents from the resin manufacturer shall be submitted to the Engineer showing dates of shipment, the originating location and the receiving location.
- J. The resin shall be used to manufacture the CIPP as shipped. No fillers or additives shall be added at the wet-out facility except for the required catalyst as recommended by the resin manufacturer. The Contractor shall submit a Certificate of Authenticity from the resin manufacturer for each shipment to the wet-out facility (to include the date of manufacture and the Heat Distortion Temperature). This information shall be submitted prior to manufacturing any CIPP.
- K. The Contractor shall identify the wet-out facility where all CIPP under this Contract will be manufactured. All CIPP shall be manufactured from this designated wet-out facility throughout the entire Contract unless specifically approved otherwise by the Engineer in writing. Multiple wet-out facilities shall not be allowed.
- L. The Engineer, Owner and/or an agent of the Owner may inspect the CIPP during manufacturing (during “wet-out”). The Contractor shall submit a schedule for manufacturing the CIPP to the Engineer every Friday for the following week. The Engineer and Owner must be given an opportunity to witness the manufacturing of all CIPP for this project. If the CIPP is manufactured without providing the required notice to the Engineer, the CIPP will be marked as rejected prior to installation and will not be approved for installation in this project.
- M. If the Engineer and/or Owner decide to inspect the manufacturing of the CIPP, the Contractor shall provide full access to witness the wet-out process and shall provide any

and all information related to the manufacturing as requested by the Engineer, Owner or the Owner's agent without delay and without claims of confidentiality or product privacy.

- N. The Engineer or Owner may take samples of the resin from the wet-out facility for infrared analyses (IR Scan) throughout the duration of this Contract. This standard analytical test involves shining a beam of light in the infrared frequency region through a thin sample of the subject resin. The frequency of light is then varied across the infrared spectrum. Chemical functional groups present in the resin being analyzed will absorb infrared light at specific frequencies and with characteristic absorption intensities.

The Owner will pay for all such infrared analyses and resin testing. To allow the resin samples to be taken, the Contractor shall place a sampling valve in-line at a point prior to the resin/catalyst mixing stage and after the resin/catalyst mixing stage. These sampling valves shall remain in place throughout the duration of the Contract and shall always be accessible to the Engineer and Owner.

The infrared analyses will be used to verify that the resin and resin/catalyst composition and mixture being used is the approved resin and resin/catalyst system. Payment will not be made for any CIPP manufactured with unapproved resin and resin/catalyst mixtures. The Contractor shall submit results of infrared analyses of the proposed resin and resin/catalyst mixture, performed and certified by the resin manufacturer, prior to manufacturing any CIPP as a shop drawing. The results of these analyses (the resin's chemical fingerprint) will be used as the standard for verifying the resin and resin/catalyst mixture being used throughout the Contract.

The Engineer will compare the submitted chemical fingerprint with the fingerprint of AOC 102NA or Reichhold PolyLite 33420 resin (for isothalic polyester resin) or Reichhold Atlac 580-20 (for vinyl ester resin) for a baseline comparison. The Contractor and resin manufacturer shall fully describe, explain and justify any differences between the AOC/Reichhold resin and proposed resin fingerprints without delay or claim to confidentiality.

- O. When cured, the CIPP shall form a continuous, tight-fitting, hard, impermeable liner which is chemically resistant to any chemicals normally found in domestic sewage. The liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to the sewer pipe to be lined.
- P. The CIPP shall be fabricated to a size that will tightly fit the sewer being rehabilitated after being installed and cured. The liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline. Allowance for longitudinal and circumferential expansion shall be taken into account when sizing and installing the liner. All dimensions shall be verified in the field by the Contractor prior to fabrication of the liner. Field measurements shall be used to ensure maximum closure between the new liner and the existing sewer pipe. There shall be no leakage of groundwater between the existing pipe and the CIPP at the manhole connection or service

lateral connections. Any leakage found shall be eliminated by the Contractor at no additional cost to the Owner.

- Q. The application of the resin to the felt tubing (wet-out) shall be conducted under factory conditions and the materials shall be fully protected against UV light, excessive heat and contamination at all times.
- R. The length of the liner shall be the length deemed necessary by the Contractor to effectively carry out the insertion of the liner and sealing of the liner at the outlet and inlet manholes. The required length of liner shall be verified in the field by the Contractor prior to fabrication of the liner.
- S. The installed thickness shall be measured as specified elsewhere herein. The Contractor shall submit his proposed plan for ensuring that the installed CIPP meets the above minimum thickness requirements. The plan shall include the proposed CIPP thickness to be installed (pre-installation thickness) and detailed inversion or pull-in procedures to reduce stretching and to reduce migration of resin.

### **PART 3 EXECUTION**

- A. Care shall be taken in shipping, handling and laying to avoid damaging the CIPP. Any CIPP damaged in shipment shall be replaced as directed by the Engineer. Any CIPP showing a split or tear or has been mishandled shall be marked as rejected and removed at once from the work. The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. Any liner showing evidence of premature curing will be rejected for use and will be removed from the site immediately.
- B. The Contractor shall continuously notify the public of the work being performed.
- C. The Contractor shall develop and submit to the Engineer a protocol for addressing odor complaints during the CIPP installation process (primarily styrene odor complaints). The protocol shall include steps to be taken by on-site and management personnel immediately when the complaint is received, including discussing the odor with the property owners/residents to address their concerns and alleviating the odor from the home/residence or business using fans or other means as necessary. The Contractor shall also maintain a calibrated portable styrene test unit to immediately document the atmospheric concentrations of the styrene on the site and in the house/residence/business when a complaint is received. The styrene concentrations must be tested prior to exhausting the odors from the house/residence/business. The Contractor shall also utilize blowers (vacuum blowers) during the CIPP installation to exhaust odors from the sewers and into the atmosphere during the installation as deemed necessary. This will help to minimize the potential for odors to travel up service laterals and into homes/businesses. The blowers shall be strategically placed to exhaust the concentrated odors in an isolated

location. The costs for addressing such odors issues/complaints shall be included in the unit prices bid for CIPP.

- D. The Contractor shall perform and provide all necessary traffic control measures to complete the work.
- E. The Contractor shall develop and submit to the Engineer a proposed shot plan at least 30 days prior to CIPP installation. The shot plan shall identify where the CIPP will be inserted, the direction of insertion (upstream or downstream), the sewers included in each shot, plans for addressing CIPP in manholes that the shot goes through, access points, curing method, and any other relevant information. The Engineer will review and comment or approve. The Contractor must address the Engineer's comments and resubmit until resolved.
- F. The Contractor shall clean and televise each length of pipe to be lined as specified in the Section 02650 – Cleaning and Television Inspection. Prior to lining the main sewer and the pre-rehabilitation television inspection, protruding service lateral connections shall be internally cut/ground down flush with the pipe wall with a robotic cutter specifically designed for this purpose and all required point repairs shall be completed. The internal cutter shall be capable of cutting any pipe material including cast iron, PVC, vitrified clay pipe, ductile iron pipe and orangeburg pipe.
- G. Water for use on this project will be available from selected hydrants owned and operated by the Owner. The Owner will provide water for use by the Contractor free of charge. The Contractor shall coordinate with the Owner to have bulk water meters provided at hydrants. Water from the Owner's hydrants may only be obtained by the connection of a Town-provided meter assembly.

The Contractor may use water from nearby streams, lakes, and ponds as needed. The water shall be filtered before use. All water pulled from nearby streams, lakes, and ponds must be discharged to the wastewater collection system.

- H. The Contractor shall bypass pump sewage flows around the lining work while it is being performed as specified in the Section 02150 – By-Pass System.
- I. The Contractor shall take precautions to avoid damage or flooding to public or private property being served by the sewer being lined. The Contractor shall be responsible for all flooding and pay for cleanup from flooding to the satisfaction of the property owner. The Contractor shall document all backups and submit documentation to the Engineer including the reason for the backup, the time and date of the backup, the property owner's name, address and phone number, the resolution to problem, the time and date the problem was resolved, and any special cleanup work that had to be performed. This required documentation shall be submitted for all backups regardless of when they occur. All cleanup shall be completed within 4 hours of the backup.

- J. The Contractor shall furnish and install the CIPP lining in the full length of sewer. The installation of the CIPP shall be in complete accordance with the applicable provisions of ASTM F1216 or ASTM F1743 except as modified herein, these specifications and the manufacturers' specifications.
- K. Water or air shall be used to invert CIPP installed via ASTM F1216 or to invert the calibration hose through CIPP installed via ASTM F1743. The water inversion of the CIPP and calibration hoses shall be accomplished by using natural water pressure (head) achieved by erecting platforms or scaffolding to an elevation determined by the Contractor or by using CIPP installation vessels/units that creates water pressure. The Contractor shall determine the necessary inversion heads (pressure) for each line segment. If an installation vessel/unit is used, a pressure relief valve shall be installed on the vessel so that the necessary pressure/inversion heads are not exceeded at any time during the inversion. Water or air pressure shall not be varied by any means throughout the inversion process except when approved by the Engineer. The Contractor shall submit required inversion heads/inversion processes for each installation as a shop drawing without delay and claim to confidentiality or product/installation privacy.
- L. CIPP shall be cured with water or steam in strict accordance with the manufacturer's recommendations. This shall include achieving cooking temperatures, cooking times, and cool-down procedures. The Contractor shall submit required curing schedules and procedures for each installation as a shop drawing without delay and claim to confidentiality or product/installation privacy.

Cool down shall meet the minimum criteria established herein or the manufacturer's recommendations, whichever is more stringent. The water temperature inside the pipe shall be cooled at a maximum rate of 20 degrees per hour until the water temperature is within 20 degrees of the ambient temperature. Do not "shock" the liner with dramatically cooler water. Slowly introduce cooler water into the cool down cycle. The cool down period cannot be less than 1 hour even if the water temperature inside the pipe is within 20 degrees of the ambient temperature.

- M. The Contractor shall install and utilize the VeriCure process (or approved equal) for monitoring the cure temperature of the CIPP. VeriCure shall be installed from manhole to manhole under the bottom of the CIPP. The installation and use of VeriCure shall be in strict accordance with the manufacturer's recommendations. The cure temperature data shall be recorded electronically with the required monitoring devices/computers/computer software. Printed color data reports with detailed descriptions/summaries of the data along with the digital data file shall be submitted to the Engineer for review prior to requesting payment for the CIPP. All special software to review the data file shall also be submitted.
- N. In larger diameter sewers (30 inch or larger) and/or when the section being water cured has a volume of 20,000 gallons or greater, the cure water shall be released from the sewer being lined in a slow, methodical manner. A quick "batch" release of the water shall not be allowed. The cure water shall be released by cutting a small/narrow opening in the

CIPP to allow the water to slowly drain while the CIPP cool-down process is being implemented. This will serve to slowly release the water and also allow some cool-down of the water prior to/during the release. The entire release process shall occur over a minimum 6-hour period unless approved otherwise by the Engineer. The Owner may also sample the cure water during the release to test for chemical compounds that may have a detrimental effect on the downstream water reclamation facility. The Contractor shall accommodate all sampling efforts by the Owner. If damaging chemical compounds (such as styrene or vinyl chloride) exist at high enough levels that may impact treatment processes (as determined by the Owner), the Contractor shall modify the cure water release time to further slow the release of the water to allow additional time and dilution in the sewer system.

- O. The CIPP shall be neatly cut 2 inches from the manhole walls after installation unless otherwise directed by the Engineer. The CIPP shall be sealed at the manholes to provide a watertight liner connection at the manhole. There shall be no leakage of groundwater into the manhole between the CIPP and existing sewer pipe and between the existing sewer pipe and manhole wall. A hydrophilic waterstop (non-bentonite) comprised of modified chloroprene rubber shall be installed around the liner 6 inches from each manhole wall prior to processing the liner to provide additional waterstop protection. As the CIPP is expanded, the waterstop shall be pressed tightly against the existing sewer to provide a leak-tight seal. The waterstop shall be Hydrotite as manufactured by Greenstreak (St. Louis, Missouri) or equal. All CIPP connections to manholes shall be further sealed with an approved non-shrink grout to completely cover the CIPP/manhole connection point. CIPP lining shall be sealed to manhole linings (where specified) in an acceptable manner as approved by the Engineer. Further, all invert channels shall be coated with an approved grout to match the CIPP elevations in the manhole. Submit detailed drawings of the pipe-manhole connections to the Engineer for approval, including termination points in manholes and transitions with manhole linings where installed.
  
- P. The Contractor shall fully reopen all of the existing active service connections in each length of sewer following lining. The service connections shall be reopened from inside the sewer by means of a closed-circuit television camera controlled cutting device appropriate for the CIPP. All openings shall be clean and neatly cut and shall be flush with the lateral pipe. The openings shall also be buffed with a wire brush to remove rough edges and provide a smooth finish. The bottom of the openings shall be flush with the bottom of the lateral pipe to remove any lip that could catch debris. Openings shall be 100% of the service lateral pipe. The Contractor shall re-open any service lateral that does not meet this requirement as evidenced by the post-rehabilitation inspections at no additional cost to the Owner. The Contractor shall be fully responsible for all backups and damage caused by not fully opening a lateral connection, including paying all costs associated with repairing damage as required by the Engineer, Owner and/or property owner.
  
- Q. Preliminary Post-CIPP TV Inspections: Immediately after the CIPP is installed and the services connections are completely opened and brushed, the Contractor shall televise the

installed CIPP to verify and document that the CIPP was properly installed and cured and that all service connections have been opened as specified. The preliminary post-CIPP TV inspection videos shall be submitted to the Engineer within 1 day of the CIPP being installed. This will allow the Engineer to confirm that there are no CIPP issues that need addressed on this sewer and/or future installations and that the service laterals are properly opened. The preliminary post-CIPP inspections shall clearly show the CIPP liner and all service connections.

The Engineer will accept these preliminary post-CIPP TV inspections for approving payment of the installed CIPP with the final post-CIPP inspections as specified herein being required prior to final payment. The Contractor may submit these inspections as the final post-CIPP inspections if all grout/concrete work is finalized in the connecting manholes (including grouting the pipe connections, coating the invert channels, and performing the specified manhole rehabilitation) and all specifications are met. Completing all of the manhole work may be difficult to get finished so that the TV inspections can be submitted within 1 day as specified above. The Contractor's unit price bid for the CIPP shall include preliminary post-CIPP and final post-CIPP TV inspections.

- R. Installation reports shall be generated for each segment of liner installed. The reports shall document installation, including manhole numbers, street names/sewer location, project number, date, time, temperature, curing temperature, curing time, liner thickness, etc. A sample report shall be submitted to the Engineer for approval prior to installing any lining. The reports shall be submitted to the Engineer prior to requesting payment.
- S. For every sewer segment that is lined (sewer segment is defined as the sewer between two manholes), the Contractor shall remove one restrained sample of the installed liner at least 12 inches in length for testing of installed CIPP flexural properties and thickness. The CIPP testing shall include determining flexural strength, flexural modulus, tensile strength and thickness of each sample. These four separate individual tests make up one completed CIPP test. Payment will be made for each completed CIPP test at the unit price bid after the test results are submitted to the Engineer.

For sewers 12 inches in diameter and smaller, the sample shall be captured by installing the lining through a section of PVC pipe (same diameter as the existing sewer diameter) within the most downstream manhole of the installation and at all intermediate manholes if multiple sewer segments are lined at the same time. For sewers 15 inches in diameter and larger, plate samples shall be taken and cured in the same water as the installed CIPP.

The Contractor shall be responsible for capturing the samples and preparing the samples for testing (cutting the samples to the required dimensions, removing the PVC pipe, etc.). The testing laboratory shall specify the dimensions for the samples. In addition, the Contractor shall cut a 1-inch wide representative sample (taken at least 2 inches from the end of the specimen) for the Engineer's records. The Contractor shall label all samples including writing on the samples where they were taken (manhole numbers, work orders, and other relevant information) and the date they were taken.

The Engineer will direct the Contractor which samples to submit to the testing laboratory. The Contractor shall retain a sample from all samples that are submitted to the testing laboratory until the end of the project. These samples shall be available upon request from the Engineer. The Contractor will copy the Engineer on all submittals to the testing laboratory. The testing laboratory shall submit all test results directly back to the Contractor with a copy to the Engineer. The test results shall be returned to the Contractor and Engineer within 21 days from the laboratory receiving the samples. If the results are not received in this timeframe, payment will be withheld. It shall be the Contractor's responsibility to ensure that the laboratory meets the specified schedule.

The Contractor shall select the independent testing laboratory and shall pay the laboratory for all tests. The Contractor will be paid for the tests through the Contract at the unit price bid for each completed test. All testing shall be performed by an independent, accredited, certified and experienced (minimum 5 years of experience) testing laboratory as chosen by the Contractor. The Contractor shall submit the name and location of the testing laboratory for approval. The submittal shall include the laboratory's experience testing CIPP samples, the laboratory's accreditation/certification to perform CIPP testing from a recognized accreditation body, and a certified statement from the laboratory that they are independent from and not associated with the Contractor in any way.

The tests shall be used to verify that the installed CIPP meets these specifications. CIPP thickness shall be measured in accordance with ASTM D5813. Flexural properties shall be determined per ASTM D790. Tensile strength shall be determined per ASTM D638.

- T. Any lining that does not meet the specified installed strength and/or thickness requirements, regardless of the amount below the specified requirements, shall be corrected by the Contractor in a manner approved by the Engineer at no additional cost to the Owner. The Engineer's decision on how to correct deficient CIPP installations shall be final. Options for correcting deficient liner that will be considered by the Engineer include removing the liner and re-lining the sewer, excavating and replacing the sewer from manhole to manhole, pipe bursting the sewer from manhole to manhole, re-lining sewers completely from manhole to manhole, or providing the Owner with a substantial credit.

Credits will only be considered for lining that does not meet the required thickness. CIPP lining thickness may be up to 5% below the specified minimum installed thickness before the credit will be applied. For example, if the minimum specified thickness is 6 mm, the credit will only apply if the CIPP is less than 5.7 mm thick. There will be no "re-calculations" of required thicknesses based on actual flexural test results for that sample. The minimum specified thicknesses shall be required regardless of the final flexural properties of the CIPP as installed. If a credit is acceptable to the Engineer and Owner, the credit shall be calculated by multiplying the bid price by the percent that the liner thickness is below the minimum required installed thickness as follows:

$$\text{Credit} = (1 - (\text{installed CIPP thickness}/\text{min required thickness})) \times \text{Bid Price}$$

The Contractor shall not assume that a credit will be acceptable to the Engineer or Owner or that the above formula will be used in all situations or for all installed CIPP thicknesses. Liner thickness of less than 85% of the required minimum thickness will not be eligible for any payment.

All credits shall be accounted for on the monthly pay estimates (each and every month) as the failed test results are received by the Engineer. Credits shall not accumulate until the end of the Contract. In addition, any other defective CIPP shall be repaired within 21 days of being identified or payment will be withheld and work will not be allowed to continue.

- U. Following installation of the CIPP, reopening and brushing of all active service lateral connections, and completion of all manhole rehabilitation including vacuum testing (where applicable), the Contractor shall conduct a final post-rehabilitation television inspection of the completed work to verify that the liner installation is acceptable as defined herein. The sewers shall be thoroughly cleaned prior to performing the television inspections. No cleaning equipment shall be in the sewers during the post-rehabilitation inspections. The pipe shall be dry so that the entire CIPP can be seen. This will require that temporary plugging or bypass pumping be provided for all post-rehabilitation television inspections.

The post-rehabilitation television inspections shall be in accordance with the inspections specified in Section 02650 – Cleaning and Television Inspection. The post-rehabilitation television inspections shall be within 3 feet of the actual sewer length as measured above ground from center of manhole to center of manhole. Any inspection that exceeds this limit shall be re-performed and re-submitted to the Engineer prior to payment at no additional cost to the Owner. One copy of the final post-rehabilitation inspections shall be submitted to the Engineer for review and approval as specified. The inspections must be in order, correct and complete or the Engineer will immediately return the inspections to the Contractor for corrections.

- V. Payment will not be made for any sewer lining until the Engineer has reviewed and approved the final CCTV inspection. The final CCTV inspection shall not be performed until all manhole rehabilitation work is completed (including vacuum testing where applicable). As specified previously herein, the Engineer will accept preliminary post-CIPP TV inspections for payment with the final post-CIPP TV inspections being required prior to payment of the manhole rehabilitation work (where applicable) and/or final payment. The Contractor shall submit the required digital inspections a minimum of 10 days in advance of any payment request to provide the Engineer ample time to review the information.
- W. There shall be no holes, dry spots, lifts, ribs, wrinkles, blisters, ridges, splits, bulges, cracks, delaminations or other type defects in the CIPP lining. In addition, there shall be no groundwater leakage through the CIPP or between the liner and the existing pipes including at the connections to manholes. Defective lining and groundwater leakage

shall be repaired in a manner suitable to and approved by the Engineer at no additional cost to the Owner.

The Engineer's decision on how to correct defective lining shall be final. Options for repairing defective lining that will be considered by the Engineer include removing the liner and re-lining the sewer, excavating and replacing the sewer from manhole to manhole, pipe bursting the sewer from manhole to manhole, re-lining sewers completely from manhole to manhole, or installing a sectional CIPP patch to repair the defective area.

In addition, the Engineer and Owner may require an additional warranty beyond the standard warranty period (defined elsewhere in these Specifications) for defective CIPP at no additional cost to the Owner. This additional warranty will be for a maximum of five years (one year standard warranty plus four additional years). The warranty should include all costs associated with the remedial work and be non pro-rated. This additional warranty may also be required on the entire "batch" of CIPP if the defect appears to be material related (resin, felt, catalyst, etc.) or wet-out related regardless of the acceptance test results or visual review of any particular CIPP liner section in that "batch".

If a CIPP patch is approved as a repair method for manhole-to-manhole CIPP, the Owner will not pay the full bid price for that sewer segment (manhole to manhole). The price reduction (credit) shall be negotiated with the Contractor and shall be acceptable to the Owner. The credit shall be equal to at least 25% of the unit price bid for the CIPP installation and shall apply to the entire CIPP lining from manhole to manhole. The Owner shall have the final decision on the amount of the credit. Any such credits shall be accounted for on the monthly pay estimates (each and every month) as the defective CIPP is repaired. Credits shall not accumulate until the end of the Contract.

END OF SECTION

SECTION 21000  
**SPECIAL CONSTRUCTION**  
(Revised 1/4/24)

The following requirements are project specific, are in addition to the provisions outlined in the Contract Documents and Standard Specifications, and shall supersede any conflicting information stated elsewhere in the Contract Documents and Town of Cary Standard Specifications and Details Manual

**PART 1 – GENERAL**

- A. Project Phasing: Time is of the essence. There are other Town projects that are reliant on this project being completed per schedule. The contractor shall be responsible for scheduling multiple crews as needed to perform all work at all sites to meet the construction schedule. In all cases, proposed work shall be performed so that roads are not permanently blocked, allow for local traffic to safely pass, and meet all fire code requirements.
- B. Water Service Interruptions: The Contractor shall schedule water service interruptions to occur between 9 a.m. and 4 p.m. with a 4-hour maximum time frame per interruption. Affected residents and businesses shall be notified by the Contractor 24 hours prior to the interruption, with an additional verbal notification prior to shutting down service.
- C. Traffic Control: Traffic control shall be provided and maintained on each street by the Contractor in strict conformance with the Traffic Control Plans (Sheet 28), the NCDOT Supplement to the MUTCD, the MUTCD or as directed by the Engineer. Any work requiring road closures that is not shown on the plans will require a detour plan to be prepared by the Contractor and submitted to the Engineer for review and approval as soon as possible but no later than 2 weeks prior to the requested closure(s). Once the detour plan is approved, the Contractor shall properly fill out a Town of Cary Public Information Office (PIO) Form and submit it to the Engineer at least five (5) business days prior to construction activities beginning within the right-of-way. The Engineer will forward this form to PIO so that a traffic alert can be issued in advance of the road closure.

Pedestrian access along each sidewalk corridor shall be maintained at all times. If sidewalk closures are required, the Contractor shall be responsible for preparing and submitting a pedestrian detour plan to the Engineer for review and approval as soon as possible but no later than 2 weeks prior to the requested sidewalk closure(s).

- D. Street Cleaning: All work debris shall be swept, removed and disposed of offsite prior to the end of each workday. The Contractor shall minimize dust during cleaning operations by methods including but not limited to the use of water, dust shrouds, low speed brooming, or other methods suitable for reducing the amount of dust distributed through the air. This work is considered incidental to the various bid items indicated in the Itemized Proposal.
- E. Obstruction Removal: The Contractor shall coordinate removal of vehicles, trailers, and all other objects that may obstruct the work from the work area in accordance with Section 05000, Part 1, Paragraph E.

- F. Waste Disposal: All waste and debris generated by this contract shall be hauled offsite at the end of each work day and disposed of at a waste site permitted by the Solid Waste Management Division of the North Carolina Department of Environmental Quality. The Contractor shall provide a copy of the proposed commercial waste site's NCDEQ Permit or License and any other applicable permits or regulatory licenses at the Preconstruction Conference.
- G. Landscaping: The Contractor shall verify any trees or landscaping items to be preserved or removed with the Engineer prior to performing the work. Contractor shall provide notice to the Engineer for these items that cannot be preserved or removed as noted on the Drawings prior to removal.

Prior to work commencing, the Contractor shall review the entire project corridor to determine the proposed scope and extent of pruning vegetation that interferes with or will be affected by construction. The Contractor shall coordinate and obtain approval through the Town of Cary prior to pruning.

All trimming, pruning, and maintenance of existing trees and/or landscaping within public right-of-way or private property as part of this project shall be completed by a Certified Arborist provided by the Contractor in a manner consistent with established arboricultural standards.

The preservation or removal of trees and/or landscaping is considered incidental to the various bid items indicated in the Itemized Proposal. There will be no additional payment for this item.

- H. AC Pipe: The Contractor shall identify the OSHA certified supervisor to the Engineer prior to working on, around, cutting, tapping, or removing asbestos materials. The Contractor shall comply with all State, Federal, and local laws regarding handling and removal of asbestos materials.

Coupons from wet taps and samples 12-inches long for removed sections of AC pipe shall be retained by the Contractor and safely and securely stored until they are picked up by the Owner's testing agency. The RPR shall coordinate with the testing agency to schedule removal. The Contractor shall provide a safe storage facility for the samples and assistance in transporting the samples until the Owner's testing agency takes possession of the samples. Coupons and pipe sections retained shall be labeled/tagged with pertinent information including location, size, date collected, etc.

- I. Subsurface Information: Subsurface information is not available on this project. Limited geotechnical and level A test hole information is provided for background, but should not be considered part of the contract documents for more than informational purposes only. The Contractor shall make his own interpretations of all subsurface conditions.
- J. Erosion Control: Standard Sediment Control Devices are to be furnished, installed, and maintained in good working order at storm inlets as shown on the plans and at the discretion of the design Engineer to ensure project sediment is properly controlled within the project limits.
- K. Partial Payment Applications: All applications for payment shall be accompanied by up to date digital copies of the project schedule and redline drawings. Redline drawings shall include at minimum all deviations from the Drawings and encountered utilities not

shown on the Drawings. All deviations, encountered utilities, etc. shall be distance referenced to features shown on the Drawings. Applications for payment will not be processed until up to date project schedule and redline drawings are received by the Engineer.

- L. Backfill and Subgrade Compaction Testing: The Contractor shall be responsible for achieving the required density on all trench backfill and pavement subgrade installed under this contract. The Owner shall provide the services of a testing laboratory to check compaction throughout the backfill and on pavement subgrade as necessary to prove the results of the Contractor's compaction methods. The Contractor shall provide safe access to the testing laboratory at all times.

The Engineer may order additional testing in the event of an unsatisfactory test result. The Contractor shall provide access and assistance for any such additional testing, including but not limited to digging back to expose additional test sites. The Contractor shall bring into conformance or remove and replace any backfill or subgrade that does not meet density requirements at no additional cost to the Owner.

The Contractor shall schedule subgrade compaction testing with the RPR at least 24 hours in advance of paving.

- M. Pavement Compaction Testing: The Contractor shall be responsible for achieving the required density on all pavement installed under this contract. The Owner shall provide the services of a testing laboratory to check density on pavement after installation to prove the results of the Contractor's compaction methods. The Contractor shall bring into conformance or remove and replace any pavement that does not meet density requirements at no additional cost to the Owner.

The Contractor shall not install additional material on top of pavement that has not been tested. The Contractor shall schedule compaction testing for subgrade or previously installed pavements at least 24 hours in advance of installing additional material over untested subgrade or pavement.

## PART 2 – TRENCH BACKFILL

- A. Trench Backfill – Aggregate Base Course: All excavated material beneath pavement, curb & gutter, driveways, and sidewalk shall be removed and disposed of offsite. The pipe shall be bedded and the trench backfilled with ABC in accordance with the Ductile Iron Pipe Bedding and Backfill Detail included in the Drawings. The ABC backfill material shall be used for the full trench depth minus the asphalt binder lifts and final asphalt surface lifts per the Pavement Repair Patch – Trench Repair line item. This work is considered incidental to the various bid items indicated in the Itemized Proposal.
- B. Water Service Line Bedding – Processed Fill: Water service lines beneath pavement, curb & gutter, and sidewalk that are not installed by trenchless methods shall be bedded in 12-inches of processed fill prior to backfill with ABC. This work is considered incidental to the Water Service Connection bid item.
- C. Concrete Cradle/Pipe Crossing (Item #20): This item shall include all labor, equipment, and material necessary to furnish and install flowable fill at the point of crossing between

utility lines. The area between utilities shall be filled with a minimum 125-psi compressive strength, quick setting, excavatable flowable fill as shown on the Drawings.

Payment for “Concrete Cradle/Pipe Crossings” shall be paid at the contract unit price per EACH installed as specified.

- D. Pipe Identification and Marking: Marker Tape and Marker Balls shall be installed per the latest Town of Cary Standards Specifications and Details (July 1, 2023), Section 6010(D).

As part of the record drawing submittal, the contractor shall submit the following information for each Marker Ball, fitting and valve installed in a Microsoft Excel file or comma delimited text file, using the headings shown for integration into the Town of Cary Geographic Information System (GIS):

**X coordinate** (submeter accuracy)  
**Y coordinate** (submeter accuracy)  
**Fitting type** or other location description

Testing of the marker tape and marker balls shall be performed by the Contractor at the completion of the project to ensure proper operation of all marker tape and marker balls. The Contractor shall furnish all necessary equipment for testing marker tape and marker balls. Any defective, missing, or otherwise non-locatable marking tape or marker balls shall be replaced by the Contractor at no additional cost to the Owner.

This work is considered incidental to the various bid items indicated in the Itemized Proposal.

### PART 3 – PAVEMENT

- A. Concrete Driveway Aprons: Concrete driveway aprons and adjacent gutters shall be restored to equal to or better than preconstruction condition including all joints, bevels, and other architectural details. Driveway aprons and gutters that have been modified for the thickness of the existing pavement overlay shall be replaced to provide a smooth transition from the proposed pavement overlay to the apron or gutter. This work is considered incidental to the various bid items indicated in the Itemized Proposal. Contractor shall coordinate with home owner to prevent loading on driveway prior to concrete curing.

Driveways or driveway aprons that are damaged by causes related to the work performed under this contract that are not shown on the Drawings to be replaced shall be replaced by the Contractor at no additional cost to the Owner.

- B. Pavement Trench Repair – Pavement Repair Patch-Type S9.5C (Item #37) and Type I19.0C (Item #38): This item shall include all labor, equipment, and materials necessary to install trench repair pavement as shown on the pavement repair patch detail drawing and as specified herein. The trench shall be repaired with 4-inches of Type I19.0C hot mix asphalt, and overlaid with 1.5-inches of Type S9.5C hot mix asphalt. The surface overlay shall extend a minimum of 12-inches beyond the I19.0C layer and shall be flush

with the surrounding pavement. All required milling and pavement removal shall be included within the Type S9.5C installation for overlays either in trench repair areas or adjoining mill and overlay areas. This item shall include restoration of standard pavement undulations (speed humps) to their original grade.

Payment for “*Pavement Repair Patch – Type S9.5C*” and “*Pavement Repair Patch – Type I19.0B*” shall be paid at the contract unit price per TON of asphalt installed as specified.

Pavement that is damaged by causes related to the work performed under this contract that is not shown on the Drawings to be replaced shall be replaced by the Contractor at no additional cost to the Owner.

- C. ABC Including Subgrade Removal (Item #40): This item shall include all labor, equipment, and material necessary to remove and dispose of unsuitable subgrade material beneath the road surface and furnish, install, and compact aggregate base course (ABC). This item is intended to be used in pavement restoration areas where the subgrade is determined to be unsuitable or repaving (outside of the trench backfill areas). Trench backfill (with ABC) will be in accordance with 21000-3. Part 2, A. This item shall be used only as directed by the Engineer.

Payment for “*ABC Including Subgrade Removal*” shall be paid at the contract unit price per CUBIC YARD of aggregate base course installed as specified.

- D. Remove and Replace Concrete Curb (Item #43): This item shall include all labor, equipment, and material necessary to remove and replace existing concrete curb and gutter in accordance with *Section 06000*.

Payment for “*Remove and Replace Concrete Curb and Gutter*” shall be paid at the contract unit price per LINEAR FOOT of concrete curb and gutter installed as specified.

The Contractor shall notify the Engineer prior to commencing work of any curb and gutter that is not shown on the Drawings to be replaced, but in the opinion of the Contractor will require replacement to facilitate the work. The Engineer may, at his sole discretion, approve additional curb and gutter for replacement. Curb and gutter that is damaged by causes related to the work performed under this contract that is not shown on the Drawings to be replaced or otherwise preapproved for replacement shall be replaced by the Contractor at no additional cost to the Owner.

## PART 5 – DEBRIS DISPOSAL

The Town of Cary does not have a disposal site available to the contractor to receive debris retrieved from the sewers during cleaning operations. It shall be the contractor’s responsibility to transport debris to a properly permitted disposal facility and to comply with all pertinent regulations.

The Town will provide a location for the placement of a temporary roll-off type dumpster/filter box for the purpose of temporary storage and dewatering of solids prior to transporting debris offsite for permanent disposal. The Town will assist the contractor by sampling the debris at the beginning of the project and sending it to a certified testing laboratory to generate a waste profile, if requested, to facilitate disposal at an approved facility.

## PART 5 – MISCELLANEOUS

- A. Restoration of Lawn Grass - (Item #4): This item shall include all labor, equipment, and material necessary to furnish and install lawn grass in disturbed areas throughout the project area. Lawn grass shall be installed in accordance with *Section 16000, Part 4*.

Lawn grass shall be restored to equal to or better than preconstruction condition with the same species of grass in the immediate vicinity of the grass to be restored. Restoration method shall depend upon the grass type and shall be seed and straw for cool season grasses in accordance with *Section 16000, Part 4, paragraph C.ii* and sodding for warm season grasses in accordance with *Section 16000, Part 4, paragraph C.iv*. The table on DWG G3 in the construction plan set provides known locations for lawn grass restoration.

The Contractor shall submit location, existing grass type/species, and restoration method for all addition sites not listed in the table below to the Engineer for review and approval prior to disturbing grass in the additional site(s). Additional sites include laydown site(s), staging area(s), and all sites that will be disturbed by work related to this contract.

Any areas requiring restoration and seeding outside of lawns shall be considered incidental to the "Restoration of Lawn Grass" line item.

The Contractor shall notify the Engineer of any discrepancies from the tabulated grass classes encountered in the field prior to disturbing grass in the vicinity of the discrepancy.

Payment for "*Restoration*" shall be paid as a LUMP SUM for material satisfactorily installed as specified. Payment shall be released as specified in *Section 16000, Part 4, Paragraph E*.

- B. Fire Hydrant Assembly (Item #9): In addition to the requirements of the *Contract Documents* and *Standard Specifications* this item shall include all labor, equipment, and material necessary to:

- Excavate, remove/dispose, and replace existing curb, gutter, and sidewalk. Concrete shall be repaired as outlined in *Section 06000*. Curb and gutter shall be removed up to an additional 5-feet on either side of the trench if an existing control/expansion joint or drainage structure is within that proximity. Sidewalk shall be removed to the nearest control joint.

Payment for "*Fire Hydrant Assembly*" shall be paid at the contract unit price per EACH fire hydrant assembly installed as specified.

- C. Water Service Connections (Item #21): In addition to the requirements of the *Contract Documents* and *Standard Specifications* this item shall include all labor, equipment, and material necessary to:

- Transfer the existing water service to the new meter box in accordance with the *Standard Water Service Transfer* detail and abandon the existing water service.

- Excavate, remove/dispose, and replace existing pavement as well as driveway, sidewalk, curb and gutter. Asphalt pavement shall be repaired as outlined in *Section 05000* and concrete shall be repaired as outlined in *Section 06000*. Driveways, curb and gutter shall be removed up to an additional 5-feet if an existing control/expansion joint or drainage structure is within that proximity. Sidewalk shall be removed to the nearest control joint.

Payment for “*Water Service Connection, 1-Inch*”, “*Water Service Connection*” shall be paid at the contract unit price per EACH water service connection installed as specified.

D. Water Service Connections (SW Maynard Rd) (Item #22): In addition to the requirements of the *Contract Documents* and *Standard Specifications* this item shall include all labor, equipment, and material necessary to:

- Transfer the existing water service to the new meter box in accordance with the *Standard Water Service Transfer* detail and abandon the existing water service.
- Excavate, remove/dispose, and replace existing pavement as well as driveway, sidewalk, curb and gutter. Asphalt pavement shall be repaired as outlined in *Section 05000* and concrete shall be repaired as outlined in *Section 06000*. Driveways, curb and gutter shall be removed up to an additional 5-feet if an existing control/expansion joint or drainage structure is within that proximity. Sidewalk shall be removed to the nearest control joint.

Payment for “*Water Service Connection, 1-Inch*”, “*Water Service Connection*” shall be paid at the contract unit price per EACH water service connection installed as specified on DWG C14.

E. Vacuum Excavation (Item #23): This item shall include all labor, equipment, and material necessary to provide for vacuum excavation (and spoil replacement and compaction) in areas of congested buried utilities for proposed water service locations in areas where mechanical excavation and hand digging are impractical. Maximum excavation limit dimensions shall be 10-feet long, 14-inches wide, and up to 30-inches deep for each vacuum excavation. Use of this pay item shall be reviewed and authorized in the field prior to work.

Payment for “*Vacuum Excavation*” shall be paid at the contract unit price per EACH according to location used.

F. All existing disturbed or damaged pavement striping shall be replaced to preconstruction configurations with Town standard thermoplastic markings and/or paint markings (matching existing).

Payment - All striping and painting shall be considered incidental to the “Asphalt Roadway Patching” pay item.

G. Any sewer lateral reconnections required along the sewer replacement extents shall be reconnected to the new main in accordance with Town standards. This shall include all labor, equipment, and material necessary to provide fully functioning sewer services.

Payment - All lateral reconnections shall be considered incidental to the respective sanitary sewer replacement pay item associated with the main replacement.

- H. The Contractor shall document with a digital video recorder the entire project site including all concrete and asphalt pavements, curb and gutter, fencing to remain, structures to be demolished, and existing structures that are to be modified. To provide referencing between the Contract Documents and the video, the Contractor shall provide visible markings along the alignment at 100 foot increments of stations which match the plan stations. Performance of videotaping shall be done with Owner's resident project representative present. The original video shall be turned over to the Engineer prior to beginning construction activities. Engineer shall review and approve video prior to construction for clarity purposes. The video shall be provided as a standard video file capable of playback on any standard video program and shall be provided on a flash drive. The video shall clearly identify existing site and structural conditions prior to construction and any additional photos or documentation of noted issues or deficiencies shall also be included for "pre-construction conditions" documentation for the project files.

Payment – All preconstruction video/documentation work and deliverables shall be considered incidental to the project mobilization.

- I. Remove and Replace Storm RCP (Item #36) Any billings under this item shall include all labor, equipment, and material necessary to replace failing RCP discovered during waterline excavations. This item shall not be used to repair stormwater pipe damaged as a result of contractor damage or lack of protection during installations, but only used for discovered failing condition pipe. This allowance shall only be used as authorized in the field.

Payment for "*Remove and Replace Storm RCP*" work under this item shall be reviewed, agreed upon, and authorized individually prior to installation.

- J. Exploratory Excavation ½ Day (Item #41) Any billings under this item shall include all labor, equipment, and material necessary to determine unexpected field conditions that differ from the drawings and cannot be readily determined by other methods. Use of this pay item shall be reviewed and authorized in the field prior to work.

Payment for "*Exploratory Excavation ½ Day*" shall be paid at the contract unit price per EACH according to location used.

- K. Ductile Iron Fittings (Item #10) Fittings shall be installed according to specifications as written in Section 10000. However, fitting shall be measured and paid for according to actual weight of fittings installed. Such fittings shall not include specialty transition couplings or fire hydrant tees that are paid for under separate line items.

Payment for "*Ductile Iron Fittings*" shall be paid at the contract unit price per POUND according to actual amount installed.

END OF SECTION

NO SPECIFICATIONS ON THIS PAGE FOR FORMATTING PURPOSES



January 12, 2024

**ATTACHMENT 4**

Mr. Alex Biermann, PE  
[abiermann@cjsconveyance.com](mailto:abiermann@cjsconveyance.com)  
CJS Conveyance, PLLC  
320 S. Academy St.  
Cary, North Carolina 27511

Re: **Geotechnical Report Addendum No. 01**  
Town of Cary 2023 Watermain Replacements  
Cary, North Carolina  
Falcon Project No.: G22081.00

Alex,

As requested, we have completed an additional subsurface investigation for the above referenced project. The work was performed in general accordance with the scope outlined in our email correspondence on December 8, 2023. The project information, field and laboratory test results, and recommendations presented herein are meant to supplement our Geotechnical Report of Subsurface Investigation dated January 9, 2023.

## PROJECT DESCRIPTION

Based on our email correspondence, drawings provided, and CAD files provided, we understand that the scope of the Town of Cary 2023 Watermain Replacement project has expanded to include the following:

- Approximately 330 linear feet of new 8-inch diameter Restrained Joint Ductile Iron (RJDI) pipe on Midland Valley Way.
- Approximately 185 linear feet of new 8-inch diameter RJDI pipe on Elmhaven Way.
- Approximately 625 linear feet of 8-inch diameter RJDI pipe on Boyd St to replace the existing main.
- Approximately 1,150 linear feet of 8-inch diameter RJDI pipe on King Rd to replace the existing main.
- Approximately 1,030 linear feet of 8-inch diameter RJDI pipe on Sycamore St to replace the existing main as well as approximately 528 linear feet of 8-inch diameter ductile iron pipe to replace the existing sanitary sewer.
- Approximately 355 linear feet of new 6-inch diameter RJDI pipe on Linda Ct to replace the existing main.
- Approximately 250 linear feet of new 4-inch diameter RJDI pipe on Red Bud Ct to replace the existing main.
- The project also includes some sanitary sewer lining and installation of new water services which do not require subsurface investigation.

Should any of the above information or assumptions made by Falcon be inconsistent with the planned project, we request that you contact us immediately to allow us to make any necessary modifications to this report.

## SITE GEOLOGIC DESCRIPTION

According to the *Geologic Map of North Carolina* (1985) and the *Geologic Map of the Cary 7.5-Minute Quadrangle, Wake and Durham Counties, North Carolina* (2016), Midland Valley Way and Elmhaven Way are located within the Triassic Basin geologic formation of the Piedmont Physiographic Province of North Carolina. The Triassic Basin was formed when the super continent, Pangea,

began to rift, or split, apart. A *rift basin* formed along the Jonesboro Fault and began infilling with upland sediments. The subsequent consolidation of these sediments formed into sedimentary rocks. Specifically, rocks at the site are noted as the Newark Supergroup, Chatham Group; undivided (**Trcs/c**) siltstone with interbedded sandstone.

- Sandstone is a clastic sedimentary rock generally containing sand-size particles. It also contains a cementing material that binds the sand grains together and may contain a matrix of silt or clay-size particles that occupy the spaces between the sand grains.
- Siltstone is a clastic sedimentary rock generally containing silt-sized particles that are bound together.

The other additional work areas of the project are located within the geologic formations noted in our original report:

- **Pots Branch greenstone (CZpbg)** Equally light-dark to dark colored minerals, fine to medium-grained rocks. Greenstone is a common term for variably metamorphosed mafic to ultramafic volcanic rock bounded with an unconformity at the top and/or bottom of the strata. The name comes from the green hue imparted by the color of the metamorphic minerals within the mafic rocks: the typical green minerals are chlorite, epidote, albite, actinolite, and other green amphiboles.
- **Big Lake-Raven Rock schist (upper) (CZbr1)** Light-colored minerals, fine to medium-grained, well foliated and locally lineated schist. Resistant outcrops are commonly white mica schist. Locally, outcrops contain clasts of white to gray phyllite or fine-grained volcanic rocks (e.g. tuff).

## FIELD INVESTIGATION

On December 18th, 2023, six (6) Standard Penetration Test (SPT) soil borings (Labeled B-09 to B-14) were performed within the Project Corridors. The SPT borings were advanced to a maximum depth of approximately 10.0 feet below the existing pavement surface by a CME 55 truck mounted drill rig. SPT borings were performed in general accordance with ASTM D1586 “Penetration Test and Split-Barrel Sampling of Soils”. Soil samples were obtained from soil borings at regular intervals using a split-barrel sampler and visually classified in accordance with the Unified Soil Classification System (USCS). An automatic hammer was used to advance the sampler. All soil samples were sealed in moisture retarding containers, labeled, and transported to our laboratory for further analysis. After borings were completed, the borings were inspected for the presence of ground water and backfilled with auger cuttings for safety reasons. The surface was patched with asphalt cold patch and as-drilled boring coordinates were obtained with a Trimble Geo7X hand-held GPS unit capable of submeter accuracy. Ground elevations at boring locations were interpolated using the terrain model provided.

## LABORATORY TESTING

All soil samples were reviewed by our geotechnical staff in the field and were visually-manually classified in accordance with ASTM D2488 “Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)” and the Unified Soil Classification System (USCS). Two (2) split-spoon (SS-##) samples were tested for natural moisture content, Atterberg limits, and mechanical sieve analysis. Four (4) split-spoon samples were tested for natural moisture content only. Moisture content results are shown on individual test borings. Laboratory test results are included in the appendix of this letter report.

## SURFACE AND SUBSURFACE CONDITIONS

Surface materials encountered in the borings consisted of bituminous concrete (asphalt) underlain by aggregate base course (ABC stone). Asphalt and ABC stone thicknesses generally measured 2 to 6 inches and 2 to 7 inches, respectively, where explored. The pavement sections within the Project Corridor should be considered variable in thickness and composition.

Fill soils are best described as man-placed deposits of materials used to raise or restore grades which typically include soil and rock but can sometimes consist of trash and debris. Fill soils were identified in borings B-11 (Boyd St) and B-14 (Sycamore St) extending approximately 3.0 to 5.5 feet below the existing pavement surface. Recovered samples of fill were visually-manually

classified as lean clay (CL) with varying amounts of sand and gravel. Relative moisture of fill samples recovered indicate moist conditions. Fill likely exists elsewhere within the Project Corridors, extending to various depths, in areas not explored.

Triassic Residual soils are formed from the in-place weathering of the parent Triassic bedrock (e.g., sandstone, siltstone, mudstone). Triassic residual soils were identified in borings B-09 (Midland Valley Way) and B-10 (Elmhaven Way) beneath surface materials. Recovered samples of Triassic residuum were either laboratory or visually-manually classified as clayey sand (SC) and lean clay (CL). Relative moisture contents of samples recovered indicate moist conditions. Triassic residual soils are identified by their sedimentary origin, moisture sensitivity, and colors (reddish-browns, purplish-brown, and brown with various gray).

Residual soils are formed from the in-place weathering of the parent bedrock. Residual soils were identified in all borings beneath surface materials or fill soils. Recovered samples of residuum were either laboratory or visually-manually classified as clayey sand (SC), silt (ML), and lean clay (CL). Relative moisture contents of samples recovered indicate moist to wet conditions.

Partially Weathered Rock (PWR) is a very hard geomaterial with properties intermediate of soil and rock and defined as a geomaterial that yields 6 inches of penetration or less after 50 blows by a split-spoon sampler when subjected to Standard Penetration Testing. PWR in the form of weathered Triassic mudstone and sandstone was encountered at borings B-09 and B-10 at depths ranging approximately from 4.0 to 6.5 feet below the existing pavement surface corresponding to approximate elevations of 344.0 to 351.8 feet. PWR was not encountered outside of the Triassic basin borings; however, weathered boulders and/or rock ledges may exist within the other Project Corridors.

Groundwater was not observed in any boring at the completion of drilling. Cave-in depths were measured and are shown on the boring logs. Shallow cave-in depths may indicate the presence of perched groundwater. Some recovered samples were observed to be wet which may indicate the water table and/or perched groundwater is within several feet of the sample interval; however, we did not observe any saturated samples. All boreholes were backfilled immediately for safety reasons and patched.

## **RECOMMENDATIONS**

The recommendations presented in our original report are applicable to this addendum and the project additions as we understand them. It should be noted that waterlines to be installed in Morrisville will be within Triassic basin soils/PWR which have a different composition than the soils within the other work areas. While Triassic soil composition is distinct from the other work areas, no specific earthmoving recommendations are required provided excavations are backfilled per the Town's standard specifications and details.

PWR is anticipated along Midland Valley Way and the Malvern Hill Ln connection in excavations extending deeper than 4 feet below the pavement surface. For your consideration we recommend including an allowance of at least 55 cubic yards of PWR/rock excavation in the contract documents. This estimate is based on a trench length of 355 feet, a trench width of 3 pipe diameters (24"), and an average PWR thickness of 2 feet.

PWR is anticipated along Elmhaven Way in excavations extending deeper than 6 feet below the pavement surface. For your consideration we recommend including an allowance of at least 5 cubic yards of PWR/rock excavation in the contract documents. This estimate is based on a trench length of 15 feet crossing beneath the existing 24-inch storm drain, a trench width of 3 pipe diameters (24"), and an average PWR thickness of 2 feet.

PWR/rock excavation is not anticipated for the remaining work areas; however, we recommend including a marginal allowance (e.g., 5 cubic yards per unique work area) to be used as a contingency and to establish a unit price.

## **CLOSURE**

Recommendations provided by Falcon are based on the project description as outlined herein. Our field investigation and analyses were performed in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed

or implied, is made. Falcon appreciates the opportunity to have provided geotechnical services to you for this project. If you have any questions regarding this letter report, please contact our office at 919.871.0800.

Sincerely,

**FALCON ENGINEERING, INC.**



Allan Paul, PE  
Principal / Senior Project Manager  
Enclosure: Attachment(s)



Jeremy R. Hamm, PE  
Principal / Director of Engineering

## **APPENDIX**

LEGEND TO SOIL AND ROCK CLASSIFICATIONS AND SYMBOLS

BORING LOCATION PLAN

TEST BORING LOGS

LABORATORY TEST RESULTS

# LEGEND TO SOIL AND ROCK CLASSIFICATION AND SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)	FRACTURE SPACING	CONSISTENCY OF COHESIVE SOILS		RELATIVE DENSITY OF COHESIONLESS SOILS
SYMBOLS	TERM	TERM	CONSISTENCY	RELATIVE DENSITY
BITUMINOUS CONCRETE (ASPHALT)	VERY WIDE	MORE THAN 10 FEET	VERY SOFT	VERY LOOSE
CONCRETE	WIDE	3 TO 10 FEET	SOFT	LOOSE
AGGREGATE BASE COURSE	MODERATELY CLOSE	1 TO 3 FEET	FIRM	MEDIUM DENSE
TOPSOIL	CLOSE	0.16 TO 1 FEET	STIFF	DENSE
LOW-PLASTICITY ORGANIC SILT/CLAY (OL)	VERY CLOSE	LESS THAN 0.16 FEET	VERY STIFF	VERY DENSE
HIGH-PLASTICITY ORGANIC SILT/CLAY (OH)			HARD	
PEAT (PT)			VERY HARD	
WELL-GRADED GRAVEL (GW)				
POORLY-GRADED GRAVEL (GP)				
SILTY GRAVEL (GM)				
CLAYEY GRAVEL (GC)				
WELL-GRADED SAND (SW)				
POORLY-GRADED SAND (SP)				
SILTY SAND (SM)				
CLAYEY SAND (SC)				
SILT (ML)				
ELASTIC SILT (MH)				
LEAN CLAY (CL)				
PLASTIC CLAY (CH)				
PARTIALLY WEATHERED ROCK				
NON-CRYSTALLINE ROCK				
CRYSTALLINE ROCK				
COASTAL PLAIN SEDIMENTARY ROCK				
MAN PLACED FILL OR BACKFILL				
ALLUVIAL SOILS				
IMMEDIATE WATER LEVEL				
STATIC WATER LEVEL				
PIPE INVERT ELEVATION				
AUGER PROBING				
SPT BORING				
SPT BORING WITH ROCK CORE				
CONE PENETRATION TEST SOUNDING				
HAND AUGER + TEST				
ROD SOUNDING				
TEST PIT				
SPT N-VALUE				
SPLIT SPOON SAMPLE				
BULK SAMPLE				
SHELBY TUBE SAMPLE				
ROCK SAMPLE				

## WEATHERING

<b>FRESH</b>	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
<b>VERY SLIGHT (V. SL.)</b>	Rock generally fresh, joints stained, some joints may show thin clay coatings if open, crystals on a broken specimens face shine brightly. Rock rings under hammer blows if of a crystalline nature.
<b>SLIGHT (SLI.)</b>	Rock generally fresh, joints stained and discoloration extends into rock up to 1 inch. Open joints may contain may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rock rings under hammer blows.
<b>MODERATE (MOD.)</b>	Significant portions of rock shows discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored, some show clay. Rock has dull sound under hammer blows and show significant loss of strength as compared with fresh rock.
<b>MODERATE SEVERE (MOD. SEV.)</b>	All rocks except quartz discolored or stained. In granitoid rocks, all feldspars and discolored and a majority show kaolinitization. Rocks shows severe loss of strength and can be excavated with a geologist's pick. Rock gives "clunk" sound when struck. If tested would yield spt refusal.
<b>SEVERE (SEV.)</b>	All rocks except quartz discolored or stained. Rock fabric clear and evident but reduced in strength to strong soil. In granitoid rocks all feldspars are kaolinitized to some extent. Some fragments of strong rock usually remain. If tested, yields spt n-values > 100 bpf.
<b>VERY SEVERE (V. SEV.)</b>	All rocks except quartz discolored or stained. Rock fabric elements are discernible but the mass is effectively reduced to soil status, with only fragments of strong rock remaining. Saprolite is an example of rock weathered to a degree such that only minor vestiges of the original rock fabric remain. If tested, yields spt n-values < 100 bpf.
<b>COMPLETE</b>	Rock reduced to soil. Rock fabric not discernible or discernible only in small and scattered concentrations. Quartz may be present as dikes or stringers. Saprolite is also an example.

## ROCK HARDNESS

<b>VERY HARD</b>	Cannot be scratched by knife or sharp pick. Breaking of hand specimens requires several hard blows of the geologist's pick.
<b>HARD</b>	Can be scratched by knife or pick only with difficulty. Hard hammer blows required to detach hand specimens.
<b>MODERATELY HARD</b>	Can be scratched by knife or pick. Gouges or grooves to 0.25 inches deep can be excavated by hard blow of a geologist's pick. Hand specimens can be detached with moderate blows.
<b>MEDIUM HARD</b>	Can be grooved or gouged 0.5 inches deep by firm pressure of knife or pick point. Can be excavated in small chips to pieces 1 inch maximum size by hard blows of the point of a geologist's pick.
<b>SOFT</b>	Can be grooved or gouged readily by knife or pick. Can be excavated in fragments from chips to several inches in size by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.
<b>VERY SOFT</b>	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 inch or more in thickness can be broken by finger pressure. Can be scratched readily by fingernail.

## ROCK DEFINITION

Hard rock is non-coastal plain material that when tested, would yield spt refusal. An inferred rock line indicates the level at which non-coastal plain material would yield SPT refusal. SPT refusal is penetration by a split-spoon sampler equal to or less than 0.1 foot per 50 blows. In non-coastal plain material, the transition between soil and rock materials are typically divided as follows:

PARTIALLY WEATHERED ROCK (PWR)		Non-coastal plain material that yields SPT N-values > 100 blows per foot.
CRYSTALLINE ROCK (CR)		Fine to coarse grained, igneous and metamorphic rock that would yield SPT refusal if tested. Rock type includes granite, gneiss, gabbro, schist, etc.
NON-CRYSTALLINE ROCK (NCR)		Fine to coarse grained, metamorphic and non-coastal plain sedimentary rock that would yield SPT refusal if tested. Rock type includes phyllite, slate, sandstone, etc.
COASTAL PLAIN SEDIMENTARY ROCK (CP)		Coastal plain sediments cemented tinto rock but may not yield SPT refusal. Rocky type includes limestone, sandstone, cemented shell beds, etc.

## ABBREVIATIONS

ABC	Aggregate base course	FIAD	Filled immediately after drilling	RES	Residuum
ALLUV	Alluvium	FOSS	Fossiliferous	SAP	Saprolitic
AR	Auger refusal	FRAC	Fractured	S	Soft
BC	Bituminous concrete (asphalt)	FRAGS	Fragments	SAT	Saturated
BLDR	Boulder	GR	Gravel	SD	Sand
BPF	Blows per foot	GS	Specific gravity	SDY	Sandy
BT	Boring terminated	GW	Groundwater	SED	Sediments
CALC	Calcareous	HR	Hard rock	SL	Silt, silty
CI	Caved-in	MED	Medium	SLI	Slightly
CL	Clay	MIC	Micaceous	SPT	Standard penetration test
CLY	Clayey	MOT	Mottled	SWR	Soft weathered rock
COB	Cobble	NS	No sample taken	TCR	Tricone refusal
CSE	Coarse	ORG	Organic	TS	Topsail
DPT	Dynamic penetration test	PP	Pocket penetrometer	VST	Vane shear test
DST	Estimated	PP	Pocket penetrometer	V	Very
F	Fine	PWR	Partially weathered rock	W/	With
		REF	Refusal		

## TERMS AND DEFINITIONS

- ALLUVIUM: soils which have been transported and deposited by water.
- AQUIFER: a water bearing formation or strata.
- ARENACEOUS: applied to rocks that have been derived from sand or that contain sand. Argillaceous: applied to all rocks or substances composed of clay minerals, or having a notable proportion of clay in their composition, as shale/slate/etc.
- ARTESIAN: groundwater that is under sufficient pressure to rise above the level at which it is encountered, but which does not necessarily rise to or above the ground surface
- CALCAREOUS: soils which contain appreciable amounts of calcium carbonate.
- COLLUVIUM: rock fragments mixed with soil deposited by gravity on a slope or bottom of a slope.
- CORE RECOVERY: total length of all material recovered in the core barrel divided by total length of core run and expressed as a percentage.
- DIKE: a tabular body of igneous rock that cuts across the structure of adjacent rocks or cuts massive rock.
- DIP: the angle at which a stratum or any planar feature is inclined from the horizontal.
- DIP DIRECTION: the direction or bearing of the horizontal trace of the line of dip, measured clockwise from north.
- FAULT: a fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture.
- FILL: man-made deposits of natural soils or rock products and waste materials.
- FISSLE: a property of splitting along closely spaced parallel planes.
- FLOAT: rock fragments on surface near their original position and dislodged from parent material.
- FLOOD PLAIN: land bordering a stream, built of sediments deposited by the stream.
- FORMATION: a mappable geologic unit that can be recognized and traced in the field.
- JOINT: fracture in rock along which no appreciable movement has occurred.
- LEDGE: a shelf-like ridge or projection of rock whose thickness is small compared to its lateral extent.
- LENS: a body of soil or rock that thins out in one or more directions.
- MOTTLED: irregularly marked with spots of different colors. Mottling in soils usually indicates poor aeration and lack of good drainage.
- PERCHED WATER: water maintained above the normal groundwater level by the presence of an intervening impervious stratum.
- RESIDUUM: soil formed in place by weathering of the parent rock.
- ROCK QUALITY DESIGNATION (ROD): a measure of rock quality described by: total length of rock segments equal to or greater than 4 inches divided by the total length of core run and expressed as a percentage.
- SAPROLITE: residual soil which retains the relic structure or fabric of the parent rock.
- SILL: an intrusive body of igneous rock of approximately uniform thickness and relatively thin compared with its lateral extent, which has been emplaced parallel to the bedding or schistosity of the intruded rocks.
- SLICKENSIDE: polished and striated surface that results from friction along a fault or slip plane.
- STANDARD PENETRATION TEST (SPT): number of blows of a 140 pound hammer falling 30 inches required to produce a penetration of 1 foot (N-value or blows per foot) into soil with a 2 in outside diameter split spoon sampler. SPT refusal is less than 0.1 foot penetration with 50 blows.
- STRATA CORE RECOVERY: total length of strata material recovered divided by total length of stratum and expressed as a percentage.
- STRATA ROCK QUALITY DESIGNATION: a measure of rock quality described by total length of rock segments within a stratum equal to or greater than 4 inches divided by the total length of strata and expressed as a percentage.
- STRATUM: a section of a formation consisting of the same kind of material throughout.
- TOPSOIL: surface soils usually containing organic material.



**NOTES:**  
 1. Georeferenced aerial imagery obtained from www.NCOneMap.gov

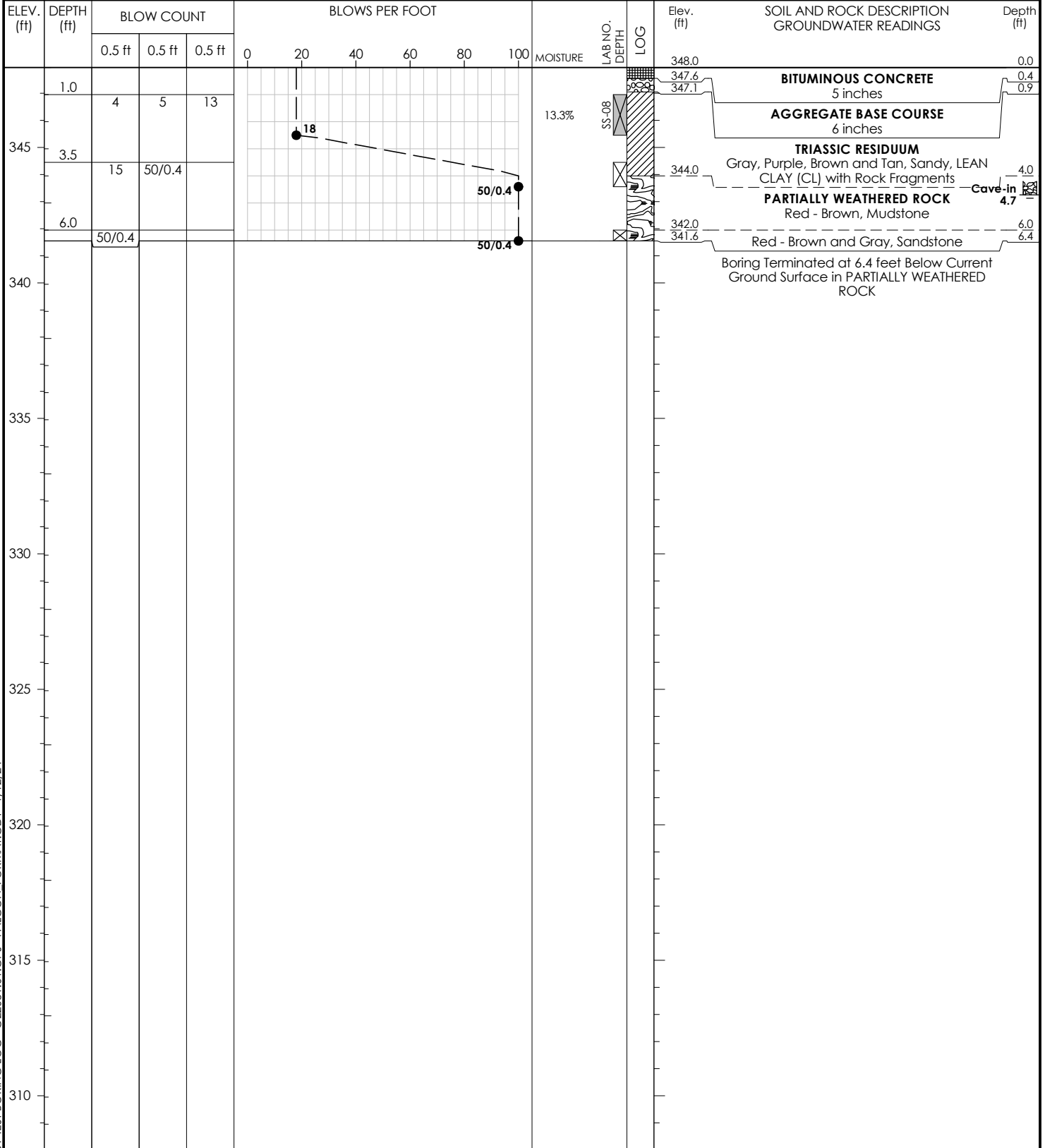
<b>SHEET:</b> BORING LOCATION PLAN		<b>INVESTIGATED BY:</b> SKB	
<b>PROJECT NAME:</b> TOC 2023 WATERMAIN REPLACEMENTS		<b>DRAWN BY:</b> EJB	
<b>PROJECT NO.:</b> G22081.01	<b>HORIZONTAL SCALE:</b> AS SHOWN	<b>CHECKED BY:</b> ASP	
<b>PROJECT LOCATION:</b> CARY, NORTH CAROLINA		<b>DATE:</b> 2024-01-12	



FALCON ENGINEERING, INC.  
 1210 TRINITY ROAD, SUITE 110  
 CARY, NC 27513  
 PHONE: 919.871.0800  
 www.falconengineers.com



PROJECT NO. G22081.01		PROJECT LOCATION Cary, NC		LOGGED BY Berglin, S.		GROUND WATER	0 HOUR	STATIC
PROJECT NAME Town of Cary 2023 Watermain Replacements						HOLE	Dry	FIAD
BORING NO. B-09		BORING LOCATION See Boring Location Plan				DEPTH		
ELEVATION (ft) 348.0		NORTHING (ft) 754308		DRILL MACHINE CME 55 TRUCK		DATE 12/18/2023		
TOTAL DEPTH (ft) 6.4		EASTING (ft) 2048485		DRILLER Hodges, T.		SURFACE WATER DEPTH (ft) N/A		
DATE STARTED 12/18/2023		DATE COMPLETED 12/18/2023		DRILL METHOD Hollow Augers		HAMMER TYPE Automatic		



01 TEST BORING LOG: G22081.01.GPJ FALCON FORMAT.GDT 1/12/24

Vertical Scale: 1"=5'



PROJECT NO. G22081.01		PROJECT LOCATION Cary, NC			LOGGED BY Berglin, S.		GROUND WATER	0 HOUR	STATIC							
PROJECT NAME Town of Cary 2023 Watermain Replacements							HOLE	Dry	FIAD							
BORING NO. B-10		BORING LOCATION See Boring Location Plan			DRILL MACHINE CME 55 TRUCK		DEPTH									
ELEVATION (ft) 358.3		NORTHING (ft) 757194		DRILLER Hodges, T.		DATE	12/18/2023									
TOTAL DEPTH (ft) 9.3		EASTING (ft) 2042137		DRILL METHOD Hollow Augers		SURFACE WATER DEPTH (ft) N/A										
DATE STARTED 12/18/2023			DATE COMPLETED 12/18/2023		DRILL METHOD Hollow Augers		HAMMER TYPE Automatic									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					MOISTURE	LAB NO. DEPTH LOG	Elev. (ft)	SOIL AND ROCK DESCRIPTION GROUNDWATER READINGS	Depth (ft)		
		0.5 ft	0.5 ft	0.5 ft	0	20	40	60	80						100	
	1.0	3	6	5									358.3		0.0	
	3.5	6	6	8						15.9%	SS-09		358.0 357.5	BITUMINOUS CONCRETE 4 inches	0.3 0.8	
	6.0	6	28	50/0.3						Moist				AGGREGATE BASE COURSE 5 inches		
	8.5	40	50/0.3											TRIASSIC RESIDUUM Gray, Purple - Brown and Tan, Sandy, LEAN CLAY (CL) with Rock Fragments		
															Cave-in	6.1
														PARTIALLY WEATHERED ROCK Gray and Purple - Brown, Sandstone	6.5	
																9.3
														Boring Terminated at 9.3 feet Below Current Ground Surface in PARTIALLY WEATHERED ROCK		

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Vertical Scale: 1"=5'



PROJECT NO. G22081.01		PROJECT LOCATION Cary, NC			LOGGED BY Berglin, S.		GROUND WATER	0 HOUR	STATIC						
PROJECT NAME Town of Cary 2023 Watermain Replacements							HOLE	Dry	FIAD						
BORING NO. B-11		BORING LOCATION See Boring Location Plan					DEPTH								
ELEVATION (ft) 499.3		NORTHING (ft) 743295		DRILL MACHINE CME 55 TRUCK			DATE	12/18/2023							
TOTAL DEPTH (ft) 10.0		EASTING (ft) 2065310		DRILLER Hodges, T.			SURFACE WATER DEPTH (ft) N/A								
DATE STARTED 12/18/2023			DATE COMPLETED 12/18/2023		DRILL METHOD Hollow Augers		HAMMER TYPE Automatic								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					MOISTURE	LAB NO. DEPTH LOG	Elev. (ft)	SOIL AND ROCK DESCRIPTION GROUNDWATER READINGS	Depth (ft)	
		0.5 ft	0.5 ft	0.5 ft	0	20	40	60	80						100
	1.0	3	4	3							15.1%	SS-10	499.3 499.0 498.5	BITUMINOUS CONCRETE 4 inches AGGREGATE BASE COURSE 6 inches	0.0 0.3 0.8
495	3.5	6	4	5	7						Wet		493.8	FILL Red and Brown, Sandy, LEAN CLAY (CL) with Gravel, Asphalt Fragments	5.5
	6.0	5	4	6	9						Moist			RESIDUUM Red, Orange and White, Sandy, LEAN CLAY (CL) with Rock Fragments	6.4
490	8.5	3	4	7	10						Moist				10.0
					11								489.3		
														Boring Terminated at 10.0 feet Below Current Ground Surface in RESIDUUM	
485															
480															
475															
470															
465															
460															

01 TEST BORING LOG G22081.01.GPJ FALCON FORMAT.GDT 1/12/24

Vertical Scale: 1"=5'



PROJECT NO. G22081.01		PROJECT LOCATION Cary, NC		LOGGED BY Berglin, S.		GROUND WATER	0 HOUR	STATIC								
PROJECT NAME Town of Cary 2023 Watermain Replacements						HOLE	Dry	FIAD								
BORING NO. B-12		BORING LOCATION See Boring Location Plan				DEPTH										
ELEVATION (ft) 443.1		NORTHING (ft) 741933		DRILL MACHINE CME 55 TRUCK		DATE 12/18/2023										
TOTAL DEPTH (ft) 10.0		EASTING (ft) 2059985		DRILLER Hodges, T.		SURFACE WATER DEPTH (ft) N/A										
DATE STARTED 12/18/2023		DATE COMPLETED 12/18/2023		DRILL METHOD Hollow Augers		HAMMER TYPE Automatic										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					MOISTURE	LAB. NO. DEPTH LOG	Elev. (ft)	SOIL AND ROCK DESCRIPTION GROUNDWATER READINGS	Depth (ft)		
		0.5 ft	0.5 ft	0.5 ft	0	20	40	60	80						100	
	1.0	3	3	5									443.1		0.0	
	1.0	3	3	5									442.6	<b>BITUMINOUS CONCRETE</b> 6 inches	0.5	
	1.0	3	3	5									442.4	<b>AGGREGATE BASE COURSE</b> 2 inches	0.7	
440	3.5	3	4	4	8						Moist					
	3.5	3	4	4	8						36.1%	SS-11		<b>RESIDUUM</b> Gray, White and Orange - Brown, Sandy, LEAN CLAY (CL) with Rock Fragments		
	6.0	6	8	11							Moist		437.6	Gray and Orange, CLAYEY SAND (SC) with Mica, Saprolitic	5.5	
435	8.5	5	7	12	19						Moist			<b>Cave-in</b>	6.8	
	8.5	5	7	12	19						Moist		433.1		10.0	
														Boring Terminated at 10.0 feet Below Current Ground Surface in RESIDUUM		
430																
425																
420																
415																
410																
405																

01 TEST BORING LOG: G22081.01.GPJ FALCON FORMAT.GDT 1/12/24

Vertical Scale: 1"=5'



PROJECT NO.		PROJECT LOCATION		LOGGED BY		GROUND WATER	0 HOUR	STATIC								
G22081.01		Cary, NC		Berglin, S.		HOLE	Dry	FIAD								
PROJECT NAME		BORING NO.		BORING LOCATION		DEPTH										
Town of Cary 2023 Watermain Replacements		B-13		See Boring Location Plan												
ELEVATION (ft)		NORTHING (ft)		DRILL MACHINE		DATE										
463.1		741612		CME 55 TRUCK		12/18/2023										
TOTAL DEPTH (ft)		EASTING (ft)		DRILLER		SURFACE WATER DEPTH (ft)										
10.0		2059498		Hodges, T.		N/A										
DATE STARTED		DATE COMPLETED		DRILL METHOD		HAMMER TYPE										
12/18/2023		12/18/2023		Hollow Augers		Automatic										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					MOISTURE	LAB NO. DEPTH	LOG	Elev. (ft)	SOIL AND ROCK DESCRIPTION GROUNDWATER READINGS	Depth (ft)	
		0.5 ft	0.5 ft	0.5 ft	0	20	40	60	80							100
	1.0	7	5	9							18.7%	SS-12		463.1		0.0
	3.5	7	7	6							Moist			462.9 462.5	BITUMINOUS CONCRETE 2 inches	0.2 0.6
460	6.0	5	12	13							Moist				AGGREGATE BASE COURSE 5 inches	
	8.5	8	10	17							Moist			457.6	RESIDUUM White, Orange and Red, Sandy, SILT (ML) Saprolitic	5.5
455											Moist				White, Sandy, SILT (ML) Saprolitic	6.3
											Moist			453.1		10.0
															Boring Terminated at 10.0 feet Below Current Ground Surface in RESIDUUM	

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Vertical Scale: 1"=5'



PROJECT NO. G22081.01		PROJECT LOCATION Cary, NC			LOGGED BY Berglin, S.		GROUND WATER	0 HOUR	STATIC						
PROJECT NAME Town of Cary 2023 Watermain Replacements							HOLE	Dry	FIAD						
BORING NO. B-14		BORING LOCATION See Boring Location Plan					DEPTH								
ELEVATION (ft) 451.6		NORTHING (ft) 741241		DRILL MACHINE CME 55 TRUCK			DATE 12/18/2023								
TOTAL DEPTH (ft) 10.0		EASTING (ft) 2059699		DRILLER Hodges, T.			SURFACE WATER DEPTH (ft) N/A								
DATE STARTED 12/18/2023			DATE COMPLETED 12/18/2023		DRILL METHOD Hollow Augers		HAMMER TYPE Automatic								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					MOISTURE	LAB NO. DEPTH LOG	Elev. (ft)	SOIL AND ROCK DESCRIPTION GROUNDWATER READINGS	Depth (ft)	
		0.5 ft	0.5 ft	0.5 ft	0	20	40	60	80						100
												451.6			0.0
	1.0	3	3	3								451.4	<b>BITUMINOUS CONCRETE</b> 2 inches	0.2	
												450.8	<b>AGGREGATE BASE COURSE</b> 7 inches	0.8	
450	3.5	4	2	3	6					Moist		448.6	<b>FILL</b> Brown, Sandy, LEAN CLAY (CL) with Gravel	3.0	
	6.0	3	4	7	5					22.8%	SS-13	446.1	<b>RESIDUUM</b> Gray and Brown, LEAN CLAY (CL) with Sand, Mottled	5.5	
445	8.5	5	6	7	11					Moist		443.6	Gray and Tan, Sandy, SILT (ML)	7.5	
					13					Moist		441.6	Gray, Brown and Black, CLAYEY SAND (SC) Saprolitic	10.0	
440													Boring Terminated at 10.0 feet Below Current Ground Surface in RESIDUUM		
435															
430															
425															
420															
415															

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# SUMMARY OF SOIL INDEX TESTING

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<b>Project Number:</b> G22081.01												
<b>Project Name:</b> Town of Cary 2023 Watermain Replacements												
<b>Project Location:</b> Cary, NC												
Sample ID	Boring ID	Depth (ft)	Natural Moisture Content (%)	Percent Passing			Atterberg Limits			Percent Organics	Symbol	
				#10	#40	#200	LL	PL	PI		USCS	AASHTO
SS-08	B-09	1.0 - 2.5	13.3							-		
SS-09	B-10	1.0 - 2.5	15.9	89	77	52.1	31	19	12	-	CL	A-6
SS-10	B-11	1.0 - 2.5	15.1							-		
SS-11	B-12	3.5 - 5.0	36.1							-		
SS-12	B-13	1.0 - 2.5	18.7							-		
SS-13	B-14	3.5 - 5.0	22.8	97	95	79.0	39	22	17	-	CL	A-6



