TECHNICAL SPECIFICATIONS

INDEX

SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.01. SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents
3. Work by Owner
4. Future Work
5. Purchase contracts.
6. Owner-furnished products.
7. Contractor-furnished, Owner-installed products
8. Access to site
9. Coordination with occupants
10. Work restrictions
11. Coordination with third parties
12. Specification and drawing conventions
13. Alteration of quantities

1.02. PROJECT INFORMATION

A. Project Identification: <Insert Bid Title>

1. Project Location: <Insert Location Information>

B. Owner: Fulton County

1. Owner's Representative: <Insert Contact and Info for PM>

C. Engineer: <Insert Engineer Contact Info>

1.03. WORK COVERED BY CONTRACT DOCUMENTS

A. The work of the Project is defined by the Contact Documents and consists of the following:

1. The work will consist of providing all labor, equipment and materials necessary for the construction, installation, and emergency repair of sewer mains, waste water service lines, and other required improvements to the wastewater collection system within Fulton County.

2. ll work shall be in conformance with the Contract Documents, Drawings, and Fulton County Standards and Specifications, and the relevant government agencies Standards and Specifications.

1.04. WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1. <Insert description or "None.">

B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. <Insert description or "None.">

C. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. <Insert description or "None.">

D. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. <Insert description or "None.">

1.05. FUTURE WORK

A. The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:

1. <Insert description or "None.">

1.06. PURCHASE CONTRACTS

A. General: Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise noted.

B. Purchase Contracts Information:

1. <Insert description or "None.">

1.07. OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner-Furnished Products:

1. <Insert description or “None.”>

1.08. CONTRACTOR-FURNISHED, OWNER-INSTALLED PRODUCTS

A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning over to Owner at Project closeout.

B. Contractor-Furnished, Owner-Installed Products:

1. <Insert description or “None.”>

1.09. ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.10. COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy:

1. The existing facilities to which these improvements are being made will continue operation during the period of construction.

2. Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

3. Provide not less than 48 hours' notice to Owner of activities that will affect Owner's operations.

1.11. WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in existing buildings to normal business working hours of <Insert time> a.m. to <Insert time> p.m., Monday through Friday, except as otherwise indicated.

1. Weekend Hours: <Insert restrictions on times permitted for weekend work>

2. Hours for Utility Shutdowns: <Insert Owner's restrictions>

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Fulton County not less than two days in advance of proposed utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

E. Controlled Substances: Use of alcohol, tobacco products and other controlled substances on the Project site is not permitted.

1.12. COORDINATION WITH THIRD PARTIES

A. The Contractor shall coordinate the work with third parties (such as power, natural gas, or telephone companies) in areas where such parties may have rights to underground property or facilities.

B. The Contractor shall request from involved third parties maps or other descriptive information as to the nature and location of such underground facilities or property. The Contractor shall make all necessary investigations to determine the existence and location of underground utilities.

C. The Contractor will be held responsible for any damage to and for maintenance and protection of existing utilities and structures whether or not if the utility has been located by the owner. The Contractor shall contact the utility owners and the individual property owners for the location of the utilities within the area of Work.

D. The Contractor shall coordinate the work with owners of private and public property where access is required for the performance of the work. Legal access will be acquired and provided by the Owner.

1.13. SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.14. ALTERATION OF QUANTITIES

A. The Owner reserves the right to alter the quantities of work to be performed or to extend or shorten the improvements at any time when and as found necessary, and the Contractor shall perform the work as altered, increased or decreased.

1. Payment for such increased or decreased quantity will be made in accordance with the Instructions to Bidders.
2. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 11 10

GEOTECHNICAL INFORMATION

PART 1 – GENERAL

1.01. SCOPE

A. The following geotechnical report document is available for review in the appendix of these contract documents:

Report of Subsurface Exploration and Geotechnical Engineering Evaluation
<Insert Project Title>

Prepared by:
<Insert Geotechnical Consultant>

Interpretations, evaluations, and conclusions as to the nature of the geotechnical materials, the difficulties of making and maintaining the required excavations, and the difficulties of doing other work affected by geotechnical conditions shall be the sole responsibility of the Contractor. At no additional cost to the Owner, the Contractor may conduct, with Owner's approval, other investigations and tests it deems appropriate.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 11 55

CONSTRUCTION STAKING

PART 1 – GENERAL

1.01 SCOPE

A. Construction staking shall include all of the surveying work required to layout the Work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the Construction Manager. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.

B. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the Contractor shall:

1. Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.

2. Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and shall bear the cost of re-establishing same if disturbed.

3. Stake out the permanent and temporary easements or the limits of construction to ensure that the Work is not deviating from the indicated limits.

4. Be responsible for all damage done to reference points, baselines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, baselines, center lines and temporary bench marks as a result of the operations.

C. Baselines shall be defined as the line to which the location of the Work is referenced including, but not limited to, edge of pavement, road centerline, property line, right of way or survey line.

D. Record Drawing surveys shall be performed in accordance with Section 01 78 39 of these Specifications.

1.02 PROJECT CONDITIONS

A. The Drawings provide the location and/or coordinates of principal components of the Project. The alignment of some components of the Project may be indicated in the Specifications. The Construction Manager may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.

B. The survey points, control points, and baseline to be provided to the Contractor shall be limited to only that information which can be found on the Project site by the Contractor.

C. A topographic survey is included on the Drawings.

1.03 QUALITY ASSURANCE

A. The Contractor shall furnish documentation, prepared by a surveyor currently registered in the State of Georgia, confirming that staking is being done to the horizontal and vertical alignment shown in the Contract Documents. This requires that the Contractor hire, at the Contractor's own expense, a currently registered surveyor, acceptable to the Owner, to provide ongoing construction staking or confirmation of such.

B. Any deviations from the Drawings shall be confirmed by the Construction Manager prior to construction of that portion of the Project.

C. Quantities for payments measured under this Contract shall be certified by the registered surveyor.

D. Construction Verification Surveying Cash Allowance

1. This cash allowance is solely for the use of the Construction Manager for verification of the Contractor's reference points, centerlines and work performed and is not to be used by the Contractor to provide cut sheets.

2. The presence of this cash allowance in no way relieves the Contractor of the responsibility of installing reference points, centerlines, temporary bench marks, verifying that the work has been performed accurately, and all other work covered by this Section.

1.04 SANITARY SEWERS

A. Staking Precision: The precision of construction staking required shall be that which the correct location of the sanitary sewer, manholes and other appurtenances can be established for construction and verified by the Construction Manager.

B. Reference Points

1. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right of way. The location of the reference points shall be recorded in a log with a copy provided to the Construction Manager for use, prior to verifying reference point locations.

2. Distances shall be accurately measured to 0.01 foot.

3. The Contractor shall give the Construction Manager reasonable notice that reference points are set. The reference point locations must be verified by the Construction Manager prior to commencing clearing and grubbing operations.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 11 80

ENVIRONMENTAL CONDITIONS

PART 1 – GENERAL

1.01 ENVIRONMENTAL CONDITIONS

A. This section describes the environmental conditions which have been observed at the site of the Work and which may reasonably be anticipated throughout the life of the project.

1.02 CLIMATE CONDITIONS

A. The site of the Work is at an elevation of approximately 860 feet to 1,200 feet above mean sea level.

B. Climate conditions are described as follows:

Description	Range of Conditions
Winter	Cool and damp
Summer	Hot and humid
Relative humidity, percent	
• Indoors	20 to 90
• Average outdoors	20 to 100
Air temperature, degrees F	
• Outdoors	15 to 105
• Indoors	30 to 105
Barometric pressure, inches, mercury	29.1 to 31.0

1.03 ADDITIONAL CONDITIONS

A. Additional conditions which may be applicable are specified in other sections.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 14 13

INSPECTION OF WORK

PART 1 – GENERAL

1.01 SCOPE

A. The work covered by this Section includes the Construction Manager's and Contractor's responsibilities and obligations regarding inspection of the work performed.

1.02 CONSTRUCTION MANAGER'S INSPECTION

A. The Construction Manager shall have the right of access to and inspection of the Work at all times. Materials, equipment and products shall be subject to the Construction Manager's review as specified herein.

B. The Construction Manager is responsible for general surveillance of the work on behalf of the Owner. The Construction Manager is not responsible for construction means, methods, sequences, or procedures or for safety precautions and programs in connection with the Work. The Construction Manager is not responsible for supervision of the Work and shall not give instruction to the Contractor's personnel as to methods of execution of the Work. The Construction Manager is not responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

1.03 CONTRACTOR'S DUTIES

A. The Contractor is responsible for all materials, equipment, methods, and procedures in execution of the Work.

B. The Contractor shall correct to the satisfaction of the Construction Manager any work or material found to be defective or of deficient quality. Such corrections shall be made by the Contractor at no additional expense to the Owner.

1.04 RIGHT OF ENTRY

A. Representatives of Fulton County, the Environmental Protection Division of the Georgia Department of Natural Resources, and the U.S. Department of Agriculture, Soil Conservation Services and others as may be identified by the Owner shall have access to the Work wherever it is in preparation or progress.

B. The Contractor shall provide proper facilities for such access and inspection.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 14 16

OCCUPANCY

PART 1 – GENERAL

1.01 PARTIAL OCCUPANCY BY OWNER

A. Whenever, in the opinion of the Construction Manager, any section or portion of the Work or any structure is in suitable condition, it may be put into use upon the written order of the Construction Manager and such usage will not be held in any way as an acceptance of said Work or structure, or any part thereof, or as a waiver of any of the provisions of these Specifications and the Contract.

B. Pending final completion and acceptance of the Work, all necessary repairs and replacements, due to defective materials or workmanship or operations of the Contractor, for any section of the Work so put into use shall be performed by the Contractor at Contractor's own expense.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 22 00

MEARUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 SCOPE

A. The Bid lists each item of the Project for which payment will be made. **No payment will be made for any items other than those listed in the Bid**. The Project Manager will clarify all contradictions.

B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit shall be considered as included in the unit prices bid for the various Bid items. The Contractor shall prepare the Bid accordingly.

C. Work includes furnishing all labor, equipment, tools and materials, which are not furnished by the Owner and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings.

1.02 DESCRIPTIONS

A. Measurement of an item of work will be by the unit indicated in the Bid. Work performed for items not included in the Bid shall be paid in accordance with Section 8, 00700-87.

B. Final payment shall be based on the actual work or service performed, calculated, and field measured, using the unit prices set forth in the Contract Document.

C. Payment for an item of work includes all necessary and incidental related work required to complete the Work, whether specified or not.

D. Unless otherwise stated in individual sections of the Specifications or in the Bid, or as approved in writing by the Construction Manager prior to beginning the Work, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the Work.

1. The costs for all such items required shall be included in the price bid for item of which it is a part.

2. In the event that the Owner requests work that is agreed by both the Owner and the Contractor as not included in the Bid, that item of work will be paid for in accordance with Section 8, 00700-87.

E. Payment will be made by extending unit prices multiplied by quantities provided and then summing the extended prices to reflect actual work.

1. Such price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials not furnished by the Owner and for performing all operations required to provide to the Owner the entire Project, complete in place, as specified and as indicated on the Drawings.

F. "Products" shall mean materials or equipment permanently incorporated into the work.

G. "Provide" shall mean furnish and install.

1.03 NON PAYMENTS

A. No separate payment shall be made for the restoration of developed property and the cost shall be included in the overall prices for the execution of the Work unless specifically noted otherwise.

B. No separate payment shall be made for pipe, pipe appurtenances, excavation, disposal of rubbish and debris, pipe bedding, backfill, dewatering of trench, repair of damaged properties unless otherwise stated. All testing required for the execution of the Work shall be done as part of the price for the item involved.

C. No separate payment shall be made for any traffic control, work area protection, recording, safety measures, set-up of equipment and set-up of staging area except as indicated below. Payment for these items shall be part of the unit price bid for each particular item of work.

D. No separate payment shall be made for providing detail surveys needed for construction. The Contractor shall be responsible in providing further survey necessary to complete the Work. The Contractor shall carefully preserve the established points. In case of willful or careless destruction, the Contractor shall be responsible for the costs of reestablishing the bench marks, reference points and stakes.

E. No separate payment shall be made for delay or extra cost encountered by the Contractor due to protection, avoidance or relocation of existing utilities, mains, or services shown or not shown on the Project Construction Drawings.

F. No separate payment shall be made for abandoning and/or removal of any existing materials from the project area or work site. The cost of such work and materials shall be included in the Bid Unit Price for each particular item.

G. No separate payments shall be made for existing pavement removal and replacement associated with the construction of the Project unless listed separately in the Bid. The cost of such work and materials shall be included in the Bid Unit Price for each particular item.

H. No separate payments shall be made for saw cutting existing pavement, any cutting activities necessary to install the proposed work, and including beveling of pipes.

I. No separate payments shall be made for temporary and/or permanent Erosion and Sedimentation Controls unless listed separately in the Bid, or except as noted on the Project Drawings or as directed and approved by the Owner.

J. No separate or additional payments shall be made for the Project area where the Contractor need to reseed for the following causes:

1. Inadequate watering and maintenance.
2. Loss of seeds caused by site erosion, e.g. wind and rain.
3. Inadequate germination of seeds.
4. Inadequate coverage and/or density.
5. Providing permanent species at the appropriate season, after temporary grassing has been performed.

K No separate or additional payments shall be made for providing temporary species of grass, where the seasonal limitations does not allow for the proper germination of a permanent species of grass. The cost for sowing or planting temporary species shall be included in the Unit Price Bid for the item it pertains.

L. No separate or additional payments shall be made for following reasons:

1. Materials that were not installed,
2. The replacement of defective materials.
3. Any section of the Project activity which does not pass the applicable tests.
4. If the area has not been clean up to the satisfaction of the Construction Manager.

M. No separate or additional payments shall be made for maintaining traffic flow, on and/or near or through the Project's area detour, roadways, streets, driveways, and work segment impacted by the construction activities unless listed separately in the Bid.

N. No separate or additional payments shall be made for existing rock or pipe line soil excavation, for the Project's construction. The cost shall be included in the particular work item Bid Unit Price.

O. No separate or additional payment shall be made for removing and replacing the damaged pre-construction area condition adjacent to the Project's site, damaged curb and gutter, driveway areas and pavements, caused by Contractor working on the Project.

P. No payments shall be made for restoration and the regrading of easements. The cost shall be included in the particular work item Bid Unit Price.

Q. No separate or additional payments shall be made for temporary measures required or necessary to make the road passable and drivable, including backing to the top of the trench temporarily with crusher run or granular material or placing a temporary asphalt topping surface.

R. No separate or additional payments for trench excavation, backfill and trench stabilization, shall be made for any special or unique method, means, techniques or equipment necessary for the Contractor's compliance with Specifications, regulatory requirements, permits, and laws or regulations, applicable to the Project.

S. No separate payments shall be made for trench excavation and backfill. All costs shall be included in the Bid Unit Price for the item to which pertains.

T. No separate payments shall be made for providing any sheeting, bracing, and shoring. All costs shall be included in the Bid Unit price for item to which it pertains.

1.04 CONTRACTOR MOBILIZATION

A. All costs associated with mobilization of all required resources, a one-time cost, shall be included in the unit prices bid for CONTRACTOR MOBILIZATION, based on the project sizes listed in the Bid.

1.05 SEWERS AND ACCESSORIES

A. Existing Utilities and Obstructions

1. Horizontal Conflict: Payments for conflicts with existing utilities shall be made only where additional manholes, and/or additional lengths of pipe are approved by the Construction Manager.

a. Said payment shall be made at the unit prices in the Bid.

b. No other payment will be made for any delay or extra cost encountered by the Contractor due to protection, avoidance or relocation of existing utilities, mains or services or changing the horizontal alignment of the sewer.

2. Vertical Conflict: Where authorized by the Construction Manager, payment for additional depth of cut required to avoid vertical conflicts shall be made at the unit prices bid for sewer line. No payment will be made for relocation of existing utilities except as authorized by the Construction Manager.

B. Location and Grade: No separate payment shall be made for survey work performed by or for the Contractor in the establishment of reference points, bench marks, cut sheets, limits of right of way or easement, including their restoration, as well as centerline or baseline points.

1. The Construction Verification Surveying cash allowance is solely for the use of the Construction Manager, for the verification of Contractor's reference points, centerlines, and work performed.

2. This cash allowance, in no way relieves the Contractor of the responsibility of, including but not limited to, installing the required Project reference points, centerlines, temporary and permanent bench marks, or verifying that their work has been performed accurately.

C. Construction Along Highways, Streets and Roadways: No separate payment shall be made for traffic control or maintaining highways, streets, roadways and driveways, except as authorized by the Construction Manager.

1. The Bid Unit Price shall include the cost of erecting and maintaining barriers, Signs, lights, traffic control measures and channelization devices, flagmen, and whatever is necessary to provide a safe work zone, and to protect the public safety, in accordance with the Traffic control Plan, and the current Manual on Uniform Traffic Control Devices for Streets and Highways.

D. Gravity Sewers – Ductile Iron, C900 PVC and HDPE

1. Payment for gravity sewer shall be made at the unit price bid for GRAVITY SEWER, for the quantity and type provided at the appropriate depth. Payment will be made at the one unit price for the actual depth of the sewer line.

2. Measurement for payment at the unit price for gravity sewer shall be made along the centerline of the pipe, through fittings, from inside face of structure wall penetrated to inside face of structure wall penetrated. Depth of cut shall be measured from pipe invert to ground level at pipe centerline. Cut sheets prepared by the Contractor and approved by the Construction Manager shall be the basis for payment.

3. The unit price bid for GRAVITY SEWER shall include all costs for installation of the sewer as required including, but not limited to, materials, labor, excavation, dewatering, shoring, bedding, haunching, backfill, compaction, clean-up, testing, bypass pumping, traffic control, and all other related items not listed as separate items in the Bid.

4. Payment for pipe INSTALLED IN STEEL CASING will be made in addition to payment for gravity sewer installed at the appropriate depth.

a. The unit price bid for pipe INSTALLED IN STEEL CASING shall include all additional costs associated with providing the appropriate size steel casing pipe, spacers, grout, brick, as required for the complete installation of pipe in casing via open-cut installation.

b. All costs associated with installation of the sewer line, including excavation, dewatering, etc. shall be included in the unit price bid for GRAVITY SEWER.

5. No payment shall be made for sections of pipe which are not installed.

6. No additional payment shall be made for replacement of defective materials.

7. No additional payment will be made for maintaining or stopping flow while placing the new sewer in service.

8. No payment shall be made for sections of pipe which have not passed required tests, or if the area has not been cleaned up to the satisfaction of the Construction Manager.

9. No separate payment will be made for cutting and beveling pipe.

E. Clean up and Testing: No separate payment will be made for clean-up and pressure testing.

1. All costs associated with clean up and testing of the gravity sewer shall be included in the unit price bid for GRAVITY SEWER.

2. No payment shall be made for tests that fail to verify required results.

F. Pipe Bursting

1. Measurement for payment at the unit price for PIPE BURSTING shall be made along the centerline of the pipe from inside face of structure wall penetrated to inside face of structure wall penetrated.

2. No separate payment shall be made for launch pits or receiving pit.

G. HDPE, Fusible PVC and Spiral Wound Sliplining

1. Measurement for payment at the unit price for HDPE, Fusible PVC and Spiral Wound Sliplining shall be made along the centerline of the pipe from inside face of structure wall penetrated to inside face of structure wall penetrated.

H. Cured-In-Place Lining

1. Measurement for payment at the unit price for CURED-IN-PLACE LINING shall be made along the centerline of the pipe from inside face of structure wall penetrated to inside face of structure wall penetrated. No payment shall be made for "down-tube" or dry felt used in conjunction with an inversion.

I. Sewer Cleaning

1. No payment shall be made for normal cleaning of sewers and manhole associated with rehabilitation of these items.

2. The costs of such cleaning shall be included in the Unit Price Bid of each item involved.

J. Manhole Rehabilitation

1. Measurement for payment at the unit price for MANHOLE REHABILITATION shall be made from the invert to the base of the manhole frame for each method of rehabilitation bid at the price for the depth range listed.

1.06 SEWER SERVICE CONNECTIONS

A. The unit price bid for SEWER SERVICE CONNECTIONS shall include all costs associated with installing a service connection as listed in the Bid including, but not limited to, all materials, labor, tools, excavation, backfill, compaction, manhole coring, grouting, manhole boot, fittings including wye or tee, and all incidental items required for a complete installation. No additional payment will be made for plugging the fitting or for cutting an existing sewer pipe to locate the fitting.

B. Measurement for payment for service connections will be made along the centerline of the pipe, through fittings, from centerline of manhole or pipe to the inside face of the clean-out box.

C. The unit price bid for CLEAN-OUT ASSEMBLY shall include, but is not limited to, all materials, labor, tools, fittings, vertical pipe, cleanout, cast iron box and cover, and all incidental items as required to provide a complete clean-out assembly.

D. Payment for re-establishing sewer service connections shall be made under the unit prices bid for SERVICE LINE RECONNECTIONS.

1.07 PRECAST CONCRETE MANHOLES AND ACCESSORIES

A. The unit price bid for 4-FOOT DIAMETER PRECAST MANHOLES, at the depths listed in the Bid, shall include all costs associated with construction of a complete manhole on a new sewer line, including excavation, shoring, dewatering, backfilling, compaction, crushed stone bedding, concrete slab, precast base, riser sections, cone or flat top, coring, rubber boots, grouting, sleeves, concrete, invert, mastic sealant, brickwork, mortar, connection of pipes to the manhole, vacuum testing, and all incidental items required to complete the installation.

B. The unit price bid for 4-FOOT DIAMETER DOGHOUSE MANHOLES, at the depths listed in the Bid, shall include all costs associated with construction of a complete manhole on an existing sewer line, including excavation, shoring, dewatering, backfilling, compaction, crushed stone bedding, concrete slab, base, riser sections, cone or flat top, coring, rubber boots, grouting, concrete, invert, diversion of flow, cutting existing pipe, connecting pipes to manhole, mastic sealant, brickwork, mortar, vacuum testing, and all incidental items required to complete the installation.

C. Measurement for payment at the unit price for MANHOLES shall be made from the invert to the top of the top section. Payment for manholes shall be made at the unit price bid for MANHOLES, for the type provided at the appropriate depth. Payment will be made at the one unit price for the actual depth of the manhole.

D. Manhole Accessories

1. The unit price bid for MANHOLE RING AND COVER shall include the cost of providing the appropriate type ring and cover on a new manhole or new riser section including materials, labor, grouting, brick and mortar, minor grade adjustments (up to three inches either way vertically) and all incidental items required to complete the installation.

E. Manhole Modifications

1. The unit price bid for ADJUST EXISTING MANHOLE COVER TO GRADE shall include all costs associated with adjusting an existing manhole cover by up to three inches using steel or concrete adjusting rings or brick and mortar, as ordered by the Construction Manager, including pavement repair if applicable. Measurement for payment will be made based on the actual quantity of manhole covers adjusted.

2. The unit price bid for ADJUST EXISTING PRECAST MANHOLE shall include all costs associated with raising or lowering an existing manhole including, but not limited to, excavation, shoring, dewatering, backfilling, compaction, removal and replacement of existing cone or flat top, removal or addition of riser sections, disposal of removed materials, grouting, steps, brickwork, mortar, mastic and all incidental items required to complete the installation. In the event that a new cone or flat top section is required, it will be paid for at the unit price bid for 4-FOOT DIAMETER PRECAST MANHOLE.

3. The unit price bid for ADJUST EXISTING BRICK MANHOLE shall include all costs associated with raising or lowering an existing manhole including, but not limited to, excavation, shoring, dewatering, backfilling, compaction, removal or addition of brick, disposal of removed materials, grouting, steps, mortar, and all incidental items required to complete the installation.

4. Payment for pavement patching associated with ADJUST EXISTING MANHOLE shall be paid for at the unit price bid for FULTON COUNTY STANDARD UTILITY CUT.

5. Measurement for payment for ADJUST EXISTING MANHOLE will be made from the original manhole cover elevation to the proposed elevation of the new manhole cover. Vertical distance will be measured to the nearest tenth of a foot.

6. Measurement for payment for REESTABLISH MANHOLE INVERT shall include all costs associated with reestablishing inverts within an existing manhole including, but not limited to dewatering, concrete placement, removal of unusable materials and debris, disposal of removed materials, grouting, mortar, and all incidental items required to complete the installation. Payment for bypassing associated with REESTABLISH MANHOLE INVERT shall be paid for under the ALLOWANCE for Bypass Pumping.

F. Manhole Connections: The unit price bid for MANHOLE CONNECTIONS shall include all costs associated with connecting a new sewer line to an existing manhole, including drop connection fittings, tees, or core and boot as appropriate for the type of connection, flow diversion, penetration of manhole wall, sealing connection, forming new invert, and all incidental items required to complete the connection. Costs for excavation, shoring, dewatering, backfilling, compaction, and bedding shall be included in the unit price bid for GRAVITY SEWER.

G. Measurement for payment for drop connection vertical pipe shall be made from the invert of the upstream sewer to the invert of the manhole. Payment for the measured vertical feet of pipe will be made for the unit price bid for GRAVITY

SEWER. Inside drop connection vertical piping will be paid for at the 0.0 to 6.0 foot depth price for gravity sewer. Outside drop connection vertical piping will be paid for based on the actual depth of the of the drop connection.

1.08 BORE AND JACK CASINGS

A. The unit price bid for BORE AND JACK CASING shall include all costs associated with furnishing and installation of the casing pipe and carrier pipe, including but not limited to excavation, shoring, dewatering, backfilling, compaction, steel casing pipe, ductile iron sewer pipe, spacers, grout, brick, and other accessories, for installing the pipe complete in place.

1. The unit price bid shall assume that all jack and bore casing installations exceed 60 feet in length.

B. Payment for casing shall be made only at the completion of all work specified for the casing installation. No partial payment shall be made for the construction of the casing without carrier pipe.

C. Measurement for payment shall be made along the centerline of the pipe line to the limits of bore and jack as ordered by the Construction Manager.

D. Casing pipe may be included in Partial Payment Requests as stored materials, if, in the opinion of the Construction Manager, the casing pipe is stored and properly protected at the Project site. Casing pipe which has been properly installed, but has not yet been paid for as installed casing, may also be included as stored materials.

E. Payment for pipe in casing shall be made only at the completion of all work specified for the pipe installation. Payment for pipe in the casing shall be made only at the one unit price bid for BORE AND JACK CASING.

F. In the event that rock is encountered during the installation of the pipe casing which, in the opinion of the Construction Manager, cannot be removed through the casing then the Construction Manager may authorize the Contractor to complete the crossing by another method via a change order.

G. No additional payment shall be made for rock excavation through the casing.

1.09 FREE BORE / DIRECTIONAL DRILL

A. Payment for installation of sewer pipe via either free bore or directional drill installation methods shall be made at the unit price bid for FREE BORE / DIRECTIONAL DRILL for the appropriate size and type of pipe installed to the limits ordered by the Construction Manager. The unit price bid shall include all costs for construction of the pipe via free bore or directional drilling methods in lieu of open cut, including but not limited to excavation, shoring, dewatering, backfilling, compaction, carrier pipe, and other accessories, for installing the pipe complete in place.

B. The unit price bid for FREE BORE / DIRECTIONAL DRILL shall include all costs for free bore failures and the subsequent bore and jack installation if required as well as for bore and jack casing if the Contractor elects to provide the casing in lieu of free bore.

C. Measurement for payment shall be made along the centerline of the pipe installed, to the limits for free bore or directional drill ordered by the Construction Manager.

1.10 STORM DRAIN PIPE INSTALLATION

A. The unit price bid for STORM DRAIN PIPE shall include all costs associated with the installation or replacement of the appropriate size and type of storm drain piping associated with construction of a gravity sewer, where directed by the Construction Manager. Costs for excavation, shoring, dewatering, backfilling, compaction, and bedding shall be included in the unit price bid for STORM DRAIN PIPE.

B. Measurement for payment will be made along the centerline of the storm drain pipe installed.

C. No separate payment will be made for support of existing pipe when installing new sewer line over or under existing storm water piping. All costs for support shall be included in the unit price bid for GRAVITY SEWER.

D. Costs for removing and replacing existing storm water pipe for ease of construction when installing new sewer line shall be included in the unit price bid for GRAVITY SEWER. Payment for storm drain pipe will only be made where removal or replacement is approved or ordered by the Construction Manager prior to removal.

1.11 EROSION AND SEDIMENTATION CONTROL

A. General

1. No separate payment shall be made for erosion and sedimentation controls unless listed separately in the Bid and except as noted below. All other erosion and sedimentation control costs shall be included in the unit price bid for the item to which it pertains.

2. No payment will be made for any portion of the Project for which temporary erosion and sedimentation controls are not properly maintained.

3. Quantities for payment of erosion and sedimentation controls devices, if bid separately, shall be based upon actual quantity constructed by the Contractor.

B. Construction Exits:

1. All costs for construction exits, including installation, maintenance, repair, and removal, shall be included in the unit price bid for CONSTRUCTION EXITS.

2. The unit price bid shall include geotextile underliner, stone, and all incidental costs associated with maintaining a construction exit to Fulton County standards.

3. If the action of the construction vehicles traveling over the gravel pad does not sufficiently remove mud and debris, the vehicle tires shall be washed prior to allowing vehicles to enter public right-of-way. No additional payment will be made for the cost of washing tires.

4. No payment will be made for construction exits that are improperly constructed or use materials that are not approved.

C. Reinforced Silt Fence: All costs for Type S silt fence, where ordered by the Construction Manager, including installation, maintenance, repair, replacement, and removal, shall be included in the unit price bid for REINFORCED SILT FENCE.

D. Hay Bale Check Dams: All costs for hay bale check dams, including hay bales, necessary earthwork, staking, periodic maintenance and repair, and removal of sediment and hay bales following establishment of permanent erosion control measures shall be included in the unit price bid for HAY BALE CHECK DAMS.

E. Stone Check Dams: All costs for stone check dams, including stone, geotextile underliner, necessary earthwork, periodic maintenance and repair, and removal of sediment and stone following establishment of permanent erosion control measures shall be included in the unit price bid for STONE CHECK DAM. Measurement for payment will be made to the limits allowed in accordance with the Standard Details and Specifications.

F. Curb Inlet Filter and Protection: All costs for temporary fabric, blocks, wires, and the furnishing of all labor, material, equipment and tools for installation, maintenance, repair and removal, shall be included in the Unit Price Bid for CURB INLET FILTER. Payment shall be based on the actual field quantity installed.

G. Inlet Sediment Traps: All costs for temporary inlet sediment traps (silt box), including installation, maintenance, repair and removal, shall be included in the unit price bid for INLET SEDIMENT TRAPS.

H. Pigs-in-a-Blanket: All costs for pigs in a blanket, including installation, maintenance, repair and removal shall be included in the unit price bid for PIGS-IN-A-BLANKET.

I. Rip Rap with Filter Fabric Underlay: All costs for rip rap, including filter fabric, installation, maintenance, repair and removal, as required by the Standard Details and Specifications, or as directed by the Construction Manager, shall be included in the unit price bid for RIP RAP WITH FILTER FABRIC UNDERLAY.

J. Rip Rap: All costs for rip rap, excluding RIP RAP WITH FILTER FABRIC UNDERLAY, installation, maintenance, repair and removal, as required by the

Standard Details and Specifications, or as directed by the Construction Manager, shall be included in the unit price bid for RIP RAP.

K. Box Gabion – 3'x3'x6' Baskets: All costs for box gabions, including stone, wire mesh, stakes, anchors, filter fabric, assembly of box gabion, placement, excavation, backfill, compaction, and all incidental costs shall be included in the unit price bid for BOX GABION.

L. Tree Protection Fence: All costs for tree protection fence, also known as orange mesh safety fence, including installation, maintenance, repair and removal, shall be included in the unit price bid for TREE PROTECTION FENCE.

1.12 VEGETATION RESTORATION

A. Temporary Seeding: Temporary seeding and mulching shall be applied to all disturbed area to be left exposed for a period greater than 14 days, or as ordered by the Construction Manager.

1. The unit price bid for TEMPORARY SEEDING shall include all costs associated with spreading fast growing seed, mulching, watering, maintenance and repair until permanent grassing is established.

B. Permanent Seeding: All costs for permanent seeding, including fine grading, raking, soil preparation (removal of rocks and other objectionable materials), sewing the appropriate type of grass seed, fertilizing, mulching, watering, temporary protective measures, maintenance and repair until permanent grassing is established, shall be included in the unit price bid for PERMANENT SEEDING.

1. Permanent seed will be applied only after final grading and dress-up of disturbed area have been completed to the satisfaction of the Construction Manager.

C. Sod Grassing: Where ordered by the Construction Manager, sod shall be provided at the unit price bid for SOD GRASSING for any type.

1. All costs for proper installation, including preparation of surface, installation, rolling, compacting, watering, maintenance, repair, and any temporary measures required to protect the sod until establishment, shall be included in the unit price bid for SOD GRASSING.

D. Hydroseeding: All costs for hydroseeding, including preparation of surface, maintenance, repair, and any temporary measures required to protect the area until establishment, shall be included in the unit price bid for HYDROSEEDING.

E. In no case shall any one area be paid more than once for temporary grassing or for permanent grassing.

F. If an area is temporarily grassed and as directed by the Construction Manager to leave the area that way permanently, no additional payment will be made for permanent grassing.

G. Measurement for payment will be made by square yard, along the sewer centerline, to the widths allowed by the Standard Details and Specifications.

1.13 TEMPORARY STREAM CROSSING

A. Temporary Stream Crossing: All costs for constructing temporary stream crossings, whether for contractor access to the work or for work crossing streams, shall be included in the unit price bid for TEMPORARY STREAM CROSSING.

B. All labor and materials including temporary culverts, temporary bridge(s), stone, filter fabric underlay, check dams, bypassing, necessary earthwork, periodic maintenance and repair, and removal of sediment and all materials placed by the Contractor, following the end of the usefulness of the temporary crossing, shall be included in the unit prices bid for TEMPORARY STREAM CROSSING.

C. Stream Crossings shall be constructed as shown in the Standard Details and Specifications, limited to 10 feet upstream and 10 feet downstream from top of trench excavation and from five feet beyond top of bank, across stream or ditch bank and bottom, to five feet beyond top of bank.

D. Any other areas at streams or ditches disturbed by the Contractor, which may require rip rap, shall be rip rapped at no additional cost to the Owner.

1.14 TRENCH EXCAVATION AND STABILIZATION

A. No separate or additional payment will be made for any special or unique method, means, techniques or equipment necessary for the Contractor's compliance with the Specifications, regulatory requirements, permits, laws or regulations which govern this Project.

B. Trench Excavation: No separate payment will be made for trench excavation. All costs shall be included in the unit price bid for the item to which it pertains at the appropriate depth.

C. Sheeting, Bracing and Shoring: No separate payment will be made for providing any sheeting, bracing and shoring. All costs shall be included in the unit price bid for the item to which it pertains at the appropriate depth.

D. Dewatering Excavations: All costs of equipment, labor and materials required for dewatering shall be included in the price bid for the item to which it pertains.

E. Trench Foundation And Stabilization

1. No payment for trench stabilization shall be authorized until after the trench has been dewatered.

a. If the pipe is installed in an inadequately prepared trench bottom, the Construction Manager shall notify the Contractor in writing of

the deficiency and will not authorize payment for that portion of that length of pipe which was improperly installed.

2. Payment for trench stabilization shall be made on the basis of the amount authorized and the unit price bid for TRENCH STABILIZATION.

   a. Payment shall include all costs for the removal and disposal of the unsuitable material and replacement with the materials listed in the Bid including filter fabric.

   b. No additional payment will be made for material required for specified bedding.

F. Bedding and Haunching

1. The unit price bid for pipe for GRAVITY SEWER shall include excavation of the trench to the depth below the pipe necessary to provide specified bedding and to lay the sewer to grade. Measurements for payment will be made only to the pipe invert.

2. No separate payment will be made for material used to provide specified bedding. The cost of all bedding materials shall be included in the unit price bid for the item to which it relates, except for trench stabilization.

3. No additional payment will be made for improved bedding required to compensate for over excavation of the trench.

G. Trench Rock Excavation

1. Rock excavation shall be paid for in addition to payment for normal pipe excavation accounted for in the unit price bid for gravity sewer.

   a. Payment will be made for the measured quantity of rock excavated, at the sum of the unit prices for Trench Rock Base Cost and Trench Rock Premium Cost if applicable.

2. The unit price for Trench Rock Base Cost is for the normally anticipated cost of rock excavation, the cost of additional bedding and backfill material as specified and all costs incidental thereto.

3. The unit price bid for Trench Rock Premium Cost shall be for all additional costs for rock excavation which, in the opinion of the Contractor, are in excess of the Base Cost:

   a. Including but not limited to extra blasting protection, closer grouping of blasting holes, more detonator caps, more caution, etc.

   b. The Contractor shall not bid less than zero (bid a deduct) for the Trench Rock Premium Cost. Any Bids containing a deduct will be declared non-responsive and rejected by the Owner.

4. The maximum allowable volume of rock excavation for payment shall be based on a trench width equal to the outside diameter of the pipe barrel plus 18 inches, but not less than 36 inches, and depth of rock on the pipe centerline, from the top of the rock to the bottom of the rock or the specified bottom of the trench, whichever has the higher elevation.

5. The Construction Manager must be given reasonable notice to measure all rock. Payment will not be made for excavated rock that was not measured and approved by the Construction Manager prior to removal.

6. No allowance shall be made for excavating to extra widths for construction of manholes or other appurtenances, for excavating to sloping sides, or for excavations made necessary by the physical limitations of the Contractor's equipment. Cost of such additional rock excavation shall be included in the unit price bid for the item to which it pertains.

7. Payment for blasting monitoring shall be made from the BLASTING MONITORING cash allowance.

   a. A fee must be agreed upon by the Construction Manager prior to the Contractor employing an independent, qualified specialty subcontractor to monitor the blasting.

   b. If the Contractor employs the specialty subcontractor prior to the Construction Manager's approval of the fee, all such costs are subject to non-reimbursement.

H. Initial Backfill

1. No separate payment shall be made for initial backfill.

2. No separate payment shall be made for drying out the initial backfill material in order to meet the compaction requirements.

3. No separate payment shall be made for the adding of moisture to the initial backfill materials in order to meet the compaction requirements.

4. No separate payment shall be made for providing select material if the insitu material cannot meet the compaction requirements.

I. Concrete Encasement: Payment for concrete encasement shall be at the unit price in the Bid for GENERAL CONCRETE PLACEMENT.

J. Final Backfilling

1. No additional payment will be made for additional material when excavated materials are used.

2. No separate payment shall be made for drying out the final backfill material in order to meet the compaction requirements.

3. No separate payment shall be made for the adding of moisture to the final backfill materials in order to meet the compaction requirements.

4. No additional payment will be made for providing select material if the insitu material cannot meet the compaction requirements.

K. Backfill Density testing for compacted Trench material placed, shall be included in the Unit Price Bid item BACKFILL DENSITY TEST.

1. The Unit Price shall include, but not limited to, labor, equipment, lab cost, cost incidentals and/or related items, and the relevant specification.

2. Field measurement cost shall be based on a density test per 500 linear feet interval, along installed pipe length, and the Contractor and sub-contractor are responsible to provide documentation and/or daily record of the actual number of field tests, as approved by The Construction Manager.

L. Additional Material: No separate payment will be made for additional earth or fill materials imported to the Project site.

1.15 EASEMENT CLEARING AND GRUBBING

A. The unit price bid for EASEMENT CLEARING AND GRUBBING shall include all costs associated with clearing a 20-foot wide easement of the specified type, as approved by the Construction Manager prior to clearing, including but not limited to removal and disposal of trees, stumps, roots, undergrowth, debris, or other objectionable matter.

B. LIGHT CLEARING shall be defined by an easement that is dense with shrubs, brush, and trees up to one foot in diameter.

C. MEDIUM CLEARING shall be defined by an easement that is dense with shrubs, brush, and trees averaging one to two feet in diameter.

D. HEAVY CLEARING shall be defined by an easement that is dense with shrubs, brush, and trees averaging over two feet in diameter, including specimen trees.

E. The cost of moving and reestablishing landscape features, including labor and materials, shall be included in the unit price bid for the item to which it pertains.

F. No payment will be made for clearing and grubbing in grassed areas and in areas with non-established vegetation. The costs associated with such clearing shall be included in the unit price bid for the item to which it pertains.

1.16 REMOVE, REPAIR AND REPLACE DRIVEWAY, CURB AND GUTTER, AND SIDEWALK

A. General:

1. Payment for removing and replacing driveway shall be made based on the actual field measured quantity replaced for the type pavement, at the Unit Price Bid, for REMOVE AND REPLACE PAVEMENT.

2. The Unit Price Bid shall include all costs associated with the following:

a. Cutting, removing and disposing of existing materials

b. Replacing and compacting materials for base, subbase,

c. All related items as required for a complete driveway repair, including:

1) Providing select backfill if necessary,

2) All traffic control and temporary measures for maintaining traffic, and access, in accordance with the Project Drawings Standard Details and Specifications and/or per the applicable jurisdiction Standard Details and Specifications.

3. Payment shall be made only for that length for which the pipeline is constructed underneath or within four feet of the edge of the pavement to a width as shown in the Standard Details and Specifications.

4. Payment for driveway soils testing shall be made from the SOILS, CONCRETE, ASPHALT, AND MATERIALS TESTING cash allowance.

5. No payment shall be made for tests that fail to verify required results.

6. No additional payment will be made for removing and replacing damaged adjacent pavement.

7. No additional payment will be made for saw cutting of driveways or curbs.

B. Payment for removing and replacing Gravel Driveways will be made based on the actual measured quantity replaced at the unit price Bid for GRAVEL DRIVEWAY.

1. The unit price bid shall include all costs associated with removing, replacing, and compacting a minimum of four-inches of GAB or #57 stone, and all related items as required for a complete driveway repair, including:

a. All traffic control and temporary measures for maintaining traffic and access in accordance with the Project Drawing Standard Detail and Specifications and/or per the applicable jurisdiction Specifications.

2. Payment will be made for the length for which the pipeline is constructed underneath the driveway and for the width as limited by the Standard Details and Specifications.

C. Payment for removing and replacing Commercial Concrete Driveways

1. Shall be made based on the field measured quantity replaced at the unit price Bid for CONCRETE DRIVEWAY - COMMERCIAL.

2. The Unit Price Bid shall include all costs associated with the following:

a. Cutting, removing, and disposing of existing materials.

b. Replacing and compacting materials for base, subbase.

c. Placing a minimum of six inches concrete with reinforcing steel.

d. All related items as required, including:

1) Providing select backfill if necessary.

2). All traffic control and temporary measures for maintaining traffic, and access, in accordance with the Project Drawings Standard Details and Specifications and/or per the applicable jurisdiction Standard Details and Specifications.

3. Payment will be made for the length for which the pipeline is constructed underneath the driveway and for the width to the nearest construction joint on either side of the new pipeline.

D. Payment for removing, repairing and replacing Concrete Driveway

1. Shall be made based on the actual field measured quantity replaced, at the Unit Price Bid, for CONCRETE DRIVEWAY - RESIDENTIAL.
2. The Unit Price Bid shall include all costs associated with the following:
   a. Cutting, removing, and disposing of existing materials,
   b. Replacing and compacting materials for base, subbase, and
   c. All related items as required for a complete driveway repair, including:
      1) Providing select backfill if necessary,
      2) All traffic control and temporary measures for maintaining traffic, and access, in accordance with the Project Drawings Standard Details and Specifications and/or per the applicable jurisdiction Standard Details and Specifications.
3. Payment will be made for the length for which the pipeline is constructed underneath the driveway and for the width to the nearest construction joint on either side of the new pipe line.

E. Payment for removing and replacing Asphalt Driveways

1. Shall be made based on the actual measured quantity replaced at the unit price Bid for ASPHALT DRIVEWAY- RESIDENTIAL.
2. The unit price bid shall include all costs associated with the following:
   a. Cutting, removing existing pavement, disposing of removed materials,
   b. Replacing and compacting materials for base, subbase, and
   c. Compacting and placing a minimum of four inches of GAB and 1-1/2 inches of 9.5 mm Superpave asphalt.
   d. All related items as required for a complete driveway repair, including:
      1) Providing select backfill if necessary
      2) All traffic control and temporary measures for maintaining access in accordance with the Project Drawing Standard Detail and Specifications and/or per the applicable jurisdiction Specifications.
3. Payment will be made for the length for which the pipeline is constructed underneath the driveway and for the width as limited by the Standard Details and Specifications.

F. Payment for removing and replacing Concrete Sidewalk shall be made based on the field measured quantity replaced, at the Unit Price Bid for SIDEWALK.

1. The Unit Price Bid shall include all costs associated with cutting, removing existing sidewalk, removing, replacing, displacing existing materials, and compacting placement material, and all other items as required for completing the sidewalk repair, including all traffic control measures, and temporary measures for maintaining sidewalk capability, in accordance with the Project Drawings Sidewalk Standard Details and Specifications, and/or per the applicable jurisdiction specification.

2. No payment for sidewalk shall be made where the centerline of the new pipe is more than 5-feet from the closest edge of the sidewalk.

3 The Unit Price Bid for removing, disposal and replacing existing Sidewalk, shall include, but not limited to base, bricks, concrete, forms, curing, finishing, labor, materials, tools, and appliances, and all related items necessary to complete the work, and/or per the applicable jurisdiction Standard Detail and Specification.

G. Payment for removal and replacement of curb and gutter shall be made based on the actual field measured quantity replaced, and the Standard Details and Specifications, at the unit prices bid for CONCRETE CURB AND GUTTER or for GRANITE CURB as appropriate.

1. The Unit Price Bid shall include all costs associated with cutting, removing, replacing, and displacing existing materials, and all related items as required, including all traffic control measures.

2. No payment for curb and gutter shall be made where the centerline of the new pipe is more than 5-feet from the closest edge of the curb and gut

1.17 ASPHALT PAVEMENT REMOVAL AND REPLACEMENT

A. Payment for removing and replacing pavement shall be based on the field verifiable measured quantity replaced, at the Unit Price Bid for ASPHALT PAVEMENT REPLACEMENT.

1. The Unit Price Bid shall include all costs associated with the following:

a. Trench cutting, existing asphalt pavement saw cut, labor. materials, tools and equipment.

b. Removing, and disposing of existing materials.

c. Replacing and compacting materials for base, subbase.

d. All related items as required, including:

1) Providing select backfill if necessary, as required by and approved by Construction Manager.

2) All traffic control and temporary measures for maintaining traffic, and access, in accordance with the Project Drawings Standard Details and Specifications and/or per the applicable jurisdiction Standard Details and Specifications.

B. Payment for removal and replacement of asphalt pavement (Type A Cut Repair), where the Fulton County Standard Utility Cut (Type C Cut Repair) is not required, shall be made at the unit price bid for ASPHALT PAVEMENT REMOVAL AND REPLACEMENT.

1. The unit price bid shall include all costs associated with a Type A Cut Repair, including:

   a. Cutting, removing existing pavement, disposing of removed materials.

   b. Compacting and placing a minimum of six inches of crusher run and 1-1/2 inches of 9.5 mm Superpave asphalt.

   c. All related items as required for a complete repair, including road plates and all traffic control and temporary measures as specified above.

2. Payment will be made for the length for which the pipeline is constructed underneath the roadway and for the width as limited by the Standard Details and Specifications, or as approved by the Construction Manager.

C. Payment for Fulton County Standard Utility Cut (Type C Cut Repair) shall be made at the unit price bid for COMPLETE FULTON COUNTY STANDARD UTILITY CUT.

1. The unit price bid shall include all costs associated with a Type C Cut Repair, including:

   a. Cutting, removing existing pavement.

   b. Disposing of removed materials.

   c. Eight inch concrete cap, bituminous tack coat, and 1-1/2 inches of 9.5 mm Superpave asphalt.

   d. All related items as required for a complete repair, including road plates and all traffic control and temporary measures as specified above.

2. Payment will be made for the length for which the pipeline is constructed underneath the roadway and for the width as limited by the Standard Details and Specifications, or as approved by the Construction Manager.

D. No separate or additional payment shall be made for temporary measures required to make the road or driveway surface passable, including backfilling the top of the trench temporarily with crusher run or granular material or placing a temporary asphalt topping.

E. Payment for milling shall be made at the unit price bid for ROAD SURFACE MILLING.

1. The Unit Price shall include all costs associated with the milling activity, such as:

   a. Lowering of existing water valves or manholes.

   b. Milling the existing pavement to the required thickness.

c. Disposing all waste materials.

d. All related items, including:

1) All traffic control and temporary measures as specified above.

2) As required by the Municipality Standard Detail and Specification, and/or the Construction Manager.

2. Payment shall be made for the actual field measured road surface area length and width milled, as approved by the Construction Manager.

F. Payment for overlay shall be made at the unit price bid for ROAD SURFACE OVERLAY.

1. The unit price bid shall include all costs associated with overlaying a road surface with a bituminous tack coat and a minimum of one and 1-1/2 inches of 9.5 mm Superpave asphalt, and all related items as required including all traffic control and temporary measures as specified above.

2. Measurement shall be made based on actual area overlaid, as approved by the Construction Manager.

G. Payment for road resurfacing shall be made at the Unit Price Bid for ROAD RESURFACING.

1. The limits eligible for payment shall be based on actual field measured area width and length, relevant Municipality Standard and Specification, Project Drawings, as approved by Construction Manager.

2. The Unit Price Bid shall include all costs associated with road resurfacing:

a. Labor, materials, tools, equipment.

b. Bituminous tack coat.

c. Replacing existing stripping and traffic devices.

c. Raising existing water valves, or manholes.

d. Potholes repair.

e Replacing items affected by the resurfacing activity, and restoring the road to its pre-construction condition.

f. All related items as required including all traffic control and temporary measures as specified above.

1.18 PAVEMENT MARKING AND STRIPING

A. The unit price bid for PAVEMENT MARKING AND STRIPING shall include all costs associated with applying standard DOT striping and paint as listed in the Bid and as ordered by the Construction Manager. All required materials, labor, tools, equipment, and traffic control shall be included in the unit price bid.

1.19 TRAFFIC CONTROL

A. All costs for providing traffic control in compliance with the Manual on Uniform Traffic Control Devices (MUTCD) and Georgia Department of Transportation (GDOT) specifications shall be included in the unit price bid for the item to which it pertains. No additional payment will be made for complying with MUTCD or GDOT requirements.

B. Payment for TRAFFIC CONTROL as indicated in the Bid will be made only for additional traffic control devices beyond the requirements of the MUTCD and / or GDOT as ordered by the Construction Manager.

C. The unit price bid for STANDARD DOT BARRIER shall include all costs for providing, installing and removing a standard DOT barrier, as directed by the Construction Manager.

1. No excavation in or near roadways will be left open overnight. Therefore, all concrete barriers will be required to be removed from the roadway and moved to a location where vehicular and pedestrian traffic are not obstructed. The cost of moving the barriers as such shall be included in the unit price bid.

2. Measurement for payment shall be made based on the actual linear footage of barrier installed, per day, approved by the Construction Manager and serving the purpose for which it was intended. Payment will not be made for excess barriers stored by the Contractor in any location.

D. The unit price bid for MUTCD STANDARD SAFETY BARREL shall include all costs for providing, installing and removing a standard MUTCD safety barrel, as directed by the Construction Manager. Only safety barrels directed by the Construction Manager, in addition to those required by the MUTCD and GDOT, shall be paid for separately.

E. The unit price bid for POLICE CRUISER shall include all costs for providing a police cruiser for additional traffic control. Payment will be made for hours spent on site, which may be a portion of a standard work day. Payment will be made only for hours documented and approved by the Construction Manager.

F. The unit price bid for CERTIFIED FLAGMAN shall include all costs for providing a flagman for additional traffic control, as directed by the Construction Manager, in addition to the requirements of MUTCD and GDOT.

1. The flagman shall be certified and dedicated to maintaining and directing traffic flow.

   a. An individual who works part time as a flagman and part time as a laborer or acts in dual capacity will not be approved for payment under this item.

   b. Proof of certification may be required by the Construction Manager prior to acceptance for payment.

2. Payment will be made for hours spent on site performing dedicated flagman duties, which may be a portion of a standard work day.

3. Payment will be made only for hours documented and approved by the Construction Manager.

G. The unit price bid for LIGHT PLANT shall include all costs for providing a light plant, including generator and lighting system, for night work, as directed by the Construction Manager.

H. The unit price bid for ELECTRONIC MESSAGE BOARD shall include all costs for providing an electronic message board, as directed by the Construction Manager.

1.20 REMOVE AND REPLACE EXISTING FENCE

A. The unit price bid for REMOVE AND REPLACE EXISTING FENCE shall include all costs associated with removing and replacing an existing fence of the type and material listed in the Bid, including disposing of waste materials, restoration of site to original condition, and all other associated work for a complete installation.

1.21 CAST IN PLACE CONCRETE

A. Structural Concrete: The unit price bid for STRUCTURAL CONCRETE shall include all costs associated with placing concrete as directed by the Construction Manager including excavation, dewatering, formwork, placing of concrete, and all associated labor, tools, and materials. This item will not be utilized for concrete piers for stream crossings

B. Reinforcing Steel: The unit price bid for REINFORCING STEEL shall include all costs associated with providing reinforcing steel for structural concrete, including providing steel as directed by the Construction Manager and all labor, tools, and materials required.

C. The unit price bid for REINFORCED CONCRETE PLACEMENT shall include all costs of placing reinforced concrete as directed by the Construction Manager. Reinforced concrete placement shall only be used for concrete requiring the installation of rebar reinforcement in addition to items listed elsewhere in the Bid.

D. The unit price Bid for CONCRETE PIERS shall include all costs associated with installation of concrete piers under sewer line including excavation, backfill, compaction, dewatering, drilling grout holes, grouting dowels in place, concrete, reinforcement, and all other work required for pier installation. Measurement for vertical height of the piers shall include the thickness of the footing.

E. The cost of services of the consulting soil and foundation Construction Manager will be paid by the Contractor from the SOILS, CONCRETE, ASPHALT, AND MATERIALS TESTING cash allowance.

F. The unit price bid for GENERAL CONCRETE PLACEMENT shall include all costs of placing general concrete as directed by the Construction Manager. General concrete placement shall only be used for concrete in addition to items listed elsewhere in the Bid.

G The unit price bid for CONCRETE – FLOWABLE FILL shall include all costs of filling abandoned pipes with concrete as directed by the Construction Manager. Flowable fill shall only be used for concrete in addition to items listed elsewhere in the Bid.

1.22 PROGRAMMABLE ELECTRONIC MARKING DEVICES

A. The unit price bid for PROGRAMMABLE ELECTRONIC MARKING DEVICES shall include the cost of providing the marking devices including:

1. Programmer/locator as specified.
2. Programming the devices and placing them along the water line.
3. The cost of excavation shall be included in the unit price bid for GRAVITYSEWER or UTILITY LOCATION.
4. Measurement for payment will be based on the quantity installed as directed by the Construction Manager.

1.23 CCTV

A. The unit price bid for CCTV shall include all costs associated with utilizing CCTV equipment to record work on assets, measuring depth, diameter and type of pipes and all conditions of the run of the pipe from manhole to manhole. Measurement shall be made based on distance recorded on video of the CCTV, as approved by the Construction Manager.

B. For all CCTV work, PACP data requirements are as follows:

1. PACP database must be NASSCO compliant.
2. Data must be delivered in PACP or GaniteXP format.
3. PACP format is only acceptable for the following versions: Nothing earlier then 2.0.2 nothing later 6.0.3.
4. Asset ID in the database needs to be implemented as provided by Fulton County. If the CCTV contractor discovers additional assets that are not currently mapped by Fulton County, then the discovered asset(s) should be identified with a TMP prefix joined with the next known downstream Asset ID. If there is no downstream and upstream IDs contractor need to use sequence number identified with a TMP.
5. If a new Data (manhole, pipe) is found, map update (sketch) needs to be provided.
6. Data and videos should be provided on a flash drive with the label of the project.
7. Videos will only be accepted in MPG format.
8. Video needs to be delivered per section of the pipe from manhole to manhole.

1.24 UTILITY LOCATION – EXCAVATION AND BACKFILL

A. Soft Dig Hydro Excavation:

1. The unit price bid for SOFT DIG HYDRO EXCAVATION shall include all costs associated with the following:
    a. Locating the assigned utility.
    b. Excavating to directly above the pipe.
    c. Measuring the depth, diameter and type of the pipe.
    d Backfilling and compacting the hole up to two feet from existing grade with soil.
    e Encoding a 3M ID marker device and installing the marker above the pipe at a depth of two feet.
    f. Backfilling with soil and dressing the disturbed area with like surrounding materials.
2. Measurement for payment shall be based on the actual field number of locations, only when directed and approved by the Construction Manager prior to any soft dig excavation.
3. Cost of the 3M ID marker shall be paid separately per each.

B. Where utility location is performed in roadways or sidewalks, other materials may be required for backfill.

1. Select materials will be paid for at the unit prices bid for TRENCH STABILIZATION.
2. Measurement for payment will be made on the actual quantity of material used for backfill of the hole where the marker ball is installed.

C. Exploratory Excavation:

1. The unit price bid for EXPLORATORY EXCAVATION shall include all costs associated with excavation of an area by machine and by hand where necessary with the intent of locating an existing utility, including all equipment, tools, and labor.
2. The costs associated with removal and replacement of roadway, driveway, sidewalk, or curb and gutter shall be included under the appropriate pay item.
3. Measurement for payment will be based on the actual hours required to locate the utility, only when ordered by the Construction Manager prior to any excavation.
4. This item shall not be used for standard locating of utilities as required to perform the work.

D. No payment will be made for excavation that does not locate the assigned utility, or where the marker ball is not installed directly above the pipe.

E. No separate or additional payment will be made for any special or unique method, means, techniques or equipment necessary for the Contractor's compliance with these Specifications, regulatory requirements, permits, laws or regulations which govern this Project.

1.25 CASH ALLOWANCES

A. General

1. The Contractor shall include in the Bid Total all allowances stated in the Contract Documents.

a. These allowances shall cover the net cost of the services provided by a firm selected by the Owner.

b. The Contractor's handling costs, labor, overhead, profit and other expenses contemplated for the original allowance shall be included in the items to which they pertain and not in allowances.

2. No payment will be made for nonproductive time on the part of testing personnel due to the Contractor's failure to properly coordinate testing activities with the work schedule or the Contractor's problems with maintaining equipment in good working condition.

3. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests.

4. No payment shall be provided for services that fail to verify required results.

B. Should the net cost be more or less than the specified amount of the allowance, the Contract will be adjusted accordingly by Change Order. The amount of change order will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance.

C. Documentation

1. Submit copies of the invoices with each periodic payment request from the firm providing the services.

2. Submit results of services provided which verify required results.

D. Schedule of Cash Allowances

1. Soils, Concrete, Asphalt, and Materials Testing: Allow the amount provided in the Bid for the services of a Geotechnical Engineering firm and testing laboratory to verify soils conditions including trench excavation and backfill, asphalt coring and density tests, testing of concrete cylinders for poured in place concrete, pipe materials, and similar issues as directed by the Construction Manager.

a. Services will be reimbursed at direct cost with no markup.

b. Contractor must provide invoices for Owner approval.

c. This allowance amount specified in the Bid, is for additional testing services not included in the Unit Price Bid for the item to which it relates, and for services not specifically required in the applicable authorized Specifications but is requested or directed and for approval by the Construction Manager, prior to the start of work activity.

2. Unforeseen Conditions: Allow the amount specified in the Bid to resolve unforeseen project situations and/or site conditions during construction, to be pre–approved and approved by Construction Manager, prior to the start of work activity.

a. Utility Conflicts: Allow the amount specified in the Bid to resolve any unforeseen utility conflicts, which may accrue during the Project's construction, including its relocation and/or replacement, as directed and approved by the Construction Manager.

1) Known on site located utility which was not shown or accurately field marked by Fulton County water locators, but is necessary to be relocated to accommodate the installation of the proposed pipeline.

2). Unknown on site located utility which was not marked by Fulton County water locators, but requires significant relocation work, prior to the start of the proposed pipeline installation.

3. Large Tree Removal:

a. Allow the amount specified in the Bid for the services of a tree removal specialist to remove individual trees as directed by the Construction Manager.

b. Services will be reimbursed in accordance with 1.25.D.9 below.

c. Contractor must provide invoices for Owner approval.

d. No payment will be made for trees removed as part of clearing and grubbing.

4. Bypass Pumping:

a. Bypass pumping is included within the Item of Work. Allow the amount specified in the Bid for the services of a bypass pumping specialty contractor to provide bypass pumping services as directed and approved by the Construction Manager.

b. Services will be reimbursed in accordance with 1.25.D.9 below.

c. Contractor must provide invoices for Owner approval.

d. Costs for bypass pumping will be reimbursed only with prior approval of the Construction Manager.

e. If bypass pumps are provided without prior Construction Manager approval, payment may not be made for services at the discretion of the Construction Manager.

5. Preblast Survey/Inspection and Blasting Monitoring:

a. Allow the amount provided in the Bid for the services of an independent, qualified specialty subcontractor to monitor the blasting, as directed and approved by the Construction Manager.

b. The services will be reimbursed at direct cost with no mark–up.

c. The Contractor must provide an estimated invoice for services or activities to be performed, for pre-approval by the Construction Manager, prior to the start of work.

d. Contractor must provide invoices for Owner approval.

6. Construction Verification Surveying:

a. Allow the amount provided in the Bid for Project construction field staking surveying of the proposed pipeline horizontal centerline alignment, depth of cover checks throughout installation of pipeline, and as-built verification and accuracy of pipe line, if deemed necessary by the Construction Manager.

b. The Construction Manager shall pre-approve and approve the independent surveying firm selection by the Contractor.

c. The Contractor must provide an estimate invoice from the approved selected survey firm to perform the work activity, prior to the start of work.

d. This allowance shall only be utilized by the Owner or Construction Manager, for field verification of the Contractor's reference points, proposed pipeline centerline, and project activities performed by the Contractor.

e. This cash allowance does not in any way relieves the Contractor of their responsibilities, for installing the necessary project reference points, field staking the proposed pipeline horizontal centerline, field checking, or verifying the installed pipeline required minimum depth of cover, installing temporary and permanent bench marks, and field verifying the accuracy of the Contractor's work activities performed, including as-built drawings.

7. Exploratory Excavation: Allow the amount provided in Bid for subsurface investigation to field locate and identify existing water lines size, depth, pipe type, within the Project's pipeline installation limit, where there is no as-built or record drawings.

a. The Construction Manager shall pre–approve and approve all exploratory excavation locations, the number of locations, and exploratory excavation request by Contractor, including estimated cost, prior to the start of work.

8. Additional Landscaping, not shown on the Project Drawings: Allow for the amount specified in the Bid for additional existing or current landscaping replacement, not shown on the Project Drawings, or specified, but is affected by the Project construction.

a. The Contractor must provide an estimate invoice for activities to be performed, for pre-approval and approval, by the Construction Manager, prior to the start of work activity.

b. Contractor must provide invoices for approval of payment by Owner.

9. In Subparagraphs 3 and 4 above, the items included in "Cost and "Overhead" shall be based on the following schedule:

a. Unless otherwise provided in the Contract Documents, "Cost" shall be limited to the following: cost of materials incorporated into the Work, including sales tax and cost of delivery; cost of direct labor (labor cost may include a pro rata share of foreman's account of the change) including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; workers' or workmen's compensation insurance; rental value of equipment and machinery; costs for preparing Shop Drawings.

b. Unless otherwise provided in the Contract Documents, "Overhead" shall include the following: bond and insurance premiums including increase and decreases from change in the Work, supervision, superintendence, construction parking, wages of timekeepers, watchmen and clerks, small tools, consumable supplies, expendables, incidentals, general office expense, the cost of additional reproduction for the Contractor's subcontractors beyond that agreed upon in the Contract Documents, construction parking, any additional costs of craft supervision by the Contractor's or subcontractors' superintendents, and overhead charges which would be customary and expended regardless of the change in the Work due to other overlapping activities which are included as part of the original Contract, and all other expenses not included in "Cost" above.

1.26 EMERGENCY SERVICES

A. The following labor and equipment are included in the Bid for when the County needs manpower or additional equipment to assist in making emergency repairs other than those specified above as unit price items.

1. Hourly rate items below shall **NOT** apply when work is performed under non-emergency conditions.

2. The Notice to Proceed for each project will indicate emergency or non-emergency project status.

a. On emergency projects, the Contractor shall have a representative on site within 2 hours of notification to assess the work to be performed and have emergency work crews on site with the proper equipment within 4 hours of the original notification.

3. Once an emergency is declared contained by the Construction Manager, the project will go forward as non-emergency utilizing line items and a notice to proceed will be issued for the remainder of the work.

B. The unit price bid for the following items shall include all costs for providing the specified personnel on an hourly basis as required by the Owner.

1. Sewer Superintendent with pickup truck
2. Sewer Crew Truck - Fully equipped with tools and repair parts including but not limited to pipe saw, wacker-packer, chain saw, and miscellaneous hand tools, including sewer foreman and three laborers.
3. Rubber Tired Front End Loader with Trailer and Operator
4. Rubber Tired Backhoe with Trailer and Operator
5. Excavator with Trailer and Operator
6. Trench Compactor with Operator
7. Mobile Air Compressor with Hoses and Air Tools (Jackhammer, Pavement Breaker, Clay Spade, etc.)
8. 10 CY dump truck with operator.

C. Payment may be made for partial work days where applicable.

D. All overhead and direct costs, including all mobilization costs, for providing the labor, equipment, tools, supplies associated shall be included.

E. Separate payments for items not included shall be agreed to prior to providing such items.

F. No payment will be made for additional services provided without proper written notification to the Owner that the services being requested are additional.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 – GENERAL

1.01. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02. SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.03. DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

B. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work.

C. No other adjustments are made to the Contract Sum.

1.04. PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

B. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

C. Notification by Owner: The Owner will, immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

D. Execute accepted alternates under the same conditions as other work of the Contract.

1.05. SCHEDULE OF ALTERNATES

A. <To be developed for each Project>

PART 2– MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USE)

END OF SECTION

SECTION 01 25 00

SUBSTITUTIONS AND OPTIONS

PART 1 – GENERAL

1.01 SCOPE

A. This Section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

1.02 DEFINITIONS

A. For the purposes of these Contract Documents, a “substitute item” shall be defined as one of the following:

1. A product or manufacturer offered as a replacement to a specified product or manufacturer.
2. A product or manufacturer offered in addition to a specified product or manufacturer.

B. For the purposes of these Contract Documents, a “substitute construction method” shall be defined as one of the following:

1. A mean, method, technique, sequence or procedure of construction offered as a replacement for a specified mean, method, technique, sequence or procedure of construction.
2. A mean, method, technique, sequence or procedure of construction offered in addition to a specified mean, method, technique, sequence or procedure of construction.

1.03 GENERAL

A. An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence or procedure of construction is specified or shown on the Drawings, shall not be considered a substitute and shall be at the option of the Contractor, subject to the provisions in the Contract Documents for that item or construction method.

B. For products specified only by a referenced standard, the Contractor may select any product by any manufacturer, which meets the requirements of the Specifications, unless indicated otherwise in the Contract Documents.

C. If the manufacturer is named on the Drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the Specifications and Drawings are acceptable.

D. Whenever the Engineer's design is based on a specific product of a particular manufacturer, that manufacturer will be shown on the Drawings and/or listed first in the list of approved manufacturers in the Specifications. Any Bidder intending

to furnish products of other than the first listed manufacturer, or furnish substitute items, shall:

1. Verify that the item being furnished will fit in the space allowed, perform the same functions and have the same capabilities as the item specified.
2. Include in its Bid the cost of all accessory items which may be required by the other listed substitute product,
3. Include the cost of any architectural, structural, mechanical, piping, electrical or other modifications required, and
4. Include the cost of required additional work by the Construction Manager, if any, to accommodate the item.

E. Whenever a product is identified on the Drawings or in the Specifications by reference to manufacturers or vendors names, trade names, catalog numbers, etc., it is intended only to denote the quality standard of product desired and that they do not restrict Bidders to a specific brand, make, manufacturer or specific name. These listings and citations are used only to set forth and convey to Bidders the general style, type, character and quality of product desired. Equivalent products will be acceptable, subject to the substitution provisions of this Section.

1.04 APPROVALS

A. Approval, of a substitution as an acceptable manufacturer, of the Construction Manager is dependent on determination that the product offered is essentially equal in function, performance, quality of manufacture, ease of maintenance, reliability, service life and other criteria to that on which the design is based; and will require no major modifications to structures, electrical systems, control systems or piping systems.

1.05 SUBSTITUTIONS AND OPTIONS

A. No substitutions will be considered for the manufacturers listed in the Bid Form.

B. After Notice to Proceed

1. Substitute items will be considered only if the term “equal to” precedes the names of acceptable manufacturers in the Specification.
2. Where items are specified by referenced standard or specified as indicated in Article 1.03 above, such items shall be submitted to the Construction Manager for review.
3. The Contractor shall submit shop drawings on the substitute item for the Construction Manager's review in accordance with the Section 01 33 23.

C. Prior to Opening of Bids

1. No consideration or approvals will be made for products specified by a referenced standard, or specified as indicated in Article 1.03 above. Such consideration may occur only after the Notice to Proceed.
2. No consideration or approvals will be made for products being offered where the term “equal to” precedes the name of an approved product. Such substitution consideration may occur only after the Notice to Proceed.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 – GENERAL

1.01 SCOPE

A. Work under this Section includes all scheduling and administering of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this Work.

B. Scheduling and Administration of Meeting:

1. Prepare agenda.
2. Make physical arrangements for the meetings.
3. Preside at meetings.
4. Record minutes and include significant proceedings and decisions.
5. Distribute copies of the minutes to participants.

1.02 PRECONSTRUCTION CONFERENCE

A. The Construction Manager shall schedule the preconstruction conference prior to the issuance of the Notice to Proceed.

B. Representatives of the following parties are to be in attendance at the meeting:

1. Owner
2. Design Engineer
3. Construction Manager
4. Project Manager
5. Contractor and superintendent
6. Major subcontractors
7. Representatives of governmental or regulatory agencies when appropriate.

C. The agenda for the preconstruction conference shall consist of the following as a minimum:

1. The Work – including, but not limited to:
   a. Adequacy of distribution of Contract Documents.
   b. Scheduling and phasing requirements.
   c. Schedule and submittal of shop drawings, product data and samples.
   d. Major equipment deliveries and priorities.

e. Critical work sequencing.

f. Use of premises, including office and storage areas and Owner's requirements.

g. Special conditions and coordination.

h. Security.

i. Work hours.

2. Distribution and discussion of major subcontractors and tentative construction schedule, and project phasing requirements.

3. Communications – including, but not limited to:

a. Designation of responsible personnel and emergency telephone numbers.

b. Change and persons authorized to direct changes.

c. Requests for Information (RFI), field decisions, and clarifications.

d. Processing of field decisions and change orders.

e. Non-Conformance Reports.

f. Hazard communication.

g. Project meetings.

4. Contractor's Site Specific Safety Plan and first aid procedures.

5. Administrative and procedural requirements including, but not limited to:

a. Contract modification.

b. Progress payment.

c. Pay request format, submittal cutoff date, pay date and retainage.

d. Submittals - including Contractor's Construction Progress Schedule.

e. Electronic Communications.

f. Apprentice and Journey Level Worker Utilization Reporting, if required.

6. Owner testing and inspection.

7. Contractor Quality Control.

8. Procedures for maintaining record documents.

9. Temporary Facilities and Controls including, but not limited to:

a. Deliveries and storage.

b. Temporary utilities and enclosures.

c. Security procedures.

d. Noise and vibration control.

e. Cutting, patching, and field engineering.

f. Utility shutdowns.

g. Contractor parking.

h. Housekeeping and waste management.

10. Closeout Procedures – including Project Record documents.

D. Contractor shall conduct a like meeting, covering the same body of information, with each Subcontractor's project manager and foreman supervising the Work prior to the performance of any work on site by that Subcontractor.

1. Provide Construction Manager with copies of meeting minutes prepared by the Contractor with each Subcontractor, when requested by Construction Manager.

1.03 PROJECT COORDINATION MEETINGS

A. Project Coordination Meetings may be requested at any time at the discretion of the Owner, Construction Manager or Contractor. The party requesting a meeting shall provide the other two parties with as much advance notice as possible, as well as a written agenda for such meeting.

B. Schedule regular monthly or bi-weekly meetings as directed by the Construction Manager.

C. Hold called meetings as the progress of the work dictates.

D. The meetings shall be held at the location indicated by the Construction Manager.

E. Representatives of the following parties are to be in attendance at the meetings:

1. Construction Manager
2. Design Engineer
3. Project Manager
4. Contractor and superintendent
5. Major subcontractors as pertinent to the agenda
6. Owner's representative as appropriate
7. Representatives of governmental or other regulatory agencies as appropriate.

F. Contractor shall:

1. Administer the meetings.
2. Provide schedules, logs and other construction activity data in support of the issues discussed and recorded in meeting minutes.
3. Record and distribute copies of minutes prior to the next meeting.

G. Construction Manager will:

1. Will review meeting minutes and ascertain that the Work is in accordance with the Construction Documents and the Construction Progress Schedule.

H. The minimum agenda for progress meetings shall consist of the following:

1. Review and approve minutes of previous meetings.
2. Review work progress since last meeting.
3. Review plans for progress during subsequent work period.
   a. Identify pending meetings.
   b. Discuss safety activities and Job Hazards Analysis.
4. Discuss field observations, problems, and conflicts.
   a. Identify problems impeding the Construction Progress Schedule.
5. Identify problems which impede planned progress.
6. Review Quality Control.
   a. Non-conformance reports - discuss corrective Work actions.
7. Review off-site fabrication, delivery schedules and problems.
8. Review Contractor's corrective measures and procedures to regain plan schedule.
9. Review Contractor's revision to the construction schedule as outlined in the Supplementary Conditions.
10. Review submittal schedule and RFIs; - present methods to expedite as required to maintain schedule.
11. Maintenance of quality and work standards.
12. Review proposed changes in the Work and substitution requests for:
    a. Timely processing.
    b. Effect on Construction Progress Schedule and on completion date.
    c. Effect on any other contracts of the Project.
13. Identify and track action items for all parties. The intent is to maintain a running list of action items with specific designation for parties responsible and expected completion dates.
14. Complete other current business.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULES

PART 1 – GENERAL

1.01 SCOPE

A. The work under this Section includes preparing, furnishing, distributing, and periodic updating of the construction schedules as specified herein.

B. The purpose of the schedule is to demonstrate that the Contractor can complete the overall Project within the Contract Time and meet all required interim milestones.

C. The schedule also provides a basis for determining the progress status of each phase and the Project relative to specific dates and completion time.

1.02 DESCRIPTION

A. The Contractor shall provide a graphic construction schedule prepared by the critical path method of analysis. The critical path schedule shall be prepared from estimates of the required duration and sequence for each item of work and function to be performed.

B. A general guide for preparing such a schedule is contained in "The Use of CPM in Construction, A Manual for Contractors," published by the Associated General Contractors of America.

C. Tabulation and analysis of the work schedule shall be performed by computer using a commercially available critical path software program. In addition to the capability to produce tabular reports, the computer software shall plot the construction schedule after the Contractor has produced it in draft form as required by paragraph 1.03 Submittals.

D. The schedule shall depict all significant construction activities and all items of work listed in the breakdown of contract prices submitted by the Contractor in accordance with the General Conditions of the Contract Documents. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.

E. No activity on the schedule shall have a duration longer than 21 days or assigned value greater than $100,000, except activities comprising only fabrication, and delivery may extend for more than 21 days. Activities which exceed these limits shall be divided into more detailed components. The schedule duration of each activity shall be based on the work being performed during the normal 40-hour workweek with allowances made for legal holidays and normal weather conditions.

1.03 SUBMITTALS

A. Overall Project Schedule (OPS)

1. Submit the schedule within 10 days after date of the Notice to Proceed.
2. The OPS schedule shall identify various critical project milestones, in order to address the public and activities within the project's area.
3. The Construction Manager will review the schedule and return it within 10 days after receipt.
4. If required, resubmit within 10 days after receipt of a returned copy.

B. Near Term Schedule (NTS)

1. Submit the first Near Term Schedule within 10 days of the Notice to Proceed.
2. The Construction Manager will review the schedule and return it within 10 days after receipt.

C. Submit an update of the OPS and NTS with each progress payment request.

D. Submit the number of copies required by the Contractor, plus four copies to be retained by the Construction Manager.

1.04 APPROVAL

A. Approval of the Contractor's detailed construction program and revisions thereto shall in no way relieve the Contractor of any of Contractor's duties and obligations under the Contract.

B. Approval is limited to the format of the schedule and does not in any way indicate approval of, or concurrence with, the Contractor's means, methods and ability to carry out the work.

1.05 OVERALL PROJECT SCHEDULE (OPS)

A. The Contractor shall submit to the Construction Manager for approval a detailed Overall Project Schedule of the Contractor's proposed operations for the duration of the Project. The OPS shall be in the form of a Gantt/bar chart. Primavera P6 shall be used to produce this Gantt/bar chart.

B. Gantt/Bar Chart Schedule

1. Each activity with a duration of five or more days shall be identified by a separate bar. Activities with a duration of more than 21 days shall be sub-divided into separate activities.
2. The schedule shall include activities for shop drawing preparation and review, fabrication, delivery, and installation of major or critical path materials and equipment items. .

3. The schedule shall show the proposed start and completion date for each activity. A separate listing of activity start and stop dates and working day requirements shall be provided unless the information is shown in text form on the Gantt/bar chart.
4. The schedule shall identify the Notice to Proceed date, the Contract Completion date, major milestone dates, and a critical path.
5. The schedule shall be printed on a maximum 11 x 17-inch size paper. If the OPS needs to be shown on multiple sheets, a simplified, one page, summary bar chart showing the entire Project shall be provided.
6. The schedule shall have a horizontal time scale based on calendar days and shall identify the Monday of each week.
7. The schedule shall show the precedence relationship for each activity.

1.06 NEAR TERM SCHEDULE (NTS)

A. The Contractor shall develop and refine a detailed Near Term Schedule showing the day to day activities with committed completion dates which must be performed during the upcoming 30 day period. The detailed schedule shall represent the Contractor's best approach to the Work which must be accomplished to maintain progress consistent with the Overall Project Schedule.

B. The Near Term Schedule shall be in the form of Gantt/bar chart and shall include a written narrative description of all activities to be performed and describe corrective action to be taken for items that are behind schedule.

1.07 SCHEDULE REVISIONS

A. Revisions to the accepted critical path construction schedule may be made only with written approval of the Owner.

B. Changes in timing for activities which are not on the critical path may be modified with written agreement of the Contractor and Construction Manager.

C. A change affecting the contract value of any activity, the timing of any activity on the critical path, the completion time and specific dates as specified in the Contract Documents, and work sequencing may be made only in accordance with applicable provisions of the General Conditions of the Contract Documents.

1.08 UPDATING

A. Project status review and update shall be provided each month as specified in the General Conditions of the Contract Documents.

B. Show all changes occurring since previous submission of the updated schedule.

C. Indicate progress of each activity and show actual completion dates.

D. The Contractor shall be prepared to provide a narrative report at the Project Coordination Meetings. The report shall include the following:

1. A description of the overall Project status and comparison to the OPS.
2. Identify activities which are behind schedule and describe corrective action to be taken.
3. A description of changes or revisions to the Project and their effect on the OPS.
4. A description of the Near Term Schedule of the activities to be completed during the next 30 days. The report shall include a description of all activities requiring participation by the Construction Manager and/or Owner.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 32 33

CONSTRUCTION VIDEOS AND PHOTOGRAPHS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall furnish all equipment and labor materials required to provide the Owner with digital construction videos and photographs of the Project.

B. Videos and photographs shall be provided on a flash drive.

C. Photograph and video files shall become the property of the Owner and none of the photographs herein shall be published without express permission of the Owner.

1.02 PRE-CONSTRUCTION VIDEOS AND PHOTOGRAPHS

A. The Contractor shall provide preconstruction photographs and videos prior to commencement of work on the site. The documentation shall be digital and shall indicate the date, name of project, direction in which the images were taken and the location where the images were taken.

B. A minimum of 50 photographs shall be taken prior to construction including a video of the entire route.

C. Before construction may start, digital copies of the documentation shall be delivered on a flash drive to the Construction Manager.

D. The Contractor shall document the entire area of proposed construction and site entries and access roads from multiple perspectives.

E. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions.

F. The pre-construction photographs shall be submitted to the Construction Manager within 28 calendar days after the date of receipt by the Contractor of Notice to Proceed.

1.03 PROGRESS PHOTOGRAPHS AND SUBMITTALS

A. The Contractor shall provide digital construction images showing the progress of the work on a monthly basis.

B. Starting immediately after the date of the preconstruction documentation and continuing as long as the work is in progress, construction photographs shall be taken.

C. Photographs shall be taken to document completely the ongoing work, points of site entry and access roads.

D. A minimum of 20 photographs shall be taken each month including a video of the route.

E. Additional photographs shall be taken and be of such subjects as may be directed by the Construction Manager.

F. All photographs shall indicate the date, job title and brief description of the image(s), including the location and direction the image was taken.

G. A final set of aerial photographs shall be taken once all grassing has been established.

H. Photographs should be provided on a flash drive with each payment application. In addition, one hard copy of each photograph shall be submitted. Failure to include photographs may be cause for rejection of the payment request.

I. If software is used to organize, store and describe the photos, a copy of the software and all relevant updates shall be supplied to both the Owner and the Construction Manager by the Contractor, at no additional cost to Owner.

J. Progress photograph and video files shall be provided on flash drive as well as hard copies for photographs.

K. The file name of each photograph shall at a minimum contain the date the photograph was taken. All photographs shall be labeled to indicate date, time taken, and description of work shown.

1.04 COMPLETION DIGITAL PHOTOGRAPHS AND VIDEO

A. Following completion of the work, photographs and videos shall be made showing the same areas and features as in the pre-construction photographs.

B. The Contractor shall provide one (1) set of completion photographs after Substantial Completion has been achieved.

C. The photographs shall be digital, and shall indicate the date, name of project, direction in which the photograph was taken and the location where the photograph was taken.

D. A minimum of 50 photographs shall be taken at project completion including a video of the entire pipeline route.

E. Before Final Completion and acceptance of the project, digital copies of the photographs shall be delivered on a flash drive to the Construction Manager.

F. The Contractor shall photograph all of the constructed work, the entire area of construction and all site entries and access roads from multiple perspectives.

G. Post construction photographs and videos shall be provided prior to final acceptance of the Project.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUBMITTALS

A. Submittals covered by these requirements include manufacturers' information, shop drawings, test procedures, test results, samples, requests for substitutions, and miscellaneous work-related submittals.

B. Submittals shall also include, but not be limited to, all mechanical, electrical and electronic equipment and systems, materials, reinforcing steel, fabricated items, and piping and conduit details.

C. The Contractor shall furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules, and manufacturer's installation and other instructions as specifically required in the contract documents to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the contract documents.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. General:

1. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal.

    a. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review.

    b. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Construction Manager in each case where his submittal may affect the work of another contractor or the Owner.

    c. The Contractor shall coordinate submittals among his subcontractors and suppliers.

2. The Contractor shall coordinate submittals with the Work so that work will not be delayed. He shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another.

    a. No extension of time will be allowed because of failure to properly schedule submittals.

b. The Contractor shall not proceed with work related to a submittal until the submittal process is complete. This requires that submittals for review and comment be returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted."

3. The Contractor shall certify on each submittal document that he has reviewed the submittal, verified field conditions, and complied with the contract documents.

4. The Contractor may authorize in writing a material or equipment supplier to deal directly with the Construction Manager or the Owner with regard to a submittal. These dealings shall be limited to contract interpretations to clarify and expedite the Work.

1.03 CATEGORIES OF SUBMITTALS

A. General:

1. Submittals fall into two general categories: submittals for review and comment, and submittals which are primarily for information only. Submittals which are for information only are generally specified as Product Data in Part 2 of applicable specification sections.

B. Submittals for review and comment:

1. All submittals except where specified to be submitted as product data for information only shall be submitted by the Contractor to the Construction Manager for review and comment.

C. Submittals (product data) for information only:

1. Where specified, the Contractor shall furnish submittals (product data) to the Construction Manager for Information only. Submittal requirements for operation and maintenance manuals, which are included in this category, are specified in Section 01 78 23.

1.04 TRANSMITTAL PROCEDURE

A. General:

1. Unless otherwise specified, submittals regarding material and equipment shall be accompanied by Transmittal Form 01 33 00-A specified in Section 01 99 90.

2. Submittals for operation and maintenance manuals, information and data shall be accompanied by Transmittal Form 01 78 23-A specified in Section 01 99 90.

3. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers.

4. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.

5. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted.

    a. Original submittal numbers shall have the following format: XX XX XX.XX.YY, where 'X' denotes the applicable specification section and 'Y' denotes the individual submittal number for that particular specification section, beginning with 01.

    b. The initial submittal shall be identified as "Revision" 000.

    c. Subsequent resubmittals shall be identified 001, 002, etc. Packages shall be identified as follows: XXXXXXXXAA; where 'X' denotes the applicable specification.

B. Deviation from contract:

1. If the Contractor proposes to provide material, equipment, or method of work which deviates from the project manual, he shall indicate so under "deviations" on the transmittal form accompanying the submittal copies.

C. Submittal completeness:

1. Submittals which do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

D. Submittal schedule and log:

1. Contractor shall prepare and maintain a submittal log/schedule that includes all specified submittals for the project.

    a. Copies of the submittal log shall be provided to the Owner and Construction Manager for review within 15 days of the notice to proceed.

    b. No progress payments will be made by the Owner until the submittal log/schedule is accepted and approved by the Construction Manager.

2. The schedule shall clearly delineate submittals for review and comment and product data (submittals) for information only.

3. Submittal schedule information shall be updated monthly with the Contractor's updated project schedule.

4. The Contractor shall identify as an activity in the project schedule specified in Section 01 32 16, all major equipment submittals as well as those involving complex reviews and long lead deliveries.

1.05 REVIEW PROCEDURE

A. General:

1. Submittals are specified for those features and characteristics of materials, equipment, and methods of operation which can be selected based on the Contractor's judgment of their conformance to the specified requirements.

2. Other features and characteristics are specified in a manner which enables the Contractor to determine acceptable options without submittals.

3. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform as specified.

a. Review will not extend to means, methods, techniques, sequences or procedures of construction, or to verifying quantities, dimensions, weights or gages, or fabrication processes (except where specifically indicated or required by the project manual) or to safety precautions or programs incident thereto.

b. Review of a separate item, as such, will not indicate approval of the assembly in which the item functions.

4. When the contract documents require a submittal, the Contractor shall submit the specified information as follows:

a. Three (3) hard copies of all submitted information plus one digital pdf copy of all information shall be transmitted with submittals for review and comment.

b. Unless otherwise specified, 3 copies of all sample data shall be transmitted with submittals (Product Data) for information only.

B. Submittals for review and comment:

1. Unless otherwise specified, within 30 calendar days after receipt of a submittal for review and comment, the Construction Manager shall review the submittal and return 1 copy of the marked-up copy. The marked-up copy/returned submittal will be retained by the Construction Manager. The returned submittal shall indicate one of the following actions:

a. If the review indicates that the material, equipment or work method complies with the project manual, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.

b. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a corrected copy shall be provided.

c. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT."

Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

d. If the review indicates that the material, equipment, or work method does not comply with the project manual, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations which have not been identified clearly may be rejected. Except at his own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

C. Submittals (product data) for information only:

1. Such information is not subject to submittal review procedures and shall be provided as part of the work under this contract and its acceptability determined under normal inspection procedures.

1.06 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

A. General:

1. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Construction Manager or the Owner, or by any officer or employee thereof, and the Contractor shall have no claim under the Contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed.

2. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the Owner has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 – GENERAL

1.01 SCOPE

A. Work under this Section includes submittal to the Construction Manager of shop drawings, product data and samples required by the various sections of these Specifications.

B. Submittal Contents: The submittal contents required are specified in each section.

C. Definitions: Submittals are categorized as follows:

1. Shop Drawings

a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.

b. Provide newly prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated.

c. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings.

d. Show dimensions and note dimensions that are based on field measurement.

e. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements.

f. Do not allow shop drawings to be used in connection with the Work without appropriate final “Action” markings by the Construction Manager.

g. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section, schedule or room numbers shown on the Contract Drawings.

h. Minimum assembly drawings sheet size shall be 22 x 34 inches.

i. Minimum detail sheet size shall be 8 1/2 x 11 inches.

j. Minimum Scale:

1) Assembly Drawings Sheet, Scale: 1 inch = 30 feet.

2) Detail Sheet, Scale: 1/4 inch = 1 foot.

2. Product Data

   a. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.

   b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project.

   c. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.

3. Samples

   a. Samples include both fabricated and unfabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.

   b. Provide units identical with final condition of proposed materials or products for the work.

      1) Include “range” samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set.

      2) Provide full set of optional samples where the Construction Manager's selection is required.

      3) Prepare samples to match the Construction Manager's sample where indicated.

      4) Information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards.

      5) Samples are submitted for review and confirmation of color, pattern, texture and “kind” by the Construction Manager.

      6) Construction Manager will note “test” samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.

4. Miscellaneous submittals related directly to the Work (non-administrative) warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.02 SPECIFIC CATEGORY REQUIREMENTS

A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:

1. The date of submittal and the dates of any previous submittals.
2. The Project title.
3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
4. The Names of:
   a. Contractor
   b. Supplier
   c. Manufacturer
5. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing Number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Notification to the Construction Manager in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8 x 3 inch blank space for Contractor and Construction Manager stamps.
12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
13. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.03 ROUTING OF SUBMITTALS

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable)
2. Contractor to Construction Manager
3. Construction Manager to Contractor and Owner
4. Contractor to Supplier

PART 2 – PRODUCTS

2.01 SHOP DRAWINGS

A. Unless otherwise specifically directed by the Construction Manager, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

B. Submit all shop drawings in the form of six hard copies and one pdf file.

C. One reproducible for all submittals larger than 11 x 17 inches and no more than three prints of other submittals will be returned to the Contractor.

2.02 MANUFACTURER'S LITERATURE

A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Construction Manager's review.

B. Submit the number of copies which are required to be returned (not to exceed three) plus three copies which will be retained by the Construction Manager.

2.03 SAMPLES

A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.

B. Unless otherwise specifically directed by the Construction Manager, all samples shall be of the precise article proposed to be furnished.

C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Construction Manager.

2.04 COLORS

A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Construction Manager for review and selection.

B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

PART 3 – EXECUTION

3.01 CONTRACTOR'S COORDINATION OF SUBMITTALS

A. Prior to submittal for the Construction Manager's review, the Contractor shall use all means necessary to fully coordinate all materials, including the following procedures:

1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
2. Coordinate as required with all trades and all public agencies involved.
3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.
4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.

B. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Construction Manager without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.

C. The Owner may back charge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a “No Exceptions Taken” mark.

D. Grouping of Submittals

1. Unless otherwise specifically permitted by the Construction Manager, make all submittals in groups containing all associated items.
2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent.
    a. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Construction Manager along with Contractor's comments as to compliance, non-compliance or features requiring special attention.

E. Schedule of Submittals

1. Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated.
2. A reasonable period shall be scheduled for review and comments.
3. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.02 TIMING OF SUBMITTALS

A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.

B. In scheduling, allow sufficient time for the Construction Manager's review following the receipt of the submittal.

3.03 REVIEWED SHOP DRAWINGS

A. Construction Manager Review

1. Allow a minimum of 30 days for the Construction Manager's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals.

   a. The Construction Manager will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

   b. Allow a minimum of two weeks for reprocessing each submittal.

   c. Advise the Construction Manager on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.

2. Acceptable submittals will be marked “No Exceptions Taken”. A minimum of three copies will be retained by the Construction Manager for Construction Manager's and the Owner's use and the remaining copies will be returned to the Contractor.

3. Submittals requiring minor corrections before the product is acceptable will be marked “Make Corrections Noted”. The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked “No Exceptions Taken” prior to installation or use of products.

4. Submittals marked “Amend and Resubmit” must be revised to reflect required changes and the initial review procedure repeated.

5. The “Rejected See Remarks” notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.

6. Only two copies of items marked “Amend and Resubmit” and “Rejected See Remarks” will be reviewed and marked. One copy will be retained by the Construction Manager and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.

B. No work or products shall be installed without a drawing or submittal bearing the “No Exceptions Taken” notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Construction Manager's stamp.

C. Substitutions: In the event the Contractor obtains the Construction Manager's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Construction Manager, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

D. Use of the “No Exceptions Taken” notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents.

1. The Construction Manager's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings.

2. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site.

3. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.04 RESUBMISSION REQUIREMENTS

A. Shop Drawings

1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.

2. Indicate on drawings all changes which have been made other than those requested by the Construction Manager.

B. Project Data and Samples:

1. Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION

SECTION 01 35 00

UNIQUE REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

A. The scope of this Section is to convey to the Contractor unique and unusual stipulations and requirements which have been established for this Project.

1. Some of the stipulations and requirements are a result of negotiations with various entities and organizations which have an interest in this Project.

2. Some requirements are based on technical aspects of the Project which are not otherwise conveyed to the Contractor.

B. The provisions of this Section shall not supersede the Bidding Requirements, Contract Forms or Conditions of the Contract.

1.02 MILESTONE DATES

A. The Contractor shall be required to complete the following activities by the indicated date or days after the Notice to Proceed:

Consecutive Calendar Days after Notice to Proceed	Milestone Liquidated Damages per Calendar Day
30 Days	Completion of Administrative Period
210 Days	Substantial Completion of All Work $1,000
240 Days	Final Completion of All Work $250

Revise per specific contract term

B. Substantial Completion, for the purposes of assessing liquidated damages, shall be defined as the time at which the work (or a specified part thereof) has progressed to the point where, in the opinion of Construction Manager, the work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the work (or a specified part thereof) can be utilized for the purposes for which it is intended.

C. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof. At minimum, Substantial Completion shall be defined as:

1. That degree of completion of the Project’s operating facilities or systems sufficient to provide the Owner full time, uninterrupted, continuous operation of the work; and

2. All required functional, performance, and operational or startup testing has been successfully demonstrated for all components, devices, equipment, systems, including instrumentation and controls to the satisfaction of the Construction Manager in accordance with the requirements of the Specifications; and

3. All inspections required have been completed. Specific items of work that must be completed prior to the Construction Manager's issuance of a certificate of Substantial Completion include, but are not limited to, the following:

   a. Correcting deficient work items listed by any regulatory agencies.

   b. All submittals must be received and approved by the Construction Manager, including, but not necessarily limited to, the following:

      1) Record documents.

      2) Factory test reports.

      3) Equipment and structure test reports.

      4) Manufacturer's Certificate of Proper Installation.

      5) Operating and Maintenance information, instructions, manuals, documents, drawings, diagrams, and records.

      6) Spare parts lists.

   c. All additional warranty or insurance coverage requirements have been provided.

1.03 STANDARDS

A. Existing pavement, sidewalks and curb and gutter, driveways or storm sewer, if affected by the construction, shall be replaced, in accordance with the relevant City and/or the Georgia Department of Transportation specifications and standards to match existing conditions at a minimum.

1.04 SUBMITTALS

A. Sequence Submittal

1. Submit a proposed sequence in accordance with Section 01 32 16 with appropriate times of starting and completion of tasks to Construction Manager for review.

2. The Contractor may propose alternatives to the sequencing constraints to that shown in this Section in an attempt to reduce the disruption of the operation of the existing facility or streamline the tasks of this Contract.

3. The Owner and Construction Manager are not obligated to accept any of these alternatives.

B. All requested submittals must be approved by the Owner or Construction Manager, prior to any on site work.

1. This includes, but is not limited to the construction sequencing schedule, Erosion and Sedimentation Control Plan, Tree Protection Plan, Traffic Management Plan, product shop drawings, and health and safety and loss prevention programs.

1.05 EXISTING FACILITY OPERATIONS

A. All existing services and continuity of sewer service must be maintained during the time construction activities are in progress.

B. The Contractor shall coordinate all work with the Construction Manager, so that the construction will not restrain or hinder the operation of the existing services.

1. If, at any time, any portion of the existing service will be interrupted, the Contractor must obtain approval from the Construction Manager, one week in advance, as to the date, time and length of time that portion of the services will be interrupted, until the services are restored.

C. Connections to the existing facilities or alteration of existing facilities will be made at times when the facility involved is not in use or at times, established by the Owner, when the use of the facility can be conveniently interrupted for the period of time needed to make the connection or alteration.

D. After having coordinated the work with the Owner, the Contractor shall prepare a submittal in accordance with Section 01 33 23 to include the time, time limits and methods of each connection or alteration and have the approval of the Construction Manager before any work is undertaken on the connections or alterations.

E. The Contractor shall comply with the stipulations contained in permits obtained from the relevant or applicable government entity, pertaining to work hours, lane closures, noise pollution, traffic detours, and road closures.

F. Before driveways are interrupted, the Contractor is responsible to coordinate their work activities with the property residence, so that construction will not hinder excess to the property.

G. Before any roadway or facilities are blocked off, the Owner's approval shall be obtained to coordinate operations for the Work.

H. The Contractor shall not open or close valves or take any other such actions concerning the operation of existing systems.

1.06 SEQUENCING

A. General

1. The Contractor is responsible for all construction activities sequencing, unless adjustment to any construction activity sequencing, is due to the Project’s constraint, and/or requested by Construction Manager.

2. The completion of specific preliminary sequencing tasks will be required, prior to any construction activities.

3. The Contractor is responsible to verify the project's existing topography, prior to the procurement and delivery of pipe materials.

4. The Contractor is responsible to keep the road fully operational and functional, during the execution of the Project, unless approval is given by the relevant governing authority.

B. The Contractor shall notify the Construction Project Manager in writing at least 72 hours, prior to starting work that will require taking existing facilities out of service.

C. The Contractor may utilize multiple crews to construct the pipeline concurrently at various locations with the approval of the Construction Manager, in order to maintain the Project's completion schedule, or as required by the Construction Manager.

D. The Contractor is responsible to make their own assessment and determination of requirements that affect or may affect the work progress and sequencing.

E. Prior to the procurement of the proposed sewer line materials, the Contractor is responsible to field locate the starting and ending, tie-in points and connections locations of existing sewer pipe line. Field stake the horizontal center line of the proposed pipe line, in order to better procure the total amount of proposed sewer line linear footage.

F. The Contractor is responsible to provide, as an attachment to their Progress Payment Request Submittals, the applicable to date As-Built progress drawing of the installed sewer line that will support linear footage of the sewer line, to be approved for payment.

1.07 SEQUENCING CONSTRAINTS

A. The following construction sequencing constraints are to emphasize critical tasks of the work in this Contract. It is not a complete list of all work to be completed.

1. <add constraints>

1.08 SITE PHYSICAL CONDITIONS

A. The Contractor shall field verify the locations of existing subsurface structures, utilities, services, and depth of underground facilities, prior to the start of excavation and construction.

B. The Contractor is responsible to identify, locate, and make the necessary exploratory excavations where existing underground utilities, services, and structures may potentially conflict with propose construction.

C. All exploratory excavations shall be conducted sufficiently ahead to avoid possible delays to the Contractor's proposed sewer line installation schedule, and project's Contract Time.

D. The Contractor is responsible to field locate accurately and document, prior to start of work, the existing site condition of all landscaping features, walls, sidewalk, and curb and gutter alignment, including any existing features that may be impacted

1.09 TRAFFIC CONTROL

A. The Contractor is responsible to furnish the necessary traffic flagmen and/or escorts to direct traffic in the roadway areas affected by their construction operations, whenever and wherever, in the opinion of the Construction Manager traffic is sufficiently congested or public safety is endangered.

B. Under the Contract Terms, the employment or presence of traffic flagmen or escort, shall not in way relieve the Contractor of their responsible and/or liability.

1.10 CONSTRUCTION STAKING

A. The Project Construction Drawings show the alignment of the sewer line, and the location of manholes and other appurtenances.

B. The base line shall be defined as the centerline to which the location of the sewer line is referenced, or survey line. The Contractor shall be responsible for performing all survey work required for constructing the sewer line, including the establishment of its base line and/or centerline, and any details surveys needed for the sewer line installation and construction.

C. This work shall include the staking out of permanent and temporary easements, to ensure that the Contractor is not deviating from the designated easements.

D. The sewer line level of detail of survey shall be that the correct location, as described on the Construction Drawings or as laid out in the field can be established for construction and can be verified in the field by the Construction Project Manager.

1.11 REFERENCE POINTS

A. The Contractor shall take all precautions necessary, which includes, but not limited to, installing reference points, in order to protect and preserve the centerline or baseline established.

B. Reference points shall be placed at or no more than three (3) from the outside of the construction easement or right-of-way.

C. The location of the reference points shall be recorded in a log with a copy provided to the Construction Project Manager, prior to reference point locations verification.

D. The distances between reference points and the sewer centerline shall be accurately measured to 0.01 foot.

E. The Contractor shall give the Construction Project Manager reasonable notice to field verify the set reference points.

1.12 ADMINISTRATION PERIOD

A. During the Administration Period the Contractor shall be limited in site access to only the following:

1. Nondestructive field verification of existing conditions.
2. Construction of Contractor's temporary field offices.

B. During the Administration Period the Contractor shall complete, as a minimum, the following:

1. Issuance of contracts, subcontracts, and purchase orders for all major products and systems.
2. Complete all submittals, release for manufacture, and schedule delivery for the products or systems referenced above.
3. Prepare and submit approvable documents required by Section 01 32 16, including OPS.
4. Install Contractor's temporary field offices complete with all required utilities, internet, network, supplies, and furnishings required.
5. Complete and submit all preconstruction photos, videos, and initial aerial photographs.

C. The duration of the Administration Period is 30 consecutive calendar days, after which time the Construction Period shall automatically begin.

D. Construction Period may begin prior to the 30 days, provided all requirements of the Administration Period have been completed, submitted, and approved by the Construction Manager.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 35 29

HEALTH, SAFETY AND EMERGENCY RESPONSE PROCEDURES

PART 1 – GENERAL

1.01. CONTRACTOR'S RESPONSIBILITY FOR SAFETY

A. The Contractor shall determine the safety hazards involved in prosecuting the Work and the precautions necessary to conduct the Work safely.

1. If the Contractor is unsure as to any special hazards which may be unique to the various processes and facilities involved in wastewater conveyance and treatment, it shall be Contractor's responsibility to determine such information prior to beginning the Work.

B. The Contractor shall conduct its operations and perform all work safely and perform all work necessary to ensure the safety of its personnel and others and shall be solely and completely responsible for the conditions on the jobsite, including the safety of all persons and property, both public and private, during the Contract period.

C. This protection shall be provided for all persons including but not limited to his employees, employees of other contractors or subcontractors, members of the general public, Owner's employees including the Construction Manager, Engineer's employees, and regulatory agencies' personnel that may be on or about the work. Protection of public and private property including but not limited to utilities, pipes, equipment, motor vehicles, and structures.

D. The Contractor's responsibility for protection is described in Article 25 of the General Conditions.

E. These requirements shall apply continuously and not be limited to normal working hours.

F. The Contractor shall bear all risks associated with performing the Work and shall fully indemnify and hold harmless the Owner, the Construction Manager and Engineer.

PART 2 – SAFETY AND HEALTH REGULATIONS

2.01. GENERAL

A. Safety provisions shall conform to the Federal and State Departments of Labor Occupational Safety and Health Act (OSHA), and all other applicable Federal, State, County, and local laws, ordinances, codes, the requirements set forth herein, and any regulations that may be specified elsewhere in these Contract Documents.

B. Where any of these are in conflict, the more stringent requirement shall be followed. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations or relieve him of the penalties set forth therein.

C. All construction shall be conducted in accordance with the latest applicable requirements of the following:

1. Part 1926 - Safety and Health Regulations for Construction of the Occupational Safety and Health Act.
2. Section 107 of the Contract Work Hours and Safety Standards Act.
3. Any other local, state or federal safety codes, laws, regulations and standards that apply.

D. Copies of these regulations may be obtained from Labor Building, 14th and Constitution Avenue N.W., Washington, DC 20013.

PART 3 – EXECUTION

3.01. SAFE ACCESS TO THE WORK

A. The Contractor shall at all times provide proper facilities for safe access to the work by the Owner, the Construction Manager, their authorized representatives and by all authorized government officials.

3.02. CONSTRUCTION SAFETY PROGRAM

A. Contractor shall develop a written job safety program specifically suited for this project.

B. The Contractor shall appoint for the duration of this Contract a qualified supervisory employee to develop and supervise the Contractor's job safety program that will effectively implement the required safety provisions.

C. Neither the Owner nor the Construction Manager shall be responsible for safety precautions and programs in connection with the construction work.

D. The Contractor shall provide the Owner and Construction Manager with two copies of the Contractor's safety program within 15 working days after the Notice to Proceed.

3.03. EXCAVATION PLANS

A. In accordance with the governing State and Federal requirements, the Contractor shall submit a detailed excavation plan to the Construction Manager before excavation, showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches five feet or more in depth.

B. The excavation plan shall be prepared, sealed and signed by a licensed engineer registered in the state of Georgia.

C. This submittal is for record purposes only and will not be reviewed and approved by the Owner or Construction Manager.

D. The plan is the complete responsibility of the Contractor and submitting it to the Owner and Construction Manager shall not relieve the Contractor for overall responsibility and liability for the work.

E. It shall be understood that the above stipulated requirements are considered to be the minimum to be provided. It shall be the Contractor's responsibility to provide the additional strength required to support the side of the excavation against loads which may exceed those employed to derive the criteria set forth in the Industrial Safety Orders.

F. The Contractor shall be solely responsible for any and all liabilities which may arise from his failure to provide adequate shoring, bracing, or sheeting as necessary to support the excavation under any or all of the conditions of loading which may exist, or which may arise during the construction of the project.

3.04. SAFETY EQUIPMENT

A. The Contractor shall maintain at the jobsite safety equipment applicable to the Work as prescribed by the governing safety authorities and all articles necessary for giving first aid to the injured and shall establish the procedure for the immediate removal to a hospital or a doctor's care of persons who may be injured on the jobsite.

B. The performance of all work and all construction, particularly with respect to ladders, platforms, structure opening, scaffolding, shoring, lagging, and machinery guards, shall be in accordance with the requirements of applicable governing safety authorities.

3.05. ACCIDENT REPORTS

A. If death or serious injuries or serious damage are caused, the accident shall be reported immediately by telephone or messenger to the Owner. In addition, the Contractor must promptly report in writing to the Owner all accidents in connection with work, giving full details, names, and statements of witnesses.

B. If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Owner, giving full details of the claim.

3.06. TRAFFIC SAFETY AND ACCESS TO PROPERTY

A. Comply with all rules and regulations of the City, State, and County authorities regarding closing or restricting the use of public street or highways.

B. No public or private road shall be closed, except by express permission of the Owner.

C. Conduct the work so as to assure the least possible obstructions within traveled roadways by installing approved signs, barricades, and lights where necessary for the safety of the public.

D. The convenience of the general public and residents adjacent to the project, and the protection of the persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.

3.07. FIRE PREVENTION AND PROTECTION

A. The Contractor shall execute all work in a fire-safe manner and shall supply and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires.

B. The Contractor shall comply with applicable federal, local, and state fire prevention regulations.

C. Where these regulations do not apply, applicable parts of the National Fire Prevention Standards for Safeguarding Building Construction Operations, (NFPA No. 241) shall be followed.

D. Sufficient number of fire extinguishers of the type and capacity required to protect the Work and ancillary facilities, shall be provided and maintained by the Contractor in readily accessible locations.

3.08. SPECIAL REQUIREMENTS

A. The Contractor's attention is directed to the fact that construction activities involving existing wastewater facilities and sewer systems will occasionally involve work in potentially hazardous environments in which oxygen deficient, toxic or explosive conditions may exist.

B. Additional hazards arise from the presence of pathogens in the wastewater and sludge and from the slime and scum layer that coat walking, working and other surfaces.

C. In dealing with these hazards, the Contractor shall take special precautions to ensure worker safety. Such precautions shall include, but are not limited to, the following, as applicable:

1. Installing temporary forced air ventilation equipment and ducts for fresh air in enclosed areas.
2. Using pneumatic tools and equipment instead of electric driven equipment in hazardous areas.
3. Avoiding the use of cutting torches, field welding and grinders in hazardous areas.
4. Cleaning and disinfecting working surfaces with hot water, high pressure washers prior to commencing work.

5. Installing sealed wooden baffles or bulkheads to isolate working areas from hazardous atmospheres.
6. Providing portable oxygen meters, combustible gas detectors and hydrogen sulfide detectors to continuously monitor the atmosphere in enclosed working areas.
7. Providing safety harnesses, safety lines and recovery crews for workers in hazardous areas.
8. Providing self-contained breathing apparatus with spare air cylinders for workers in hazardous areas.
9. Providing dry chemical fire extinguishers and connected fire hoses in areas where a danger of fire or explosion exists.
10. Providing adequate, oxygen equipped, first aid facilities.
11. Providing suitable wash up areas and facilities for workers.
12. Installing temporary lighting using explosion proof fixtures in hazardous environments.
13. Installing approved warning and hazard signs and posting safety procedures.
14. Instructing all workers as to the hazards present, the procedures to be followed and the proper function and use of all safety and emergency equipment furnished.

D. Prior to entering or commencing work in a hazardous area, the Contractor shall ensure that all safety and emergency equipment is in place and in satisfactory operating condition.

E. Prior to commencing Work on existing facilities and equipment, the Contractor shall notify the system/facility superintendent and shall ensure that the source of electrical energy to all affected equipment is shut off and locked out at the appropriate motor control center. Local switches and pushbutton stations, where provided, shall be locked in the “off” position.

3.09. EMERGENCY PHONE NUMBERS

A. Emergency phone numbers (fire, medical, police) shall be posted at all telephone locations at the Site of the Work and their locations made known to all.

END OF SECTION

SECTION 01 35 43

ENVIRONMENTAL PROCEDURES

PART 1 – GENERAL

1.01 SITE MAINTENANCE

A. The Contractor shall keep the work site clean and free from rubbish and debris. Materials and equipment shall be removed from the site when they are no longer necessary.

B. Upon completion of the Work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

1.02 TEMPORARY DAMS

A. Except in time of emergency, earth dams are not acceptable at catch basin openings, local depressions or elsewhere.

B. Temporary dams of sand bags, asphaltic concrete, or other acceptable material will be permitted when necessary to protect the Work, provided their use does not create a hazard or nuisance to the public.

C. Such dams shall be removed from the site as soon as they are no longer necessary.

1.03 AIR POLLUTION CONTROL

A. The Contractor shall not discharge smoke, dust, and other contaminants, into the atmosphere that violate the regulations of any legally constituted authority.

B. The Contractor shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water or other means as necessary. The use of water, in amounts that result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.

C. The Contractor shall provide dust control at no additional cost to the Owner.

1.04 NOISE CONTROL

A. Noise from Contractor's operations shall not exceed limits established by applicable laws or regulations and local noise ordinances.

1.05 SEDIMENTATION AND EROSION CONTROL

A. Contractor shall employ best management practices in accordance with Local, State and Federal guidelines and regulations for erosion and sedimentation control. Unless otherwise noted, Contractor shall obtain related permits or approvals and pay applicable fees.

1.06 STATE OR FEDERAL WATERS

A. State or Federal waters, wetlands or other environmental features shall not be disturbed without proper approvals, permits or notifications, which are the responsibility of the Contractor.

1.07 HAZARDOUS MATERIALS STORAGE

A. The Contractor shall submit Material Safety Data Sheets (MSDSs) for all hazardous chemicals contained onsite to the Construction Manager.

B. The Contractor shall also maintain a copy of all applicable MSDSs onsite at all times.

C. The Contractor shall notify the Owner and the Construction Manager upon receipt of any hazardous chemicals onsite.

D. All hazardous chemicals onsite must be placed in approved containment with an appropriate leak detection system. Flammable materials such as paints, thinners, solvents, etc. must be stored in approved fire storage cabinets.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

A. Permits and Responsibilities: The Contractor shall, without additional expense to the Owner, be responsible for obtaining all necessary licenses and permits, including building permits, and for complying with any applicable federal, state, county and municipal laws, codes and regulations, in connection with the prosecution of the Work.

B. In addition, City Work Permits, Right of Way Encroachment permits, plumbing permits and similar type permits, and all appropriate licenses are the responsibility of the Contractor.

C. If land disturbance permits, DOT permits or easements are required, they will be obtained by the County as part of the design process.

D. The Contractor shall take proper safety and health precautions to protect the Work, the workers, the Owner and his representatives, the Construction Manager, the Engineer and his representatives, the public and the property of others.

E. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the Work, except for any completed unit of construction thereof which may heretofore have been accepted.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 42 00

CODES AND STANDARDS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.

B. The inclusion of an organization under one category does not preclude that organization' standards from applying to another category.

C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.

D. All material and equipment, for which a UL Standard, an AGA or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed in Article 1.02.

1.02 STANDARD ORGANIZATIONS

A. PIPING AND VALVES

ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
DIPRA	Ductile Iron Pipe Research Association
FCI	Fluid Controls Institute
MSS	Manufacturers Standardization Society
NCPI	National Clay Pipe Institute
NSF	National Sanitation Foundation
PPI	Plastic Pipe Institute
Uni Bell	PVC Pipe Association

B. MATERIALS

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials

C. PAINTING AND SURFACE PREPARATION

NACE	National Association of Corrosion Engineers
SSPC	Steel Structures Painting Council

D. ELECTRICAL AND INSTRUMENTATION

AEIC	Association of Edison Illuminating Companies
AIEE	American Institute of Electrical Engineers
EIA	Electronic Industries Association
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	The Instrumentation, Systems, and Automation Society
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
REA	Rural Electrification Administration
TIA	Telecommunications Industries Association
UL	Underwriter's Laboratories
VRCI	Variable Resistive Components Institute

E. ALUMINUM

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association

F. STEEL AND CONCRETE

ACI	American Concrete Institute
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
CRSI	Concrete Reinforcing Steel Institute
NRMA	National Ready Mix Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute

G. WELDING

ASME	American Society of Mechanical Engineers
AWS	American Welding Society

H. GOVERNMENT AND TECHNICAL ORGANIZATIONS

AIA	American Institute of Architects

APHA	American Public Health Association
APWA	American Public Works Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
CFR	Code of Federal Regulations
CSI	Construction Specifications Institute
EDA	Economic Development Administration
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FmHA	Farmers Home Administration
FS	Federal Specifications
IAI	International Association of Identification
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
NBFU	National Board of Fire Underwriters
(NFPA)	National Fluid Power Association
NBS	National Bureau of Standards
NISO	National Information Standards Organization
OSHA	Occupational Safety and Health Administration
SI	Salt Institute
SPI	The Society of the Plastics Industry, Inc.
USDC	United States Department of Commerce
WEF	Water Environment Federation

I. GENERAL BUILDING CONSTRUCTION

AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AITC	American Institute of Timber Construction
APA	American Parquet Association, Inc.
APA	American Plywood Association
BHMA	Builders Hardware Manufacturers Association
BIFMA	Business and Institutional Furniture Manufacturers Association
DHI	Door and Hardware Institute
FM	Factory Mutual Fire Insurance Company
HPMA	Hardwood Plywood Manufacturers Association
HTI	Hand Tools Institute
IME	Institute of Makers of Explosives
ISANTA	International Staple, Nail and Tool Association
ISDSI	Insulated Steel Door Systems Institute
IWS	Insect Screening Weavers Association
MBMA	Metal Building Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NAGDM	National Association of Garage Door Manufacturers
NCCLS	National Committee for Clinical Laboratory Standards
NFPA	National Fire Protection Association
NFSA	National Fertilizer Solutions Association
NKCA	National Kitchen Cabinet Association

NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
RMA	Rubber Manufacturers Association
SBC	SBCC Standard Building Code
SDI	Steel Door Institute
SIA	Scaffold Industry Association
SMA	Screen Manufacturers Association
SPRI	Single Ply Roofing Institute
TCA	Tile Council of America
UBC	Uniform Building Code

J. ROADWAYS

AREA	American Railway Engineering Association
DOT	Department of Transportation
SSRBC	Standard Specifications for Construction of Transportation Systems, Georgia Department of Transportation

K. PLUMBING

AGA	American Gas Association
NSF	National Sanitation Foundation
PDI	Plumbing Drainage Institute
SPC	SBCC Standard Plumbing Code

L. REFRIGERATION, HEATING, AND AIR CONDITIONING

AMCA	Air Movement and Control Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
HEI	Heat Exchange Institute
IIAR	International Institute of Ammonia Refrigeration
NB	National Board of Boilers and Pressure Vessel Inspectors
PFMA	Power Fan Manufacturers Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMC	SBCC Standard Mechanical Code
TEMA	Tubular Exchangers Manufacturers Association

M. EQUIPMENT

AFBMA	Anti Friction Bearing Manufacturers Association, Inc.
AGMA	American Gear Manufacturers Association
ALI	Automotive Lift Institute
CEMA	Conveyor Equipment Manufacturers Association
CMAA	Crane Manufacturers Association of America
DEMA	Diesel Engine Manufacturers Association
MMA	Monorail Manufacturers Association
OPEI	Outdoor Power Equipment Institute, Inc.

PTI	Power Tool Institute, Inc.
RIA	Robotic Industries Association
SAMA	Scientific Apparatus Makers Association

1.03 SYMBOLS

A. Symbols and material legends shall be as scheduled on the Drawings.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.01 SCOPE

A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.

B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, such as concrete strength and slump testing, soil compaction, etc.

C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, such as testing of pipes.

D. The testing laboratory or laboratories will be selected by the Owner. The testing laboratory or laboratories will work for the Owner.

1.02 PAYMENT FOR TESTING SERVICES

A. The cost of testing services required by the Contract to be provided by the Contractor shall be paid for by the Owner through the CASH ALLOWANCE, e.g., concrete testing, soil compaction, asphalt testing, etc.

B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner or Construction Manager, shall be paid for by the Owner through the CASH ALLOWANCE.

C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.

D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor. Retesting shall be performed by the testing laboratory working for the Owner.

1.03 LABORATORY DUTIES

A. Cooperate with the Owner, Construction Manager and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials.

1. Comply with specified standards, ASTM, other recognized authorities and as specified.

2. Ascertain compliance with requirements of the Contract Documents.

D. Promptly notify the Construction Manager and Contractor of irregularity or deficiency of work which are observed during performance of services.

E. Promptly submit one copy of inspection and/or test reports to the Construction Manager and Contractor with the following information included:

1. Date issued
2. Project title and number
3. Testing laboratory name and address
4. Name and signature of inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification section
9. Location of Project
10. Type of inspection or test
11. Results of test
12. Observations regarding compliance with the Contract Documents

F. Perform additional services as required.

G. The laboratory is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

1.04 CONTRACTOR RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or manufacturer's requirements.

B. Provide to the laboratory, representative samples and in required quantities, of materials to be tested.

C. Furnish copies of test reports.

D. Furnish required labor and facilities to:

1. Provide access to Work to be tested.
2. Obtain and handle samples at the site.
3. Facilitate inspections and tests.
4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.

E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Construction Manager, and shipped to the laboratory by the Contractor at Contractor's expense.

G. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Construction Manager.

1.05 QUALITY ASSURANCE

A. Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.06 PRODUCT HANDLING

A. Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.07 FURNISHING MATERIALS

A. The Contractor shall be responsible for furnishing all materials necessary for testing.

1.08 CODE COMPLIANCE TESTING

A. Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.09 CONTRACTOR'S CONVENIENCE TESTING

A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.10 SCHEDULES FOR TESTING

A. ESTABLISHING SCHEDULE

1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back charged to the Contractor and shall not be borne by the Owner.

1.11 TAKING SPECIMENS

A. Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the Construction Manager.

1.12 TRANSPORTING SAMPLES

A. The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 50 10

TEMPORARY FACILITIES

PART 1 – GENERAL

1.01 SCOPE

A. Contractor shall provide temporary facilities required for this Work include, but are not necessarily limited to:

1. Temporary utilities such as water and electricity.
2. First aid facilities.
3. Sanitary facilities.
4. Potable water.
5. Temporary enclosures and construction facilities.

1.02 GENERAL

A. Contractor shall provide first aid facilities, sanitary facilities and potable water. These shall be available on the Project site on the first day that any activities are conducted on site. The other facilities shall be provided as the schedule of the Project warrants.

B. Maintenance: Contractor shall use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the Work. In the event of loss or damage, immediately make all repairs and replacements necessary, at no additional cost to the Owner.

C. Removal: Contractor shall remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

1.03 STAGING AREAS

A. The Contractor shall establish a staging area for construction as required.

B. Allowable staging areas shall be within site property, road right of way, temporary easements, or permanent easements where approved by the Owner.

C. Any required grading within the staging areas shall be the responsibility of the Contractor and shall be approved by Owner and Construction Manager.

D. The Contractor shall be solely responsible for damages to equipment or materials due to heavy rains or flooding.

1.04 TEMPORARY UTILITIES

A. General

1. Contractor shall provide and pay all costs for all water, electricity and other utilities required for the performance of the Work.
2. Contractor shall pay all costs for temporary utilities until Project completion.
3. Contractor shall pay all costs for temporary utilities and shall include all power, water and the like necessary for testing equipment as required by the Contract Documents.

B. Temporary Water:

1. The Contractor shall coordinate with the Owner in providing metered water suitable for flushing and testing the mains, and for any other construction purposes.
2. The Contractor shall be responsible for providing an Owner approved backflow and metering device.
3. The Contractor shall provide all necessary temporary piping and, upon completion of the Work, remove all such temporary piping.
4. The Contractor is responsible for paying service charges for water used.

C. Temporary Power and Lighting:

1. Provide all necessary wiring for the Contractor's use.
2. The Contractor shall make arrangements with the electrical utility and with the Owner for power takeoff points from the existing service, voltage and phasing requirements, transformers and metering and shall pay the costs and fees arising therefrom.
3. The Contractor shall provide the special connections required for his work.
4. Furnish, locate and install area distribution boxes such that the individual trades may use, their own construction type extension cords to obtain adequate power, and artificial lighting at all points where required by inspectors and for safety.
5. The Contractor shall provide sufficient electrical lighting so that all work may be done in an efficient manner when there is not sufficient daylight.
6. The Contractor shall remove all temporary lighting when such light is no longer necessary.

D. Telephone

1. The Contractor shall provide telephone service for all construction site offices.
2. Cell phones are an acceptable substitute.

1.05 FIRST AID FACILITIES

A. The Contractor shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment.

B. The Contractor shall have standing arrangements for the removal and hospital treatment of any injured person.

C. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and the Construction Manager's personnel.

1.06 SANITARY FACILITIES

A. Prior to starting the Work, the Contractor shall furnish, for use of Contractor's personnel on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be either chemical toilets or shall be connected to the Owner's sanitary sewer system.

B. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the Work is performed.

C. Adequacy of these facilities will be subject to the Construction Manager's review and maintenance of same must be satisfactory to the Construction Manager at all times.

1.07 POTABLE WATER

A. The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, Construction Manager, engineers and the Owner who are associated with the Work.

1.08 ENCLOSURES AND CONSTRUCTION FACILITIES

A. The Contractor shall furnish, install and maintain for the duration of construction, all required storage, scaffolds, tarpaulins, canopies, steps, bridges, platforms and other temporary construction necessary for proper completion of the Work in compliance with all pertinent safety and other regulations.

1.09 PARKING FACILITIES

A. Parking facilities for the Contractor's and Contractor's subcontractors' personnel shall be the Contractor's responsibility.

B. The storage and work facilities provided by the Owner shall not be used for parking by the Contractor's or subcontractor's personnel.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 56 16

DUST CONTROL

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the Construction Manager.

B. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

1.02 PROTECTION OF ADJACENT PROPERTY

A. The Contractor shall visit the site and note the buildings, landscaping, roads, parking areas and other facilities near the Work site that may be damaged by their operations.

B. The Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from Contractor's operations.

C. The Contractor shall protect all existing facilities (indoors or out) from damage by dust, fumes, spray or spills (indoors or out).

D. Protect motors, bearings, electrical gear, instrumentation and building or other surfaces from dirt, dust, welding fumes, paint spray, spills or droppings causing wear, corrosion, malfunction, failure or defacement by enclosure, sprinkling or other dust palliatives, masking and covering, exhausting or containment.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 56 33

JOB SITE SECURITY

PART 1 – GENERAL

1.01 BARRICADES, LIGHTS AND SIGNALS

A. The Contractor shall furnish and erect such barricades, fences, lights and danger signals and shall provide such other precautionary measures for the protection of persons or property and of the Work as necessary.

B. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any Work under construction.

C. The Contractor will be held responsible for all damage to the Work due to failure of barricades, signs and lights and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at Contractor's cost and expense.

D. The Contractor's responsibility for the maintenance of barricades, signs and lights shall not cease until the Project has been accepted by the Owner.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 58 00

PROJECT IDENTIFICATION AND SIGNS

PART 1 – GENERAL

1.01 SCOPE

A. The work under this Section shall include the furnishing of a minimum of two painted signs for each Division of work of not less than 32 square feet in area, with painted graphic content that includes:

1. Project title.
2. Owner's name.
3. Names of governmental units participating in the Project.
4. Names and titles of other parties to be directed by the Construction Manager.
5. Logos.

1.02 DESIGN

A. The Contractor shall provide a scale drawing showing the graphic design, style of lettering and colors to the Construction Manager for approval.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Structure and framing: May be new or used, wood or metal in sound condition, structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior soft wood plywood with medium density overlay, standard large sizes to minimize joints.

C. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

D. Rough Hardware: Galvanized.

E. Paint: Exterior quality.

PART 3 – EXECUTION

3.01 ERECTION

A. Erect the sign on the site in a high visibility location, adjacent to the Project as approved by the Construction Manager.

3.02 MAINTENANCE

A. Contractor shall maintain the Project Sign in good condition during the Contract period.

END OF SECTION

SECTION 01 65 00

TRANSPORTATION AND HANDLING

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the work site.

B. The Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the work.

C. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

D. The Contractor shall maintain and keep in good repair the Work covered by these Drawings and Specifications until acceptance by the Owner.

1.02 TRANSPORTATION

A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.

B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.

C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately.

D. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.03 HANDLING

A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed.

1. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment.

2. Shafts and operating mechanisms shall not be used as lifting points.

3. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.

C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 66 00

STORAGE AND PROTECTION

PART 1 – GENERAL

1.01 SCOPE

A. The work under this Section includes, but is not necessarily limited to, the furnishing of all labor, tools and materials necessary to properly store and protect all materials, equipment, products and the like, as necessary for the proper and complete performance of the Work.

1.02 PIPE

A. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

1.03 STORAGE

A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.

B. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

C. Should the Contractor choose to store material or equipment or use for assembly property which is not owned by the Fulton County or the Contractor, a letter of permission signed by the legal owner of the property shall be obtained by the Contractor and submitted to the Construction Manager a minimum of 24 hours prior to delivery. All material and equipment stored at any facility other than the site shall be tagged with the Owner’s name and the project number. Payment shall not be made for “Stored Materials” for any material stored at locations or in any manner not suitable to the Owner.

D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel and sheet construction products shall be stored with one end elevated to facilitate drainage.

E. Unless otherwise permitted in writing by the Construction Manager, building products and materials such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location.

F. Building products such as rough lumber, plywood, concrete block and structural tile may be stored outdoors under a properly secured waterproof covering.

G. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

H. All materials shall meet the requirements of these Specifications at the time that they are used in the Work.

I. Store products in accordance with manufacturer's instructions.

1.04 PROTECTION

A. Use all means necessary to protect the materials, equipment and products of every section before, during and after installation and to protect the installed work and materials of all other trades.

B. All materials shall be delivered, stored and handled to prevent the inclusion of foreign materials and damage by water, breakage, vandalism or other causes.

C. Substantially constructed weathertight storage sheds, with raised floors, shall be provided and maintained as may be required to adequately protect those materials and products stored on the site which may require protection from damage by the elements.

1.05 DAMAGE

A. Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired.

B. In the event of damage, immediately make all repairs and replacements necessary for the approval of the Construction Manager and at no additional cost to the Owner.

C. Damage shall be corrected to conform to the requirements of the Contract before the assembly is incorporated into the Work.

D. All property damaged by reason of storing of material shall be properly replaced at no additional cost to the Owner.

1.06 EXTENDED STORAGE

A. In the event that certain items of major equipment, such as large diameter valves, have to be stored for an extended period of time, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Construction Manager.

B. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

C. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.

1.07 PACKAGE AND MARKING

A. All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.

B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or sub-assembled units where possible

1.08 IDENTIFICATION

A. Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel. Location of label will be easily visible.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 71 33

PROTECTION AND MAINTENANCE OF PROPERTY AND WORK

PART 1 – GENERAL

1.01. SUMMARY

A. This Section specifies protection and maintenance of underground and above ground utilities, structures, fences, parking strips, sidewalks, driveways, streets, and other improvements which may be affected by the Work.

1.02. SUBMITTALS

A. Procedures: Section 01 33 00.

B. Action submittal items:

1. Listing and schedule of all potholing.
2. Listing of all utilities/facilities to be physically protected and relocated.

C. Informational submittal items for this section:

1. Shoring for all affected structures and utilities.
2. Submit detail drawings of proposed methods to support, protect, and buttress utilities and structures where the depth of the excavation is greater than the horizontal distance from the structure or utility.

1.03. LOCATION OF EXISTING UNDERGROUND FACILITIES

A. The Drawings indicate the existence of underground facilities known to the Owner.

1. Utilities are shown schematically on the plans and are not necessarily accurate in location as to plan or elevation.
2. Determine the location of all utilities that may be impacted during construction.
3. The Contractor shall familiarize himself with and comply with the provisions of O.C.G.A. Section 25-9-1 et. seq.

B. The Contractor shall call, by law, the Utilities Protection Center, d/b/a Georgia 811 at “811” or 1-800-282-7411 and shall request that all owners of utilities, including, but not limited to, gas companies, electric companies, telephone companies, cable companies and governmental units, prior to starting any excavation of the Project, locate and mark their respective facilities.

C. Locate existing underground utilities. Review with the Owner the locations of existing utilities in relation to the new construction and evaluate areas of conflict.

D. Excavate and expose all major and minor existing utilities prior to new construction to determine utility elevations in relation to the new facilities.

E. Examine and repair all pipelines prior to pipelines being buried.

1.04. EXISTING UTILITIES AND FACILITIES

A. Protect, modify, and/or relocate all existing utilities required to complete the Work.

B. The locations of existing major utilities, whether above ground or underground, are indicated on the Drawings.

1. This information has been obtained from utility maps and field surveys.

2. The Owner does not guarantee the accuracy or completeness of this information, and it is to be understood that other above ground or underground facilities not shown on the Drawings may be encountered during the course of the Work.

C. Contractor shall be responsible for damages resulting from any failure to contact utility owners for location, routing and marking of a specific utility and its subsequent effects.

D. The Drawings may show underground utilities which are to be relocated. Contractor shall be responsible for all these relocations prior to commencing work in the area.

E. Protect, modify or relocate existing utilities and facilities required to accommodate Contractor's means and methods.

1. Specific means and methods to be utilized by the Contractor are not known to the Owner. Therefore, the Owner will not be liable for utility protection, modification and relocation not shown on the Drawings that are required by the Contractor due to its means and methods.

2. It is the Contractor's responsibility to determine the work required by the Construction Documents and make provision for protection, modification and relocation required.

3. Coordinate all protection, modification and relocation work through the affected utility.

4. Complete work to the utility owner's requirements and standards.

F. Underground Utilities:

1. For the purpose of this Section an underground utility will be defined as a transmission, collection or distribution line where it would be customary to expect that drawings would exist for the line and the utility owner would be aware of the line.

2. An existing underground utility is considered to be in conflict if it crosses or projects into the specified excavation at an elevation between the top

and bottom of the new facility or when parallel to the new facility, and projects into the specified excavation.

3. Contractor shall be responsible for all protection, affects and damage on utilities not in conflict with the new construction, whether or not the utilities are shown on the Drawings.

4. When not shown on the Drawings and in conflict with the new construction, meet and agree with the Owner on how to proceed.

5. When not shown on the Drawings and no conflict with the new facility exists, no additional payment will be considered.

6. When in a substantially different location and not in conflict with the new construction, no additional payment will be considered.

7. When in a substantially different location and in conflict with the new construction, reimbursement for additional work per the General Conditions.

G. Abandoned pipelines shown on the Drawings shall be removed and plugged per the local agency requirements when encountered.

H. Locate existing underground utilities with the field staking. Review with the Owner the locations of existing utilities in relation to the new construction and evaluate areas of conflict

I. Storm and Sanitary Sewers:

1. Existing live sewers shall remain in service. Adequate provision shall be made for disposal of existing sewage flow.

   a. Immediately repair construction damage to the existing sewer system and manholes to a condition equal to or better than that existing prior to the damage.

   b. Repair all damage which results from the disturbance of the existing sewer.

2. Remove water accumulating during construction from the new sewers and prevent it from entering existing lines.

3. Flush existing pipes which were affected by the construction to the point of the next upstream connection and repair any pipelines or manholes damaged by gravel, rocks, or other debris that has entered the existing system during construction.

4. The physical connection to an existing manhole or sewer line shall not be made until so authorized by the Owner.

J. Aboveground Electrical, Cable, and Communication Facilities:

1. Attention is called to all overhead items including, but not limited to, power, communication and telephone lines, temporary traffic signals, traffic signal mast arms, overhead sign bridges, sign support span wires, signs, and street lights.

2. Observe the location of these overhead facilities and plan and conduct work operations, accordingly.
3. Take precautions to protect and avoid damage to all overhead facilities.
4. Relocate facilities as required to meet the means and methods to be utilized.
5. Observe and investigate the presence of facilities that may be affected by the Work.
    a. Consult with and rely on the information given by utility owners and operators to determine the extent of any hazards and measures required.
    b. Determine the extent of any hazard created by facilities in all areas and follow approved safety procedures during the work.
6. Support poles at risk of being undermined by the Work.
7. Follow the requirements of the local power company for all energized primary conductors.
    a. For 50 kV lines and less, at no time shall personnel or equipment approach closer than 10 feet to any energized primary conductors.
    b. For greater than 50 kV, meet the requirements of the local power company.

K. Underground Electrical, Cable, and Communication Facilities:

1. Determine the protection necessary to proceed safely to protect these underground facilities.

L. Gas:

1. As required by the appropriate utility owner, protect, maintain, support in place, or relocate all gas mains crossing the pipeline trenches.
2. Provide a minimum of 12 inches of clearance, measured from edge to edge, between gas mains or gas service lines and new facilities
    a. If relocating either utility is not practical, a protective wrap shall be provided for the entire distance where less than 12 inches of vertical clearance and less than 6 inches of horizontal clearance are provided.
    b. Wrapping material shall consist of either a split polyvinyl chloride (PVC) pipe or PVC wrapping of at least 0.04 inch in thickness, and shall be applied to either one of the pipes.
3. All abandoned gas mains encountered in the trench area shall be removed.
4. All temporary gas service slack lines shall be protected and maintained during pipeline installation.
5. Notify the Owner and the utility at least two business days (minimum of 48 hours) in advance of any excavation in the vicinity of any gas piping.

6. The utility may require one of its inspectors to be onsite anytime work is conduct near gas lines.

M. Water:

1. As required by the appropriate utility, protect, maintain, support in place, or relocate all water pipelines affected by the Work.
2. Maintain water service along the alignment of work at all times.
3. Thrust blocks may not be shown on the Drawings and shall be assumed to be present at all water line deflections of 11-1/4 degrees or greater.
4. Notify the Owner in writing immediately of any damage. Begin repairs immediately, and work continuously until water service is restored.

N. Roadways:

1. Take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, adjoining property, and structures, and avoid damage.
2. Traffic signage, paint striping, and channelization shall be protected and replaced if damaged.
3. Maintain the existing illumination pattern for signs and roads at all times.
4. Install temporary roadway lighting as necessary.
5. Access for emergency equipment shall be maintained at all times.

1.05. SHORING AND BRACING

A. Shore up, brace, under-pin, and protect as necessary, the foundations and other parts of existing structures adjoining the site of the Work that may be affected by the Work.

B. Contractor is responsible for any damages because of settlements or the loss of lateral or subjacent support of adjoining property and from all loss and damages to adjoining and adjacent structures and their premises.

C. Fully comply with the requirements of the authority having jurisdiction (AHJ) and the State of Georgia, as applicable.

1.06. EMERGENCIES

A. Whenever work endangers the safety of life or property, including adjoining property or property in the immediate proximity of the Work, take all reasonable and prudent actions to prevent threatened loss or injury.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

3.01. GENERAL

A. Contact the Owner and the affected utilities prior to an excavation per the General Conditions.

B. Pothole to locate and expose all utility locations to be affected by the Work prior to new construction in the area of the utility.

C. Adjust work when location of utility is different than shown on the Drawings and materially impacts construction.

D. If the utility requires relocation not shown on the Drawings and the Contractor incurs additional cost, the Owner will consider additional costs.

E. Relocation of minor utilities such as irrigation lines less than 4 inches, water service lines, building drainage pipes will be considered incidental and will not be considered for additional costs.

F. If damage to a utility occurs, repair damage to the requirements of the utility owner prior to backfilling said utility.

END OF SECTION

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers the general cleaning which the Contractor shall be required to perform both during construction and before final acceptance of the Project unless otherwise shown on the Drawings or specified elsewhere in these Specifications.

1.02 QUALITY ASSURANCE

A. Daily, and more often if necessary, conduct inspections verifying that requirements of cleanliness are being met.

B. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

1.03 HAZARDOUS MATERIAL AND WASTE

A. The Contractor shall handle hazardous waste and materials in accordance with applicable local, State, and Federal regulations. Waste shall also be disposed of in approved landfills as applicable.

B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.

C. Burning or burying rubbish and waste materials on the site will not be allowed.

D. Disposal of hazardous wastes or materials into sanitary or storm sewers will not be allowed.

PART 2 – PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

A. Use only the cleaning materials, methods and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Construction Manager.

PART 3 – EXECUTION

3.01 PROGRESS CLEANING

A. General

1. Do not allow the accumulation of scrap, debris, waste material and other items not required for construction of this Work.
2. At least each week and more often if necessary, completely removes all scrap, debris and waste material from the job site.
3. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the environment.

B. Site

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.
2. Restack materials stored on site weekly.
3. At all times maintain the site in a neat and orderly condition which meets the approval of the Construction Manager.

C. Structures

1. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep all interior spaces clean. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by using a hand-held broom.
3. As required preparatory to installation of successive materials, clean the structures or pertinent portions as recommended by the manufacturer of the successive material.
4. Following the installation of finish floor materials, clean the finish floor daily. “Clean”, for the purpose of this Paragraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Manager, may be injurious to the finish floor material.
5. Schedule cleaning operation so that dust and other contaminants resulting from cleaning operations will not fall on wet, recently painted surfaces.

3.02 FINAL CLEANING

A. Definitions: Unless otherwise specifically specified, “clean” for the purpose of this Article shall be interpreted as the level of cleanliness generally provided by

commercial building maintenance subcontractors using commercial quality building maintenance equipment and materials.

B. General: Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in 3.01 above.

C. Site: Unless otherwise specifically directed by the Construction Manager, hose down all paved areas on the site and all public sidewalks directly adjacent to the site; rake clean other surfaces of the grounds. Completely remove all resultant debris.

D. Structures

1. Remove all traces of soil, waste material, splashed material, and other foreign matter to provide a uniform degree of exterior cleanliness.

   a. Visually inspect all exterior surfaces and remove all traces of soil, waste material, and other foreign matter.

   b. Remove all traces of splashed materials from adjacent surfaces.

   c. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.

   d. In the event of stubborn stains not removable with water, the Construction Manager may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Visually inspect all interior surfaces and remove all traces of soil, waste material, smudges and other foreign matter. Remove all paint droppings, spots, stains and dirt from finished surfaces.

3. Clean all glass inside and outside.

4. Polish all surfaces requiring the routine application of buffed polish. Provide and apply polish as recommended by the manufacturer of the material being polished.

E. Post Construction Cleanup: All evidence of temporary construction facilities, haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other evidence of construction, as directed by the Construction Manager.

F. Restoration of Landscape Damage: Any landscape feature damaged by the Contractor shall be restored as nearly as possible to its original condition at the Contractor's expense. The Construction Manager will decide what method of restoration shall be used.

G. Timing: Schedule final cleaning as approved by the Construction Manager to enable the Owner to accept the Project.

3.03 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and

final cleaning of the occupied spaces shall be as determined by the Construction Manager in accordance with the Supplementary Conditions of the Contract Documents.

3.04 DISPOSAL OF WASTE

A. The definitions contained in Georgia Environmental Protection Division Rules 391-3-4-.01 shall be applicable to this Project. The term waste shall include excess and surplus materials, and shall include liquid and solid wastes.

B. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

C. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

D. Remove and transport waste in a manner that will prevent spillage on adjacent surfaces and areas.

E. Burning: Do not burn waste materials on site.

F. Waste removed from the Project site shall be disposed of in sites permitted by the Georgia Environmental Protection Division for the acceptance of type of waste being disposed. The acceptable types of permitted disposal facilities are as follows:

1. Inert Waste Landfills
2. Municipal Solid Waste Landfills
3. Municipal Solid Waste Landfills permitted to receive only construction and demolition wastes.

G. Exceptions to Paragraph F are as follows:

1. Hazardous waste shall be disposed of in accordance with Georgia Environmental Protection Division Rules 391-3-11.
2. Asbestos-containing waste shall also be handled and disposed of in accordance with Georgia Environmental Protection Division Rules 391-3-14.

H. No waste shall be placed at a transfer station facility.

I. The Contractor shall maintain records related to all waste removed from the Project site so as to allow the Owner or the Construction Manager to readily determine the following:

1. Date waste removed from Project site.
2. Name of hauler (company and driver) transporting such waste.
3. General description of waste transported.

4. “Truck tickets” indicating the waste disposal site and amount of waste disposed therein.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.02 REQUIREMENTS

A. Conditions of the contract. Fiscal provisions, legal submittals and additional administrative requirements.

B. Section 01 78 39: Record Documents.

C. The respective sections of Specifications: Closeout Submittals Required of Trades.

1.03 SUBSTANTIAL COMPLETION

A. When Contractor considers the Work is substantially complete, he shall submit the following to the Construction Manager:

1. A written notice that the Work, or designated portion thereof, is substantially complete.
2. A list of items remain to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Construction Manager will make an inspection to determine the statue of completion.

C. Should the Construction Manager determine that the work is not substantially complete:

1. Construction Manager will promptly notify the Contractor in writing, giving the reasons therefore.
2. Contractor shall remedy the deficiencies in the Work, and send second written notice of substantial completion to the Construction Manager.
3. Construction Manager will reinspect the work.

D. When the Construction Manager finds that the work is substantially complete, he will:

1. Prepare and deliver to the Owner a tentative Certificate of Substantial Completion, with a tentative list of items to be completed or corrected before final payment.

2. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and when the Construction Manager considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

E. Substantial Completion: The Certificate will identify the date of Substantial Completion and list any incomplete Work.

1.04 FINAL COMPLETION

A. Prior to Final Completion: Final Completion is achieved when all Work is fully complete in accordance with the Construction Documents.

B. Tasks to complete include, but are not limited to, the following:

1. All Work is complete and correct to the satisfaction of the Owner.
2. All temporary facilities and controls removed.
3. All final cleaning complete per Cleaning Specification.
4. Final Operation and Maintenance Manuals provision per Section 01 78 23.
5. Warranties and Bond Manual submission per Section 01 78 36.
6. Submittal of the Project Record Documents per Section 01 78 39.
7. Spare parts delivery and acceptance.
8. Landscaping complete.
9. All final permits submitted, including Certificates of Occupancy.
10. All Change Orders are approved and signed by both parties.
11. Draft Final Application for Payment submitted.

C. FINAL INSPECTION

1. When Contractor considers the work is complete, he shall submit written certification that:
   a. Documents have been reviewed.
   b. Work has been inspected for compliance with Contract Documents.
   c. Work has been completed in accordance with Contract Documents.
   d. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
   e. Work is completed and ready for final inspection
2. Construction Manager will make the final inspection to verify the status of completion with reasonable promptness after receipt of such certification.

3. Should the Construction Manager consider that the work is incomplete or defective:
    a. Construction Manager will promptly notify the Contractor in writing, listing the incomplete or defective work.
    b. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to the Construction Manager that the work is complete.
    c. Construction Manager will reinspect the work.
4. When the Construction Manager finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.05 REISNPECTION FEES

A. When the Construction Manager performs reinspections due to failure of the work to comply with the claims of status of completion made by the Contractor:
    1. Contractor shall compensate the Owner for expenses incurred by the Construction Manager for such additional services.
    2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.06 CLOSEOUT SUBMITTALS TO CONSTRUCTION MANAGER

A. Evidence of compliance with requirements of governing authorities.

B. Record Documents: To requirements of Section 01 78 39.

C. Evidence of payments and Release of Liens: To requirements of General and Supplementary Conditions.

D. Certificate of Insurance for Products and Completed Operations.

1.07 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Construction Manager.

B. Statement shall reflect all adjustments to the Contract Sum:
    1. The original Contract Sum.
    2. Additions and deductions resulting from:
        a. Previous Change Orders.
        b. Allowances.
        c. Unit Prices.
        d. Deductions for uncorrected work.
        e. Penalties and Bonuses.

f. Deductions for liquidated damages.

g. Deductions for re-inspection payments.

h. Other adjustables.

3. Total Contract Sum as adjusted.

4. Previous payments.

5. Sum remaining due.

C. Construction Manager will prepare a final Change Order reflecting approved adjustments to the Contract Sum which were not made by previous Change Orders.

1.08 APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures.

1.09 FINAL ACCEPTANCE

A. Final Application for Payment approved and payment made to Contractor.

B. The Owner will establish the date of Final Acceptance and issue the Letter of Final Acceptance after the Contractor completes all Construction Document requirements.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SCOPE

A. Operation and maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.

B. O&M instructions must be submitted and accepted before on-site training may start.

1.02 TYPES OF INFORMATION REQUIRED

A. General:

1. O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. In addition, one or more of the following items of information shall be provided as applicable.

B. Operating Instructions:

1. Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:

a. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.

b. Operator Prestart: Provide requirements to set up and prepare each system for use.

c. Start-Up, Shutdown, and Post-shutdown Procedures: Provide a control sequence for each of these operations.

d. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.

e. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

f. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

g. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

C. Preventive Maintenance:

1. The following information shall be provided for preventive and scheduled maintenance to minimize corrective maintenance and repair:

a. Lubrication Data: Provide lubrication data, other than instructions for lubrication in accordance with paragraph 1.02 Operator Service Requirements.

1) A table showing recommended lubricants for specific temperature ranges and applications;

2) Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

3) A lubrication schedule showing service interval frequency.

b. Preventive Maintenance Plan and Schedule: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

D. Corrective Maintenance:

1. Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.

a. Troubleshooting Guides and Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

b. Wiring Diagrams And Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.

c. Maintenance and Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.

d. Removal and Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test and illustrations.

e. Spare Parts and Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

f. Corrective Maintenance Man-hours: Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

E. Appendices:

1. The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.

a. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

b. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

c. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

d. Testing Equipment and Special Tool Information: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.03 TRANSMITTAL PROCEDURE

A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with Section 01 33 00 accompanied by Transmittal Form 01 78 23-A and Equipment Record Forms 01 78 23-B and/or 01 78 23-C, as appropriate, all as specified in Section 01 99 90. The transmittal form shall be used as a checklist to ensure the manual is complete. Only complete sets of O&M instructions will be reviewed for acceptance.

B. One (1) electronic and six (6) hard copies of the specified O&M information in final format, with all prior comments addressed to the satisfaction of the Construction Manager, shall be provided following preliminary review and pre-final review of the O&M information.

1. Electronic copies of O&M manuals also shall be provided per Section 01 33 00. For electronic copies, files shall be proved on flash drive in an indexed PDF file format.
2. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment number as it appears in the project manual.
3. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual.
4. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.
5. Binders shall be heavy-duty, D-ring.

C. If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

1.04 PAYMENT

A. Acceptable O&M information for the project must be delivered to the Construction Manager prior to the project being 65 percent complete. Progress payments for work in excess of 65 percent completion will not be made until the specified acceptable O&M information has been delivered to the Construction Manager.

1.05 FIELD CHANGES

A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the Contractor to reflect any field changes or information requiring field data.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 78 36

WARRANTIES AND BONDS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties required by the Construction Documents, including manufacturer's Standard Product Warranties and Special Warranties.

B. Refer to the General Conditions for terms of the Contractor's Warranty of Construction.

C. If there is any discrepancy in the Construction Documents regarding the warranty period or its date of commencement, the passage granting the Owner the longest warranty period ending on the latest date shall govern.

D. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors that are required to countersign Special Warranties with the Contractor.

1.02 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by, or incorporated in, the Construction Documents, either to extend time limits provided by Standard Product Warranties or to provide greater rights to the Owner. Refer to individual sections of the Specifications for Special Warranty requirements.

1.03 PROJECT MAINTENANCE AND WARRANTY

A. The Contractor shall maintain and keep in good repair the Work covered by these Drawings and Specifications until acceptance by the Owner.

B. The Contractor shall warrant for a period of two years, except where specified otherwise, from the date of Owner's written acceptance of certain segments of the Work and/or Owner's written final acceptance of the Project, as defined in the Contract Documents that the completed Work is free from all defects due to faulty products or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects.

1. The Owner will give notice of observed defects with reasonable promptness.

2. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred.

3. The Performance Bond shall remain in full force and effect throughout the warranty period.

C. The Contractor shall not be obligated to make replacements which become necessary because of the following:

1. Ordinary wear and tear.

2. As a result of improper operation or maintenance.

3. As a result of improper work or damage by another Contractor or the Owner.

4. Any work performed by personnel other than a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the two year warranty described above, the affected unit shall be disassembled, inspected and modified or replaced as necessary to prevent further occurrences.

1. All related components which may have been damaged or rendered non serviceable as a consequence of the failure shall be replaced.

2. A new 24 month, except where specified otherwise, warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation.

3. As used herein, multiple failure shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items.

4. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear or excessive leakage around seals.

5. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over or under lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one year warranty.

6. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified or replaced as necessary and re-warranted for two years.

E. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any

structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by the Contractor.

1. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract.

1. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one year from the date of final acceptance. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.

H. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.

I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.

J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

K. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

L. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Construction Documents.

M. The Owner reserves the right to refuse to accept Work for the Project where a Special Warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

N. Owner acceptance of warranties does not relieve the Contractor of the warranty requirements specified in the General Conditions.

O. Ensure all Standard Product Warranties and Special Warranties are transferrable to Owner.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Warranties and Bonds Manual: Assemble executed licenses, certificates, warranties, bonds, and any required service and maintenance contracts from the respective manufacturers, suppliers, and Subcontractors. Provide two (2) preliminary review copies, identified “Preliminary.” Provide four (4) final signed copies of the Warranties and Bonds Manual following review and acceptance of the preliminary manual by the Owner.

1. Out of the four final signed copies, one (1) shall be an original.
2. Provide one (1) flash drive with scanned Adobe Acrobat (.pdf) files, including an index with hyperlinks to the individual sections.

C. Include complete information for each of the following:

1. Neatly typed Table of Contents, in a complete and orderly sequence.
2. Product or work item, including applicable specification section number(s) per the Construction Documents.
3. Firm, with name of principal, address, telephone number, email address, and web site address.
4. Scope of warranty.
5. Start date of warranty or service and maintenance contract.
6. Duration of warranty or service and maintenance contract.
7. Proper procedure in case of failure.
8. Instances which might affect validity of warranty or bond.
9. Contractor, name or responsible principal, address, and telephone number.
10. For Special Warranties, prepare a written document containing all pertinent information and ready for execution by the required parties.

D. Copies shall be bound in slant-D, 3 ring view binders with an insert accepting clear vinyl overlay on the front cover and spine.

1. Provide cover slip sheet typed with "WARRANTIES AND BONDS", Project name, Project number, Contractor, and blank field for the date. Label volumes consecutively.
2. Each copy shall have a typewritten index and tabbed dividers between equipment categories or specification sections.
3. The contents of the manual shall be printed on white 8-1/2” x 11” acid free, recycled copy paper and shall not exceed 75% capacity of the binder.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 78 39

RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SCOPE

A. The work under this Section includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of project record documents as herein specified.

B. Record documents refer to those documents maintained and annotated by the Contractor during construction and are defined as:

1. A neatly and legibly marked set of contract drawings showing the final location of piping, equipment, structures, electrical conduits, outlet boxes and cables.
2. Specifications annotated with addenda and change order items, by section.
3. Change orders and other modifications to the Contract.
4. Construction Manager field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums.
5. Reviewed shop drawings, product data and samples.
6. Daily work reports.
7. Field test data.
8. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the Specifications.

C. The Contractor shall maintain on the Project site throughout the Contract Time an up to date set of Record Drawings.

1.02 GENERAL REQUIREMENTS

A. Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry and legible condition.

B. Record documents shall not be used for construction purposes and shall be available for review by the Owner and Construction Manager during normal working hours.

C. At the completion of the Work, prior to final payment, all record drawings and any CAD files shall be submitted to the Owner.

D. The record documents shall be maintained continuously.

E. Prior to each request for partial progress payment, Construction Manager will review record drawings with Contractor.

F. Progress payment requests will not be processed unless record drawings are current.

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Storage

1. The Contractor shall store documents and samples in the Contractor's field office, apart from documents used for construction.
2. The Contractor shall provide files and racks for storage of documents.
3. The Contractor shall provide locked cabinet or secure storage space for storage of samples.

B. The Contractor shall file documents and samples in accordance with format of these Specifications.

C. Maintenance

1. The Contractor shall maintain documents in a clean, dry, legible condition and in good order.
2. Do not use record documents for construction purposes.
3. The Contractor shall maintain at the site for the Owner one copy of all record documents.

D. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.04 QUALITY ASSURANCE

A. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain Record Documents.

B. Accuracy of Records:

1. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.1 foot.
2. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01 foot for all pertinent items constructed by the Contractor.
3. Coordinate changes within Record Documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
4. Purpose of Project Record Documents is to document factual information regarding aspects of Work, both concealed and visible, to enable future modification of Work to proceed without lengthy and expensive site measurement

C. Make entries within 24 hours after receipt of information that a change in Work has occurred.

D. Prior to submitting each request for progress payment, request Construction Manager's review and approval of current status of Record Documents. Failure to properly maintain, update, and submit Record Documents may result in a deferral by Construction Manager to recommend the whole or any part of the Contractor's Application for Payment, either partial or final.

1.05 CONTRACTOR MARK-UPS AND DATA ENTRY REQUIREMENTS

A. The Contractor shall provide one set of the Contract drawings, with all changes recorded in that one set.

B. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed.

C. Annotations to the record drawings shall be made with an erasable colored pencil conforming to the following color code:

1. Additions – Red
2. Deletions – Green
3. Comments – Blue
4. Dimensions – Graphite

D. Legibly mark drawings to record actual construction, including:

1. Changes of dimension and detail.
2. Changes made by Requests for Information (RFI), field order, work change directives, clarification memorandums or by change order.
3. Details not on original Drawings.

E. Legibly mark to record actual depths, horizontal and vertical location of underground facilities, piping, taps, fitting, valves, underground structures, equipment, raceways, cables, and appurtenances referenced to permanent surface improvements. The horizontal locations shall be referenced to at least

two easily identifiable, permanent landmarks (e.g., power poles, valve markers, etc.) or benchmarks.

F. Horizontal and vertical locations of all exposed and underground utilities and appurtenances, both new facilities constructed and those utilities encountered, referenced to permanent surface improvements.

G. Location of and dimensions of roadways and parking areas, providing dimensions to back of curb when present.

H. Provide elevation of piping through vaults / structures, invert elevation of all pipes entering manholes, junction boxes, valves, clean outs, etc. Provide center of manholes, and corners of facilities or structures with northing, easting and bottom / top elevations.

I. The Contractor shall obtain a set of signed/sealed as-built drawings from the Georgia registered surveyor and submit to the Owner. Survey shall accurately reflect installed location, depth, pipe size and other pertinent details.

J. Record Drawings shall be prepared using a survey that ties the site and improvements horizontally and vertically to the following state plane coordinate system or as amended by the Owner.

1. Horizontal Control: North American Datum 83 (NAD83) (HARN) 1994
2. Vertical Control: North American Vertical Datum of 1988 (NAVD88).
3. Grid Zone: Georgia West 1002 (US Survey feet)

K. As-built drawings shall include the following:

1. GPS coordinates for manholes and other above grade appurtenances.
2. Top and invert elevations of the manholes
3. Size and invert of all sewers entering/exiting the manholes

L. Label each document “Project Record” in neat, large printed letters.

M. Specifications

1. Legibly mark each section to record:
   a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
   b. Changes made by Requests for Information (RFI), field order, clarification memorandums, or by change order.

N. For CCTV work, PACP data requirements are as follows:

1. PACP database must be NASSCO compliance.
2. Data must be delivered in PACP or GaniteXP format.
3. PACP format is only acceptable for the following versions: Nothing earlier then 2.0.2 nothing later 6.0.3.

4. Asset ID in the database needs to be implemented as provided by Fulton County. If the CCTV contractor discovers additional assets that are not currently mapped by Fulton County, then the discovered asset(s) should be identified with a TMP prefix joined with the next known downstream Asset ID. If there is no downstream and upstream IDs contractor need to use sequence number identified with a TMP.
5. If a new Data (manhole, pipe) is found, map update (sketch) needs to be provided.
6. Data and videos should be provided on a flash drive with the label of the project
7. Videos will only be accepted in MPG format.
8. Video needs to be delivered per section of the pipe from manhole to manhole.

1.06 SUBMITTAL

A. At contract closeout, deliver Record Documents to the Construction Manager for the Owner.

B. Accompany submittal with transmittal letter containing:

1. Date
2. Project title and number
3. Contractor's name and address
4. Title and number of each record document
5. Signature of Contractor or Contractor's authorized representative

C. Cad Files

1. All as-built plans submitted to the Fulton County Department of Public Works must be provided in electronic computer aided design (CAD) format. CAD files to be submitted in accordance with Appendix A – "Fulton County As-Built CAD Standards".

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

APPENDIX A

Fulton County As-Built CAD Standards Effective Date: JANUARY 01, 2010 Version 0.2

Revised: 20 Feb 2009

As of *01 JANUARY 2010*, all water and wastewater as-built plans submitted to the Fulton County Department of Public Works must be provided in electronic computer aided design (CAD) format. The following standards must be followed for all plans. Construction will not be approved until these standards are met.

Template (or seed) drawing file available at http://www.fultoncountyga.gov/county/dpw under Developer Information on the left side-bar.

Table of contents

1) General Requirements

a) All as-built drawings must be georeferenced to the US State Plane coordinate system, NAD 83, GA West Zone, US Survey Feet. All drawings must contain two reference pins (i.e. property corners), which are labeled and tied to the Fulton County (FULCO) GPS monument network (please identify referenced GPS monuments with the monument number and coordinates). Reference pins must be able to be field verified using GPS and must be easily accessible (i.e., must not be in a creek). The survey method (GPS or conventional) used to place the reference pins should be identified in the HORIZONTAL_AND_VERTICAL_TEXT layer. Information on the FULCO GPS survey monuments can be found using the FULCO Monument Locator map application web site at: http://wms.co.fulton.ga.us/ms/gps/ or may be obtained in person at the

Fulton County Government Center, Department of Public Works.

b) All features depicted in the as-built drawings must be surveyed *after* construction. FULCO will spot check all coordinates to ensure accuracy. Table 1 specifies the features that must be surveyed. Water system features must be surveyed at a horizontal accuracy of ≤ 0.3 ft and vertical accuracy of ≤ 0.5 ft. Sewer system features must be surveyed at a horizontal accuracy of ≤ 0.5 ft and a vertical accuracy of ≤ 0.1 ft.

c) The following feature geometry types must be shot directly using the survey instrument and tied to the FULCO GPS monument network:

1) All point features (hydrants, valves, sewer manholes, etc.),

2) All line features at all endpoints, bends, and turns (pipes, etc.),

3) All polygon features at all corners and bends (project boundaries, lots, right-of- ways, etc.)

d) The following feature types are acceptable: Lines, Polylines, Text, Insert/Blocks. The Leaders as feature types must not be used. Where there is a need for Leaders they shall be drawn using *Line* features and must be put on a text layer. For example, the leader for the diameter of a water pipe should be on the WATER_LINE_TEXT layer, not the WATER_LINE layer.

e) A template (or seed) drawing file, file containing the required FULCO blocks and AutoCAD tool pilot will be provided through the Department of Public Works website http://www.fultoncountyga.gov/county/dpw.

f) The project boundary must be labeled on the PROJECT_BOUNDARY_TEXT layer, and the label must be within the extent of the project boundary.

2) Layers:

a) Layer names for required layers must appear exactly as in Table 1.

b) All required layers listed in FULCO CAD layers must contain only the features that are described for that layer. For example, the BOUNDARY_LINE layer must only contain the boundary line and not such features as north arrows or parcels.

c) All required layers must be present in the drawing except for features that do not pertain to a particular project. For example, some commercial projects or apartment complexes may not contain sewer taps as part of the construction and should not be included in the drawing.

d) All layers must be clearly differentiated from each other.
   1) Two layers having the names "WATER_LINE" and "WATER_LINES" should not exist in the same drawing.

e) SEWER_LINE_TEXT and SEWER_TEXT should not exist in the same drawing. All text must appear on separate layers from the layers they annotate. For example, text describing a sewer line must be on the SEWERLINE_TEXT layer, not the SEWER_LINE layer.

3) Drawing

a) All layers must conform to the proper geometry type (insert/block, line, polygon, text) as indicated in Table 1 below.

Table 1: Layer Names and Geometry Types

Layer Name	*Type*	*Layer Contents*	*Surveyed*
ADDRESS_TEXT	Text	Street postal address number	No
BLOCK_LETTER_TEXT	Text	Indicates the block letter of a subdivision	No
CITY_BOUNDARY	Line	City boundary line	No
CITY_BOUNDARY_TEXT	Text	City names associated with the CITY_BOUNDARY	No
COUNTY_BOUNDARY	Line	County boundary lines	No
COUNTY_BOUNDARY_TEXT	Text	County Names for the COUNTY_BOUNDARY layer	No
CONTOUR	Line	Topological delineation information	
CONTOUR_TEXT	Text	Description info for contour layer	
CORNER_POINTS	Point	Establishing Reference points	
FIRE_HYDRANT	Insert	Fire Hydrants	Yes
FIRE_HYDRANT_TEXT	Text	Text Associated with FIRE_HYDRANT layer	No
FLOODPLAIN_100YR	Line	Existing floodplain delineation	
FLOODPLAIN_100YR_FUTURE	Line	Proposed floodplain delineation	
FLOODPLAIN_100YR_FUTURE_TEXT	Text	Text for proposed floodplain delineation	
FLOODPLAIN_100YR_TEXT	Text	Text for existing floodplain delineation	
FLOW_ARROW	Insert	Sewer line flow arrows	No
GABION_WALL	block	Any retaining type wall construction	
GREASE_TRAPS	block	Grease traps	
HORIZONTAL_AND_VERTICAL_CONTROL_POINT	Point	Survey control points (rebar or monuments) with x,y,z	Yes
HORIZONTAL_AND_VERTICAL_TEXT	Text	Corresponding text (coordinate values, monument number, Survey method etc.).	No
LAND_LOT_LINE	Line	Layer Contents	
LAND_LOT_LINE_TEXT	Text	Land lot numbers and other text.	No
LOT_NUMBER_TEXT	Text	Individual lot numbers	No
PROJECT_BOUNDARY	Poly	The boundary line of the subdivision or property.	Yes
PROJECT_BOUNDARY _TEXT	Text	Project (Development) Name	No

Table 1: Layer Names and Geometry Types			
PROPERTY_ID_TEXT	Text	Property Information	
PROPERTY_LINE	Poly	Property Lines (parcel lines)	Yes
PUMP_STATION	Point	Represents the centermost point of a pump station	Yes
PUMP_STATION_TEXT	Text	Text associated with PUMP_STATION	No
RAILROAD_LINE	Line	Railroad Lines	Yes
RAILROAD_TEXT	Text	Text Associated with RAILROAD	No
ROAD_EDGE_OF_PAVEMENT	Poly	Street Edge of Pavement (not back of curb); this layer should not include parking lots or curbing	Yes
ROAD_TEXT	Text	Road Names	No
ROAD_RIGHT-OF-WAY	Poly	Road Right-of-Way	Yes
ROAD_RIGHT-OF-WAY_TEXT	Text	Text relating to the road right of way layer	No
SEWER_END-OF-LINE	Insert	End of sewer line.	Yes
SEWER_END-OF-LINE_TEXT	Text	Text associated with SEWER_END-OF-LINE	No
SEWER_EXISTING	Line	Sewer lines present before the subdivision/project	Yes
SEWER_EXISTING_TEXT	Text	Text associated with the SEWER_EXISTING layer	No
SEWER_MANHOLE_EXISTING	Block	Existing Sewer Manholes	Yes
SEWER_MANHOLE_ EXISTING_TEXT	Text	Text for the SEWER_MANHOLE EXISTING layer	No
SEWER_FORCE_MAIN	Line	Sewer force mains	Yes
SEWER_FORCE_MAIN_TEXT	Text	Text associated with SEWER_FORCE_MAIN	No
SEWER_LINE	Line	Sewer lines built as part of the subdivision/project.	Yes
SEWER_LINE_TEXT	Text	Text associated with the SEWER_LINE layer.	No
SEWER_MANHOLE	Block	Sewer Manholes	Yes
SEWER_MANHOLE_TEXT	Text	Text associated with the SEWER_MANHOLE layer	No
SEWER_SEPTIC_TANK	Line	Septic tank	
SEWER_TAP	Line	Sewer taps	Yes
SEWER_TAP_TEXT	Text	Distance between taps in feet	Yes
SEWER_TUNNEL	Line	Subsurface Sewer tunnel construction	
STORM_BMP	Poly	Engineered structures designed to improve management of Stormwater system (see section e-I)	
STORM_BMP_TEXT	Text	Label showing the BMP_ID (see section e-II)	No
STORM_BMP_EXISTING	Poly	Engineered structures designed to improve management of Stormwater system (see section e-I)	No
STORM_BMP_EXISTING_TEXT	Text	Text associated with the STORM_BMP_EXISTING	No
STORM_CULVERT	Poly	A polygon representing the extent of pipe culvert or box Culvert structure (see section e-III)	Yes
STORM_CULVERT_TEXT	Text	Label for the features ID (see section e-III)	No
STORM_CULVERT_EXISTING	Poly	A polygon representing the extent of a culvert structure (see section e-III), prior to construction	Yes
STORM_CULVERT_EXISTING_TEXT	Text	Label for the features (see section e-III)	No
STORM_CULVERT_CHART	n/a	Describes the required parameters (e-III)	n/a

Table 1: Layer Names and Geometry Types			
STORM_DROPINLET	Block	Stormwater drop inlet. (see section e-IV)	Yes
STORM_DROPINLET_TEXT	Text	Text describing layer (i.e. Invert Elevation)	No
STORM_DROPINLET_EXISTING	Block	Stormwater drop inlet (see section e-IV) that existed prior to construction	Yes
STORM_DROPINLET_EXISTING_TEXT	Text	Text describing layer	No
STORM_FLUME	Line	The centerline drawn in flow direction (see section V)	Yes
STORM_FLUME_TEXT	Text	Text for: material (lining), slope (see section e-VI)	No
STORM_FLUME_EXISTING	Line	The centerline that existed prior to construction Must be drawn in flow direction (see section V).	Yes
STORM_FLUME_EXISTING_TEXT	Text	Text associated with layer (see section e-VI)	No
STORM_HEADWALL	Block	Proposed new placement point of construction	
STORM_HEADWALL_TEXT	Text	Text associated with new headwall	
STORM_HEADWALL_EXISTING	Block	Headwall which existed prior to construction	
STORM_HEADWALL_EXISTING_TEXT	Text	Text associated which existed prior to construction	
STORM_JUNCTION_BOX	Insert	Block in the location of a Stormwater Junction Box	Yes
STORM_JUNCTION_BOX_TEXT	Text	Text for layer that must at least show: Rim Elevation, Invert Elevation, and Junction Box material.	No
STORM_JUNCTION_BOX_EXISTING	Insert	Pre-existing block for the Storm Junction Box	Yes
STORM_JUNCTION_BOX_EXISTING_TEXT	Text	Text for layer that must at least show: Rim Elevation, material, Invert Elevation, and Junction Box	No
STORM_LINE	Line	Pipe (i.e. Pipe line or driveway pipe) (see section e-VII)	Yes
STORM_LINE_TEXT	Text	Text for layer (i.e. slope, diameter, material)	No
STORM_LINE_EXISTING	Line	Pre-existing stormwater line (pipe line or driveway pipe) drawn in the direction of flow (see section e-VII)	Yes
STORM_LINE_ EXISTING_ TEXT	Text	Text associated with layer (i.e. slope, diameter, material)	No
STORM_OPEN_CHANNEL	Line	Centerline drawn in the direction of flow (see section e-V)	Yes
STORM_OPEN_CHANNEL_TEXT	Text	Text layer: material (lining), slope (see section e-VI)	No
STORM_OPEN_CHANNEL_EXISTING	Line	Centerline of structure. Must be drawn in the direction of flow (see section e-V)	Yes
STORM_OPEN_CHANNEL_EXISTING_ TEXT	Text	Text associated with layer (see section e-VI)	No
STORM_LINE_END	Insert	The structure at the Line End or a node representing the bare end of pipe (see section e-VIII)	Yes
STORM_LINE_END_TEXT	Text	Text layer (i.e. slope, diameter, material)	No
STORM_LINE_END_EXISTING	Insert	The structure at the Line End or a node representing the	Yes
		bare end of pipe (see section e-VIII)	
STORM_LINE_END_EXISTING_TEXT	Text	Text associated with layer	No
STRUCTURE	Line	Above ground construction (Buildings, apartments, etc.)	
STRUCTURE_TEXT	Text	Name, or other information associated with the structure	
TANK_PROPOSED	Line	Any proposed tank construction	
TRASH_RACKS	Block	Trash Racks	
UTILITY_EASEMENT	Poly	Utility line easements	Yes
UTILITY_EASEMENT_TEXT	Text	Text Associated with Utility Easements	No

Table 1: Layer Names and Geometry Types			
WATER_CAP	Insert	Cap at the end of water line.	Yes
WATER_CAP_TEXT	Text	Text associated with WATER_CAP_TEXT	No
WATER_EXISTING	Line	Water lines before the subdivision/project was built	Yes
WATER_EXISTING_TEXT	Text	Text associated with WATER_EXISTING	No
WATER_LINE	Line	Water lines built as part of the subdivision/project.	Yes
WATER_LINE_TEXT	Text	Text associated with WATER_LINE	No
WATER_METER	Insert	Customer water meters	Yes
WATER_METER_TEXT	Text	Text associated with WATER_METER	No
WATER_REDUCER	Insert	Water line reducer	Yes
WATER_REDUCER_TEXT	Text	Text associated with WATER_REDUCER	No
WATER_SERVICE	Line	Water service lines	Yes
WATER_SERVICE_TEXT	Text	Text associated with WATER_SERVICE	No
WATER_STORAGE_SYSTEM	Block	Water Storage System construction	
WATER_STORAGE_SYSTEM_TEXT	Text	Text for Water Storage System construction	
WATER_VALVE_EXISTING	Insert	Existing water valves	Yes
WATER_VALVE_EXISTING_TEXT	Text	Text associated with WATER_VALVE_EXISTING	No
WATER_VALVE	Insert	Water valves	Yes
WATER_VALVE_TEXT	Text	Text associated with WATER_VALVE	No
WATER_VAULT	Insert	Large meter or fire connection vault	Yes
WATER_VAULT_TEXT	Text	Text associated with WATER_VAULT	No
WETLAND	Line	Wetland area	
WETLAND_TEXT	Text	Text associated with the Wetland	

b) All Polygon type features must be completely closed. Lines may need to be duplicated on more than one layer.

1) Subdivision/project parcels must to be closed figures on their layer (not closed with the subdivision/project boundary).

2) Road edge-of-pavement and road right-of-way must be drawn as closed polygons.

3) Where a polygon feature extends beyond the edge of the plan, the property boundary (repeated on the polygon feature's layer) will be used to close the polygon.

4) All edges on polygon features must be snapped together at the vertices. Gaps in polygon boundaries will not be accepted.

c) Sewer Features

1) Sewer Lines and Sewer Taps need to be digitized with proper directionality: lines must be drawn from the uphill node to the downhill node or flipped after the lines have been digitized.

2) All tangents between sewer manholes need to be drawn with a single line. Lines must not continue for more than one tangent.

3) All tangents must be snapped at endpoints intersecting at the exact center of the manhole. No gaps should exist between tangents.

4) Manholes need to be symbolized consistently with an insert centered and snapped on the tangent endpoints.

5) Sewer tap locations must be snapped to the sewer tangent and accurately placed. Placement shall be based on the televising reports. FULCO will verify tap placement against the televising report. The as-built engineer is responsible for obtaining the televising report.

d) Water Features

1) Water lines must be digitized with all straight-line pipes consisting of only two end points. Straight-line pipes will begin and end at the following features (nodes): hydrants, valves, meters, pumps, tees, crosses, and valves. Polylines should be used wherever a water line contains elbows or bends (i.e., when the line does make a straight run from node to node).

2) Curves may be digitized with enough vertices to capture the curve geometry, but they must be single, continuous lines. Curves or arcs may also be used to designate curved pipe.

3) Hydrants must be shown in their true, surveyed location, and must be connected to the water main via a valved fire hydrant line.

4) All water lines must be continuous, with pipe endpoints snapped to each other at endpoints (nodes).

5) End-of-line caps must be drawn to differentiate end-of-lines from lines that extend beyond the extent of the drawing. Caps should be drawn for lines that are to be permanently capped when the project is complete, not for lines that are temporarily capped pending inspection.

e) Stormwater Features

1) The entire BMP must be represented on the Storm_BMP layer using a polygon. The following are the examples of BMPs: Enhanced Swale, Stormwater Pond, Stormwater Wetland, Sand Filter, Bioretention Cell, Infiltration Trench, Filter Strip, Gravity Oil-Grit Separator, Proprietary Structural Control, Underground Detention, Porous Concrete, Modular Porous Paver System. Please consult with the FULCO water resources engineer for a list of currently accepted BMPs.

2) A BMP_ID is going to be assigned to each STORM_BMP feature by the FULCO engineer during the plan review process. The contractor must clearly mark every BMP feature with the assigned BMP_ID in the STORM_BMP_TEXT layer of the asbuilt.

3) In the STORM_CULVERT and STORM_CULVERT_EXISTING layers, the structures must be drawn as polygons to show their length, width, location, and orientation. All the corners of the culvert extents must be surveyed. All culverts must be labeled in the corresponding STORM_CULVERT_TEXT or STORM_CULVERT_EXISTING_TEXT layer with the number matching the culvert chart shown on the asbuilt. The storm culvert chart shall be put in the STORM_CULVERT_CHART layer. For Culvert Chart contents see the Stormwater Development Guidelines.

4) In the STORM_DROPINLET and STORM_DROPINLET_EXISTING layers, the structures shall be drawn with different inserts (blocks) according to the type of the Drop Inlet: Single Wing Catch Basin, Double Wing Catch Basin, Square Catch Basin, Rectangular Catch Basin, Grate Cover Inlet, Catch Basin with Grate, Curb Inlet, Circular Weir Inlet, Rectangular Weir Inlet. The contractor must only use the blocks provided by FULCO for these features.

5) In the STORM_OPEN_CHANNEL, STORM_OPEN_CHANNEL-EXISTING, STORM_FLUME and STORM_FLUME_EXISTING layers, the feature shall be represented by a line reflecting the centerline of the structure and must be drawn in the direction of flow. The lines shall be broken at any point where the slope percent changes. All endpoints (including the points of slope changes) shall be surveyed.

6) STORM_OPEN_CHANNEL_TEXT, STORM_OPEN_CHANNEL_EXISTING_TEXT, STORM_FLUME_TEXT and STORM_FLUME_EXISTING TEXT layers shall contain a label indicating the percent slope and a type

of material (lining) of the corresponding open channel or flume.

7) In the STORM_LINE or STORM_LINE_EXISTING layers, the features must be drawn in the direction of flow. This feature must be digitized with all straight-line pipes consisting of only two end points. Straight-line pipes will begin and/or end at the following features: STORM_LINE_END, STORM_JUNCTION_BOX, STORM_DROP_INLET.

8) In the STORM_LINE_END and STORM_LINE_END_EXISTING layers, the structures must be drawn with different inserts (blocks) according to the type: Straight Headwall, U-type Headwall, Tapered Headwall, L-Type Headwall, Flared- End Section, Straight Wingwall, Angled Wingwall, Bare End and BMP Outlet. STORM_LINE_END and STORM_LINE_END_EXISTING features must be snapped to the ends of the STORM_LINE or STORM_LINE _EXISTING or the centers of STORM_CULVERT or STORM_CULVERT_EXISTING openings. The contractor must only use the blocks provided by FULCO for these features (see section 4) Symbolization)

4) Table Specifications

a) A table with the following attribute data for each **sewer line**

1) Unique identifier matching the identifier in the as-built drawing
2) Unique identifier matching upstream manhole identifier in the as-built drawing
3) Upstream Measure Down - Distance from the upstream manhole lid top to invert of pipe as measured in feet
4) Upstream Invert – Elevation (z) of the invert of the upstream end of the pipe
5) Unique identifier matching downstream manhole identifier in the as-built drawing
6) Downstream Measure Down - Distance from downstream manhole lid top to invert of pipe as measured in feet
7) Downstream Invert – Elevation (z) of the invert of the downstream end of the pipe
8) Pipe diameter measured in inches
9) Pipe Material (CI, DI, PVC, VC, RCP, UNK, IRON, TRAN, PE, TR)
10) Pipe Length measured in feet

Example Table: Sewer Line

Pipe ID	Upstr MH ID	Upstr Measure Down	Upstr Invert	Downstr MH ID	Downstr Measure Down	Downstr Invert	Pipe Diameter	Pipe Material	Pipe Length
Pipe#1	SSMH#1	6.1	906.78	Pump Station	10.2	905.06	8	PVC	291
Pipe#2	SSMH#2	7.1	908.33	SSMH#1	6.05	906.83	8	PVC	238
Pipe#3	SSMH#3	8	908.76	SSMH#2	7.1	908.03	8	PVC	64

b) A table with the following attribute data for each **water line**

1) Unique identifier matching the identifier in the as-built drawing
2) Pipe diameter measured in inches
3) Pipe Material (CI, PVC, DI, GV, PB, CO, UNK, TRAN,CP, SC.)
4) Pipe Length measured in feet
5) End1 ID (Valve, Meter, Reducer, etc.)
6) End2 ID (Valve, Meter, Reducer, etc.)

Example Table: Water Line

Pipe ID	Pipe Diameter	Pipe Material	Pipe Length	End1 ID	End2 ID
WL #1	8	PVC	291	WV #2	FH #23
WL #2	8	PVC	238	WM #43	WV #2
WL #3	8	PVC	64	WV #2	WV #54

c) A table with the following attribute data for each **storm line**

1) Unique identifier matching the identifier in the as-built drawing
2) Unique identifier matching upstream structure identifier in the as-built drawing
3) Upstream Measure Down - Distance from the upstream structure elevation to invert of pipe measured in feet
4) Upstream Invert – Elevation (z) of the invert of the upstream end of the pipe
5) Unique identifier matching downstream structure identifier in the as-built drawing
6) Downstream Measure Down - Distance from downstream structure elevation to invert of pipe measured in feet
7) Downstream Invert – Elevation (z) of the invert of the downstream end of the pipe
8) Pipe Shape (Box, Elliptical, Circular, etc.)

9) Pipe height measured in inches
10) Pipe width measured in inches
11) Pipe Material (BCCMP, RCP, HDPE, CMP.)
12) Pipe Length measured in feet

Example Table: Storm Line

Pipe ID	Upstr-ID	Upstr Measure Down	Upstr Invert	Downstr-ID	Downstr Measure Down	Downstr Invert	Pipe Shape	Pipe Height	Pipe Width	Pipe Material	Pipe Length
Pipe #1	DI #1	6.1	906.78	JB #3	10.2	905.06	Circular	24	24	BCCMP	291
Pipe #2	CB #2	7.1	908.33	FES #1	6.05	906.83	Ellipse	36	24	BCCMP	238
Pipe #3	HW #1	0	908.76	HW #2	0	908.33	Box	60	84	RCP	64

5) Symbolization

a) Symbols must be standardized according to examples provided in the FULCO template file. The following "point" features must be symbolized using standard FULCO CAD symbols and drawn as inserts:

1) Vault
2) Valve
3) Hydrant
4) Manhole
5) Meter
6) End of Line/Cap
7) Reducer
8) Junction Box
9) Grease Traps
10) Trash Racks
11) Water Cap

b) All blocks used in the STORM layers must be drawn as inserts. The blocks must be standard and symbolized using only FULCO CAD blocks provided on the FULCO CAD Digital Data Submission Standards template available through the Department of Public Works website http://www.fultoncountyga.gov/county/dpw.

1) Single Wing Catch Basin
2) Double Wing Catch Basin

3) Square Catch Basin
4) Rectangular Catch Basin
5) Grate Cover Inlet
6) Catch Basin with Grate
7) Curb Inlet
8) Circular Weir Inlet
9) Rectangular Weir Inlet
10) Straight Headwall
11) U-type Headwall
12) Tapered Headwall
13) L-type Headwall
14) Flared-End Section
15) Straight Wingwall
16) Angled Wingwall
17) Bare End
18) BMP Outlet
19) Junction Box
20) Rectangular Weir Inlet

6) Annotations

a) Any non-standard water and sewer lines must be annotated as such. Line diameter, material, ownership, etc. that does not conform to standard practice should be noted in the corresponding annotation layer. For example, standard subdivision sewer lines are 8" in diameter. Any other diameter must be annotated on the SEWER_LINE_TEXT layer.

b) All addresses and lot numbers must be number data type (that is no text or symbols: #, -, ft, _, ", ', etc.). If the lot does not have a number, this layer should be blank.

c) All required text must be single line text. Project (Development) name shall be on one line.

d) All annotation for polyline (polygon) features must be bounded by the polyline it annotates. For example, the project name must be within the project boundary, and not extend beyond it.

7) File naming and revisions

a) File names should correspond exactly to the subdivision or project name and should be consistent from one version to the next. The file name should contain the drawing revision date (in YYMMDD format) as part of the name. There should be no blanks spaces in the name, only underscores. An example file name for the May 12, 2008 revision for the third phase of the Peaceful Valley subdivision is: "Peaceful_Valley_3_080512". If a development name changes from that of indicated in the originally approved plans, the original name shall also be provided with the submittal of the as-built.

b) File revision dates should only be updated by the contractor/developer and not by FULCO or Fulton County.

8) Deliverable Format

a) All files shall be delivered in AutoCAD (release 14 or higher), DXF or DWG format (for projects created in Microstation) in a single flash drive. Files should not be spanned over more than one drive.

b) All deliverables will be labeled with the file name, company name, contact name, and phone number. A transmission letter restating this information along with a statement requesting as-built review will also accompany the disk.

SECTION 01 99 90
REFERENCE FORMS

PART 1 – FORMS

1.01 DESCRIPTION

A. The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01 33 00-A	Submittal Transmittal Form
01 78 23-A	Operation and Maintenance Transmittal Form
01 78 23-B	Equipment Record Form
01 78 23-C	Equipment Record Form
43 05 11-A	Manufacturer's Installation Certification Form

01 33 0-A. SUBMITTAL TRANSMITTAL FORM
Submittal Transmittal

Submittal Description:	Submittal No:[1]	Spec Section:

	Routing	Sent	Received
Owner:	Contractor/CM		
Project:	CM/Engineer		
	Engineer/CM		
Contractor:	CM/Contractor		

We are sending you:
☐ Attached
☐ Under separate cover via _____
☐ Submittals for review and comment
☐ Product data for information only
Remarks: _____

Item	Copies	Date	Section No.	Description	Review Action[a]	Reviewer Initials	Review Comments Attached

[a]*Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected*
Attach additional sheets if necessary.

Contractor

Certify either a or b:

a. ☐ We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).

b. ☐ We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____

Contractor's Signature: _____

[1]See *Section 01 33 00-1.04. A, Transmittal Procedure.*

01 78 23-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date:	Submittal No:[2]
To:	Contract No:
	Spec. Section:
	Submittal Description:
Attention:	From:

Checklist		Contractor		Construction Manager	
		Satisfactory	N/A	Accept	Deficient
1.	Table of contents				
2.	Equipment record forms				
3.	Manufacturer information				
4.	Vendor information				
5.	Safety precautions				
6.	Operator prestart				
7.	Start-up, shutdown, and post-shutdown procedures				
8.	Normal operations				
9.	Emergency operations				
10.	Operator service requirements				
11.	Environmental conditions				
12.	Lubrication data				
13.	Preventive maintenance plan and schedule				
14.	Troubleshooting guides and diagnostic techniques				
15.	Wiring diagrams and control diagrams				
16.	Maintenance and repair procedures				
17.	Removal and replacement instructions				
18.	Spare parts and supply list				
19.	Corrective maintenance man-hours				
20.	Parts identification				
21.	Warranty information				
22.	Personnel training requirements				
23.	Testing equipment and special tool information				

Remarks:

[2] *See Section 01 33 00-1.04.A, Transmittal Procedure*.

Contractor's Signature :

01 78 23-B. EQUIPMENT RECORD FORM

Eqpt Description		Eqpt Location	
Eqpt No.	Shop Dwg No.	Date Installed	Cost
Mfr		Mfr Contact	
Mfr Address			Phone
Vendor		Vendor Contact	
Vendor Address			Phone

Maintenance Requirements	D	W	M	Q	S	A	Hours

Lubricants:	Recommended:
	Alternative:

Misc. Notes:

Recommended Spare Parts			
Part No	Quantity	Part Name	Cost

Electrical Nameplate Data			
Equipment			
Make			
Serial No.		Id No.	
Model No.		Frame No.	
HP	V	Amp	Hz
Ph	Rpm	Sf	Duty
Code	Insl. Cl	Des	Type
Nema Des	C Amb	Temp Rise	Rating
Misc.			

Mechanical Nameplate Data			
Eqpt			
Make			
Serial No.		Id No.	
Model No.		Frame No.	
HP	RPM	Cap	Size
TDH	Imp Size	Belt No.	Cfm
PSI	Assy No.	Case No.	
Misc			

01 78 23-C. EQUIPMENT RECORD FORM

Eqpt Description		Eqpt Location	
Eqpt No.	Shop Dwg No.	Date Installed	Cost
Mfr		Mfr Contact	
Mfr Address			Phone
Vendor		Vendor Contact	
Vendor Address			Phone

Maintenance Requirements	D	W	M	Q	S	A	Hours

43 05 11-A. MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No: Specification section:

Equipment name:

Contractor:

Manufacturer of equipment item:

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments:

Manufacturer	Contractor
Signature of Authorized Representative	Signature of Authorized Representative
Date	Date

SECTION 02 41 13.33

PAVING REMOVAL

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Equipment
2. Trench paving removal
3. Milling Operations

1.02 REFERENCES

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.

B. Georgia Department of Transportation Standard Specifications.

1.03 WORK INCLUDED

A. The Contractor shall furnish all labor, equipment, tools and materials necessary to remove asphalt and/or concrete paving as required for the installation of proposed water mains or sewer mains and related appurtenances under the Contract and as directed by Owner.

1.04 SUBMITTALS

A. The Contractor shall submit for approval to Owner, County DOT and Georgia DOT when work is within a state road right-of-way, all working drawings and schedules of materials and methods proposed to follow in the execution of the Work under this item.

B. The Contractor shall submit photographs or video recordings, sufficiently detailed, of existing conditions of project site. These shall be used to evaluate project areas that might be misconstrued as damage, caused by debris, or construction material removal.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Milling Equipment:

1. Use power-driven, self-propelled milling equipment that is the size and shape that allows traffic to pass safely through areas adjacent to the work. Also use equipment that is:

   a. Designed to mill and remove specified depth of existing asphalt and/or concrete paving

   b. Equipped with grade slope controls operating from a string line or ski and based on mechanical or sonic operation

   c. Capable of removing pavement to an accuracy of 1/8 in.

   d. Furnished with lighting system for night work, as necessary

   e. Provided with conveyors capable of side, rear, or front loading to transfer the milled material from the roadway to a truck.

B. Dust Control

1. Provide power brooms, vacuum sweepers, power blowers, or other means to remove loose debris or dust. Do not allow dust control to restrict visibility of passing traffic or to disrupt adjacent property owners.

PART 3 – EXECUTION

3.01 TRENCH PAVING REMOVAL

A. Where trench excavation within a paved surface is required, the Contractor shall saw cut in a straight line, vertical joints for the entire depth of pavement. The saw cut joints shall extend for the entire length of trench on both sides of the trench. Ragged edges shall be trimmed so as to provide a substantially straight line juncture between the old and new surfaces.

B. The removal of existing pavement shall be performed in accordance with the requirements of the authority within whose jurisdiction such pavement is located.

C. The saw cut joints shall be a minimum of 12 inches outside of the maximum width of excavated trench.

D. Whenever the removal of pavements (other than gravel types) is required, the Contractor shall outline the area to be removed by making straight saw cuts, providing vertical kerfs in straight lines in order to permit removal in a straight line.

E. Should pavement breakage occur beyond the original saw cut, the Contractor shall be required to make a new saw cut beyond the farthest point of breakage.

F. Pavement shall be removed, hauled off site and disposed of in a proper legal manner. Contractor shall be careful not to disturb or damage any pavement that is to remain.

3.02 MILLING OPERATION

A. Follow the Plans to mill the designated areas and depths, as required. Ensure the following requirements are met:

1. Schedule the construction operation. Use milling methods that will produce a uniform finished surface and maintain a constant cross slope between extremities in each lane.
2. Provide positive drainage to prevent water accumulation on the milled pavement, as shown on the Plans or directed by the Construction Manager.
3. Bevel back the longitudinal vertical edges greater than 2 inches that are produced by the removal process and left exposed to traffic. Bevel them back at least 3 inches for each 2 inches of material removed. Use an attached mold board or other approved method.
4. When removing material at ramp areas and ends of milled sections, taper the transverse edges 10 ft to avoid creating a traffic hazard and to produce a smooth surface.
5. Protect with a temporary asphaltic concrete tie-in (paper joint) vertical edges at other areas such as bridge approach slabs, drainage structures, and utility appurtenances greater than ½-inch that are left open to trans versing vehicles. Place the temporary tie-in at taper rate of at least 6 to 1 horizontal to vertical distance.
6. Remove dust, residue, and loose milled material from the milled surface. Do not allow traffic on the milled surface and do not place asphaltic concrete on the milled surface until removal is complete.

B. The reclaimed asphaltic and/or concrete pavement becomes the Contractor's property unless otherwise specified.

END OF SECTION

SECTION 02 42 11

REMOVAL OF CONSTRUCTION MATERIALS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Workmanship

1.02 REFERENCES

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.

1.03 WORK INCLUDED

A. The Contractor shall furnish all labor, equipment, and materials necessary to remove all unwanted construction material and debris, as directed by Owner and/or Construction Manager.

1.04 SUBMITTALS

A. The Contractor shall submit for approval to Owner and Fulton County DOT, all working drawings and schedules of materials and methods proposed to follow in the execution of the Work under this item.

B. The Contractor shall supply identification and license of company hauling/transporting material from the site.

C. The Contractor shall submit photographs and/or videotape, sufficiently detailed, of existing conditions of project site. These shall be used to evaluate project areas that might be misconstrued as damage, caused by debris, or construction material removal.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 WORKMANSHIP

A. The Contractor shall follow all Federal, State, and local regulations related to removal, hauling, and disposal of trash and debris.

B. The Contractor shall comply with any ordinances / regulations for hauling and disposal of all solid waste removed from the site for the duration of the Work.

C. The Contractor shall load, haul away, and dispose of debris, trash, structures, automobiles, etc., that may be pre-existing on the Worksite, to a legally permitted location.

D. The Contractor shall load, haul away, and dispose of construction material that is generated in execution of the Work, to a legally permitted location; including, but not limited to any debris, trash, structures, piping, etc.

E. The Contractor shall remove and dispose of all unused construction materials prior to Final Acceptance of the Work by Owner and the Engineer.

F. No additional payment shall be made for excavation or disposal of excavated material required for placement or removal of backfill placed above the foundation of the pavement; or for preparation of subgrade. The cost thereof shall be considered included in the pavement unit prices bid.

END OF SECTION

SECTION 03 30 00

CAST IN PLACE CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies cast in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures and finishes.

1.02 SUBMITTALS

A. In accordance with specification Section 01 33 23 and in addition to the requirements of that section, the following submittals shall be provided.

B. Design Mixtures: For each concrete mixture.

C. Shop Drawings: For steel reinforcement. Material test reports.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 – PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A185, plain, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A497, flat sheet.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C.

B. Normal-Weight Aggregates: ASTM C33, graded, 1-inch (25-mm) nominal maximum coarse-aggregate size.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C94/C 94M and potable.

D. Air-Entraining Admixture: ASTM C260.

2.04 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.05 RELATED MATERIALS

A. Expansion- and Isolation- Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

2.06 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.45.

3. Slump Limit: 4 inches, plus or minus 1 inch.

4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

2.07 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85° F and 90° F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes.

2. When air temperature is above 90° F, reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded

3.03 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.05 JOINTS

A General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.07 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Revise locations in subparagraph below to suit Project. Retain rubbed finish option if additional finishing is required.

1. Apply to concrete surfaces exposed to public view.

B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.

2. Do not apply cement grout other than that created by the rubbing process

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.08 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- (3.05-m-) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).

3.09 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable

width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer. Retain subparagraph below if requiring removal of curing compounds that may interfere with adhesion of floor coverings. Curing and sealing compound in subparagraph below is usually for floors and slabs and may act as a permanent surface finish.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Construction Manager. Remove and replace concrete that cannot be repaired and patched to Construction Manager's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION

SECTION 03 40 00

PRECAST CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope

1. This section specifies the materials and labor required for the manufacture and erection of precast concrete structures.

B. Type

1. Precast concrete includes precast boxes, manholes and precast structural concrete.

1.02 QUALITY ASSURANCE

A. General

1. The Contractor shall provide certification from the precast concrete manufacturer that the materials and manufacture of precast work supplied conforms to these specifications. The certification shall be signed by an officer of the manufacturer's corporation.
2. The responsibility for furnishing and installing precast concrete conforming to the specifications is solely that of the Contractor.

B. Testing Laboratory

1. All testing shall be performed by recognized independent laboratories specializing in the particular test to be performed, and conforming to the requirements of the National Bureau of Standards and ASTM E329.

C. Reference Standards

1. The appropriate reference standards are specified in the following documents. They are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
ACI 318	Building Code Requirements for Reinforced Concrete
AWS D1.1	Structural Welding Code - Steel
AASHTO	Standard Specification for Highway Bridges
MNL-116	Prestressed Concrete Institute's Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products, third edition

1.03 SUBMITTALS

A. In accordance with specification Section 01 33 23 and in addition to the requirements of that section, the following submittals shall be provided:

B. Concrete Mix

1. Prior to casting any precast elements, concrete mix design shall be submitted to the Construction Manager for acceptance.

C. Shop Drawings

1. Three copies of shop drawings shall be provided showing product location, fabrication details, number identification marks, reinforcement, connection details including field installed anchor sizes and locations, if required, openings, loose or embedded items and inserts, dimensions and relationship to adjacent materials in sufficient detail to cover manufacture, handling, and erection.

2. Shop drawings shall be accompanied by a letter signed by the manufacturer, certifying that, the shop drawings submitted represent construction which meets or exceeds the requirements of the Contract Documents and the requirements of codes and agencies having jurisdiction over the Work.

1.04 LABELING

A. Each precast unit shall have an identification mark indicating its location in the structure as shown on the placing diagrams and date of casting.

1.05 HANDLING AND STORAGE

A. Unless specified otherwise herein, fabrication, handling and erection of precast elements shall be in accordance with the recommendations made by ACI 318 and ACI Committee 533.

B. Precast elements shall be properly supported off the ground to avoid damage during curing, storage, handling and hauling.

C. Lateral support shall be sufficient to prevent bowing, warping, or permanent set due to creep.

D. Edges of the units shall be adequately protected by padding or other means to prevent staining, chipping or spalling of concrete.

E. Lifting devices shall have a minimum safety factor of 4.

PART 2 – PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Concrete mix design and compressive strength shall meet 4000 psi at 28 days.

B. Design live loads shall be AASHTO H-20.

2.02 PRECAST CONCRETE MATERIALS

A. Cement

1. Concrete in contact with soil or liquids shall be formulated using Type II portland cement conforming to ASTM C150.
2. Concrete not in contact with soil or liquids may be formulated using Type I or Type III portland cement.
3. Cement shall contain less than 0.60 percent alkalies and shall be from one source throughout the entire project.

B. Aggregates

1. Aggregates for normal weight concrete shall conform to ASTM C33 with a maximum size of 3/4 inch.

C. Water

1. Water shall be clean, potable, and free from injurious amounts of oil, alkalies, organic materials and other deleterious substances.

D. Admixture

1. Admixture shall be Pozzolith 300 R manufactured by Master Builders, Plastiment manufactured by Sika Chemical Corp. or equal.
2. Admixture shall be used in strict accordance with manufacturer's recommendations.
3. Calcium chloride or any admixture containing calcium chloride shall not be used.

E. Reinforcing Steel

1. Reinforcing steel shall conform to ASTM A615, including supplementary requirements, and shall be Grade 60 except that bars to be welded shall be Grade 40 or ASTM A706.

F. Embedded Items and Anchorage Devices

1. All embedded items, inserts, and anchorage devices exposed to view, moisture or weather shall be hot dipped galvanized steel.
2. Anchorage devices shall be fabricated from ASTM A36 steel.

G. Penetrations

1. All required penetrations and openings larger than 6 inches in diameter or 6 inches square shall be formed in place at the time of casting.
2. Additional reinforcing shall be added where required to meet loading requirements.
3. Openings and penetrations smaller than 6 inches may be core drilled.

H. Molds

1. Material from which molds are to be fabricated shall be steel, concrete, fiberglass, reinforced plastic or wood.
2. The selection of materials for molds shall be at the manufacturer's option, except that wood shall not be used without the express approval of the Construction Manager.
3. All elements shall be cast in molds of rigid construction, accurate in detail with precise corners and arises, and designed to provide a close control of dimensions and details as indicated on the drawings.
4. Prior to casting of precast elements, molds shall have all surface joints, radii, corners, etc., filled, ground, filed, straightened or otherwise removed to provide a finished concrete surface that is smooth and dense, free of honeycombing, large air pockets, offsets, sinkages or other irregularities.

I. Parting Compound

1. All molds shall be coated with parting compound to facilitate removal of elements from molds.
2. Parting compound shall be non-petroleum, nonstaining and shall be of a nature and composition not deleterious to concrete.

J. Manhole Steps

1. Manhole steps shall be the cast aluminum type or extruded aluminum type.
2. Manhole steps are only allowed where specifically required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Casting

1. Casting shall be accomplished by methods and equipment that are in conformance with generally acceptable systems for this type of work.
2. All precast concrete shall be manufactured by a plant thoroughly experienced in this type of work.
3. The manufacturer shall meet all production schedules.
4. Surfaces on which units are cast shall be level and free from any imperfections detrimental to the surface appearance of the finished units.
5. Parting compound shall be applied evenly as per manufacturer's recommendations.
6. Concrete shall be so handled as to prevent segregation of materials and shall be continuously vibrated during casting, either internally or externally, to achieve proper compaction, finish and distribution of concrete.
    a. All precautions must be taken to keep the reinforcing steel in the proper location during placing and consolidation of the concrete.
    b. Unless shown otherwise and except at concrete faces exposed to soil or liquids, all reinforcing steel shall have a minimum cover of 3/4 inch.
    c. At concrete faces exposed to soil or liquids, cover shall be 1-1/2 inches minimum.
    d. Embedded items shall be accurately placed and maintained in their proper location during the casting operation.
    e. Special inserts or other devices for handling of the units for the convenience of the manufacturer shall not be exposed to view after members are erected.
    f. Embedded anchors, inserts, plates, angles and other cast in items shall have sufficient anchorage and embedment for design requirements.
7. Precast sections shall be manufactured to contain wall and roof openings of the minimum size to receive the ends of the pipes and such openings being accurately set to conform to line and grade of the pipelines.
    a. Subsequent cutting or tampering in the field, for the purpose of creating new openings or altering existing openings, will not be permitted except as directed by the Construction Manager.
8. No more than four lift holes may be cast or drilled in each section.
9. Casting, bowing, warpage and dimensional tolerances shall be in accordance with MNL 116, current edition.

B. Curing

1. All precast units shall be steam cured for a period of at least 12 hours. Fog spraying may be used when reviewed by the Construction Manager

2 Precast elements shall not be removed from molds for a minimum period of 12 hours after casting, or until concrete has attained a minimum compressive strength of 3500 pounds per square inch, whichever governs.

3. After removal from the forms, curing by steam or fog spraying shall be continued until concrete has attained specified strength and confirmed by standard tests.

4. Curing procedures shall be consistent and uniform throughout the entire project.

C. Welding

1. The quality of material and fabrication of all welded connections shall conform to the latest AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."

2. All weldments shall be made in accordance with the applicable provisions of AWS.

a. All welding, other than tacks, shall be done by certified welders. All units shall be protected from damage by field welding or cutting operations.

b. Noncombustible shields shall be provided as necessary for this purpose.

D. Joints and Joint Sealants

1. In all instances, the edges of precast concrete units and of adjacent material shall be sound, smooth, clean and free of all contaminants prior to joint treatment.

2. Sealant and primer shall be supplied by the same manufacturer and the primer, when required, shall be as recommended for the particular sealant used.

3. All sealant compounds shall be delivered to the job in the manufacturer's original sealed containers with labels intact and shall be applied in strict accordance with the manufacturer's recommendations.

E. Miscellaneous

1. All exterior surfaces of the concrete units shall be given a minimum of one shop coat of bituminous damp-proofing.

2. Gasket materials shall be top grade (100% solids, vulcanized) butyl rubber and shall meet or exceed AASHTO M 198.

3.02 ERECTION

A. Any errors or misalignment in the structure which would prevent the proper setting of the elements shall be corrected by the Contractor before the erection is commenced.

B. Erection shall be supervised and performed by workmen skilled in this type of Work.

C. Each element shall be set in the proper position, carefully plumbed and anchored securely to the structural frame.

D. Adjustments or changes in connections which could involve additional stresses in the products or connections shall not be permitted without approval of the Construction Manager.

E. All bearing surfaces shall be true to line and grade.

F. Erection tolerances shall be in accordance with MNL 116.

G. All joints shall be uniform and straight.

3.03 CLEANING AND REPAIRING

A. After installation, precast elements shall be protected from all damage until final acceptance by the Owner.

B. Precast units with cracks, spalls, and other defects shall be subject to rejection. Units reviewed for repair shall be repaired to the satisfaction of the Construction Manager.

3.04 ALTERNATIVE DESIGN

A. The Contractor may offer an alternative design for any precast element.

B. Such design shall be comparable in terms of strength, deflection, finish and all other design criteria indicated.

C. Complete drawings prepared and sealed by a Structural engineer registered in the State of Georgia where applicable shall be submitted to the Construction Manager for his review in accordance with specification Section 01 33 23 of these Contract Documents.

D. No alternative design will be permitted unless it has been specifically accepted in writing by the Construction Manager.

E. If an alternative design is accepted, all expenses resulting therefrom shall be borne by the Contractor.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes access doors and frames.

B. Unless indicated otherwise, provide access doors as follows:

1. Type I access doors over spaces intended to be dry such as pipe galleries and pump rooms.
2. Type II access doors over spaces intended to be wet such as wet wells and liquid holding basins.
3. Type III access doors where doors are subject to vehicular traffic.

1.02 REFERENCES

A. This section contains references to the following documents.

1. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
2. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM A666	Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM C578	Rigid, Cellular Polystyrene Thermal Insulation

1.03 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.
2. A copy of this Specification Section with addendum updates included, and all referenced and applicable sections with addendum updates included with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   a. Check-marks (✓) shall denote full compliance with a paragraph as a whole.

b. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph.

c. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

d. The submittal shall be accompanied by a detailed, written justification for each deviation.

e. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Shop Drawings including profiles, accessories, location, adjacent construction interface and dimensions.

B. Informational Submittals:

1. Procedures: Section 01 33 00
2. Manufacturer's product data.
3. Warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Sections 01 65 00 and 01 66 00

1.05 SPECIAL WARRANTY

A. Special Warranty: manufacturer shall warrant access doors and frames against defects in materials and workmanship for 5 years.

PART 2 – MATERIALS

2.01. MANUFACTURERS

A. Manufacturers: Candidate manufacturers are listed below. The manufacturer's standard product may require modification to conform to specified requirements:

1. Bilco
2. Halliday
3. Approved Equal

2.02. GENERAL

A. Door leaf(s) shall withstand a live load of 300 pounds per square foot.

B. Where access doors are subject to vehicular traffic, Door leaf(s) shall withstand an AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span.

C. All aluminum plate and structural shapes shall conform to ASTM B308, Type 6061-T6.

D. Hardware shall be ASTM A666 Type 316 stainless steel.

E. Aluminum in direct contact with concrete shall receive a protective coating on all surfaces that will be in contact with concrete.

F. The door shall open to 90 degrees and lock automatically in that position.

2.03. ACCESS FOOR LEAF

A. Door leaf(s) shall be minimum 1/4 inch thick aluminum diamond pattern plate stiffened with aluminum members as required. Finish of door leaf(s) and frame shall be mill.

B. Door leaf hinges shall be forged stainless steel with stainless steel pins.

1. Door leaf hinges shall be through bolted to the door leaf with tamperproof stainless steel lock bolts and to the frame with stainless steel bolts and locknuts.

2. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation.

C. Door leaf latches shall be stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle. Latch release shall be protected by a flush, gasketed, removable screw plug.

D. Double leaf access doors shall have a stainless steel chain on both sides of the door opening for personnel protection.

E. Door leaf(s) shall have compression spring lifting operators enclosed in telescopic tubes and automatic hold-open arm with release handle to automatically lock the door leaf(s) in the open (90 degree) position.

F. Door leaf(s) over spaces intended for human occupancy shall be insulated with 2 inches preformed, cellular polystyrene thermal insulation, Type X or Type IV, conforming to ASTM C578.

1. Insulation shall be fully enclosed within door leaf with minimum 1/8 inch aluminum plate.

G. A vinyl grip handle shall be provided to release the cover for closing.

H. Door shall be equipped with a snap lock and removable handle.

I. Where specifically indicated on the drawings, provide a recessed padlock hasp lock with a flush hinged lid and fully welded receptacle designed to receive a standard padlock.

2.04. SAFETY GRATE

A. All access doors shall have a safety grate directly under the door leaf(s).

1. Safety grate shall be located directly under the door leaf(s), of aluminum or fiberglass construction and shall be lockable independent of the door leaf.

2. Safety grate shall hinged to match the access door leaf(s): one piece for single access doors and two-piece for double access doors.

3. The spacing of the grid shall be no greater than five inches square.

4. The safety grate shall be designed to withstand a live load of 150 pounds per square foot.

2.05. ACCESS DOOR FRAME

A. The frame shall be ¼ inch extruded aluminum alloy 6063-T6, with built in neoprene cushion.

B. Door frame shall be on all four sides of the openings, of aluminum construction, with anchor tabs around the perimeter.

C. Where specifically indicated on the drawings, provide an EPDM gasket system that will provide an air infiltration rate of less than 1 cubic foot per minute per linear foot of cover perimeter.

D. Door frame shall have a channel profile to capture water. A 1 1/2-inch drainage coupling shall be provided in at least one corner of the frame.

PART 3 – EXECUTION

3.01. INSTALLATION

A. Install in strict accordance with manufacturer's instructions and approved submittals.

B. Access doors and frames shall be level, plumb and square. Adjust as necessary for proper operation. Repair damaged finishes to like new appearance.

C. Frames with drainage coupling shall be piped with PVC pipe to location as indicated on the drawings or prescribed by the Owner.

3.02. CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer.

END OF SECTION

SECTION 31 10 00

SITE PREPARATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.02 DEFINITIONS

A. Subsoil:

1. All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil:

1. Soil that is present at the top layer of the existing soil profile at the Project site.
    a. In undisturbed areas, the surface soil is typically topsoil.
    b. In disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil:

1. Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
2. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone:

1. Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone:

1. Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

F. Vegetation:

1. Trees, shrubs, groundcovers, grass, and other plants.

1.03 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.04 SUBMITTALS

A. Existing Conditions:

1. Documentation of existing trees and plantings, adjoining construction, and site improvements that establish preconstruction conditions that might be misconstrued as damage caused by site clearing.

a. Use sufficiently detailed photographs and/or videotape.

b. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings:

1. Identifying and accurately showing locations of capped utilities and other structural, electrical, and mechanical conditions.

1.05 QUALITY ASSURANCE

A. Pre-installation Conference:

1. Conduct conference at Project site.

1.06 PROJECT CONDITIONS

A. Traffic:

1. Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Construction Manager and authorities having jurisdiction.

b. Provide alternate routes around closed or obstructed traffic ways if required by Construction Manager or authorities having jurisdiction.

B. Salvable Improvements:

1. Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service:

1. Utilize a utility locator service for area where Project is located before site clearing.

2. Do not commence site clearing operations until temporary erosion and sedimentation control and plant-protection measures are in place.

D. Protection Zones

1. The following practices are prohibited within protection zones:
   a. Storage of construction materials, debris, or excavated material.
   b. Parking vehicles or equipment.
   c. Foot traffic.
   d. Erection of sheds or structures.
   e. Impoundment of water.
   f. Excavation or other digging unless otherwise indicated.
   g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
2. Do not direct vehicle or equipment exhaust towards protection zones.
3. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

E Soil Stripping, Handling, And Stockpiling:

1. Perform only when the topsoil is dry or slightly moist.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material:

1. Requirements for satisfactory soil material are specified in Section 31 23 00 – Trench Excavation and Fill.
2. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating:

1. Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to the Construction Manager.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

A. General:

1. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Construction Manager.

3.04 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities:

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

a. Notify Owner and Construction Manager not less than two days in advance of proposed utility interruptions.

b. Do not proceed with utility interruptions without Owner or Construction Manager's written permission.

2. Excavate for and remove underground utilities indicated to be removed.

3. Removal of underground utilities as included on the Drawings.

3.05 CLEARING AND GRUBBING

A. The sites of all excavation and grading shall be first cleared of all paving, trees, stumps, roots, brush, organic matter, crops, paving, structures, fences, sidewalks, rubbish, debris, etc., which shall be removed or disposed of in a satisfactory manner in a legally permitted location.

B. Refer to Section 31 11 10 for detailed Clearing and Grubbing requirements.

3.06 TIMBER

A. Salvage all timber within cleared area having a marketable value.

B. The timber within the cleared area shall become the property of the Contractor and the Contractor shall be responsible for selling and/or disposing the timber.

3.07 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

A. Dispose of the cleared and grubbed materials by burning or chipping. Burning shall be permitted during approved burning seasons only. During non-burning season periods, use chipping for debris disposal. Remove chipped material from the site or disposed of in areas approved by Owner.

B. If burning is allowed, do not allow a fire to be unattended. The Contractor is responsible for damage caused by such fires. Do not bury burned and nonflammable materials.

1. All Contractors should be aware that the Georgia Environmental Protection Division has issued a burning ban for thirteen (13) Metro Atlanta Counties. The ban went into effect in 1996 and shall continue each year from May 1 through September 30. This ban should be considered when bidding projects that require clearing and debris removal. It is the Contractor's responsibility to remove all construction debris from the jobsite. Any costs incurred as a result of the burning ban are the sole responsibility of the Contractor.

C. Disposal of materials in streams will not be permitted. Do not pile materials in stream channels or along the banks where it might be washed away by flood.

D. Remove all fence material within the areas to be cleared from the job site. Fence materials become the property of the Contractor.

3.08 DISCING

A. After grubbing is complete, discing of the entire area is required. Perform discing in two directions at approximate right angles. Generally, perform the second discing along the contour.

B. The construction area is to be left free-draining with a finished agricultural appearance.

3.09 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to a depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, other objects more than 2 inches in diameter, trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.10 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property and/or Project site.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 31 11 10

CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 SCOPE

A. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated.

B. Precautionary measures that prevent damage to existing features including trees, to remain are part of the Work.

C. The sites of all excavation and grading shall first be cleared of all paving, trees, walls, fences, sidewalks, stumps, brush, rubbish, and crops, which shall be removed and disposed of in a satisfactory manner.

D. On all lawns and other improved grass areas, the sod shall be carefully removed, kept alive when possible, and replaced after the backfilling is completed.

E. The Contractor shall also remove all spoil from such areas as quickly as possible after the excavation is backfilled, and shall leave the premises in as good a condition as before undertaking the work.

F. Fences which have been removed, damaged, or broken down shall be replaced at or before completion of the work to pre-construction quality or better.

G. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

1.02 QUALITY ASSURANCE

A. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

B. Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department restrictions.

C. All Contractors should be aware that the Georgia Environmental Protection Division has issued a burning ban for thirteen (13) Metro Atlanta Counties. The ban went into effect in 1996 and shall continue each year from May 1 through September 30. This ban should be considered when bidding projects that require clearing and debris removal. It is the Contractor's responsibility to

remove all construction debris from the jobsite. Any costs incurred as a result of the burning ban are the sole responsibility of the Contractor.

1.03 JOB CONDITIONS

A. Location of the Work: The area to be cleared and grubbed is shown schematically on the Drawings or specified below. It includes all areas designated for pipeline construction.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders and root rakes.

PART 3 – EXECUTION

3.01 SCHEDULING OF CLEARING

A. The Contractor shall clear at each construction site only that length of the right-of-way, permanent or construction easement which would be the equivalent of two week's pipe laying. This length shall be determined from the Contractor's Progress Schedule.

B. The Construction Manager may permit clearing for additional lengths of the pipe line provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.

C. A satisfactory stand of grass shall have no bare spots larger than one square yard. Bare spots shall be scattered and the bare area shall not comprise more than one percent of any given area.

3.02 CLEARING AND GRUBBING

A. Clear and grub no more than 3 feet on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. Materials to be cleared, grubbed and removed from the Project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris and abandoned utilities.

C. Grub, stockpile, and/or place in embankments surface rocks and boulders from the soil in accordance with the Specifications.

D. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

E. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

1. When it is necessary to cut tree roots on the surface of the ground, the ends shall be cut off smooth, without splitting or shattering and scars greater than one inch in diameter shall be sealed with an approved asphalt sealant tree paint.
2. The trunks of the trees shall be carefully protected from damage, and if unavoidable damage occurs, the injured portions shall be neatly trimmed and covered with an application of an approved asphalt sealant tree paint.
3. Excavating machinery, cranes, etc., shall be handled with care to prevent damage to trees, particularly to overhanging branches, and branches shall not be cut off except by permission of Owner.

F. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.

G. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

H. Grind down stumps and remove roots, obstructions, and debris to a depth of 24 inches below exposed subgrade.

I. Use only hand methods for grubbing within protection zones.

J. Chip removed tree branches and stockpile in approved areas or dispose of offsite, as directed by Construction Manager.

K. Landscaping features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

L. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap.

M. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

N. Any work pertaining to utility poles shall coordinate and comply with the requirements of the appropriate utility.

O. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the Construction Manager's opinion, is significantly damaged shall be replaced with new fence material.

P. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.

Q. The Contractor shall be responsible for repairs and/or replacement of all damage to existing improvements resulting from Contractor's operations.

R. Fill depressions caused by clearing and grubbing operations with proper backfill soil material, unless further excavation or earthwork is indicated by the Drawings or directed by Owner.

1. Place fill material in horizontal layers or lifts, not exceeding a loose depth of eight (8) inches, and compact each layer to 85% of maximum dry density – Standard Proctor (ASTM D698).

3.03 DISPOSAL OF DEBRIS

A. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of Federal, State, County and municipal regulations.

B. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley.

C. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the Project, shoved onto abutting private properties or buried on the Project.

END OF SECTION

SECTION 31 23 00

TRENCH EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01. SUMMARY

A. Scope

1. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines as shown on the Drawings and as specified.

B. All excavation shall be by open cut unless otherwise indicated on the Drawings or directed by the Construction Manager.

1. In general, topsoil may be removed by machine method.
2. Excavation below topsoil may also be performed by machine, but shall be supplemented by such hand dressing or leveling as may be required to conform to lines and grades as directed by the Construction Manager.
3. Material so removed shall be used in backfill, making embankments, filling low areas, or as otherwise directed.
4. Hand tool excavation shall be used where necessary to protect existing utilities and structures.

C. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation, removal, and disposal of all earth, rock or other materials including the existing pipe if any to the extent necessary to install the new pipelines and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.

D. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing. The trench is divided into five specific areas:

1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
4. Initial Backfill: The area above the haunching material and below a plane 18 inches above the top of the barrel of the pipe.
5. Final Backfill: The area above a plane 18-inches above the top of the barrel of the pipe.

E. The choice of method, means, techniques and equipment rests with the Contractor.

1. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way and the prevailing practice in the area.

1.02. QUALITY ASSURANCE

A. Density:

1. All references to “maximum dry density” shall mean the maximum dry density defined by the “Maximum Density-Optimum Moisture Test”, ASTM D698,

2. Except that for non-cohesive materials “maximum dry density” shall mean the maximum index density as determined by the “Maximum Index Density of Soils Using a Vibratory Table”, ASTM D4253.

B. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of:

1. ASTM D1556, “Density of Soil In Place by the Sand Cone Method”.

2. ASTM D2937, “Density of Soil In Place by the Drive-Cylinder Method”.

3. ASTM D2922, “Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)”.

C. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory in accordance with Section 01 45 29 of these Specifications. All imported fill materials shall meet the requirements of on-site fill materials.

1.03. SAFETY

A. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended.

B. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA publication 2226.

PART 2 – PRODUCTS

2.01. TRENCH FOUNDATION MATERIALS

A. Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.2.01, Group I (limestone, marble or dolomite) or Group II

(quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.02. BEDDING AND HAUNCHING MATERIALS

A. Bedding requirements specified herein shall apply to sanitary sewer lines only. These requirements are to be considered minimum bedding requirements and as such, do not relieve the Contractor of the responsibility to provide any additional bedding necessary for proper support of the sewer and construction.

B. Unless specified otherwise, bedding and haunching materials shall be crushed stone as specified below.

C. Crushed stone utilized for bedding and haunching shall meet the requirements of the Georgia Department of Transportation Specification 800.2.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

D. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench.

1. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials.
2. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements.
3. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping.
4. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner.

E. Filter Fabric Woven Type

1. Filter fabric associated with bedding shall be a polypropylene woven fabric.
2. The fabric shall be a high modulus type with good separation capabilities.
3. The fabric shall be inert to biological degradation and naturally occurring chemicals, alkalies and acids.
4. The fabric shall have an equivalent opening size EOS of 20 to 45.
5. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Method	Minimum Value

Grab Tensile Strength	lbs.	ASTM D 4632	200
Grab Tensile Elongation	%	ASTM D 4632	15
CBR Puncture Strength	lbs.	ASTM D 6241	700
Trapezoid Tear Strength	lbs.	ASTM D 4533	75
Permittivity	Sec^{-1}	ASTM D 4491	0.05
Water Flow rate	gpm/ft^2	ASTM D 4491	5
UV Resistance @ 500 Hours	%	ASTM D 4355	70

6. If ordered by the Construction Manager, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe.
7. This service will be furnished for a minimum of 10 days during initial pipe installation.
8. Filter fabric shall be Mirafi 500X, Amoco 2002 or Exxon GTF-200.

2.03. BACKFILLING – GENERAL

A. Materials used for backfilling shall be free from all perishable and objectionable materials; no stones larger than two (2) inches in the longest dimension shall be placed directly above the pipe. All larger stones must be placed to the sides of the ditch such that the pipe can be excavated for repair without digging through them.

B. Select compactable material shall be used in pipe trenches under roadways and other paved areas. When required on the plans or required by the Owner, graded aggregate base shall be used in pipe trenches under roadways.

2.04. BACKFILLING – INITIAL BACKFILL

A. Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.

B. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section at no additional cost to the owner.

2.05. BACKFILLING – FINAL BACKFILL

A. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2 inches at its greatest dimension, cinders, stumps, limbs, man-made wastes and other unsuitable materials.

B. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.06. SELECT BACKFILL

A. Select backfill shall be materials which meet the requirements as specified for bedding, haunching or initial backfill materials, including compaction requirements.

2.07. CONCRETE

A. Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches.

B. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C94.

C. Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

2.08. FLOWABLE FILL

A. Low strength flowable fill concrete shall meet the requirements of Section 600 of the Georgia Department of Transportation specifications.

2.09. GRANULAR MATERIAL

A. Granular material, where required for trench backfill, shall be sand, river sand, crushed stone or aggregate, pond screenings, crusher run, recycled concrete, or other angular material.

B. Granular material shall meet gradation requirements for Size No. 57 or finer.

PART 3 – EXECUTION

3.01. TRENCH EXCAVATION

A. Topsoil and grass shall be stripped a minimum of 6 inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.

B. Topsoil shall be removed to its entire depth from all areas to be excavated or graded.

1. The topsoil shall be piled in designated or approved locations where it will not interfere with construction operations.
2. Topsoil as stored shall be reasonably free of subsoil, debris, and stones larger than two (2) inches in diameter.
3. The stored topsoil shall be left in piles to be used for finished grading.

C. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.

D. All excavations shall be adequately shored to ensure worker safety. All pipe laying operations shall comply with OSHA requirements for trench safety.

E. Trench Width for Pipelines

1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe.
2. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet.
3. In order to limit loads on the pipe, the maximum width of the trench shall not be more than 36 inches wider than the outside diameter of the pipe. This trench width restriction applies to that portion of the trench 4 inches below the bottom of the pipe to 12 inches above the top of the pipe.
4. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
5. Excavation of pipe trenches with sides sloping to the trench bottom will not be permitted.
6. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
7. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 9-inches clearance between the rock and any part of the pipe barrel.
8. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the Drawings for the full trench width as actually cut.
9. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Construction Manager or Owner.

F. Depth

1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the dimensions shown on the Drawings.
2. Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8 inches for pipe 21 inches in diameter and smaller and 12 inches for larger pipe and valves.

G. Length of Trench to Be Opened

1. The length of trench to be opened, or the areas of the surface to be disturbed or unrestored at any one time, shall be limited with regard both to expeditious construction, and to the convenience, safety, and comfort of citizens directly or indirectly affected by the Work.
2. New trenches will not be permitted to be excavated if there are previously excavated trenches that require backfilling, or surface areas that require restoration.
3. In any event, no additional work of any kind will be permitted if there are existing streets or roadways that require attention to return them to a safe and proper condition.
4. IN GENERAL, NO TRENCH SHALL BE OPEN MORE THAN 500 FEET AHEAD OF PIPE LAYING AND BACKFILLING.

H. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required.
2. Top soil shall be carefully separated and lastly placed in its original location.
3. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems.
4. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

I. Storage of Materials:

1. All salvageable materials which may be removed from the site, together with all materials taken from the trenches, shall be stored in an approved, suitable place, or as directed by the Owner.
2. The Contractor shall be responsible for any loss of, or damage to, salvageable materials through careless removal or neglectful or wasteful storage of such materials.
3. In the storing of excavated material, which is to be used as backfill, the Contractor shall exercise care so as to avoid inconveniencing the public.

a. If, in the opinion of the Construction Manager, it is necessary to remove this excavated material from the streets or lots, the Contractor shall be required to do so.

3.02. SHEETING, BRACING AND SHORING

A. The Contractor shall be responsible for supporting and maintaining required excavations including sheeting and shoring the sides and ends of excavations with timber or other supports.

1. The requirement of sheeting or shoring, or the addition of supports, shall not relieve the Contractor of his responsibility of their sufficiency.

B. The need and adequacy of sheeting, shoring, bracing, or other provisions to protect workmen and equipment in a trench or other excavation, and to meet local and OSHA safety requirements, shall be the sole and exclusive responsibility of the Contractor.

C. Sheeting, bracing and shoring shall be installed in the following instances:

1. Where sloping of the trench walls do not adequately protect persons within the trench from slides or cave-ins.
2. In caving ground.
3. In wet, saturated, flowing or otherwise unstable materials.
4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

D. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

E. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

F. Steel Sheeting and Sheet Piling

1. Steel sheet piling shall be the continuous interlock type.
2. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads.
3. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times.
4. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

G. Trench Shield

1. A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting.
2. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved.
3. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously.
4. At no time shall the trench shield be “dragged” with the bottom of the shield extending below the top of the pipe or utility.

H. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property.

1. Leave sheeting in place when, in the opinion of the Construction Manager, it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline.
2. Cut off any sheeting left in place at least two feet below the surface.

I. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Construction Manager.

3.03. ROCK EXCAVATION

A. Definition of Rock: Solid mineral material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 3/4 cubic yard for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Late-model, track-mounted hydraulic excavator equipped with a 42-inch wide, maximum, short-tip-radius rock bucket.
    a. Rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf.
    b. With extra-long reach boom measured according to SAE J-1179.

B. Unless otherwise directed by the Construction Manager, rock shall be fully taken out at least twenty-five (25) feet in advance of pipe laying, at least 6 inches below the invert of the pipe, and to a trench width for the size of the pipe to be laid, as specified in Fulton County Standard Details.

C. All pipe installed within rock excavation shall be laid upon a minimum of six (6) inches of # 57 stone coarse aggregate.

D. Blasting may be allowed for removing rock for excavation when properly permitted.

1. Blasting will only be allowed with pre-approval from Fulton County.
2. Typically, blasting will not be approved.
3. When blasting, the Contractor must use all possible precautions against accidents or damages due to use or storage of explosives, and assumes all responsibility/liability associated with blasting activities.
4. ONLY LICENSED EMPLOYEES OR SUBCONTRACTORS WILL BE ALLOWED TO CONDUCT BLASTING ACTIVITIES – PROOF OF SUCH LICENSING MUST BE PROVIDED TO THE CONSTRUCTION MANAGER PRIOR TO ENGAGING IN ANY BLASTING ACTIVITIES.
5. Explosives shall be used, handled and stored as prescribed by the laws and regulations of the State of Georgia, and all applicable local laws and regulations pertaining to such.
6. All explosives shall be stored in a safe place at a sufficient distance from the work so that no damage will occur to any portion of the work should an accident occur relating to the stored explosives.
7. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Construction Manager may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
8. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.
9. The Contractor shall notify the Construction Manager prior to any blasting. Additionally, the Contractor shall notify the Construction Manager and local fire department before any charge is set
10. Furnish all labor, equipment and materials required to drill, blast, loosen, excavate, and dispose material to complete the work shown on the Drawings and specified herein.
11. The work includes, but is not be limited to:
    a. Blast round design.
    b. Planning and execution of appropriate site-specific safety measures to be employed during all blasting operations, and the safe handling and storage of high explosives and blasting agents.
    c. Drilling blast holes, loading blast holes with explosives, and wiring and safe detonation of blast rounds.
    d. Removal from the site of all excess excavated soil, debris, and rock as indicated in the Contract Documents, or as directed, and disposal of excess materials at a permitted disposal site.
    e. Dewatering and maintenance of groundwater and surface water in all excavations.

f. Performance of all surveys necessary to establish and verify the lines and grades and to determine the amount of material removed.

g. Implementation of monitoring program to monitor condition of existing structures and utilities in vicinity of proposed blasting operations to insure existing features remain undamaged by blasting procedures.

12. Make all excavations in conformance with the lines, grades and cross sections on the Drawings or established by the Construction Manager. Where blasting is required, blasting should ensure removal of six inches (6") of rock below proposed grade line.

13. All over-blast shall be removed and the resulting over-excavation backfilled and compacted with #57 gradation stone coarse aggregate.

14. Conduct all blasting operations, including transporting and storing of explosives in compliance with the Georgia State Fire Commissioner's Rules and Regulations for Explosives and Blasting Agents, latest edition and all applicable local codes.

15. Blasting Submittals

a. Submit the following in accordance with the procedures and requirements set forth in Section 01 33 00 Submittal Procedures, at least thirty (30) working days prior to beginning any blasting operations:

1) Names, addresses, telephone numbers, and qualifications of the blasting subcontractor(s) and explosives supplier(s) that will be used, including the designated Blaster-In-Charge.

2) Copies of Training Certificates for the designated Blaster-In-Charge, blasting foreman and any other key personnel that will be responsible for the work, showing that they have received specialized training in the proper handling of explosives.

3) A Blasting Plan, indicating the methods, materials and equipment to be used. The Blasting Plan should indicate the types of explosives to be used, drilling patterns, and a general layout and schedule for executing the work in accordance with state regulations.

4) A ground vibration and air blast monitoring plan, indicating structures that will be monitored, monitoring equipment that will be used, and personnel that will perform the monitoring.

16. At least 24 hours before each blast round, submit a detailed blast round design plan to the Construction Manager. The blasting plan submitted is for quality control and record keeping purposes. Review by the Construction Manager does not relieve the Contractor of his responsibilities as provided herein. Include the following in the blast round design submittals:

a. Location (state, grid coordinates) and limits of the shot.

b. Number, diameter, and depth of blast holes to be detonated in the round, and a plan showing the drill hole pattern, spacing and distance to the free face.

c. Depth of overburden.

d. Total weight of explosives in the round and the types of explosives to be used.

e. Loading diagram showing the location of explosives, primers, and initiators; and location, depth, and type of stemming to be used in each hole.

f. Initiation sequence, including delay timer and delay system, total weight of explosive to be detonated on each delay, and a list of the timing of the delays.

g. Manufacturer's data sheet for all explosives, primers, and initiators to be used.

h. Planned seismic monitoring positions, distances from the blast round, and seismograph types to be used to monitor vibrations and air blast overpressures.

i. Type and amount of blasting mats and/or depth of soil cover to be used over the top surface of the shot.

j. Any other information required by applicable state and federal regulations.

17. Within 24 hours after each blast round, submit a blasting report to the Construction Manager. Include the following in the blasting report:

a. Date and time of shot.

b. Foreman's name.

c. Number and depth of holes detonated.

d. Weather conditions at the time of detonation.

e. Type of explosives and detonators used.

f. Peak particle velocity of ground motion and primary frequency for all ground vibration monitoring stations.

g. Peak air blast overpressure measured.

h. Distance from the blast round to each monitoring station for vibrations and air blast.

i. Amount of explosive used in each hole, and maximum weight of explosive detonated on any single delay in the blast round.

E. Pre-Blast Survey

1. Contractor shall have an approved vibration consultant conduct the pre-blast survey on the residences and facilities adjacent to the proposed rock blasting in accordance with the submitted survey and monitoring plan.

2. The survey shall include, but not be limited to the following:

   a. A site plan or drawing of the structure to be examined showing the structure in relationship to the proposed rock blasting area and a full description of the structure including type of materials and construction.

   b. Examination of the structure (interior and exterior surfaces) by experienced and qualified personnel, noting any visible structural and aesthetic flaws in or on the structure. Note existing cracks and flaws, with significant cracks measured, and all cracks and flaws photographed.

   c. Upon completion of the examination, ask the structure's owner to review the report, note any corrections or omissions, and sign a statement that to the best of his knowledge, the examination report reflects the conditions of the structure prior to any rock blasting. If the structure's owner refuses to sign said report, it should be noted in the report by the examiner.

   d. Nothing contained herein shall relieve the Contractor of responsibility for claims arising from his construction operations. Failure to inspect any structure, whether or not required by these Contract Documents, or inadequacy of the inspections shall not relieve the Contractor of his responsibility. The Contractor shall indemnify the Owner from such claim.

   e. In the event that any property owner denies access for the survey of structures and facilities, notify such property owner, by certified mail, stating that this is final notification. Submit to the Construction Manager, copies of all correspondence between the Contractor and the property owner(s). The Construction Manager, upon review of the submitted correspondence may waive requirements set forth above. However, the Contractor is fully responsible for claims and damage arising from his construction operations regardless of property location.

   f. Submit two (2) sets of copies of the examination reports to the Construction Manager and Engineer for their records.

F. Use of Explosives

1. When the use of explosives is necessary for the prosecution of the Work, exercise the utmost care not to endanger life or property. Be responsible for any and all damage or injury to persons or property resulting from the use of explosives.

2. Store all explosives in a secure manner, in compliance with all laws, and clearly mark all such storage places "DANGEROUS EXPLOSIVES".

3. Notify any public utility company having facilities in close proximity to the site of the Work of the intention to use explosives.

   a. Provide this notice sufficiently in advance to enable the utility companies to take whatever steps they may consider necessary to protect their property from injury.

b. Also give the Construction Manager, all occupants of adjacent property, and all other Contractors working in or near the Project, notice of the intention to use explosives.

4. Only non-electric type initiators maybe used.

G. Blasting Operations

1. Provide explosives of such quantity and power and use in such locations as will neither open seams nor otherwise disturb the material outside the prescribed limits of excavation.

2. As the excavation approaches its final limits, reduce the depth of holes for blasting and the amount of explosives used for each hole so that the underlying or adjacent rock will not be disturbed or shattered.

3. Do not perform blasting within 100 feet of newly placed concrete that has cured less than 7 days.

4. Do not perform blasting within 50 feet of any existing structure or any new structure in progress.

H. Blast Monitoring

1. Following review by the Construction Manager regarding the proximity of permanent buildings and structures to the blasting site, Construction Manager may direct the Contractor to employ an independent, qualified specialty sub-contractor, approved by the Construction Manager to:

a. Monitor the blasting by use of seismograph,

b. Identify the areas where light charges must be used,

c. Conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

2. The Contractor shall exercise the utmost care not to damage property on-site and off-site.

a. Notify each adjoining property owner within 5,000 feet of the site of the anticipated ground vibrations and noise which will occur due to the blasting operations.

b. Provide this notice 30 days in advance to enable the adjacent property owners to take whatever precautions they may consider necessary.

c. Limit operations to minimize any disturbance to the adjacent property owners.

d. Notify motorists on adjacent roadways in accordance with state regulations.

e. Take responsibility for any damage to any structure or utility line, pipes, etc., on-site and off-site as a result of his operations.

3. For each blast round, monitor and record noise and air blast overpressures at the site perimeter nearest the blast location and at the on-site or off-site structure located nearest to the round.

a. Peak air blast overpressure shall not exceed 0.018 psi, measured at the site perimeter.

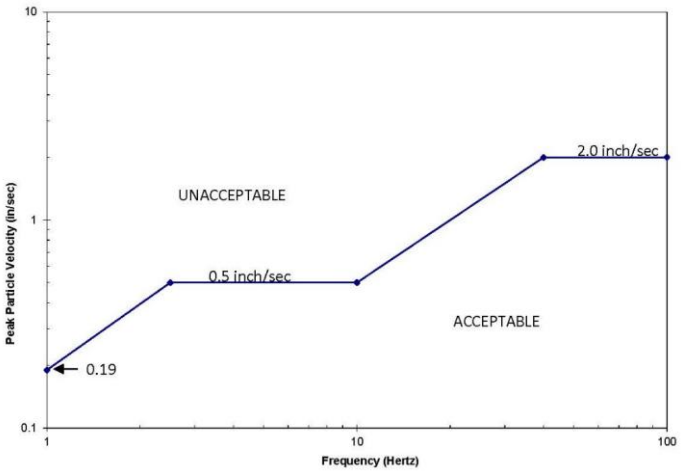
4. Sufficiently cover the site of every blast round with blasting mats or other devices to prevent any flying debris.

   a. The Contractor will be fully responsible for any damage caused by flying debris, both to on-site and off-site properties.

5. Whenever blasting is to be performed within 2,500 feet of any structure, measure the peak particle velocities of ground vibration resulting from each blast at the structure.

6. Monitor vibrations utilizing a seismograph capable of providing a record of particle velocity and frequency along three mutually perpendicular axes utilizing internal calibration.

7. Measured peak particle velocity of ground motion at the monitored structure shall not exceed the values shown in the following graph:



I. Blasting Notification

1. Give twenty-four (24) hour notice to Construction Manager and adjacent residences and/or businesses prior to each blast.

J. Complaints

1. Submit notice of blasting complaints to Construction Manager in writing within twenty-four (24) hours of receipt thereof.

   a. Identify the origin of complaint in the notice and provide a brief description of alleged damage or other circumstances upon which the complaint is predicated.

   b. Assign a number to each complaint consecutively in the order of receipt.

c. Assign each complaint a separate number and show in each letter complaint all previous complaint numbers registered by the same complainant.

d. In addition, make a summary report each month to Construction Manager. Indicate date, time and name of person investigating the complaint and amount of damages (or an estimate thereof), if any, in the summary report.

K. Post Blast Survey

1. Contractor shall have the same vibration consultant who performed the pre-blast survey conduct the post-blast survey.

2. The consultant shall examine all structures from which a complaint has originated after the blast. The survey shall include, but not be limited to the following:

a. A full description of the alleged damage caused by the blast.

1) Where appropriate, provide a sketch to more fully describe the location and type of damage.

2) Measure cracks and compare to any original measurements which may have been taken in the Pre-Blast Survey.

b. Take colored photographs of any alleged damage.

c. Submit two (2) copies of the Post Blast Survey report to the Construction Manager. The report shall include the consultant's assessment of the alleged damage and an opinion as to its likely cause.

3.04. DEWATERING EXCAVATIONS

A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.

B. The Contractor shall pump out, or otherwise remove and properly dispose of any water (including storm water), which may be found or may accumulate, as fast as it may collect in the excavation. The removal is required regardless of the source.

C. All necessary precautions shall be taken to prevent disturbance of, and to properly drain, any areas upon which concrete is to be poured or pipe is to be laid.

D. There shall be located at the work site at all times during construction, proper and approved equipment with such sufficient capacity for the removal of any water that accumulates in excavations and in such manner as not to withdraw sand or cement from any concrete.

1. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented.

2. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.

E. Contractor is also to ensure that removal of any liquids will not interfere with the proper laying of masonry or pipe, or execution of any required work for the complete construction of the project.

F. The flow in storm drains, gutters, or water courses encountered during the construction shall be adequately provided for by the Contractor to ensure these flows do not interfere with the execution of the work, and are maintained in such a manner as to ensure continuity of flow at all times in accordance with the Fulton County Erosion and Sediment Control Ordinance.

G. Unless otherwise permitted, ground water encountered within the limits of excavation shall be depressed to an elevation not less than twelve (12) inches below the bottom of such excavation.

1. This depression is to be performed before pipe laying or concrete work is started and shall be so maintained until concrete and joint materials have attained initial set.

H. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.

I. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

J. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump.

1. Sump depth shall be at least two feet below the bottom of the trench.
2. Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench.
3. Pumps shall be a type such that intermittent flows can be discharged.
4. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.

K. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom.

1. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks.
2. The casing, 6 to 10 inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

L. Should sewage or any other odorous liquids be encountered during the work in the excavation, the Owner shall be immediately notified.

1. The Owner will then determine if actions by the Contractor have caused the source of the odorous liquids to leak and will promptly notify the appropriate regulatory agencies, if necessary.
2. In addition, the Owner will instruct the Contractor as to what actions, if any, the Contractor can and cannot perform prior to any directives which may be issued by the regulatory agencies.
3. Any sewage shall be pumped and hauled to a manhole, pump station, or water reclamation facility, as directed
4. Any other liquids will be properly disposed of as directed by the Construction Manager and/or any regulatory agencies having jurisdiction.

3.05. TRENCH FOUNDATION AND STABILIZATION

A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.

B. Where foundation conditions are such that proper bedding cannot be provided, the Contractor may be directed by the Construction Manager to provide foundation cushion, concrete cradles, or other special provisions as may be required for the proper support of the pipe.

C. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Owner shall then authorize payment for trench stabilization.

D. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Construction Manager, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone as directed by the Construction Manager.

E. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom.

1. Place filter fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching and pipe have been placed at the proper grade.
2. The ends of the filter fabric shall be overlapped by one foot above the pipe.

F. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06. BEDDING AND HAUNCHING

A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.

1. Bottoms of trenches in earth must be shaped or molded and compacted to the contour of the outside of the pipe, using bedding materials, as directed, or where indicated on the Drawings, to give full support to the lower segment of the pipe and so that the pipe is firmly supported in the excavation throughout its entire length.
2. This shall be performed in such a manner as to prevent any subsequent settlement of the pipe.
3. Boulders or loose rock which might bear against the pipe will not be permitted in the trench bottom, or in the initial backfill within twelve (12) inches above the top of the pipe.
4. Bottoms of excavations which are of loose granular soils shall be compacted by vibratory compactor prior to laying of pipe.

B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation.

1. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings.
2. Bedding shall be carefully placed along the full width of the trench so that the pipe is true to line and grade of the pipe barrel.
    a. As used herein “carefully placed” means material that has been spaded or shovel-sliced so that the material fills and supports the haunch area and encases pipe to the limits specified herein.
    b. Bedding material shall be carried up the sides of the pipe to the heights shown for the various classes of bedding.
3. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe.
4. Adjustment to grade line shall be made by scraping away or filling with bedding material.
    a. Wedging or blocking up of pipe will not be permitted.
    b. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade will not be permitted.
5. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.

C. At each joint, bell holes shall be provided in all classes of bedding.

1. Excavate bell holes of ample depth and width to permit the joint to be assembled properly but small enough to ensure that support is provided throughout the length of pipe barrel to relieve the pipe bell of any load.

D. After the pipe section is properly placed, add the haunching material to the specified depth.

1. The haunching material shall be shoveled, sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole.

2. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.

E. Bedding

1. Class “A” (Bedding Factor - 2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.

2. Class “B” (Bedding Factor - 1.9): Class ‘B’ Bedding shall be installed by first undercutting the trench an adequate amount to provide bedding underneath the pipe bell as indicated. The trench shall then be brought to grade with compacted #57 Stone Coarse Aggregate placed the full width of the trench, as excavated. Haunching material shall then be carefully placed by hand and compacted to provide full support under the pipe barrel up to Centerline. At a minimum, Class ‘B’ Bedding shall be used for PVC and HDPE pipes.

3. Class “C” (Bedding Factor - 1.5): Class ‘C’ Bedding shall be installed by first undercutting the trench an adequate amount to provide bedding underneath the pipe bell as indicated. The trench shall then be brought to grade with compacted #57 Stone Coarse Aggregate placed the full width of the trench, as excavated. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel. At a minimum, Class ‘C’ Bedding shall be used for DIP.

4. Type 5: Type 5 Bedding shall be installed by first undercutting the trench an adequate amount to provide bedding underneath the pipe bell as indicated. The trench shall then be brought to grade with compacted #57 Stone Coarse Aggregate placed the full width of the trench, as excavated before installing pipe. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the top of the pipe barrel.

5. Groundwater Flow Dams may be required under certain conditions.

a. If there is a large volume of groundwater which might follow the crushed stone bedding downhill and due to the elevations involved, might build adequate pressure to create problems, flow dams will be required.

b. Flow dams consist of red clay bedding typically about three feet long and spaced about 100 feet along pipeline.

F. Excessive Width and Depth

1. If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor.

2. Crushed stone haunching and initial backfill may be used in lieu of Class "A" bedding, where Class "A" bedding is necessitated by excessive trench width.

3. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

G. Compaction: Bedding and haunching materials under pipe and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.07. BACKFILLING – GENERAL

A. Backfilling shall include initial and final backfilling, re-grading of grounds, restoration of surface and sub-surface materials and structures, including resurfacing of paved areas damaged by the Contractor.

B. Backfilling shall not be performed in freezing weather (below 32°F) except by permission of the Construction Manager and shall not be performed with frozen material or upon frozen materials.

C. All backfilling shall be left with smooth, even surfaces, free of rock on the surface, properly graded and shall be maintained in this condition until final completion and acceptance of the Work.

D. Where directed by the Construction Manager, the backfill shall be mounded slightly above the adjacent ground to allow for settlement.

E. Except as otherwise specified or directed, all forms, bracing, and lumber shall be removed before backfilling.

3.08. BACKFILLING – INITIAL BACKFILL

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.

B. Initial backfilling must be performed properly and before any filling is deposited in large quantities from a machine bucket or other vehicle.

C. Initial backfill material over PVC and HDPE pipes shall be free of rocks larger than two (2) inches in the largest dimension. Initial backfill material over DIP pipe shall be free of rocks larger than four (4) inches in the largest dimension.

D. During initial backfill, dumping from a bucket will not be allowed to fall from a height of more than one foot upon a pipe, and in all cases the bucket must be lowered so that the shock of the falling earth will not injure the pipe or structure.

E. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe barrel.

1. Layer depths shall be a maximum of 6 inches for pipe 18 inches in diameter and smaller and a maximum of 12 inches for pipe larger than 18 inches in diameter.

F. Carefully and thoroughly consolidate initial backfill in trenches where pipe has been laid, by tamping simultaneously on both sides of the pipe to prevent side pressures.

1. Compact each layer thoroughly with suitable hand tools or tamping equipment.
2. This backfilling and compacting must be performed before any backfill material is deposited directly from a machine bucket, loaders, trucks, or other mechanical equipment.
3. When utilizing a machine bucket for backfilling, the bucket must be lowered into the trench to deposit the material in such a manner as to avoid the shock of falling earth which could injure or damage the pipe or structure.
4. Under no circumstances should the material be allowed to fall from the machine or loader bucket directly onto the pipe in the trench.

G. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.

H. Only after the initial backfill has been placed to a point 18 inches above the top of the pipe, may work proceed in placing the final backfill, which must be carefully placed and compacted by tamping.

3.09. BACKFILLING – FINAL BACKFILL

A. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In 6-inch layers, if using light power tamping equipment, such as a “jumping jack”.
2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.
3. In 24-inch layers, if using a hydra-hammer.

B. Backfill carefully to restore the ground surface to its original condition.

C. All precautions must be taken to avoid having any unincorporated material which may result in future settlement in these areas. Compaction shall be accomplished by approved mechanical tampers

D. The top 6 inches shall be topsoil obtained as specified in “Trench Excavation” of this Section.

E. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Construction Manager.

1. Surplus soil may be neatly distributed and spread over the site, if approved by the Construction Manager.
2. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns.
3. Surplus rock from the trenching operations shall be removed from the site.

F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

G. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.

H. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

I. All backfilling shall be left with smooth, even surfaces, properly graded, and shall be maintained in such condition until final completion and acceptance of the work, notwithstanding applicable warranty periods.

J. Where directed by Construction Manager, the Contractor shall mound the backfill slightly above the adjacent ground to allow for settlement.

3.10. CONCRETE ENCASEMENT FOR PIPELINES

A. Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6 inches clearance from the bell of the pipe.

B. Lay the pipe to line and grade on concrete blocks.

C. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 12-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.11. ADDITIONAL MATERIAL

A. Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings.

1. Utilize excess material excavated from the trench, if the material is suitable.
2. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material at no cost to the Owner.

B. When acceptable excess material is not available from other parts of the Project for backfill, required fills, embankments, etc., the Contractor shall obtain the necessary "borrow" material at locations off the site of the work.

C, If the Construction Manager determines the original excavated material is unsuitable for use as backfill, such as perishable matter, refuse, building materials, wire, brush, stumps, ashes, large stones, mulch, or other soft materials, the Contractor shall properly dispose of the objectionable materials, and shall furnish, haul, and place borrow material suitable for proper backfill.

D. Locating such acceptable "borrow" sites shall be the sole responsibility of the Contractor. All materials to be used as borrow shall be approved by the Construction Manager.

3.12. BACKFILL UNDER ROADS

A. Final backfill material under roadways and other paved areas shall be compacted to a density of not less than 95 percent of maximum dry density as determined by ASTM D698 – Standard Proctor. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.

B. Final backfill material under non-paved areas within the road right-of-way shall be compacted to not less than 90 percent of maximum dry density as determined by ASTM D698.

C. Final backfill material in non-paved areas outside of road right-of-way shall be compacted to not less than 85 percent of maximum dry density as determined by ASTM D698 or as directed by the Construction Manager.

3.13. BACKFILL WITHIN GEORGIA DOT RIGHT-OF-WAY

A. Backfill within the Georgia DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

3.14. BACKFILL ALONG RESTRAINED JOINT PIPE

A. Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

3.15. BACKFILLING STRUCTURES

A. Backfilling of structures shall proceed as various structures or parts of structures are completed.

1. The Contractor shall refill the space outside and around the wall with material excavated from the site and stored for this purpose.

2. Immediately adjacent to the structure, the backfill material shall be placed in eight inch layers and compacted to avoid future settlement.

3. This filling shall be carried to such height as will bring the finished grade to the required elevations.

3.16. FLOWABLE FILL

A. Where flowable fill is required, excavate the trench to provide a minimum of 6 inches clearance on either side of the pipe barrel.

B. Lay the pipe to line and grade on solid concrete blocks or bricks.

C. In lieu of bedding, haunching and initial backfill, place flowable fill to the full width and depth of the trench.

D. Flowable fill shall be protected from freezing for a period of 36 hours after placement.

1. Minimum temperature of flowable fill at point of delivery shall be 50 degrees F.

E. The Contractor shall provide steel plates over flowable fill in road locations.

3.17. COMPACTED GRANULAR MATERIAL

A. Where compacted granular material is required as initial and final backfill material, it shall be placed after bedding and haunching material specified elsewhere has been placed.

B. Compacted granular material shall be compacted to a minimum 95 percent of the maximum dry density.

3.18. TRENCH SURFACE FINISH

A. Trenches cut in pavement on public roads or in areas that will become under pavement in proposed public roads (such as typical subdivision developments) shall be compacted in accordance with Fulton County Standard Details as applicable.

1. Such compaction shall be verified by an independent soils laboratory. The number, depth and location of such compaction test shall be as required by the Construction Manager.

a. Compaction tests will generally be required at approximately 400 foot intervals in existing roads and 800 foot intervals in proposed roads.

b. Compaction tests shall be performed at the Contractors' expense.

2. Trenches located perpendicular within existing public roads shall require an 8 inch thick concrete base course poured over the compacted backfill.

a. The concrete base course shall extend the full width of the trench cut plus a minimum of 12 inches on either side of the trench.

b. The existing pavement shall be neatly sawed along both sides of the trench.

c. The concrete used shall be a minimum 3,000 PSI high early strength concrete.

d. Once the concrete base course has properly set, the concrete surface shall be cleaned and a minimum 1-½ inch thick bituminous concrete pavement (to match existing pavement), shall be laid matching the level of the adjacent pavement.

B. Trenches cut in driveways or private parking areas shall require a minimum 6 inch thick, fully compacted, graded aggregate base.

1. The existing pavement shall be neatly sawed along both sides of the ditch.

2. Material of the same type and thickness shall be laid matching the level of the adjacent drive surface.

3. In restoring concrete drives, the base course shall be wetted prior to pouring new concrete.

4. Concrete used shall be 3,000 PSI high early strength.

C. Trenches cut through curbs and sidewalks shall be restored in such a manner as to conform in size, line, grade and materials with that adjoining.

1. In restoring curbs and sidewalks, entire slabs or squares shall be removed and replaced.

2. The subsoil and foundation material shall be well compacted.

3. The sub-base shall be thoroughly rolled or tamped and shall be wet just before the concrete is placed, but shall show no pools of water.

D. Should settlements, cracks, or other indications of failure appear in adjoining pavements, drives, curbs, or sidewalks, the adjoining surfaces shall be removed to the extent necessary to secure firm, undisturbed bearing and shall be re-laid in a satisfactory manner.

E. Trenches cut in non-paved areas shall be thoroughly compacted to a level 4 inches below ground surface.

1. All easements shall be adequately re-grassed to prevent soil erosion.

2. Natural topsoil at least 4 inches thick and of a good condition and tillable structure shall be placed atop the compacted trench backfill.

a. Topsoil shall be free of large stones, plant stumps, large roots, objectionable litter, or other substances potentially harmful to plant growth.

3. Grass seed shall be of a properly proportioned mixture approved for use in Zone Two, as detailed in the Georgia Department of Transportation Standard Specifications.

4. Whenever possible, replace existing grassed areas with grass of similar characteristics and appearance, meeting at a minimum, the specification requirements included herein.
5. All seeded areas shall be uniformly mulched immediately after seeding and within 10 days of construction work completion.
6. Sediment control measures must remain in place and be maintained until a comprehensive vegetative cover is established.

3.19. TESTING AND INSPECTION

A. The Owner may direct tests to be made to determine the density of the compacted material. Cost of the testing laboratory, fieldwork, and analysis shall be paid for by the Contractor.

B. When directed by the Owner, the Contractor shall arrange to have compaction tests conducted by an independent testing firm.

C. The soils testing laboratory is responsible for the following:

1. Compaction tests in accordance with Article 1.02 of this Section.
2. Field density tests for each two feet of lift, one test for each 1,000 feet of pipe installed or more frequently if ordered by the Construction Manager.
3. Inspecting and testing stripped site, subgrades and proposed fill materials.

D. The Contractor's duties relative to testing include:

1. Notifying laboratory of conditions requiring testing.
2. Coordinating with laboratory for field testing.
3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
4. Providing excavation as necessary for laboratory personnel to conduct tests.

E. Inspection

1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Construction Manager.

3.20 DISPOSAL OF MATERIAL

A. The Contractor shall be required to remove from the site of the work all earth in excess of that required to backfill the excavation or to create necessary fill.

B. This shall be performed immediately after the backfill is completed to the satisfaction of the Owner.

C. All material removed shall become the property of the Contractor and he shall make his own arrangements for its disposition.

D. All surplus material, shot rock, organics, clearing debris, stumps, and other such material deemed unfit for use as backfill, shall be disposed of by the Contractor, and shall be performed in such manner so as to give a minimum of inconvenience to the public.

E. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SCOPE

A. The Work specified in this Section consists of providing and maintaining temporary and permanent erosion and sedimentation controls as shown on the Drawings. This Section also specifies the subsequent removal of temporary erosion and sedimentation controls.

B. Temporary and permanent erosion and sedimentation controls include grassing and mulching of disturbed areas and structural barriers at those locations which will ensure that erosion during construction will be maintained within acceptable limits.

C. Acceptable limits are as established by the Georgia Erosion and Sedimentation Control Act of 1975, as amended, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations and laws of Federal, State, local and municipal authorities having jurisdiction.

D. Land disturbance activity shall not commence until the Land Disturbance Permit has been issued.

1.02 SUBMITTALS

A. Submit product data in accordance with the requirements of Section 01 33 23 of these Specifications.

1.03 QUALITY ASSURANCE

A. The temporary and permanent erosion and sedimentation control measures shown on the Drawings are minimum suggested requirements. Any additional erosion and sedimentation control measures required by the Contractor's means, methods, techniques and sequence of operation shall be installed by the Contractor at no additional cost to the Owner.

B. Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated in these Specifications. Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

C. Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Georgia Erosion and Sedimentation Control Act of 1975 as amended (OCGA §12-7-1, et. seq.), local ordinances, other permits, local enforcing agency guidelines and these Specifications.

D. Basic principles:

1. Coordinate the land disturbance activities to fit the topography, soil types and conditions.
2. Minimize the disturbed area and the duration of exposure to erosive elements.
3. Provide temporary or permanent stabilization to disturbed areas immediately after rough grading is complete.
4. Safely convey run-off from the site to a stable outlet to prevent flooding and damage to downstream facilities resulting from increased runoff from the site.
5. Retain sediment on-site that was generated on-site.
6. Minimize encroachment upon watercourses.

E. Implementation:

1. The Contractor is solely responsible for the control of erosion within the Project site and the prevention of sedimentation from leaving the Project site or entering waterways.
2. The Contractor shall install temporary and permanent erosion and sedimentation controls which will ensure that runoff from the disturbed area of the Project site shall pass through a filter system before exiting the Project site.
3. The Contractor shall provide temporary and permanent erosion and sedimentation control measures to prevent silt and sediment from entering the waterways and designated wetland areas. The Contractor shall maintain an undisturbed vegetative buffer a minimum of 25 feet from the top of the bank.
4. The Contractor shall limit land disturbance activity to those areas shown on the Drawings.
5. The Contractor shall maintain erosion and sedimentation control measures within disturbed areas on the entire site until the final acceptance of the Project at no additional cost to the Owner.
6. Maintenance shall include mulching, re-seeding, clean-out of sediment barriers and sediment ponds, replacement of washed-out or undermined rip rap and erosion control materials, to the satisfaction of the Owner and Construction Manager.
7. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.

PART 2 – PRODUCTS

2.01 SEDIMENT BARRIER

A. Silt fence:

1. Type NS silt fence shall meet the requirements of Section 171 of the Georgia Department of Transportation Standard Specifications, latest edition.
2. Type S Silt Fence is a combination of Type NS silt Fence with woven wire reinforcement. Type NS Silt Fence reinforcement shall meet the requirements of Section 171 of Georgia D.O.T. Specifications, latest edition.
3. Silt fence fabric shall be an approved product on the Georgia DOT Qualified Product List No. 36, latest edition.

B. Hay Bales: Hay bales shall be clean, seed-free cereal hay, rectangular in shape, and contain five cubic feet or more of material. Hay bales shall be bound with wire or nylon to securely contain the material.

1. Pine straw bales may be used in lieu of hay bales.
2. Bales shall be placed in a single row, lengthwise, on the contour and embedded in the soil to a depth of four (4) inches.
3. Bales must be securely anchored in place by stake or bars driven through the bales.

C. Concrete Blocks: Concrete blocks shall be hollow, non-load-bearing type.

2.02 CONSTRUCTION EXIT STONE

A. Use sound, tough, durable stone resistant to the action of air and water. Slabby or shaley pieces will not be acceptable.

B. Aggregate size shall be in accordance with the National Stone Association Size R-2 (1.5 to 3.5-inch stone) or Type 3 rip rap stone conforming to Section 805.01 of the Georgia Department of Transportation Standard Specifications.

2.03 RIP RAP

A. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and unless noted otherwise, stone rip rap shall be Type 1.

1. Type 1 Rip Rap: Rip rap size and gradation shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specification for Type 1 Stone Dumped Rip Rap.
2. Type 3 Rip Rap: Rip rap size and gradation shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specifications for Type 3 Stone Dumped Rip Rap.

B. Sand Cement Bag Rip Rap: Sand cement bag rip rap shall conform to the Georgia Department of Transportation Standard Specifications, Section 603.

2.04 GABIONS

A. Gabions shall be constructed of heavy galvanized steel wire mesh with a zinc coating of triple hexagon weave. The mesh wire diameter for the galvanized gabions shall be 2.2 mm (0.0866") + 2 1/2%; the mesh edge wire shall be not less than 2.7 mm – 2 1/2%. The lacing wire for binding the netting units together shall be 2.2 mm (0.0866") + 2 1/2%.

B. Geotextiles when used behind gabion structures shall be in accordance with AASHTO M288-96 Section 7.5, “Permanent Erosion Control Requirements.”

2.05 PLASTIC FILTER FABRIC

A. Plastic filter fabric shall conform to the Georgia Department of Transportation Standard Specifications, Section 881, for filter fabrics.

B. Plastic filter fabric shall be an approved product on the Georgia Department of Transportation Qualified Product List No. 28, latest edition.

C. Seams - Fabric may be sewn together with thread of a material having the same chemical requirements as the material forming the fabric or shall be bonded by cementing or by heat. The strength of the seams shall be equal to that of the unaged fabric. Fabrics to be used under riprap are allowed to be bonded or sewn together forming sections not less than 6 feet wide.

2.06 GRASSING

A. Grassing materials shall meet the requirements of the Georgia Department of Transportation Standard Specifications, latest edition; as shown in the table:

Material	Section No.
Topsoil	893.01
Seed and Sod	890
Fertilizer	891.01
Agricultural Lime	882.02
Mulch	893.02
Inoculants	893.04

B. Seed species shall be provided as shown on the Drawings.

C. Mulch Binder: Mulch on slopes exceeding 3 (horizontal) to 1 (vertical) shall be held in place by the use of a mulch binder, as approved by the Construction Manager. The mulch binder shall be non-toxic to plant and animal life and shall be approved by the Construction Manager.

D. Water: Water shall be free of excess and harmful chemicals, organisms, and substances which may be harmful to plant growth or obnoxious to traffic. Salt or brackish water shall not be used. Water shall be furnished by the Contractor.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor must utilize Best Management Practices to minimize siltation and erosion consistent with the Manual for Erosion and Sediment Control in Georgia.

B. Temporary and permanent erosion and sedimentation control measures shall prevent erosion and prevent sediment from exiting the site.

1. If, in the opinion of the Owner, Construction Manager or State inspector, the Contractor's temporary erosion and sedimentation control measures are inadequate, the Contractor shall provide additional maintenance for existing measures or additional devices to control erosion and sedimentation on the site at no additional cost to the Owner.

C. All erosion and sedimentation control devices and structures shall be inspected by the Contractor at least once a week and immediately after each rainfall occurrence. Any device or structure found to be damaged shall be repaired or replaced by the end of the day.

D. All erosion and sedimentation control measures and devices shall be constructed and maintained as indicated on the Drawings or specified herein until adequate permanent disturbed area stabilization has been provided and accepted by the Construction Manager.

E. Once adequate permanent stabilization has been provided and accepted by the Construction Manager, all temporary erosion and sedimentation control structures and devices shall be removed.

3.02 SEDIMENT CONTROL

A. Construction exit:

1. Construction exit(s) shall be placed as shown on the Drawings and as directed by the Construction Manager.

a. A construction exit shall be located at any point traffic will be leaving a disturbed area to a public right-of-way, street, alley, sidewalk or parking area.

b. The construction exit shall consist of a minimum of six (6) inch thick pad of aggregate as specified above and of the necessary length to accomplish the task for which it is intended.

2. Placement of Construction Exit Material: The ground surface upon which the construction exit material is to be placed shall be prepared to a smooth condition free from obstructions, depressions or debris.

a. Filter fabrics shall be required to keep the aggregate stone from becoming contaminated with subgrade soils and must be placed the full length and width of the entrance.

b. The plastic filter fabric shall be placed to provide a minimum number of overlaps and a minimum width of one foot of overlap at each joint.

c. The stone shall be placed with its top elevation conforming to the surrounding ground elevations. The stone shall be dropped from no more than a three feet height during construction.

3. Construction Exit Maintenance: The Contractor shall regularly maintain the exit with the top dressing of stone to prevent tracking or flow of soil onto public rights-of-way and paved surfaces as directed by the Construction Manager.

4. Construction Exit Removal: Construction exit(s) shall be removed and properly disposed of when the disturbed area has been properly stabilized, the tracking or flow of soil onto public rights-of-way or paved surfaces has ceased and as directed by the Construction Manager.

B. Sediment barriers:

1. Sediment barriers shall include, but are not necessarily limited to, silt fences, hay bales and any device which prevents sediment from exiting the disturbed area.

2. Silt fences and hay bales shall not be used in any flowing stream, creek or river.

3. Sediment barriers shall be installed as shown on the Drawings and as directed by the Construction Manager.

4. Sediment barriers shall be maintained to ensure the depth of impounded sediment is no more than one-half of the original height of the barrier or as directed by the Construction Manager.

5. Torn, damaged, destroyed or washed-out barriers shall be repaired, reinforced or replaced with new material and installed as shown on the Drawings and as directed by Construction Manager.

6. Accumulated sediment shall be removed from the barrier and the barrier replaced and stabilized on-site as directed by the Construction Manager.

7. Sediment barrier shall be removed once the disturbed area has been stabilized with a permanent vegetative cover and the sediment barrier is no longer required as directed by the Construction Manager.

8. All non-biodegradable parts of the barrier shall be disposed of properly.

9. The disturbed area created by barrier removal shall be permanently stabilized.

C. Sediment Boxes: All inlet grates shall be covered with sediment boxes during grading operations and shall remain so covered until all open areas are permanently stabilized against erosion.

D. Where construction dewatering pumps discharge, the water must be filtered to minimize stream siltation. As a minimum, filter fabrics or silting basins are required.

3.03 EROSION CONTROL

A. Rip rap

1. Rip rap shall be placed as shown on the Drawings and as directed by the Construction Manager.
   a. Rip rap shall be placed at all points where natural vegetation is disturbed on the banks of active streams.
   b. Compact backfill and place rip rap to prevent subsequent settlement and erosion.
   c. This requirement applies equally to construction alongside a stream as well as crossing a stream or drainage ditch.
2. When trenching across a stream or drainage ditch, place rip rap over the entire disturbed area upstream and downstream of the trench excavation.
   a. Place rip rap across creek bottom, across creek banks, and extend rip rap placement five feet beyond the top of each creek bank.
3. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought to the correct lines and grades before placement is commenced.
   a. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers.
   b. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope.
   c. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly on the site.

4. Placement of Plastic Filter Fabric:

a. Plastic filter fabric shall be placed under all rip rap unless shown or specified otherwise.

b. Filter fabric shall not be placed under rip rap on stream or drainage ditch crossings.

c. The surface to receive filter fabric shall be prepared to a smooth condition free from obstructions, depressions and debris.

d. The filter fabric shall be installed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps.

e. The fabric shall be placed to provide a minimum width of one foot of overlap at each joint. The fabric shall be placed so that the upstream strip overlaps the downstream strip.

f. The fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3 inches of the centerline of the overlap.

g. The fabric shall be placed loosely to avoid stretching and tearing during placement of the stone.

h. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals, or other contaminants.

i. Contaminated fabric or fabric damaged during installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no additional cost to the Owner.

5. Placement of Rip Rap: Rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric.

a. Rip rap shall be placed with its top elevation conforming to the finished grade or the natural existing slope of the stream bank and stream bottom.

b. The stone shall be dropped from no more than a three foot height during construction.

c. Stone rip rap shall be placed to provide a uniform surface to the thickness shown on the Drawings.

d. The thickness tolerance for the course shall be –3 inches and +6 inches.

B. Grassing:

1. Temporary Stabilization: Temporary stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site.

a. Temporary stabilization shall be provided to any area that will not receive permanent stabilization within the next 14 calendar days.

b. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

2. Permanent Stabilization:

   a. Permanent stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site. Permanent stabilization shall be provided to all areas of land disturbance within seven calendar days of the completion of land disturbance for any area greater than 0.25 acre.

   b. Where permanent stabilization cannot be immediately established because of an inappropriate season, the Contractor shall provide temporary stabilization.

   c. The Contractor shall return to the site at the appropriate season to provide permanent stabilization in areas that received only temporary stabilization.

3. Grassing shall meet the requirements of Section 700 of the Georgia Department of Transportation Standard Specifications, latest edition, unless specified otherwise.

4. Seed rate, fertilization and other requirements shall be provided as shown on the Drawings.

3.04 CLEAN-UP

A. Dispose of all excess erosion and sedimentation control materials in a manner satisfactory to the Construction Manager.

B. Final clean-up shall be performed in accordance with the requirements of these Specifications and to the satisfaction of the Construction Manager.

END OF SECTION

SECTION 32 12 16

REMOVING AND REPLACING PAVEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. The work to be performed under this Section shall consist of removing and replacing existing pavement, sidewalks and curbs in paved areas where necessary for construction of utilities and all other sewer appurtenances and structures.

B. Existing pavement, sidewalks and curbs shall be replaced to the current Fulton County standards or to match existing, whichever is more stringent.

1.02 SUBMITTALS

A. Certificates: Provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

B. Traffic paint manufacturer's application instructions and a description and other data relative to the Contractor's application equipment and methods shall be submitted to the Construction Manager for approval.

1.03 CONDITIONS

A. Weather Limitations

1. Apply bituminous prime and tack coats only when the ambient temperature has been at least 55^{o} F for 12 hours immediately prior to application.

2. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.

3. Construct asphaltic courses only when atmospheric temperature in the shade is above 40^{o} F, when the underlying base is dry and when weather is not rainy.

4. Place base course when air temperature is above 35^{o} F and rising.

B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

PART 2 – PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Graded Aggregate Base Course: Graded aggregate base course shall be of uniform quality throughout and shall meet the requirements of Section 815.01 of the Georgia Department of Transportation Standard Specifications.

B. Black Base: Black base course shall be of uniform quality throughout and shall conform to the requirements of Section 828 of the Georgia Department of Transportation Standard Specifications.

C. Binder Course: The binder course of all paved roadways shall conform to the requirements of Section 400, 12.5 mm Superpave of the Georgia Department of Transportation Standard Specifications.

D. Surface Course: The surface course for all pavement, including prime or tack coat when required by the Construction Manager, shall conform to the requirements of Section 400, 9.5 mm Superpave of the Georgia Department of Transportation Standard Specifications

E. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the Georgia Department of Transportation Standard Specifications, Section 430. Concrete shall be of the strength classifications shown on the Drawings.

F. Special Surfaces: Where driveways or roadways constructed of specialty type surfaces such as brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

2.02 TYPES OF PAVEMENTS

A. General:

1. All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Construction Manager.

2. Materials, equipment and construction methods used for paving work shall conform to the Georgia Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.

B. Aggregate Base:

1. Aggregate base shall be constructed in accordance with the requirements of Section 310 of the Georgia Department of Transportation Standard Specifications.
2. The maximum thickness to be laid in a single course shall be 6 inches compacted. If the design thickness of the base is more than 6 inches, it shall be constructed in two or more courses of approximate equal thickness.
3. After the material placed has been shaped to line, grade and cross-section, it shall be rolled until the course has been uniformly compacted to at least 100 percent of the maximum dry density when Group 2 aggregate is used, or to at least 98 percent of maximum dry density when Group 1 aggregate is used.

C. Concrete Pavement:

1. Concrete pavement or base courses shall be replaced with concrete.
2. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement.
3. The surface of the replaced concrete base course shall be left rough.
4. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick.
5. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed.
6. Concrete pavements or concrete base courses shall be reinforced.

D. Asphaltic Concrete Base, Binder and Surface Course:

1. Asphaltic concrete base, binder and surface course construction shall conform to Georgia Department of Transportation Standard Specifications, Section 400.
2. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry and the tack coat has been applied.
3. Apply and compact the base in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Construction Manager.
4. After compaction, the black base shall be smooth and true to established profiles and sections.
5. Apply and compact binder and the surface course in a manner approved by the Construction Manager.
6. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

E. Surface Treatment Pavement:

1. Bituminous penetration surface treatment pavement shall be replaced with a minimum thickness of 1 inch conforming to Section 424, Georgia Department of Transportation Standard Specifications.

F. Gravel Surfaces:

1. Existing gravel road, drive and parking area replacement shall meet the requirements of graded aggregate base course.

2. This surfacing may be authorized by the Construction Manager as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.

G. Temporary Measures:

1. During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement.

2. The backfill above the pipe shall be compacted, as specified, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

PART 3 – EXECUTION

3.01 LOCATIONS FOR PAVEMENT REPLACEMENT

A. Pavement shall be removed and replaced with similar type and thickness as the original pavement, for the entire length of pipe laying and up to required trench width as per details shown on the Drawings.

3.02 REMOVING PAVEMENT

A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.

B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.

C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.

D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.

E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

F. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

G. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

H. Cutting: Before removing any existing pavement, saw cut the pavement in full thickness.

3.03 REPLACING PAVEMENT

A. Preparation of Subgrade: Upon completion of backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by the Construction Manager. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.

1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure.

2. After the installation of the pipelines and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Drawings, shall be done immediately prior to replacing the pavement.

3. Trench backfill shall be compacted for the full depth of the trench as specified in Section 31 23 00 of these Specifications.

4. Temporary trench backfill along streets and driveways shall include 6 inches of crushed stone or cherty clay as a temporary surfacing of the trenches.

a. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the Construction Manager and permission is granted to replace the street pavement.

5. When temporary crushed stone or chert surface is considered by the Construction Manager to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.

B. Pavement Replacement

1. Prior to replacing pavement, make a final cut in concrete pavement 12 inches back from the edge of the damaged pavement with a concrete saw.

2. Remove asphalt pavement 12 inches back from the edge of the damaged pavement using pavement shearing equipment, jack hammers or other suitable tools.

a. Pavement cuts shall be parallel or perpendicular to the road centerline as much as practical.

b. On parallel installations the final cut shall be long and straight and consistent.

3. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.

4. If the temporary crushed stone or chert surface is to be replaced, the top 6 inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.

5. Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.

6. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Drawings.

   a. All edges of the existing pavement shall be cut to a straight, vertical edge.

   b. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street.

   c. Concrete base slabs and crushed stone bases, if required, shall be placed and allowed to cure for three days before bituminous concrete surface courses are applied.

   d. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.

7. Where driveways or roadways, constructed of specialty type surfaces, such as brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials.

   a. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition.

   b. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

C. Pavement Resurfacing:

1. Certain areas to be resurfaced are specified or noted on the Drawings.

   a. After all pipe line installations are complete and existing pavement has been removed and the trench route has been repaired, mill entire area to be resurfaced 1-1/2 inches, then apply tack coat and 1-1/2 inches of 9.5 mm Superpave surface course as specified.

   b. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement

material and fill the hole with black base, as specified, to the level of the existing pavement.

2. Resurfacing limits shall be perpendicular to the road centerline.

3. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.

D. Pavement Striping:

1. Pavement striping removed or paved over shall be replaced with the same type, dimension and material as original unless directed otherwise by the Construction Manager.

3.04 SIDEWALK AND CURB REPLACEMENT

A. Construction

1. All concrete sidewalks and curbs shall be replaced with concrete.

2. The Contractor shall restore all curbs and combination curbs and gutters which have been removed or disturbed in the progress of the work. Curbing shall be made to conform accurately in size, line, grade and materials with the adjoining curb.

3. The Contractor shall restore all sidewalks which have been removed or disturbed in the progress of the work.

   a. Sidewalks shall be constructed to the same dimensions and materials as the adjoining sections.

   b. Where necessary to cut a sidewalk, entire sections shall be removed and replaced unless otherwise directed by the Construction Manager.

4. Preformed joints shall be 1/2 inch thick, conforming to the latest edition of AASHTO M59 for sidewalks and AASHTO M 123 for curbs.

5. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.

6. Forms for curbs shall be metal and of an approved section.

   a. They shall be straight and free from distortions, showing no vertical variation greater than 1/8 inch in 10 feet and no lateral variation greater than 1/4 inch in 10 feet from the true plain surface on the vertical face of the form.

   b. Forms shall be of the full depth of the structure and constructed such as to permit the inside forms to be securely fastened to the outside forms.

7. Wood forms may be used on sharp turns and for special sections as approved by the Construction Manager. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.

8. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.

B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab.

C. Existing concrete shall be cut along the nearest existing construction joints. If such joints do not exist, the cut shall be made at minimum distances shown on the Drawings.

D. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed.

E. Sidewalks shall have a minimum uniform thickness of 4-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.

F. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2 inches.

1. Subgrade shall be of such width as to permit the proper installation and bracing of the forms.
2. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material.
3. Place 2 inches of porous crushed stone under all sidewalks and curbs and compacted thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.

G. Joint for Curbs

1. Joints shall be constructed as indicated on the Drawings and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4 inch of their designated position.
2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.
3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.
4. Place contraction joints every 10 feet along the length of the curbs and gutters.
    a. Form contraction joints using steel templates or division plates which conform to the cross section of the structure.
    b. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place.

c. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint.

d. Contraction joints shall be a minimum of 1-1/2 inches deep.

H. Expansion joints shall be required to replace any removed expansion joints or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2 inch of the top of finished concrete surface.

I. Finishing

1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.

2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.

3. Finish edges with an approved finishing tool having a 1/4 inch radius.

4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.

5. The finished surface shall not vary more than 1/8 inch in 10 feet from the established grade.

3.05 RESTORING DRIVEWAY PAVEMENTS

A. The Contractor shall repair or replace all driveway sections disturbed by the process of the work.

1. Driveways shall be constructed of the same materials and to the same thickness of the adjoining wearing surface.

2. In restoring driveways, the subsoil and foundation material shall be well compacted so as to prevent any future settlement or cracking of the driveway pavement.

3. Where necessary to cut a concrete driveway, the cuts shall be made with a masonry saw providing a smooth, straight line completely across the driveway.

4. Partial cut-outs, crooked cuts or cuts made by any methods other than masonry saw are not permitted. In general, where directed, concrete slab removal shall be made in entire pavement sections to the nearest existing expansion-joint.

B. Driveway and Sidewalk Ramp Openings

1. Provide driveway openings of the widths and at the locations indicated on the Drawings and as directed by the Construction Manager.

2. Provide sidewalk ramp openings as indicated on the Drawings in conformance with the applicable regulations and as directed by the Construction Manager.

C. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the Owner.

3.06 MAINTENANCE

A. The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project.

1. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Construction Manager.

2. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.07 SUPERVISION AND APPROVAL

A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.

B. Obtain the Construction Manager's approval of restoration of pavement, such as private roads and drives, that are not the responsibility of a regulatory agency.

C. Complete pavement restoration as soon as possible after backfilling.

D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

3.08 CLEANING

A. The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition. The right-of-way shall be restored to its original condition.

END OF SECTION

SECTION 32 92 10

TREE REMOVAL AND PROTECTION

PART 1 – GENERAL

1.01 SCOPE

A. The work specified in this Section includes furnishing all labor, equipment and material required to locate, identify, verify condition and remove or protect existing trees as shown on the Drawings and/or as directed by the Construction Manager.

B. The Contractor shall install orange tree protection fencing (barrier) around each tree to be protected, as shown on the Drawings and as ordered by the Construction Manager.

C. No trees or vegetation shall be removed except as specifically exempted or approved by the Construction Manager.

1.02 REFERENCE

A. "Trenching and Tunneling near Trees," by James R. Fazio. Published by the National Arbor Day Foundation.

B. "Tree Preservation Ordinance and Administrative Guide Lines," Fulton County, latest edition.

1.03 QUALIFICATIONS

A. Contractor shall have on staff for the project at least one person with a minimum of 5 years' experience as nurseryman in planting and protecting trees.

1.04 SUBMITTALS

A. Contractor shall walk the site with local City's Arborist, to understand (in more detail than shown on the Drawings) the scope and requirements of tree protection for this Project.

B. Prepare a Tree Protection Work Plan describing how tree protection will be handled during installation of the water lines. The Work Plan shall include, but is not limited to:

1. Confirmation of identification of specimen trees (shown on the Drawings) and other trees to be protected.
2. Scope of general protection of trees within right-of-ways and along the sewer line trench alignment.
3. Determination of drip line limits of protected trees and approximate free bore lengths.

4. Scope of general protection of trees outside right-of-ways but in close proximity to work areas.
5. Extent of approved or required tree limb cutting and trimming to make space for work area.
6. Extent of approved or required tree root cutting, if necessary within trench area.
7. Confirmation of the type of protective fencing, other protective measures as required, and installation details.

C. Contractor shall submit five copies of the Tree Protection Work Plan to the Construction Manager for approval. Contractor shall not begin any field activity prior to approval of this Work Plan by the Construction Manager and City Arborist.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. Protective Fencing

1. Orange Safety Fencing: Minimum 4 feet in width and shall be made of high density polyethylene resin, extruded and stretched to provide a highly visible bright orange, non-fading fence.
   a. The fabric shall remain flexible from -60° F to 200° F and shall be inert to most chemicals and acids.
   b. The fabric pattern may vary from diamond to circular with a minimum unit weight of 0.4 lbs. and a maximum opening size of 2 inches.
   c. The fabric shall have minimum tensile yield strength (horizontal) of 2,000 psi and ultimate tensile strength of 2,680 psi.
2. The fencing material shall be supported by steel pipe tee posts or U posts, that are minimum 5 ½ feet in height and spaced no more than 8 feet on centers. The fabric shall be secured to post by bands or wire ties.

B. Warning Signs: A weather proof warning sign shall be prominently displayed on each tree protection fence at 20-foot intervals. The sign shall be minimum 8.5-inches X 11-inches and clearly state in half inch tall letters: “Warning – Tree Protection Zone”.

C. Silt Fence (Type S): Silt fence shall be installed 2 feet from the outside of the tree protection fence where required or directed by the Construction Manager and City Arborist.

D. Trunk Protection: When directed by the City Arborist, the tree trunk protection shall be provided using either 2x4-inch or 2x6-inch planking or plastic strapping.

E. Tree Dressing: Dressing of any damaged areas shall be accomplished using any approved asphaltic tree wound paint immediately after damage occurs.

PART 3 – EXECUTION

3.01 EXECUTION

A. Protective Fencing:

1. All trees and shrubs in the proximity of the construction site shall be carefully checked for damage prior to initiation of any construction activity.
2. All individual trees, shrubs and natural areas scheduled for preservation shall be protected during construction with temporary fencing as indicated on the Drawings or directed by the City Arborist.
3. Protective fences shall be installed prior to the start of any site preparation work (clearing, grubbing or grading) and shall be maintained in functioning condition throughout all phases of the construction project.
4. Protective fence locations in close proximity to intersecting streets or drives shall adhere to the site distance requirements.

B. Protective fences shall be constructed around trees to be protected, at the locations (typically the outer limits of the Critical Root Zone) and with materials indicated on the Drawings to prevent the following:

1. Soil compaction in the root zone area resulting from vehicular traffic or storage of equipment or materials.
2. Root zone disturbances due to grade changes greater than 6-inch cut or fill or trenching not reviewed and authorized by the City Arborist or the Construction Manager.
3. Damage to exposed roots, trunks or limbs by mechanical equipment.
4. Other activities detrimental to trees such as chemical storage, concrete truck cleaning and fires.

C. Exceptions to the installation of protective fences at the tree drip lines may be permitted in the following cases:

1. Where there is to be an approved grade change, impermeable paving surface, tree well or other such site development, the fence shall be erected approximately 2 to 4 feet beyond the areas of disturbance.
2. When permeable paving is to be installed within a tree drip line, the fence shall be erected at the outer limits of the permeable paving area prior to any site grading so that this enclosed area is graded separately to minimize root damage.
3. When trees are located close to a proposed building or other construction activity, the fence shall be erected to allow 6 to 10 feet work space between the fence and the structure and apply organic mulch to a depth of 4 to 6 inches in the unprotected root zone area.
4. When there are street-side pedestrian walkways, fences shall be constructed in a manner that does not obstruct safe passage.

5. When there are severe space constraints due to tract size or other special requirements, the Contractor shall contact the Arborist or the Construction Manager to discuss alternatives.

6. When any of the exceptions listed above will result in a fence being located closer than five (5) feet to a tree trunk, the Contractor shall also protect the trunk with strapped-on planking to a height of 8 feet or to the limits of lower branching in addition to the reduced fencing required.

D. Repair of Damage:

1. Tree roots scarred by equipment shall be cut cleanly and covered with topsoil.

2. When tree roots are pruned, a comparable portion of selected branches shall be cut from the tree on the opposite side.

3. Limb pruning shall be made at the branch collar. All limbs greater than 1-inch in diameter shall be precut in accordance with ANSI 300 pruning methods to prevent splitting.

4. All cut limbs shall be treated with an approved tree dressing. Tools shall be disinfected with alcohol or 5 ppm chlorine solution between repairs to trees to prevent the transmission of diseases from one tree to another.

5. All trees damaged during construction shall receive an application of fertilizer within the drip line at the rate of 4 pounds per caliper inch.

E. Cutting and Filling Around Trees:

1. When the depth of an excavation or embankment exceeds 6 inches of any tree with a diameter greater than 8 inches, a tree well shall be constructed to protect the tree.

F. Free Bore:

1. Where a pipe is to be installed within critical root zone (CRZ) and inside drip line area, installation of the pipe by free bore method is required to protect trees.

2. The length of free bore shall extend a minimum of five feet beyond drip line on both sides or as recommended length in the table provided on the Drawings, whichever is greater. The depth of free bore shall be such that there is a minimum of 4 feet of cover on top of pipe.

3. The location and procedures shall be approved by the Construction Manager and City Arborist.

G. Paving Around Trees:

1. Where paving within the drip line of any tree greater than a 6 inch diameter is necessary, a permeable pavement and aeration system must be installed except for street construction.

H. Tree Removal:

1. Trees which directly interfere with construction may only be removed if approval of the Construction Project Manager and City Arborist has been obtained.
2. When a tree or shrub is scheduled for removal, it shall be cut to a depth of 12 inches below the surrounding ground line.
3. After removal, soil shall be placed in the hole to a depth matching the existing grade.
4. The tree shall be cut into sections that can be managed, removed from the site and disposed of.
5. All work shall be conducted in such a manner as to protect all facilities, improvements and vegetation in the work area. All damage resulting from tree removal or pruning shall be repaired at the Contractor's own expense.

I. Final Cleanup:

1. All temporary tree and shrub preservation and protection measures shall be removed when the construction has been completed.

J. Roots larger than 2-inch diameter shall not be cut without written permission from the City Arborist.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 – GENERAL

1.01 SCOPE

A. The work covered by this Section consists of furnishing all labor, equipment and material required to place topsoil, seed, commercial fertilizer, agricultural limestone and mulch material, including seedbed preparation, harrowing, compacting and other placement operations on graded earthen areas as described herein and/or shown on the Drawings.

B. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement or sidewalks, all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces.

C. Areas disturbed by borrow activities shall also be seeded according to these Specifications.

D. The work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion.

E. Temporary seeding shall be performed at the times and locations as directed by the Construction Manager.

F. All work shall in accordance with the Manual for Erosion and Sediment Control in Georgia, latest edition.

1.02 QUALITY ASSURANCE

A. Prior to seeding operations, the Contractor shall furnish to the Construction Manager labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished.

B. Acceptance of the seed test reports shall not relieve the Contractor of any responsibility or liability for furnishing seed meeting the requirements of this Section.

C. Prior to topsoil operations, the Contractor shall obtain representative samples and furnish soil test certificates including textural, pH, and organic analysis from the State University Agricultural Extension Services or other certified testing laboratory.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. All materials shall conform to the requirements and standards of this Section.

B. Wood-cellulose fiber mulch shall be manufactured by Weyerhaeuser Company or Conway Corporation.

2.02 TOPSOIL

A. Utilizing designated stockpiles or borrow areas on site, the Contractor shall place a minimum of 4-inches of topsoil over all graded earthen areas and over any other areas to be seeded.

1. Sources of topsoil shall be approved by the Construction Manager prior to disturbance.
2. Importing topsoil from offsite sources shall be at the discretion of the Construction Manager and shall be justification for additional compensation to the Contractor.
3. A change order properly authorized by the Owner shall be agreed upon prior to importing offsite topsoil. No additional compensation will be allowed for spreading of topsoil.

B. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips or other undesirable material harmful or unnecessary to plant growth.

C. Topsoil shall be reasonably free from perennial weeds and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.

D. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam or a combination thereof. The pH shall range from 5.5 to 7.0.

E. Topsoil shall contain not less than five percent nor more than 20 percent, by weight, of organic matter as determined by loss on ignition of oven-dried samples to 65 degrees C.

2.03 SEED

A. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.

B. All seeds shall be from the last crop available at time of purchase and shall not be moldy, wet or otherwise damaged in transit or storage.

C. Seed shall bear the growers analysis testing to 98 percent for purity and 90 percent for germination. At the discretion of the Construction Manager, samples of seed may be taken for verification against the grower's analysis.

D. Species, rate of seeding, fertilization and other requirements are shown on Table 1.

2.04 FERTILIZER AND LIMING MATERIALS

A. Fertilizer and liming materials shall comply with applicable state, local and federal laws concerned with their production and use.

B. Commercial fertilizer shall be a ready mixed material equivalent to the grade or grades specified in Table 1. Container bags shall have the name and address of the manufacturer, the brand name, net weight and chemical composition.

C. Agricultural limestone shall be a pulverized dolomitic limestone having a calcium carbonate content of not less than 85 percent by weight. Agricultural limestone shall be crushed so that at least 85 percent of the material will pass a No. 10 mesh screen and 50 percent will pass a No. 40 mesh screen.

2.05 MULCH MATERIAL

A. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.

B. Mulch shall be composed of wood cellulose fiber, straw or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.

C. Straw mulch shall be partially decomposed stalks of wheat, rye, oats or other approved grain crops.

D. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum or other approved standing field crops.

2.06 MULCH BINDER

A. Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life and shall be acceptable to the Construction Manager.

B. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977. Cutback asphalt binder shall be Grade RC 70 or RC 250.

2.07 LEGUMES

A. All leguminous seed shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

2.08 WATER

A. Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

PART 3 – EXECUTION

3.01 SECURING AND PLACING TOPSOIL

A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of the depth approved by the Construction Manager.

B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed, the product will be homogeneous in nature and will conform to the requirements of these Specifications.

C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other refuse which will hinder or prevent growth.

D. In securing topsoil from a designated pit or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil or if required by the Construction Manager, the pit shall be abandoned.

E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed, unless otherwise approved by the Construction

F. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.02 SEEDBED PREPARATION

A. Before fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line from unsightly variation, bumps, ridges and depressions and all detrimental material, roots and stones larger than 3-inches in any dimension shall be removed from the soil.

B. No earlier than 24 hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 4-inches with a weighted disc, tiller, pulvimixer or other equipment, until the surface is smooth and in a condition acceptable to the Construction Manager.

C. If the prepared surface becomes eroded as a result of rain or for any other reasons, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.

D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition, as determined by the Construction Manager.

3.03 FERTILIZATION AND LIMING

A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown on Table 1.

B. Fertilizer shall be spread evenly over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of 1-inch.

C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.

D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates shown on Drawings.

1. The specified rate of application of limestone may be reduced by the Construction Manager if pH tests indicate this to be desirable.

2. It is the responsibility of the Contractor to obtain such tests and submit the results to the Construction Manager for adjustment in rates.

E. It is the responsibility of the Contractor to make one application of a maintenance fertilizer according to the recommendations listed in Table 1.

3.04 SEEDING

A. Seed of the specified group shall be sown as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition.

B. Seeding shall be performed during the dates shown in Table 1 unless otherwise approved by the Construction Manager. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation.

C. Seed shall be uniformly sown by any approved mechanical method suitable for the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder or approved mechanical power drawn seed drills.

D. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained.

E. Care shall be taken to adjust the seeder for seeding at the proper rate before seeding operations are started and to maintain their adjustment during seeding.

Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.

F. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8 to 3/8-inch by a cultipacker or suitable roller.

G. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.

3.05 MULCHING

A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding.

B. The mulch shall be applied evenly so as to permit sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion and conserve soil moisture.

1. Approximately 45 percent of the ground shall be visible through the mulch blanket.

C. One of the following mulches shall be spread evenly over the seeded areas at the following application rates:

1. Wood Cellulose Fiber: 1,400 pounds/acre.
2. Straw: 4,000 pounds/acre.
3. Stalks: 4,000 pounds/acre.
4. These rates may be adjusted, at the discretion of the Construction Manager, depending on the texture and condition of the mulch material and the characteristics of the seeded area at no additional cost to the Owner.

D. Mulch on slopes greater than 3 to 1 ratio shall be held in place by the use of an approved mulch binder.

1. Binder shall be thoroughly mixed and applied with the mulch.
2. Emulsified asphalt or cutback asphalt shall be applied at the approximate rate of five gallons per 1,000 square feet as required to hold the mulch in place.

E. The Contractor shall cover structures, poles, fences and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.

F. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates in a manner acceptable to the Construction Manager.

3.06 WATERING

A. The Contractor shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain an adequate water content in the soil.

B. Watering shall be accomplished by hoses, tank truck or sprinklers in such a way to prevent erosion, excessive runoff and over-watered spots.

3.07 MAINTENANCE

A. Upon completion of seeding operations, the Contractor shall clear the area of all equipment, debris and excess material and the premises shall be left in a neat and orderly condition.

B. The Contractor shall maintain all seeded areas without additional payment until final acceptance of the work by the Owner, and any regrading, refertilizing, reliming, reseeding or remulching shall be done at Contractor's own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished.

C. Damage resulting from erosion, gulleys, washouts or other causes shall be repaired by filling with topsoil, compacting and repeating the seeding work at Contractor's expense.

TABLE 1

SEEDING REQUIREMENTS

Sowing Season	Species	Rates per 1,000 Square Feet		
		Seed	Fertilizer	Lime
3/15 - 8/14	Common Bermuda (hulled) (Giant Bermuda Seed, including NK-37 is not acceptable) Annual Ryegrass	2lbs. 2 lbs.	35 lbs. 6-12-12	25 lbs.
	Total	4 lbs.		
8/15 - 3/14	Common Bermuda (unhulled) Annual Ryegrass	2lbs. 2 lbs.	45 lbs. 6-12-12	25 lbs.
	Total	4 lbs.		

END OF SECTION

SECTION 32 92 23

SODDING

PART 1 – GENERAL

1.01 SCOPE

A. Sodding shall consist of establishing certain critical areas with sod as designated on the Drawings.

PART 2 – PRODUCTS

2.01 SOD

A. Sod shall consist of a live, dense, well-rooted growth of turf grass species as noted on the Drawings.

B. The sod shall be free from Johnson grass, nut grass and other obnoxious grasses and shall be of suitable character for the purpose intended and for the soil in which it is to be planted.

C. It shall be un-injured at the time of planting.

D. Sod shall be uniform in thickness, having not over 2-inches or less than 1-inch of soil.

E. Sod strips shall have a consistent width of 12 or 18-inches.

2.02 FERTILIZER

A. Fertilizer (10-10-10) used in connection with sodding, shall contain 10 percent nitrogen, 10 percent phosphoric acid and 10 percent potash. The fertilizer shall be furnished in standard containers with the name, weight and guaranteed analysis of the contents clearly marked.

B. The containers shall ensure proper protection in handling and transporting the fertilizer. All commercial fertilizer shall comply with local, State and Federal fertilizer laws.

C. Ammonium nitrate shall be a standard commercial product, shall conform to the requirements for other commercial fertilizers as specified above and shall have a minimum of 32-1/2 percent nitrogen.

2.03 LIME

A. Agricultural limestone shall be dolomitic and contain not less than 85 percent of calcium carbonate and magnesium carbonate combined, and shall be crushed so

that at least 85 percent will pass a No.10 mesh sieve and 50 percent will pass a No. 40 mesh screen.

2.04 WEATHER LIMITATIONS

A. Sod shall be planted only when the soil is moist and favorable to growth. No planting shall be done between October 1 and April 1 unless weather and soil conditions are considered favorable and permission is granted by the Construction Manager.

PART 3 – EXECUTION

3.01 SODDING

A. The area to be sodded shall be constructed to the lines and grades indicated on the Drawings or as directed by the Construction Manager, and the surface loosened to a depth of not less than 3-inches with a rake or other device.

B. If necessary, it shall be sprinkled until saturated at least 1-inch in depth and kept moist until the sod is place thereon.

C. Immediately before placing the sod, the fertilizer shall be uniformly applied at the rate of 12 pounds of Grade 10-10-10, or equivalent, per 1,000 square feet. Agricultural limestone shall be applied at the rate of 50 pounds per 1,000 square feet.

D. The entire area shall be thoroughly covered with sod. The sod shall be placed on the prepared surface with the edges in close contact and, as far as possible, with staggered joints.

E. The sod shall be maintained moist from time of removal until reset but shall be placed as soon as practicable after removal from place where growing.

F. Immediately after placing it shall be rolled with a light-weight roller or hand tamped to the satisfaction of the Construction Manager.

G. Sod on slopes steeper than 3 to 1 shall be held in place by wooden pins about 1-inch square and 6-inches long, driven through the sod into the soil until they are flush with the top of the sod.

3.02 WATERING AND MAINTENANCE

A. The sod shall be watered as directed by the Construction Manager for a period of two weeks after which ammonium nitrate shall be applied at the rate of three pounds per 1,000 square feet and the sod given a final watering.

B. The Contractor shall not allow any equipment or material to be placed on any planted area and shall erect suitable barricades and guards to prevent Contractor's equipment, labor or the public from traveling on or over any area planted with sod.

C. It shall be the obligation of the Contractor to secure a satisfactory growth of grass before final acceptance of the Project.

END OF SECTION

SECTION 33 01 30.71

PIPE BURSTING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements to rehabilitate existing gravity sanitary sewers using a pipe bursting system.

B. The work also includes reconnection of existing sewer service house connections, connections to manholes, construction of drop manholes, television inspection of the polyethylene pipe and placing replacement pipelines into service in accordance with the Contract Documents.

C. Only pneumatically operated equipment with either front or rear expanders for the proper connection to the polyethylene pipe will be allowed for use.

1. Exception to this requirement will only be considered where a static burster unit is proposed for use on isolated segments of pipeline that are to be burst closely adjacent to building foundations or other sensitive structures and where pneumatic bursting might be detrimental.

2. The pneumatic burster must be used in conjunction with a constant tension hydraulic twin capstan winch of either 20, 10 or 5 tons, the size of the winch depends on the diameter of the pipe to be replaced.

3. In no case is the constant tension on the winch to exceed 20 tons.

D. Refer to Section 33 31 00, High Density Polyethylene (HDPE) Pipe and Fittings, for additional requirements.

1.02 DEFINITIONS

A. Pipe Bursting: Process of splitting or fracturing the host sewer main and forcing the fragments into the surrounding soil, for the purpose of inserting a replacement pipe of equal or larger diameter.

1. Accomplished by use of pneumatic, static or hydraulic bursting head, with pipe splitters as cutting wheels as needed.

2. Mole or bursting head is directionally guided by host sewer main and towed under tension by winch, chain or rod assembly.

3. Replacement pipe towed or jacked in immediately behind mole or bursting head.

B. Host Sewer Main: Existing pipeline subject to pipe bursting system, made of vitrified clay, asbestos cement, polyvinyl chloride (PVC), cast iron, ductile iron, concrete, steel or lined pipe.

C. Replacement Pipe: Pipe inserted into host sewer main by pipe bursting system.

D. Continuous Pipe: Pipe, such as High Density Polyethylene (HDPE) pipe, with welded joints, assembled and inserted to form continuous section between access pits.

E. Sectional Pipe: Pipe, such as HDPE pipe, vitrified clay pipe (VCP), polymer pipe, or PVC pipe assembled using leak proof joints and inserted into host sewer main in sections.

F. Renew Lateral: Replace service lateral in public space or easement by pipe bursting, or if necessary by excavation and replacement.

1.03 REFERENCES

A. This section contains references to the following documents.

1. They are a part of this section to the extent referenced in this specification. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.

2. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.

3. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.

4. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

5. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/AWWA C906	*Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 65 in. (100 mm through 1,650 mm), for Waterworks*
ASTM C923	*Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals*
AWWA M55	*PE Pipe–Design and Installation*
ASTM D2321	*Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications*

Reference	Title
ASTM D1248	*Polyethylene Plastics Molding and Extrusion Materials*
ASTM D3035	*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*
ASTM D3261	*Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*
ASTM D3350	*Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*
ASTM D4218	*Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique*
ASTM F585	*Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers*
ASTM F714	*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter*
ASTM F1055	*Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing*
ASTM F1290	*Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings*
ASTM F1417	*Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air*
ASTM F2164	*Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure*
ASTM F2206	*Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE)*
ASTM F2620	*Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings*
ASTM F2786	*Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Gaseous Testing Media Under Pressure (Pneumatic Leak Testing)*
PPI TR-4	*PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe*

1.04 QUALITY ASSURANCE

A. The Contractor shall be certified by the pipe bursting system patent owner, Britishgas- PLC (BG-PLC}, U.S. Patent 4738565, that such a company is a fully trained and licensed user of the pipe bursting system.

B. Contractor or pipe bursting subcontractor shall have:

1. Minimum experience of 150,000 L.F. of pipe bursting existing gravity sanitary sewer pipe and replacing with polyethylene pipe within the last three years, AND

2. Minimum experience of 10,000 L.F. of pipe bursting replacement

experience with polyethylene pipe two sizes greater than the host pipe, such as 10-inch to 15-inch diameter, 12-inch to 18-inch diameter, etc., in the last three years.

C. Polyethylene pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for replacement pipe connections.

1. Personnel directly involved with installing the replacement pipe shall receive training in the proper methods for handling and installing the polyethylene pipe

2. Training shall be performed by a qualified representative.

D. Contractor shall hold the County, the Construction Manager and the Engineer harmless in any legal action resulting from patent infringements.

1.05 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section, the Contractor shall comply with the latest edition of the Standard Specifications for Fulton County Public works Construction together with the latest adopted editions of the Regional and Fulton County Supplement Amendments, especially concerning the reconstruction of manholes and cleanouts.

B. Except as otherwise indicated, the current editions of the following apply to the work of this Section:

1. ASTM D 1248 Polyethylene Plastics Molding and Extrusion Materials.

1.06 REGULATORY REQUIREMENTS

A. The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR1910.146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational Safety and Health Act of 1970

2. Construction Safety Act of 1969, as amended

3. Applicable state and local codes and standards

4. To the extent applicable with the requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.

2. Personnel involved shall have current training certificates.

3. Entry permit is required prior to entry.

1.07 RESPONSIBILITY FOR OVERFLOWS OR SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system.

B. In the event that the Contractor's work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the Construction Manager in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor, including the legal, engineering and administrative expenses of the County in defending such fines and claims.

1.08 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 23 of these Specifications.

1. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of replacement pipe and fittings. Include manufacturer's recommendations for handling, storage, joint welding and repair of pipe and fittings damaged.

2. Methodology for construction and restoration of existing sewer service connections.

3. Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewerage flow and reconnection of sewer service connections, restoration of manhole base and provision for facilitating watertight junction of replacement pipe to existing and reconstructed manholes.

4. Certification of workmen trained for HDPE pipe fusion and installation..

5. Pre and post upgrade CCTV inspection reports and videos. Post upgrade reports and videos shall be made after pipe installation and re-connection of all laterals and immediately prior to the commissioning stage.

6. Written certification that the Contractor is an approved BG-PLC licensee of the pneumatic bursting system from T.T. Technologies or approved equal.

B. Schedules

1. An initial schedule shall be submitted at the preconstruction meeting by the Contractor. The schedule submitted at the preconstruction meeting

and subsequent (quarterly meeting) schedule submitted during the course of the project shall show at a minimum:

a. Each site operation requiring the use of separate crew of equipment and/or labor as a separate activity.

b. The assumed limitations upon the sequence of activities and the anticipated start and completion time for the activities in weeks, numbered from the date of the notice to proceed of the project

c. The number, nature and size of the plant and/or labor teams which it is anticipated shall be used on each activity

d. A description of the proposed methods of construction as well as the nature and extent of temporary works

e. The critical path of activities required to complete the whole of the work.

f. List of all subcontractors including the identification of the task and number of personnel.

2. After the initial schedule is submitted, and the end of each week until contact completion has been reached, the Contractor shall submit a report in writing comprising:

a. A list of those activities shown on the current schedule which were begun during the week stating their remaining duration's and their anticipated completion times.

b. A list of those activities begun previously upon which work continued during the week and their anticipated completion times.

c. A list of those activities begun previously but upon which no work was carried out during week stating their remaining duration's in weeks and their anticipated completion times.

d. A list of activities completed during the week.

e. If the anticipated completion time of any activity reported is later than that previously reported, or where not previously reported later than the completion time shown on the current schedule, the circumstances which in the opinion of the Contractor have caused the anticipated delay shall be stated.

1) Any other matters not previously reported which in the opinion of the Contractor may cause delay to the current schedule shall be described.

2) The current schedule is the revised schedule last produced and submitted to the Construction Manager or where no revised schedule has been submitted the latest revision of the initial schedule submitted.

C. The following information shall be submitted by pipe and fitting suppliers:

1. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.

2. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be

provided by manufacturer.

3. Pipe and fitting product data indicating conformance with this Specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.

4. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this Specification and applicable pipe and fitting standards specified herein.

D. The following information shall be submitted by Fusion Providers.

1. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this specification.

2. Documentation of conformance with this Specification and applicable standards, including written documentation regarding any intended variance from this Specification and applicable standards.

a. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.

E. The following AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:

1. Fusion reports for each fusion joint performed on the project, including joints that were rejected.

2. Submittals of the Fusion Technician's joint reports are required as requested by the Owner or Construction Manager.

3. Specific requirements of the Fusion Technician's joint report shall include:

a. Pipe or fitting size and DR or pressure class rating.

b. Fusion equipment size and identification.

c. Fusion Technician Identification.

d. Job Identification Number.

e. Fusion Number.

f. Fusion joining parameters.

g. Ambient Temperature.

PART 2 - PRODUCTS

2.01 PIPE BURSTING SYSTEMS

A. Pipe Insertion Method (PIM).

1. TT Technology method.

2. Tenbusch method.

3. TRS System method.
4. TTS300 methods.
5. XPANDIT method.
6. Vermeer Hammerhead mole method.
7. Nowak Pipe Reaming InneReam method.
8. Or approved equal.

2.02 MATERIALS

A. General

1. Replacement pipe shall be High Density Polyethylene (HDPE) pipe.
    a. HDPE pipe shall conform to all additional and applicable requirements specified in Section 33 31 00, HDPE Pipe and Fittings, of these Specifications.
2. Same for mainline and lateral.
3. Minimum life span: 50 years.

B. Polyethylene Plastic Pipe shall be high density solid wall polyethylene pipe and meet the applicable requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, ASTM D1248 and ASTM D3035.

1. Sizes of the insertions to be used shall be such to renew the sewer to greater flow capacity.
    a. Size of pipe shall meet Ductile Iron Pipe Size in accordance with PE4710.
2. All pipes shall be made of virgin material. No reworked material shall be used except that obtained from the manufacturer's own production of the same formulation.
3. The pipe shall be homogenous throughout and shall be free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
4. Dimensions and Ratios: The minimum wall thickness of the polyethylene pipe shall be DR 17 throughout.
5. Material color shall be black with a green stripe. Interior of pipe shall have a light reflective color to allow easier/better viewing for television inspection.
6. Manufacturer
    a. Chevron Phillips Chemical Driscopipe
    b. WL Plastics
    c. Northern Pipe Products
    d. JM Eagle
    e. Or approved equal.

2.03 DELIVERY, STORAGE, AND HAULING

A. Transportation, handling, and storage of the polyethylene pipe and fittings shall be as recommended by manufacturer.

B. If replacement pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Construction Manager at the Contractor's expense, before proceeding further.

C. Deliver, store and handle other materials as required to prevent damage.

2.04 TESTING

A. Contractor shall furnish samples and material tests for compliance with this Specification from an independent laboratory to verify the required physical properties and characteristics of supplied materials in accordance with the applicable ASTM Specification.

1. A certificate shall be furnished by the manufacturer, upon request, for all material furnished under this specification.
2. Polyethylene plastic pipe and fittings that do not meet any of the requirements of this Specification will be rejected.
3. The Owner will pay for tests on pipe material which meets Specification requirements. Contractor shall pay for failed tests and re-testing of failed materials.

B. Circularity Tests

1. Where required by the Construction Manager, pipes may be tested at ground surface for circularity before installation and welding commences.
2. Circularity will be checked by pulling a closed cylindrical mandrel through the polyethylene pipe.
3. The mandrel’s outside dimension shall be sized to permit no more than 5.0 percent deflection.
4. The percent deflection shall be established from the base inside diameter of the pipe.
    a. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well.
5. The mandrel shall be approved by the Construction Manager prior to use.
6. The mandrel shall be at least three times the diameter of the pipe in length and not greater than inside diameter of pipe minus 2 millimeters.
7. Lines that permit safe entry may allow other deflection test options, such as direct measurements.
8. Pipes will be rejected which have greater than 5% deformation due to thermal softening.

2.05 EQUIPMENT

A. The pipe bursting tool shall be designed and manufactured to force its way through existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses.

B. The bursting unit shall be pneumatic and shall generate sufficient force to burst and compact the existing pipe line. See manufacturer's specifications for what size tool should be used in what diameter of pipe, as well as parameters of what size tool for percentage of upsize allowed.

C. The pipe bursting tool shall be pulled through the sewer by a winch located at the upstream manhole. The bursting unit shall pull the polyethylene pipe with it as it moves forward. The bursting head shall incorporate a shield/expander to prevent collapse of the hole ahead of the polyethylene pipe insertion. The pipe bursting unit shall be remotely controlled.

D. The pipe bursting tool shall be pneumatic unless static is specified. The bursting action of the tool shall increase the external dimensions sufficiently, causing breakage of the pipe at the same time expanding the surrounding ground. This action will not only break the pipe but also create the void into which the burster can be winched and enables forward progress to be made. At the same time the polyethylene pipe, directly attached to the sleeve on the rear of the burster, shall also move forward.

E. The burster shall have its own forward momentum while being assisted by winching. A hydraulic winch shall give the burster friction by which it can be move forward. To form a complete operating system, the burster must be matched to a constant tension hydraulic winching system.

2.06 WINCH UNIT

A. A winch shall be attached to the front of the bursting unit. The winch shall provide a constant tension to the burster in order that it may operate in an efficient manner. The winch shall ensure directional stability in keeping the unit on line.

B. The winch shall be of the constant tension type but shall be fitted with a direct reading load gauge to measure the winching load which must automatically be maintained at a constant tension at a set tonnage reading. The winch, which shall be hydraulically operated to provide the constant tension throughout the bursting operation, shall supply sufficient cable in one continuous length so that the pull may be continuous between approved winching points.

C. The winch, cable and cable drum must be provided with safety cage and supports so that it may be operated safely without injury to persons or property.

D. The Contractor shall provide a system of guide pulleys and bracing at each manhole to minimize cable contact with the existing sewer between manholes.

E. The supports to the trench shoring in the insertion pit shall remain completely separate from the winch boom support system and shall be so designed that neither the pipe nor the winch cable will be in contact with them.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed in accordance with manufacturer's written instructions and recommendations.

B. All work shall be completed by workmen skilled in their trade.

C. All reconstruction of existing gravity sewer mains using an HDPE product and installer shall be performed in strict accordance with this Specification and the latest revision of ASTM F585.

D. Where discrepancies exist, or any latitude is either inferred or interpreted between this Specification and ASTM product and process standards, this Specification shall govern.

3.02 PREPARATION

A. The following installation procedures shall be adhered to unless otherwise approved by the Construction Manager.

1. Carry out all operations in accordance with all Federal, State, and local safety laws, regulations, standards, policies and procedures including those promulgated by OSHA and those recommended by the manufacturer.
    a. Particular attention is drawn to those safety requirements involving entering confined spaces (follow OSHA requirements).
        1) The Contractor shall take additional precautions to secure the work area and insure the safety of everyone in or around the curing apparatus.
        2) Before utilizing this method, the Contractor shall submit a copy of the Contractor's standard operating procedures addressing safety issues for this methodology to the Construction Manager.
2. The Contractor shall bypass wastewater around the sewer segment or sewer segments designated for pipe bursting rehabilitation.
    a. Service connection effluent may be plugged only after proper notification to the affected properties.
    b. Individual's sewer service shall not be interrupted for more than 8 hours.
        1) If proposal is to interrupt service for more than 8 hours alternative means of providing service during construction will be required.
3. If a road/lane must be closed to traffic, the Contractor shall furnish a detailed traffic control plan and all labor and equipment necessary.
    a. No separate payment will be made for traffic control.

b. It shall be an incidental part for pipe bursting rehabilitation.

3.03 PRE-INSTALLATION PROCEDURE

A. Complete the following activities unless otherwise approved by the Construction Manager.

1. Perform operations in accordance with OSHA Standards.

2. Before Work commences:

a. Required pre-installation submittals shall be approved by Construction Manager, including:

1) Traffic management plan/measures.

2) Safe pedestrian passage.

3) Provision of vehicular access to property.

4) Bypass/diversion pumping.

5) Emergency measures/contingent plans.

b. Submit an Installation Access Plan including:

1) Access manhole location(s).

2) Site plan sketch showing dimensions of access within work limits and utilities.

3) Approximate installation rate (ft/day).

4) Appropriate excavation/backfill/resurfacing procedures including permits according to Georgia Department of Transportation and governing agency standards.

B Installation Responsibilities.

1. It shall be the responsibility of the Contractor to field locate and designate all access points, open and make accessible for the work based on the Contract Drawings.

2. The Contractor shall arrange for access to water hydrants for cleaning, wash downs and other work related items requiring water.

3.04 PRE-BURSTING CLEANING

A. Prior to entering access areas, such as manholes, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state or federal safety regulations.

B. Cleaning of Host Pipeline

1. Sewers shall be cleaned of all biological growth, debris, roots and other materials that would contaminate the soil and/or inhibit proper pipe bursting operations.

a Pipeline shall be cleaned with hydraulically powered equipment, high velocity jet cleaners or mechanically powered equipment.

b Heavy cleaning of sewers shall be performed if roots are present which require the use of mechanical brushes or dragging devices or, if in the judgment of the Construction Manager, the pipe is more than 25% full of debris.

c The pipe shall be cleaned to the satisfaction of the Construction Manager.

d See NASSCO Recommended Specifications for Sewer Collection System Rehabilitation as required for the HDPE lining operation.

2. Utilizing high-pressure jet cleaning equipment, several passes may be need to ensure that all biological growth and debris are removed from the pipe to the satisfaction of the Construction Manager.

3. Debris Disposal

a All debris cleaned from the host pipe shall be removed and disposed of at a dumpsite designated by the Owner at no additional cost to the Owner.

b Debris shall not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.

c Debris removed from sewer during cleaning shall be transported in watertight containers and disposed of in accordance with local, State and Federal Regulations.

4. Provision and Usage of Water

a. The Owner will make available all water required to perform this work.

b. The Owner will provide a fire hydrant meter at no cost to the Contractor beyond the normal security deposit for use on the Project.

c. Contractor shall coordinate connection and usage limits and withdrawal locations with the Owner prior to construction.

d. The Contractor shall pay for all the water used based on the meter readings.

C. Existing Dimensions

1. After cleaning, the Contractor shall measure the I.D. of the host pipe at at least two locations.

2. Prior starting the pipe bursting operation, the Contractor shall:

a. Verify the internal dimensions of the existing sewer mains to insure that the bursting equipment utilized will be of appropriate dimension.

b. CCTV inspect and record ensuring the host pipe is free of debris and biological growth.

3.05 PRE-BURSTING VIDEO INSPECTION

A. Pipelines shall be inspected via CCTV in conformance with the Fulton County Manual for Internal Sewer Condition Assessment.

B. Prior to the pipe bursting, but not more than 48 hours prior to such, the section of sewer designated for bursting shall be televised its full length using a remote television camera specifically designed for that purpose.

C. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed-circuit television.

D. Utilizing a color video inspection system with data recording capabilities, the entire pipe section to be bursted shall be recorded in a digital format and two (2) copies produced.

1. The interior of the pipe shall be carefully inspected to determine the location of any conditions, which may prevent the proper bursting and installation of the HDPE replacement pipe and it shall be noted so that these conditions can be corrected.
2. Electronic files, including a suitable log, shall be submitted to the Construction Manager.
3. Logs shall include date, line size, length, manhole numbers, project number, direction of camera travel, direction of flow and all observed defects or comments.
4. For each service connection the log shall include:
    a. The distance from manhole.
    b. Its radial location (e.g. 9:00 or 2:00 o'clock).
    c. Street address or parcel identification.
    d. Distance from mainline to cleanout.
5. Videos between manhole segments shall be continuous and no breaks or "blink-outs" in the video shall be observed. The videos shall be in digital flash drive format.
6. The full cross-sectional area of the pipe shall be visible during video inspection except where misalignment of the sewer that has resulted in standing water in bellies or sags
7. The pre-bursting video files shall be turned over to the Construction Manager prior to pipe bursting.

E. The television camera used for this purpose shall be operative in one hundred percent moisture conditions.

1. Lighting for the camera shall be sufficient to yield a clear picture of the entire periphery of the pipe.

2. The camera, television monitor and other components of the video system shall be capable of producing a five hundred line resolution picture.
3. The camera's rate of travel shall not exceed 20 feet per minute.
4. At each service connection, the camera shall come to a complete stop and the service shall be panned so that the entire cross sectional area of the service can be inspected.
5. The footage meter count shall be clearly visible.
6. If for any reason the camera becomes disabled inside the sewer and cannot further proceed, the Contractor will be responsible for retrieving the camera at no additional cost to the Owner.

F. Identification and Pre-measurement of Lateral Connections

1. A 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe.
2. At each connection the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8 to 12 inches of the lateral connection.
3. The Contractor shall be responsible for determining if the connection is active or inactive.
4. For each service connection determined by the Contractor to be active, the Contractor shall determine the condition of the service connection to the host pipe, make his recommendation for lateral connection repair and record both items in his log.

G. CCTV inspection additional requirements shall include the following:

1. Preconstruction video recordings shall be available for viewing by the Construction Manager before construction begins and throughout the project.
2. Video recordings shall be submitted to the Owner via a flash drive and shall remain property of the Owner. Contractor may retain the duplicate copy for his use.
3. All flows tributary to the reach of sewer being inspected are to be completely by-passed around the reach during pre-construction inspection if necessary and required by the Owner.
4. Should any portion of the inspection video be of inadequate quality or coverage, as determined by the Construction Manager, the Contractor shall have the portion re-inspected and video recorded at no additional expense to the Owner.

H. Line Obstructions

1. The host sewer pipe shall be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40% that may hinder or prevent the pipe bursting procedures.

2. When service connections protrude into existing pipe more than ½ inch, as measured from inside pipe wall, remove protruding portion of service connection to within ½ inch of inside pipe wall.

3. If pre-installation inspection reveals an obstruction such as a dropped joint, or a collapse that will prevent the bursting process and that cannot be removed by conventional sewer cleaning or pipe or root cutting equipment, the Contractor may be required to make a point repair excavation to uncover and remove or repair the obstruction.

4. Such excavation shall be approved in writing by the Construction Manager prior to the commencement of the work and will be considered as a separate pay item.

5. The Contractor shall remove, grind or take other precautions necessary to address sharp edges or protrusions that could tear the protective sheets or films.

6. For pipes where sags exist in the pipe segment:

   a. Water in the sag is to be removed to avoid trapping water between the replacement pipe and the surrounding soil resulting in contamination of the same.

3.06 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer subject to sliplining operations.

B. The Contractor shall provide bypass pumping during the pipe bursting/replacement process, if necessary.

   1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the replacement pipe shall be included in the cost for pipe replacement by pipe bursting.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

   1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

   1. Monitor status of flow and storage.

2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.

2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.

3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.

2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.07 BY-PASS PUMPING

A. The contractor shall provide all sewage bypass as necessary for the proper pipe bursting/replacement work.

B. Sewage flow shall be pumped around segments during the bursting replacement operation and lateral service reinstatement.

1 The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the sewer segment(s) under construction.

2. Pumping equipment shall have the capacity to convey 100% of peak flows around the construction area.

3. A standby pump of the same capacity shall be required on site.

4. Open channels or trenches shall not be used to convey flow.

5. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

C. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer main being bypassed and inform them that they will be temporarily out of service.

D. The Contractor shall notify all property owners who discharge sewage directly into the sewer main being rehabilitated at least 48 hours in advance, giving the date, starting and estimated completion time for the work being conducted and any anticipated impact to the property owner.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.

2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.

3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

E. Temporary Blocking and Back-Ups of Sewers and Sewage

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways and streets does not occur.

a. In the event that such spillage or overflow does occur during the course, or as a result, of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

b. Upon elimination of the spillage or overflow, the Contractor shall clean up and disinfect the area.

c. Work to stop or contain such event is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage or overflows of sewage during the course of the Work or because of the Work, shall be the sole responsibility of the Contractor.

e. The Contractor shall be responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.08 CONSTRUCTION METHOD

A. Equipment used to perform the work shall be located away from buildings in order to minimize noise impact which under all circumstances shall be less than 70 dB unless otherwise allowed by the Construction Manager due to circumstances beyond the control of the Contractor or pipe bursting subcontractor.

1. A silent engine compartment with the winch shall be provided to reduce

machine noise.

B The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the polyethylene pipe from damage during installation.

C. Lubrication may be used as recommended by the manufacturer. Under no circumstances shall the pipe be stressed beyond its elastic limit. The winch line must be centered in the existing pipe to be bursted with an adjustable boom.

D. The installed polyethylene pipe shall be allowed to relax and cool following installation in accordance with the manufacturer's recommended time, but not less than four (4) hours, prior to any reconnection of service lines, scaling of the annulus or backfilling of the insertion pit.

E. Sufficient excess length of replacement pipe, but not less than four (4) inches, shall be allowed to protrude into the manhole to provide for further length reduction. End restraint of pipe ends shall be achieved by means of Central Plastics Electrofusion couplings.

F. The Electrofusion couplings shall be slipped over pipe ends against manhole wall and fused in place. Installation of all electrofusion couplings shall be carried out in accordance with the manufacturers recommended procedures.

G. Following the relaxation period, the annular space may be sealed. Sealing shall be made with materials approved by the Construction Manager and/or his representative and shall extend a minimum of eight (8) inches into the manhole wall in such a manner as to form a smooth, uniform, watertight joint. The terminating pipe ends in manholes shall be connected by Central Plastics Electrofusion couplings to eliminate ground water infiltration. Electrofusion couplings shall be installed in accordance with the manufacturers recommended procedures.

3.09 PIPE JOINING

A. The polyethylene pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint in strict accordance with the manufacturer's instructions and ASTM F2620.

B. Threaded or solvent-cement joints and connections are not permitted.

C. All equipment and procedures used shall be used in strict compliance with the manufacturer's instructions and recommendations.

D. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

E. The butt-fused joint shall be true alignment and shall have uniform roll-back beads resulting from the use of proper temperature and pressure.

F. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the

pipe.

G. All joints shall be subject to acceptance by the Construction Manager and/or his representative prior to insertion.

1. All defective joints shall be cut out and replaced at no cost to the County.
2. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site.
3. Where authorized by the Construction Manager, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.
4. Any joint more than 1/8-inch high shall be trimmed to be smooth with the pipe prior to installation.

H. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Construction Manager and/or his representative shall be discarded and not used.

I. Terminal sections of pipe that are joined within the insertion pit shall be connected with Central Plastics Electrofusion Couplings or connectors with tensile strength equivalent to that of the pipe being joined.

J. When transitioning from polyethylene pipe to ductile iron pipe, pipes shall be joined with a transition sleeve as recommended by the pipe manufacturer. Transition sleeves shall be approved by the Construction Manager.

K. See Section 33 31 00 for additional HDPE pipe installation requirements.

3.10 SERVICE CONNECTIONS

A. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the replacement pipe. The complete list of service laterals, included relevant footage and diameter of lateral, shall be submitted, prior to pipe lining, to the Construction Manager for information.

B. Use CCTV to field locate existing service connections.

C. Once begun, pipe bursting and replacement pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the Construction Manager.

D. Upon completion of insertion of the replacement pipe, the Contractor shall complete the reconnection of all service laterals. Reconnection of the laterals on the segment must be completed within 8 hours of the start of service interruption to minimize any inconvenience to customers.

E. The Contractor shall reinstate all live junctions immediately after installation of the replacement pipe by excavation and point repair.

F. Confirm the number of service connections to be reinstated and complete work to bring them back on line.

1. All service lateral reinstatements shall be wire brushed to eliminate burrs and snags.

G. Existing sewer service laterals shall be internally reinstated to 100% of their pre-lining flow diameter.

1. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages.

H. Do not reconnect services from abandoned or vacant lots, unless otherwise directed by the Construction Manager.

I. Show distance from nearest downstream manhole to reconnected service on record drawings.

J. The preferred method of saddle connection to the main line shall be either by use of an Inserter Tee by Fowler Manufacturing, Oregon, or by fusion of saddle connection with one of the following approved systems:

1. Electrofusion saddles as manufactured by Central Plastics
2. Conventional Fusion saddles as manufactured by Central Plastics, Phillips Driscopipe, or Plexco
3. Saddle material shall be compatible with that of the main pipe.

K. Service connection openings shall be reinstated to 95 – 100% of their diameter and free from rough edges or protrusions.

L. The cost for correcting deficiencies discovered shall be the responsibility of the Contractor.

3.11 POST INSTALLATION

A. HDPE pipe installation shall be free from visual defects and other deformities.

1. Defects and deformities may, at discretion of the Construction Manager, be cause for rejection of entire replacement pipe.
2. Contractor shall correct failed and/or defective replacement pipes.
   a. Identified from post installation television inspection.
   b. Test reports for structural values.
3. Method of repair, which may require field or workshop demonstration, shall be approved by the Construction Manager prior to commencement of work.
4. Remove and replace pipe identified with defects or deformities that cannot be repaired to the satisfaction of the Construction Manager and/or the manufacturer.

B. Both ends of the replacement pipe shall be cut smoothly 2 inches from the inlet and outlet points in the manhole.

1. Seal with an epoxy or resin mixture compatible with the replacement pipe to provide a watertight seal.

2. Sealing material and installation method shall be submitted and approved by the Construction Manager prior to start of construction.

a. Pipe manufacturer shall also be consulted for appropriate sealing material and installation method.

3. Hydraulic cements and quick-set cement products are not acceptable.

C. Where replacement pipes of any type are installed in two or more continuous manhole segments, the replacement pipe invert through the intermediate manholes shall be left intact.

1. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed replacement pipe.

2. Neat trimming of the pipe edge where it touches the lip of the manhole bench.

3. Sealing between the replacement pipe and pre-existing manhole channel.

D. Portions of any piece of pipe material removed during installation shall be available for inspection and retention by the Construction Manager.

E. All manhole drop connections will be reviewed on an individual basis.

1. Reinstate openings for all drop assemblies after relining mainline sewer.

2. Everywhere possible, outside drop assemblies shall be lined with a liner compatible with the mainline replacement pipe, for the full length of the drop assembly and bend.

3. Drop assemblies inside of manholes are not required to be relined, unless directed by the Construction Manager.

F. Each pipe segment lined shall be CCTV inspected as soon as practical after processing.

1. Segments not fully conforming to these Specifications must be immediately brought to the Construction Manager attention with a proposed method of correction without cost to the Owner.

G. Manholes

1. Replacement: When a manhole is replaced, the replacement manhole shall be equipped with a boot connection. The boot will allow a secure connection to HDPE pipe.

2. Sealing Polyethylene Pipe in existing Manhole:

a. The annular space between the polyethylene replacement pipe and the existing sewer line shall be sealed where the replacement pipe enters or exits manholes.

b. The pipe shall be allowed to relax and come to thermal equilibrium for a period of 24 hours before sealing.

c. Seal the upstream manhole pipe connection, connect services to the replacement pipe, and then seal the downstream manhole connection. Acceptable materials are urethane foam, oakum or low shrink grout.

d. Foam sealant shall not protrude into the manhole and shall be finished over with a quick-set, non- shrink cement grout.

3.12 POST-INSTALLATION CCTV INSPECTION

A. Following installation of replacement pipelines between manholes where bursting has occurred, CCTV inspection shall be carried out in accordance with the requirements of the Fulton County Manual for Internal Sewer Condition Assessment.

B. The finished lining shall be free of defects that would affect long term strength or hydraulic performance.

C. The finished video shall be continuous over the entire length of the sewer between two manholes and shall be completely free from visual defects.

D. The audio/video recording shall be prepared in the presence of the County's Inspector and provide the following:

1. An audio description to what is being viewed.
2. A continuous running footage indicator between manholes.

E. Prior to Final Acceptance the County shall be provided with one copy of the TV inspection report and video on flash drive showing the entire length of gravity sewer being tested.

1. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type of joint, roundness and distance between manholes.
2. Any pipe found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

F. Should any portion of the inspection video be of inadequate quality or coverage, as determined by the Construction Manager, the Contractor will have that portion re-inspected and videoed at no additional expense to the County.

3.13 TESTING

A. Leakage Testing For Non-Pressure Piping

1. Non-pressure piping such as sewers shall be tested for excessive leakage in accordance with ASTM F1417.
2. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

B. Hydrostatic Leakage Testing For Pressure Piping

1. Hydrostatic leakage testing shall comply with ASTM F2164. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

2. Pneumatic (compressed air) leakage testing of PE4710 pressure piping is prohibited.

3.14 FINAL ACCEPTANCE

A. After installation of the replacement pipe, the Contractor shall, at the option of the Owner's Representative, either TV inspect the sewer line or conduct a low pressure test on the replacement pipe.

3.15 CLEAN-UP/RESTORATION

A. After the HDPE replacement pipe installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.

b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.

c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.

d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements.

3.16 WARRANTY

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the replacement pipe material.

    a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty

1. The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance and shall cover the cost of repairing and/or replacing the installed replacement pipes and any freight to project site should the installed replacement pipe have any defects in material or workmanship.

2. In addition to the standard pipe warranty, the fusing contractor shall provide in writing a three-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that requires remaking defective butt fusion, saddle fusion or electrofusion joints. The warranty shall also include freight to project site, formation, installation and pressure testing.

3. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the Contractor and/or the fusion installer of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. No bell clamps or wrap around corsets are allowed as a means of repair on new pipelines.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and replacement pipe manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. The Contractor shall be responsible for repairs to any trench settlements caused by leaking pipe, fittings, etc. He shall promptly furnish and place fill to original grade.

I. Should any leaks or trench settlement occur under the new pavement, the Contractor will be held responsible for the cost of all pavement repairs, including pavement replacement.

J. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

K. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

L. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

END OF SECTION

SECTION 33 01 30.72

HDPE SLIPLINING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sliplining of existing gravity sanitary sewers.
2. Reconnection of existing service connections.
3. CCTV inspection

B. Refer to Section 33 31 00, High Density Polyethylene (HDPE) Pipe and Fittings, for additional requirements.

1.02 DEFINITIONS

A. Sliplining: Sewer rehabilitation by which the lining unit pulls a new polyethylene pipe through an existing pipe.

1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 23 of these Specifications:

1. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings. Include manufacturer's recommendations for handling, storage, joint welding and repair of pipe and fittings damaged.
2. Methodology for construction and restoration of existing sewer service connections.
3. Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewerage flow and reconnection of sewer service connections, restoration of manhole base and provision for facilitating watertight junction of new pipe to existing and reconstructed manholes.
4. Certification of workmen trained for HDPE pipe fusion and installation.
5. Pre and post upgrade CCTV inspection reports and videotapes. Post upgrade reports and videos shall be made after pipe installation and re-connection of all laterals and immediately prior to the commissioning stage

B. The following information shall be submitted by pipe and fitting suppliers:

1. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.
2. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.
3. Pipe and fitting product data indicating conformance with this Specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.
4. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this Specification and applicable pipe and fitting standards specified herein.

C. The following information shall be submitted by Fusion Providers.

1. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this specification.
2. Documentation of conformance with this Specification and applicable standards, including written documentation regarding any intended variance from this Specification and applicable standards.
    a. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.

D. The following AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:

1. Fusion reports for each fusion joint performed on the project, including joints that were rejected.
2. Submittals of the Fusion Technician's joint reports are required as requested by the Owner or Construction Manager.
3. Specific requirements of the Fusion Technician's joint report shall include:
    a. Pipe or fitting size and DR or pressure class rating.
    b. Fusion equipment size and identification.
    c. Fusion Technician Identification.
    d. Job Identification Number.
    e. Fusion Number.
    f. Fusion joining parameters.
    g. Ambient Temperature.

1.04 QUALIFICATIONS

A. The Contractor shall be certified as a fully trained and licensed user of the pipe lining system.

B. Polyethylene pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Training shall be performed by a qualified representative.

C. Contractor shall hold the County and Engineer harmless in any legal action resulting from patent infringements.

D. Contractor or sliplining subcontractor shall have:

1. Minimum experience of 150,000 L.F. of sliplining existing gravity sanitary sewer pipe and replacing with polyethylene pipe within the last three years.

1.05 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section, the Contractor shall comply with the latest edition of the Standard Specifications for Fulton County together with the latest adopted editions of the Regional and Fulton County Supplement Amendments, especially concerning the reconstruction of manholes and cleanouts.

1.06 QUALITY ASSURANCE

A. References

1. This Section contains references to the following documents. They are a part of this section to the extent referenced in this specification.
2. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
3. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.
4. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.
5. This document references American Society for Testing and Materials (ASTM) standard specifications, which are made a part hereof by such reference and shall be the latest edition and revision.
6. It is incumbent upon the Contractor to have a working familiarity with the following ASTM Standards:
   a. ASTM D2321, Practice for Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
   b. ASTM D3035, Specification for Polyethylene (PE) Plastic Pipe (DR- PR) Based on Controlled Outside Diameter

c. ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

d. ASTM F585 Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

e. ASTM F714, Specification for Polyethylene (PE) plastic pipe (SDR- PR) Based on Outside Diameter

f. ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

g. PPI Handbook of Polyethylene Pipe

1.07 REGULATORY REQUIREMENTS

A. The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR 1910.146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational Safety and Health Act of 1970
2. Construction Safety Act of 1969, as amended
3. Applicable state and local codes and standards
4. To the extent applicable, requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.
2. Personnel involved shall have current training certificates.
3. Entry permit is required prior to entry.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Transportation, handling, and storage of the polyethylene pipe and fittings shall be as recommended by manufacturer.

B. If new pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Construction Manager at the Contractor's expense, before proceeding further.

C. Deliver, store and handle other materials as required to prevent damage.

1.09 RESPONSIBILITY FOR OVERFLOWS OR SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system.

B. In the event that the Contractor's work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the Owner and Construction Manager in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor, including the legal, engineering and administrative expenses of the County in defending such fines and claims.

PART 2 – PRODUCTS

2.01 POLYETHYLENE PIPE AND FITTINGS

A. General

1. Subject to compliance with requirements, approved products provided shall be as follows:
   a. Chevron Phillips Chemical Driscoplex 4600/4700 Series HDPE Sewer Piping
   b. Or approved equal.
2. Sizes of the insertions to be used shall be such to renew the sewer to greater flow capacity.
3. All pipes shall be made of virgin material. No reworked material shall be used except that obtained from the manufacturer's own production of the same formulation.
4. The pipe shall be homogenous throughout and shall be free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.

B. HDPE Sewer Pipe

1. Polyethylene pipe shall be manufactured in accordance with AWWA C901-96 for sizes 1¼-inch thru 3-inch IPS diameters and to the requirements of ASTM D3035.
   a. Size of pipe shall meet Ductile Iron Pipe Size in accordance with PE4710.

2. Pipe 4-inch IPS and DIPS sizes 4 inches and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-15.

3. Black PE materials used for the manufacture of polyethylene pipe shall be PE 4710 high density polyethylene meeting ASTM D3350 cell classification 445574C and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4 with a standard grade HDB rating of 1600 psi at 73°F.

4. Gray PE material, when used, shall be the same except for meeting ASTM D3350 cell classification 445574E.

5. Interior of pipe shall have a light reflective color to allow easier/better viewing for television inspection.

C. HDPE Fittings

1. Molded Fittings

a. Molded fittings shall be manufactured and tested in accordance with ASTM D3261 and so marked.

b. Fittings shall be tested in accordance with AWWA C906.

2. Fabricated Fittings

a. Fabricated fittings shall be manufactured and tested in accordance with ASTM F2206 and so marked.

b. Fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings.

c. Fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.

d. Fittings shall be tested in accordance with AWWA C906.

3. Electrofusion Fittings

a. Electrofusion fittings shall be manufactured and tested in accordance with ASTM F1055 and so marked.

b. Saddles fittings for connecting laterals to the slipliner pipe shall be electrofusion or strap-on sewer saddles. Strap-on sewer saddles shall be used only where it is not possible to use electrofusion saddles. The saddles shall be equipped for joining with a casketed hub, or plain outlet for mechanical couplings or electrofusion couplings joining.

2.02 DIMENSIONS AND RATIOS:

A. The minimum wall thickness of the polyethylene pipe shall be DR 17 throughout.

2.03 TESTING

A. Contractor shall furnish samples and material tests for compliance with this Specification from an independent laboratory to verify the required physical

properties and characteristics of supplied materials in accordance with the applicable ASTM Specification.

1. A certificate shall be furnished by the manufacturer, upon request, for all material furnished under this Specification.
2. Polyethylene plastic pipe and fittings that do not meet any of the requirements of this specification will be rejected.
3. The Owner shall pay for tests on pipe material which meets specification requirements. Contractor shall pay for failed tests and re-testing of failed materials

B. Circularity Tests

1. Where required by the Construction Manager, pipes may be tested at ground surface for circularity before installation and welding commences.
2. Circularity will be checked by pulling a closed cylindrical mandrel through the polyethylene pipe.
3. The mandrel's outside dimension shall be sized to permit no more than 5.0 percent deflection.
4. The percent deflection shall be established from the base inside diameter of the pipe.
   a. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well.
5. The mandrel shall be approved by the Construction Manager prior to use.
6. The mandrel shall be at least three times the diameter of the pipe in length and not greater than inside diameter of pipe minus 2 millimeters.
7. Lines that permit safe entry may allow other deflection test options, such as direct measurements.
8. Pipes will be rejected which have greater than 5% deformation due to thermal softening.

2.04 Winch Unit

A. The winch shall be of the constant tension type but shall be fitted with a direct reading load gauge to measure the winching load which must automatically be maintained at a constant tension at a set tonnage reading.

B. The winch, which shall be hydraulically operated to provide the constant tension throughout the lining operation, shall supply sufficient cable in one continuous length so that the pull may be continuous between approved winching points.

C. The winch, cable and cable drum must be provided with safety cage and supports so that it may be operated safely without injury to persons or property.

D. The Contractor shall provide a system of guide pulleys and bracing at each manhole to minimize cable contact with the existing sewer between manholes.

E. The supports to the trench shoring in the insertion pit shall remain completely separate from the winch boom support system and shall be so designed that neither the pipe nor the winch cable shall be in contact with them.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed in accordance with manufacturer's written instructions and recommendations.

B. All work shall be completed by workmen skilled in their trade.

C. All reconstruction of existing gravity sewer mains using an HDPE product and installer shall be performed in strict accordance with this Specification and the latest revision of ASTM F585.

D. Where discrepancies exist, or any latitude is either inferred or interpreted between this Specification and ASTM product and process standards, this Specification shall govern.

3.02 PREPARATION

A. The following installation procedures shall be adhered to unless otherwise approved by the Construction Manager.

1. Carry out all operations in accordance with all Federal, State, and local safety laws, regulations, standards, policies and procedures including those promulgated by OSHA and those recommended by the manufacturer.

a. Particular attention is drawn to those safety requirements involving entering confined spaces (follow OSHA requirements).

1) The Contractor shall take additional precautions to secure the work area and insure the safety of everyone in or around the curing apparatus.

2) Before utilizing this method, the Contractor shall submit a copy of the Contractor's standard operating procedures addressing safety issues for this methodology to the Construction Manager.

2. The Contractor shall bypass wastewater around the sewer segment or sewer segments designated for lining.

a. Service connection effluent may be plugged only after proper notification to the affected properties.

b. Individual's sewer service shall not be interrupted for more than 8 hours.

1) If proposal is to interrupt service for more than 8 hours alternative means of providing service during construction

will be required.

3. Do not install slipliner if ground water temperatures and/or ambient temperatures are excessive for the manufacturer's recommended installation procedures.

4. Where practicable, slipliners may be installed in continuous runs through manholes:

   a. Where there are two or more continuous sewer segments.

   b. Or to connect several short segments with a continuous lining.

5. If a road/lane must be closed to traffic, the Contractor shall furnish a detailed traffic control plan and all labor and equipment necessary.

   a. No separate payment will be made for traffic control.

   b. It shall be an incidental part for the sliplining system installation.

3.03 PRE-INSTALLATION PROCEDURE

A. Complete the following activities unless otherwise approved by the Construction Manager.

1. Perform operations in accordance with OSHA Standards.

2. Before Work commences:

   a. Required pre-installation submittals shall be approved by Construction Manager, including:

      1) Traffic management plan/measures.

      2) Safe pedestrian passage.

      3) Provision of vehicular access to property.

      4) Bypass/diversion pumping.

      5) Emergency measures/contingent plans.

   b. Submit an Installation Access Plan including:

      1) Access manhole location(s).

      2) Site plan sketch showing dimensions of access within work limits and utilities.

      3) Approximate installation rate (ft/day).

      4) Appropriate excavation/backfill/resurfacing procedures including permits according to Georgia Department of Transportation and governing agency standards.

B Installation Responsibilities.

1. It shall be the responsibility of the Contractor to field locate and designate all access points, open and make accessible for the work based on the Contract Drawings.

2. The Contractor shall arrange for access to water hydrants for cleaning and other work related items requiring water.

3.04 PRE-INSERTION CLEANING

A. Prior to entering access areas, such as manholes, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state or federal safety regulations.

B. Cleaning of Host Pipeline

1. Sewers shall be cleaned of all debris, roots and other materials that would inhibit proper insertion of slipliner pipe.

a Pipeline shall be cleaned with hydraulically powered equipment, high velocity jet cleaners or mechanically powered equipment.

b Heavy cleaning of sewers shall be performed if roots are present which require the use of mechanical brushes or dragging devices or, if in the judgment of the Construction Manager, the pipe is more than 25% full of debris.

c The pipe shall be cleaned to the satisfaction of the Construction Manager.

d See NASSCO Recommended Specifications for Sewer Collection System Rehabilitation as required for the HDPE lining operation.

2. Utilizing high-pressure jet cleaning equipment, several passes may need to be completed to assure that all debris is removed from the pipe to the satisfaction of the Construction Manager.

3. Debris Disposal

a All debris cleaned from the pipe shall be removed and disposed of at a dumpsite designated by the Owner at no additional cost to the Owner.

b Debris shall not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.

c Debris removed from sewer during cleaning shall be transported in watertight containers and disposed of in accordance with local, State, and Federal Regulations.

4. Provision and Usage of Water

a. The Owner shall make available all water required to perform this work.

b. The Owner shall provide a fire hydrant meter at no cost to the Contractor beyond the normal security deposit for use on the Project.

c. Contractor shall coordinate connection and usage limits and withdrawal locations with the Owner prior to construction.

d. The Contractor shall pay for all the water used based on the meter readings.

C. Existing Dimensions

1. After cleaning, the Contractor shall measure the I.D. of the host pipe at the two (2) locations.

2. Prior to ordering of the liner pipes, the Contractor shall:

a. Verify the internal dimensions of the existing sewer mains to insure that the lining utilized will be of appropriate dimension.

b. CCTV inspect and record ensuring the host pipe is free of debris and stable enough to line.

3.05 PRE-INSTALLATION VIDEO INSPECTION

A. Pipelines shall be inspected via CCTV in conformance with the Fulton County Manual for Internal Sewer Condition Assessment.

B. Prior to installation of the HDPE pipe, but not more than 48-hours prior to such installation, the section of sewer designated for sliplining shall be televised its full length using a remote television camera specifically designed for that purpose.

C. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed-circuit television.

D. Utilizing a color video inspection system with data recording capabilities, the entire pipe section to be lined shall be recorded in a digital format and two (2) copies produced.

1. The interior of the pipe shall be carefully inspected to determine the location of any conditions, which may prevent the proper installation of the HDPE pipe by sliplining and it shall be noted so that these conditions can be corrected.

2. Electronic files, including a suitable log, shall be submitted to the Construction Manager.

3. Logs shall include date, line size, length, manhole numbers, project number, direction of camera travel, direction of flow and all observed defects or comments.

4. For each service connection the log shall include:

a. The distance from manhole.

b. Its radial location (e.g. 9:00 or 2:00 o'clock).

c. Street address or parcel identification.

d. Distance from mainline to cleanout.

5. Videos between manhole segments shall be continuous and no breaks or "blink-outs" in the video shall be observed. The videos shall be in digital flash drive format.

6. The full cross-sectional area of the pipe shall be visible during video inspection except where misalignment of the sewer that may result in standing water in bellies or sags
7. The pre-installation video files shall be turned over to the Construction Manager prior to pipe lining.

E. The television camera used for this purpose shall be operative in one hundred percent moisture conditions.

1. Lighting for the camera shall be sufficient to yield a clear picture of the entire periphery of the pipe.
2. The camera, television monitor and other components of the video system shall be capable of producing a five hundred line resolution picture.
3. The camera's rate of travel shall not exceed 20 feet per minute.
4. At each service connection, the camera shall come to a complete stop and the service shall be panned so that the entire cross sectional area of the service can be inspected.
5. The footage meter count shall be clearly visible.
6. If for any reason the camera becomes disabled inside the sewer and cannot further proceed, the Contractor will be responsible for retrieving the camera at no additional cost to the Owner.

F. Identification and Pre-measurement of Lateral Connections

1. A 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe.
2. At each connection the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8 to 12 inches of the lateral connection.
3. The Contractor shall be responsible for determining if the connection is active or inactive.
4. For each service connection determined by the Contractor to be active, the Contractor shall determine the condition of the service connection to the host pipe, make his recommendation for lateral connection repair and record both items in his log.

G. CCTV inspection additional requirements shall include the following:

1. Preconstruction video recordings shall be available for viewing by the Construction Manager before construction begins and throughout the project.
2. Video recordings shall be submitted to the Owner via a flash drive and shall remain property of the Owner. Contractor may retain the duplicate copy for his use.
3. All flows tributary to the reach of sewer being inspected are to be completely by-passed around the reach during pre-construction inspection if necessary and required by the Owner.

4. Should any portion of the inspection video be of inadequate quality or coverage, as determined by the Construction Manager, the Contractor shall have the portion re-inspected and video recorded at no additional expense to the Owner.

H. Line Obstructions

1. The host sewer pipe shall be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40% that may hinder or prevent the installation of the slipling system.

2. When service connections protrude into existing pipe more than ½ inch, as measured from inside pipe wall, remove protruding portion of service connection to within ½ inch of inside pipe wall.

3. If pre-installation inspection reveals an obstruction such as a dropped joint, or a collapse that will prevent the lining installation process and that cannot be removed by conventional sewer cleaning or pipe or root cutting equipment, the Contractor may be required to make a point repair excavation to uncover and remove or repair the obstruction.

4. Such excavation shall be approved in writing by the Construction Manager prior to the commencement of the work and will be considered as a separate pay item.

5. The Contractor shall remove, grind or take other precautions necessary to address sharp edges or protrusions that could tear the slipliner pipe or the protective sheets or films.

6. For pipes where sags exist in the pipe segment:

a. Water in the sag is to be removed to avoid trapping water between the slipliner pipe and the host pipe.

3.06 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer subject to sliplining operations.

B. The Contractor shall provide bypass pumping during the pipe lining/replacement process, if necessary.

1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the sliplining system shall be included in the cost for pipe replacement by sliplining.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

1. Monitor status of flow and storage.
2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.
2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.
3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.
2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.07 BY-PASS PUMPING

A. The contractor shall provide all sewage bypass as necessary for the proper installation of sliplining system.

B. Sewage flow shall be pumped around segments during the insertion of the line pipe, the televising of sewers and lateral service reinstatement.

1 The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the sewer segment(s) under construction.

2. Pumping equipment shall have the capacity to convey 100% of peak flows around the construction area.

3. A standby pump of the same capacity shall be required on site.

4. Open channels or trenches shall not be used to convey flow.

5. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

C. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer main being bypassed and inform them that they will be temporarily out of service.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.

2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.

3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times

D. Temporary Blocking and Back-Ups of Sewers and Sewage

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways and streets does not occur.

a. In the event that such spillage or overflow does occur during the course, or as a result, of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

b. Upon elimination of the spillage or overflow, the Contractor shall clean up and disinfect the area.

c. Work to stop or contain such event is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage or overflows of sewage during the course of the Work or because of the Work, shall be the sole responsibility of the Contractor.

e. The Contractor shall be responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.08 CONSTRUCTION METHOD

A. Equipment used to perform the work shall be located away from buildings in order to minimize noise impact which under all circumstances shall be less than 70 dB unless otherwise allowed by the Engineer due to circumstances beyond the Contractor of pipelining subcontractor.

1. A silent engine compartment with the winch shall be provided to reduce machine noise.

B The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the polyethylene pipe from damage during installation.

C. Lubrication may be used as recommended by the manufacturer. Under no circumstances shall the pipe be stressed beyond its elastic limit. The winch line must be centered in the existing pipe to be lined with an adjustable boom.

D. Line Obstructions: It is the responsibility of the Contractor to clear the line of obstructions, solids, dropped joints, or collapsed pipe that would prevent insertion or damage the slipliner pipe during insertion.

1. Excavations to remove obstructions shall be approved by the Construction Manager prior to the commencement of work.

E. Excavation: Insertion pits shall be only at locations shown on the drawings. If additional insertion pits are required, the Construction Manager shall approve the insertion pits and their locations prior to starting this work. The insertion pit size shall be no larger than is necessary.

1. The pit shall be sloped as required by the manufacturer or supplier. The sides of the pit must be supported and conform to OSHA requirements.
2. The pit shall be wide enough to install the slipliner pipe without damage.
3. Ground water pumping or well pointing shall be the responsibility of the Contractor.
4. After insertion of the slipliner pipe, the trench surrounding the new slipliner pipe or surrounding the new slipliner pipe and the top of the old pipe shall be filled with suitable properly compacted material.
    a. Sand stabilized with cement, crushed stone or flowable fill may be used. Backfill shall be compacted as noted on the plans.

F. Insertion of the Fused Liner: The polyethylene liner pipe shall be installed by pulling.

1. During insertion, precautions shall be taken to protect the slipliner pipe from scratches and gouges. The slipliner pipe shall be protected from ragged edges of the broken sewer pipe.
2. The slipliner pipe shall be allowed to relax and come to thermal equilibrium before sealing the annular space between the slipliner pipe and the existing sewer pipe at the manhole. The slipliner pipe must extend at least 8” into the manhole.

G. The installed polyethylene pipe shall be allowed to relax and cool following installation in accordance with the manufacturer's recommended time, but not less than four (4) hours, prior to any reconnection of service lines, sealing of the annulus or backfilling of the insertion pit.

H. Sufficient excess length of new pipe, but not less than four (4) inches, shall be allowed to protrude into the manhole to provide for further length reduction. End restraint of pipe ends shall be achieved by means of Central Plastics Electrofusion couplings.

I. The Electrofusion couplings shall be slipped over pipe ends against manhole wall and fused in place. Installation of all electrofusion couplings shall be carried out in accordance with the manufacturers recommended procedures.

J. Following the relaxation period, the annular space may be sealed. Sealing shall be made with materials approved by the Construction Manager and shall extend a minimum of eight (8) inches into the manhole wall in such a manner as to form a smooth, uniform, watertight joint. The terminating pipe ends in manholes shall be connected by Central Plastics Electrofusion couplings to eliminate ground water infiltration. Electrofusion couplings shall be installed in accordance with the manufacturers recommended procedures.

3.09 PIPE JOINING

A. The polyethylene pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint in strict accordance with the manufacturer's instructions and ASTM D2620.

B. Threaded or solvent-cement joints and connections are not permitted.

C. All equipment and procedures used shall be used in strict compliance with the manufacturer's instructions and recommendations.

D. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

E. The butt-fused joint shall be true alignment and shall have uniform roll-back beads resulting from the use of proper temperature and pressure.

F. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe.

G. All joints shall be subject to acceptance by the engineer and/or his representative prior to insertion.

1. All defective joints shall be cut out and replaced at no cost to the County.
2. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site.

3. Where authorized by the Construction Manager, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.

4. Any joint more than 1/8-inch high shall be trimmed to be smooth with the pipe prior to installation.

H. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Construction Manager and/or his representative shall be discarded and not used.

I. Terminal sections of pipe that are joined within the insertion pit shall be connected with Central Plastics Electrofusion Couplings or connectors with tensile strength equivalent to that of the pipe being joined.

J. When transitioning from polyethylene pipe to ductile iron pipe, pipes shall be joined with a transition sleeve as recommended by the pipe manufacturer. Transition sleeves shall be approved by the Construction Manager.

K. See Section 33 31 00 for additional HDPE pipe installation requirements.

3.10 SERVICE CONNECTIONS

A. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the sliplining system. The complete list of service laterals, included relevant footage and diameter of lateral, shall be submitted, prior to pipe lining, to the Construction Manager for information.

B. Use CCTV and a robotic cutter device to field locate existing service connections.

C. Once begun, pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the Construction Manager.

D. Upon completion of insertion of the new pipe, the Contractor shall complete the reconnection of all service laterals. Reconnection of the laterals on the segment must be completed within 8 hours of the start of service interruption to minimize any inconvenience to customers.

E. The Contractor shall reinstate all live junctions immediately after installation of the slipliner pipe. Service connections may be reinstated by excavation or internally.

F. Confirm the number of service connections to be reinstated and complete work to bring them back on line.

1. Recover coupons at downstream manhole and remove.

2. All service lateral reinstatements shall be wire brushed to eliminate burrs and snags.

G. Existing sewer service laterals shall be internally reinstated to 100% of their pre-lining flow diameter.

1. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages.

H. Do not reconnect services from abandoned or vacant lots, unless otherwise directed by the Construction Manager.

I. Show distance from nearest downstream manhole to reconnected service on record drawings.

J. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming.

K. The preferred method of saddle connection to the main line shall be either by use of an Inserter Tee by Fowler Manufacturing, Oregon, or by fusion of saddle connection with one of the following approved systems:

1. Electrofusion saddles as manufactured by Central Plastics
2. Conventional Fusion saddles as manufactured by Central Plastics, Phillips Driscopipe, or Plexco
3. Saddle material shall be compatible with that of the main pipe.

L. Service connection openings shall be reinstated to 95 – 100% of their diameter and free from rough edges or protrusions.

M. All active laterals, taps, or side connections will be reinstated from inside the rehabilitated pipe where possible.

1. In smaller diameter pipe in which man-entry is not possible, side connections must be reinstated internally by suitable, TV-monitored, robotic cutting equipment.
2. Cross-sections of the opening of the side connections must be reinstated by at least 95-percent of the original opening.
3. Reinstated lateral service openings shall be brushed smooth to the satisfaction of the Construction Manager.
4. Main-to-lateral connections shall be as watertight as possible to the satisfaction of the Construction Manager and verified as such via post CCTV inspection.
5. The annular space between the original host sewer pipe and the slipliner pipe upstream and downstream of the lateral connection shall be sealed. Acceptable materials for sealing are urethane foam and oakum or low shrink grout.

N. The cost for correcting deficiencies discovered shall be the responsibility of the Contractor.

3.11 POST INSTALLATION

A. HDPE pipe installation shall be free from visual defects and other deformities.

1. Defects and deformities may, at discretion of the Construction Manager, be cause for rejection of entire slipliner.
2. Contractor shall correct failed and/or defective liner pipe.
    a. Identified from post installation television inspection.
    b. Test reports for structural values
3. Method of repair, which may require field or workshop demonstration, shall be approved by the Construction Manager prior to commencement of work.
4. Remove and replace pipe identified with defects or deformities that cannot be repaired to the satisfaction of the Construction Manager and/or the manufacturer.

B. Both ends of the slipliner pipe shall be cut smoothly 2 inches from the inlet and outlet points in the manhole.

1. Seal with an epoxy or resin mixture compatible with the slipliner pipe to provide a watertight seal.
2. Sealing material and installation method shall be submitted and approved by the Construction Manager prior to start of construction.
    a. Pipe manufacturer shall also be consulted for appropriate sealing material and installation method.
3. Hydraulic cements and quick-set cement products are not acceptable.

C. Where slipliners of any type are installed in two or more continuous manhole segments, the slipliner pipe invert through the intermediate manholes shall be left intact.

1. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed slipliner pipe.
2. Neat trimming of the slipliner pipe edge where it touches the lip of the manhole bench.
3. Sealing between the new slipliner pipe and pre-existing manhole channel.

D. Portions of any piece of liner pipe material removed during installation shall be available for inspection and retention by the Construction Manager.

E. All manhole drop connections will be reviewed on an individual basis.

1. Reinstate openings for all drop assemblies after relining mainline sewer.
2. Everywhere possible, outside drop assemblies shall be lined with a liner compatible with the mainline slipliner pipe, for the full length of the drop assembly and bend.
3. Drop assemblies inside of manholes are not required to be relined, unless directed by the Construction Manager.

F. Each pipe segment lined shall be CCTV inspected as soon as practical after processing

1. Segments not fully conforming to these Specifications must be immediately brought to the Construction Manager attention with a proposed method of correction without cost to the Owner.

G. Manholes

1. Replacement: When a manhole is replaced, the replacement manhole shall be equipped with a boot connection. The boot will allow a secure connection to HDPE pipe.

2. Sealing Polyethylene Pipe in existing Manhole:

a. The annular space between the polyethylene pipe and the existing sewer line shall be sealed where the polyethylene pipe enters or exits manholes.

b. The pipe shall be allowed to relax and come to thermal equilibrium for a period of 24 hours before sealing.

c. Seal the upstream manhole pipe connection, connect services to the HDPE pipe, and then seal the downstream manhole connection. Acceptable materials are urethane foam, oakum or low shrink grout.

d. Foam sealant shall not protrude into the manhole and shall be finished over with a quick-set, non- shrink cement grout.

3.12 TESTING

A. Leakage Testing For Non-Pressure Piping

1. Non-pressure piping such as sewers shall be tested for excessive leakage in accordance with ASTM F1417.

2. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

B. Hydrostatic Leakage Testing For Pressure Piping

1. Hydrostatic leakage testing shall comply with ASTM F2164. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

2. Pneumatic (compressed air) leakage testing of PE4710 pressure piping is prohibited.

3.13 POST-INSTALLATION CCTV INSPECTION

A. Following installation of new pipelines between manholes where lining has occurred, CCTV inspection shall be carried out in accordance with the requirements of the Fulton County Manual for Internal Sewer Condition Assessment.

B. The finished lining shall be free of defects that would affect long term strength or hydraulic performance.

C. The finished video shall be continuous over the entire length of the sewer between two manholes and shall be completely free from visual defects.

D. The audio/video recording shall be prepared in the presence of the County's Inspector and provide the following:

1. An audio description to what is being viewed.
2. A continuous running footage indicator between manholes.

E. Prior to Final Acceptance the County shall be provided with one copy of the TV inspection report and video cassette showing the entire length of gravity sewer being tested.

1. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness and distance between manholes.
2. Any pipe found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

F. Should any portion of the inspection recording be of inadequate quality or coverage, as determined by the County, the Contractor will have the portion re-inspected and video recorded at no additional expense to the County.

3.14 Manholes

A. Replacement: When a manhole is replaced, the replacement manhole shall be equipped with a boot connection. The boot will allow a secure connection to HDPE pipe.

B. Sealing Polyethylene Pipe in existing Manhole:

1. The annular space between the polyethylene slipliner pipe and the existing sewer line shall be sealed where the slipliner pipe enters or exits manholes.
2. The pipe shall be allowed to relax and come to thermal equilibrium for a period of 24 hours before sealing.
3. Seal the upstream manhole slipliner pipe connection, connect services to the slipliner pipe, and then seal the downstream manhole connection. Acceptable materials are urethane foam, oakum or low shrink grout.
4. Foam sealant shall not protrude into the manhole and shall be finished over with a quick-set, non- shrink cement grout.

3.15 CLEAN-UP/RESTORATION

A. After the HDPE sliplining system installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.
    a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.
    b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.
    c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.
    d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements.

3.16 FINAL ACCEPTANCE

A. After installation of the slipliner pipe, the Contractor shall, at the option of the Owner's Representative, either TV inspect the sewer line or conduct a low pressure test on the slipliner pipe.

3.17 WARRANTY

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the slipliner pipe material.
    a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty

1. The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance and shall cover the cost of repairing and/or replacing the installed slipliner pipes and any freight to project site should the installed slipliner pipe have any defects in material or workmanship.

2. In addition to the standard pipe warranty, the fusing contractor shall provide in writing a three-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that requires remaking defective butt fusion, saddle fusion or electrofusion joints. The warranty shall also include freight to project site, formation, installation and pressure testing.

3. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the Contractor and/or the fusion installer of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. No bell clamps or wrap around corsets are allowed as a means of repair on new pipelines.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and replacement pipe manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

I. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

J. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

END OF SECTION

SECTION 33 01 30.73

SPIRAL WOUND PVC SLIPLINING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sliplining of existing gravity sanitary sewers.
2. Reconnection of existing service connections.
3. CCTV inspections.

1.02 SYSTEM DESCRIPTION

A. Machine spiral wound PVC liner is intended for use in the rehabilitation of sanitary and storm sewers without excavation.

B. The lining process shall use a continuous one-piece PVC profile strip, which is machine wound directly into the deteriorated host pipe from an existing access chamber or manhole.

C. The system shall consist of a single, one-part PVC profile strip with “T” shaped ribs on one side. The edges of the strip shall interlock as it is spirally wound to form a liner inside the host pipe.

D. The winding process shall be continuous until the complete length of the existing pipe between access points or manholes has been lined.

E. The liner shall be wound at a fixed diameter, leaving an annular space between the liner and host pipe wall. It shall then be radially expanded by mechanical means, without the applications of heat, until the liner makes contact with the inside wall of the host pipe.

1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 23 of these Specifications:

1. Shop drawings, catalog data, and manufacturer’s technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings. Include manufacturer’s recommendations for handling, storage, joint welding and repair of pipe and fittings damaged.
2. Methodology for construction and restoration of existing sewer service connections.

3. Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewerage flow and reconnection of sewer service connections, restoration of manhole base and provision for facilitating watertight junction of new pipe to existing and reconstructed manholes.

4. Certification of workmen trained for installing pipe by machine spiral wound sliplining.

5. Pre and post upgrade CCTV inspection reports and video recordings. Post upgrade reports and video recordings shall be made after liner installation and re-connection of all laterals and immediately prior to the commissioning stage

1.04 QUALIFICATIONS REQUIREMENTS

A. Product manufacturer shall have minimum 10 years' experience in machine spiral wound PVC liner manufacturing including:

1. Manufacture of a minimum of 100,000 linear feet of machine spiral wound PVC liner.

2. References for 10 projects for machine spiral wound PVC liner with pipe diameters of similar size or greater to those found on the Contract Drawings.

3. Personal experience of the manufacturing manager with other manufacturing companies may be substituted in lieu of the current company experience.

4. The machine spiral wound PVC liner system must have a proven performance record. Documentation of performance records shall be submitted with the Contractor's bid. Failure to provide this documentation may be grounds for disqualification.

B. Contractor's Qualifications

1. The Contractor shall be certified as a fully trained and licensed installer of the machine spiral wound PVC liner system.

2. Contractor or sliplining subcontractor shall have minimum experience of 150,000 linear feet of sliplining existing gravity sanitary sewer pipe and replacing with machine spiral wound PVC liner within the last five years.

C. Contractor shall hold the County and Design Engineer harmless in any legal action resulting from patent infringements.

1.05 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section, the Contractor shall comply with the latest edition of the Standard Specifications for Fulton County together with the latest adopted editions of the Regional and Fulton County Supplement Amendments, especially concerning the reconstruction of manholes and cleanouts.

1.06 QUALITY ASSURANCE

A. References

1. This Section contains references to the following documents. They are a part of this section to the extent referenced in this specification.
2. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
3. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.
4. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.
5. This document references American Society for Testing and Materials (ASTM) standard specifications, which are made a part hereof by such reference and shall be the latest edition and revision.
6. It is incumbent upon the Contractor to have a working familiarity with the following ASTM Standards:
    a. ASTM D256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
    b. ASTM D638: Standard Test Method for Tensile Properties of Plastics
    c. ASTM D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
    d. ASTM D1784: Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
    e. ASTM F1697-18: Standard Specification for Poly Vinyl Chloride (PVC) Profile Strip for Machine Spiral-Wound Liner Pipe Rehabilitation of Existing Sewers and Conduits
    f. ASTM F1741-18: Standard Practice for Installation of Machine Wound Poly Vinyl Chloride (PVC) Liner Pipe for Rehabilitation of Existing Sewers and Conduits ASTM F714
    g. ASTM F1417: Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

B. Manufacturer's Certification

1. Product manufacturers shall provide the Construction Manager with written certification that all products furnished comply with all applicable provisions of these Specifications.

C. Contractor's Certification

1. The Contractor must certify that the liner system to be used is the exact system for which all submittals and certifications were made in the bid.

2. No substitutions will be allowed, and misrepresentations and/or omissions may be grounds for contract termination with the Contractor waiving any and all claims against the Owner for work performed or costs incurred.

D. Acceptable Manufacturer

1. Sekisui SPR Americas

2. Approved equal

1.07 REGULATORY REQUIREMENTS

A. The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR 1910.146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational Safety and Health Act of 1970.

2. Construction Safety Act of 1969, as amended.

3. Applicable State and local codes and standards.

4. To the extent applicable, requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.

2. Personnel involved shall have current training certificates.

3. Entry permit is required prior to entry.

1.08 DELIVERY, STORAGE AND HANDLING

A. Transportation, handling and storage of the extruded PVC profile strips shall be as recommended by manufacturer.

B. If the profile strips become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Construction Manager at the Contractor's expense, before proceeding further.

C. Deliver, store and handle other materials as required to prevent damage.

1.09 RESPONSIBILITY FOR OVERFLOWS OR SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system.

B. In the event that the Contractor's work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the designated Construction Manager in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor, including the legal, engineering and administrative expenses of the County in defending such fines and claims.

PART 2 – PRODUCTS

2.01 SPIRAL WOUND PVC LINING PROFILE STRIPS

A. Materials

1. The extruded PVC profile strip shall be made from unplasticized PVC compounds meeting the minimum requirements for cell classification 13354 or higher, as defined in ASTM D1784.

2. PVC profile strip for machine spiral wound liner pipe rehabilitation of existing sewers shall comply with ASTM F1697-18 except as modified herein.

B. Material and Equipment Acceptance

1. At the time of manufacture, each lot of extruded PVC profile strip shall be inspected for defects and tested for physical properties as specified.

   a. A "lot" is defined as a continuous extrusion run of a given profile designation on a spool.

2. PVC profile strip minimum dimensions and initial stiffness factors shall be in accordance with Table 1 below. In accordance with ASTM F1697-18, other profile configurations are permitted, provided similar details are provided as in Table 1.

TABLE 1

Profile Type	Minimum Width		Minimum Height		Minimum Waterway Wall		Minimum Initial Stiffness Factor (EI)	
	mm	in	mm	in	mm	in	MPa-mm^3	(in^3 – lbf/in^2)
1	51.0	2.00	5.5	0.216	1.4	0.0551	21.2x10^3	188.0
2	80.0	3.14	8.0	0.314	1.4	0.0551	63.4x10^3	561.0
3	121.0	4.76	13.0	0.511	1.6	0.0630	242.7x10^3	2148.0
7	121.0	4.76	19.0	0.748	2.1	0.0830	450x10^3	3983.0

Note: Initial Stiffness Factors are derived from testing in accordance with ASTM D790 as modified by ASTM F1697-18, using flat strips of profile

3. The following values of modulus of elasticity of PVC shall be used in design:
    a. Short Term: 400,000psi (2,750 MPa)
    b. Long Term: 116,000psi (800 MPa)
4. Design stiffness values for a specific PVC profile strip shall be available from the manufacturer and submitted to the Construction Manager.
5. Sealants and gaskets necessary for effective interlocking of the edges of PVC strip shall be pre-applied at the time of manufacture. They shall be suitable for use in a sewer environment.

C. Material Testing

1. Before installation of the liner has commenced, a sample of the PVC profile strip from each production run shall be tested to confirm that the value of initial stiffness factor detailed in Table 1 exceeds specified minimum values.
2. If requested by the Owner, Contractor shall furnish samples and material tests for compliance with this specification from an independent laboratory to verify the required physical properties and characteristics of supplied materials in accordance with the applicable ASTM Specification
    a. A certificate shall be furnished by the manufacturer, upon request, for all material furnished under this Specification.
    b. Profile strips that do not meet any of the requirements of this specification may be rejected.
    c. The Owner will pay for tests on profile material which meets specification requirements.
    d. Contractor shall pay for failed tests and re-testing of failed materials.

D. Marking

1. Each PVC profile strip shall be distinctly marked on its inside surface at intervals not to exceed 60 inches with a code number identifying the manufacturer, plant, date of manufacture shift and profile type.

. This information shall also appear on each reel.

E. Sizes of the spiral wound PVC liner to be used shall be such as to renew the sewer to greater flow capacity.

F. All profile strips shall be made of virgin material. No reworked material shall be used.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed in strict accordance with manufacturer's written instructions and recommendations.

B. All work shall be completed by workmen skilled in their trade.

C. All reconstruction of existing gravity sewer mains using an approved machine spiral wound PVC liner product and installer shall be performed in strict accordance with this Specification and the latest revision of ASTM F1697.

D. Where discrepancies exist, or any latitude is either inferred or interpreted between this specification and ASTM product and process standards, this Specification shall govern.

3.02 PREPARATION

A. The following installation procedures shall be adhered to unless otherwise approved by the Construction Manager.

1. Carry out all operations in accordance with all Federal, State, and local safety laws, regulations, standards, policies and procedures including those promulgated by OSHA and those recommended by the manufacturer.

a. Particular attention is drawn to those safety requirements involving entering confined spaces (follow OSHA requirements).

1) The Contractor shall take additional precautions to secure the work area and insure the safety of everyone in or around the spiral wound machinery.

2) Before utilizing this method, the Contractor shall submit a copy of the Contractor's standard operating procedures addressing safety issues for this methodology to the Construction Manager.

2. If necessitated by site conditions, the Contractor shall bypass wastewater around the sewer segment or sewer segments designated for lining.

a. Service connection effluent may be plugged only after proper notification to the affected properties.

b. Individual's sewer service shall not be interrupted for more than 8 hours.

1) If proposal is to interrupt service for more than 8 alternative means of providing service during construction shall be required.

3. Do not install liner if ground water temperatures and/or ambient temperatures are excessive for the manufacturer's recommended installation procedures.

4. Where practicable, liners may be installed in continuous runs through manholes:

a. Where there are two or more continuous sewer segments.

b. Or to connect several short segments with a continuous lining.

5. If a road/lane must be closed to traffic, the Contractor shall furnish a detailed traffic control plan and all labor and equipment necessary.

a. No separate payment will be made for traffic control.

b. It shall be an incidental part for spiral wound liner installation.

3.03 PRE-INSTALLATION PROCEDURE

A. Complete the following activities unless otherwise approved by the Construction Manager.

1. Perform operations in accordance with OSHA Standards.

2. Before work commences:

a. Required pre-installation submittals shall be approved by Construction Manager, including:

1) Traffic management plan/measures.

2) Safe pedestrian passage.

3) Provision of vehicular access to property.

4) Bypass/diversion pumping.

5) Emergency measures/contingent plans.

b. Submit an Installation Access Plan including:

1) Access manhole location(s).

2) Site plan sketch showing dimensions of access within work limits and utilities.

3) Approximate installation rate (ft/day).

4) Appropriate excavation/backfill/resurfacing procedures including permits according to Georgia Department of

Transportation and governing agency standards.

B Installation Responsibilities.

1. It shall be the responsibility of the Contractor to field locate and designate all access points, open and make accessible for the work based on the Contract Drawings.

2. The Contractor shall arrange for access to water hydrants for cleaning and other work related items requiring water.

3.04 PRE-INSERTION CLEANING

A. Prior to entering access as manholes, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, State or Federal safety regulations.

B. Cleaning of Host Pipeline

1. Host pipes shall be cleaned of all debris, roots and other materials that would inhibit proper insertion of spiral wound PVC liner.

a Pipeline shall be cleaned with hydraulically powered equipment, high velocity jet cleaners or mechanically powered equipment.

b Heavy cleaning of sewers shall be performed if roots are present which require the use of mechanical brushes or dragging devices or, if in the judgment of the Construction Manager, the pipe is more than 25% full of debris.

c The host pipe shall be cleaned to the satisfaction of the Construction Manager.

d See NASSCO Recommended Specifications for Sewer Collection System Rehabilitation as required for the machine spiral wound lining operation.

2. Utilizing high-pressure jet cleaning equipment, several passes may need to be completed to assure that all debris is removed from the pipe to the satisfaction of the Construction Manager.

3. Debris Disposal

a All debris cleaned from the pipe shall be removed and disposed of at a dumpsite designated by the Owner at no additional cost to the Owner.

b Debris shall not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.

c Debris removed from sewer during cleaning shall be transported in watertight containers and disposed of in accordance with local, State, and Federal Regulations.

4. Provision and Usage of Water

a. The Owner shall make available all water required to perform this work.

b. The Owner shall provide a fire hydrant meter at no cost to the Contractor beyond the normal security deposit for use on the Project.

c. Contractor shall coordinate connection and usage limits and withdrawal locations with the Owner prior to construction.

d. The Contractor shall pay for all the water used based on the meter readings.

C. Existing Dimensions

1. After cleaning, the Contractor shall measure the I.D. of the existing pipe at the two (2) locations.

2. Prior to ordering of the liner, the Contractor shall:

a. Verify the internal dimensions of the existing sewer mains to insure that the lining utilized will be of appropriate dimension.

b. CCTV inspect and record ensuring the host pipe is free of debris and stable enough to line.

3.05 PRE-INSTALLATION VIDEO INSPECTION

A. Pipelines shall be inspected via CCTV in conformance with the Fulton County Manual for Internal Sewer Condition Assessment.

B. Prior to installation of the spiral wound liner, but not more than 48-hours prior to such installation, the section of sewer designated for machine spiral wound lining shall be televised its full length using a remote television camera specifically designed for that purpose.

C. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed-circuit television.

D. Utilizing a color video inspection system with data recording capabilities, the entire pipe section to be lined shall be recorded in a digital format and two (2) copies produced.

1. The interior of the pipe shall be carefully inspected to determine the location of any conditions, which may prevent the proper installation of the CIPP and it shall be noted so that these conditions can be corrected.

2. Electronic files, including a suitable log, shall be submitted to the Construction Manager.

3. Logs shall include date, line size, length, manhole numbers, project number, direction of camera travel, direction of flow and all observed defects or comments.

4. For each service connection the log shall include:

a. The distance from manhole.

b. Its radial location (e.g. 9:00 or 2:00 o'clock).

c. Street address or parcel identification.

d. Distance from mainline to cleanout.

5. Videos between manhole segments shall be continuous and no breaks or "blink-outs" in the video shall be observed. The videos shall be in digital flash drive format.

6. The full cross-sectional area of the pipe shall be visible during video inspection except where misalignment of the sewer that may result in standing water in bellies or sags

7. The pre-installation video files shall be turned over to the Construction Manager prior to pipe lining.

E. The television camera used for this purpose shall be operative in one hundred percent moisture conditions.

1. Lighting for the camera shall be sufficient to yield a clear picture of the entire periphery of the pipe.

2. The camera, television monitor and other components of the video system shall be capable of producing a five hundred line resolution picture.

3. The camera's rate of travel shall not exceed 20 feet per minute.

4. At each service connection, the camera shall come to a complete stop and the service shall be panned so that the entire cross sectional area of the service can be inspected.

5. The footage meter count shall be clearly visible.

6. If for any reason the camera becomes disabled inside the sewer and cannot further proceed, the Contractor will be responsible for retrieving the camera at no additional cost to the Owner.

F. Identification and Pre-measurement of Lateral Connections

1. A 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe.

2. At each connection the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8 to 12 inches of the lateral connection.

3. The Contractor shall be responsible for determining if the connection is active or inactive.

4. For each service connection determined by the Contractor to be active, the Contractor shall determine the condition of the service connection to the host pipe, make his recommendation for lateral connection repair and record both items in his log.

G. CCTV inspection additional requirements shall include the following:

1. Preconstruction video recordings shall be available for viewing by the Construction Manager before construction begins and throughout the project.

2. Video recordings shall be submitted to the Owner via a flash drive and shall remain property of the Owner. Contractor may retain the duplicate copy for his use.

3. All flows tributary to the reach of sewer being inspected are to be completely by-passed around the reach during pre-construction inspection if necessary and required by the Owner.

4. Should any portion of the inspection video be of inadequate quality or coverage, as determined by the Construction Manager, the Contractor shall have the portion re-inspected and video recorded at no additional expense to the Owner.

H. Line Obstructions

1. The host sewer pipe shall be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40% that may hinder or prevent the installation of the insertion of the liner system

2. When service connections protrude into existing pipe more than ½ inch, as measured from inside pipe wall, remove protruding portion of service connection to within ½ inch of inside pipe wall.

3. If pre-installation inspection reveals an obstruction such as a dropped joint, or a collapse that will prevent the lining installation process and that cannot be removed by conventional sewer cleaning or pipe or root cutting equipment, the Contractor may be required to make a point repair excavation to uncover and remove or repair the obstruction.

4. Such excavation shall be approved in writing by the Construction Manager prior to the commencement of the work and shall be considered as a separate pay item.

5. The Contractor shall remove, grind or take other precautions necessary to address sharp edges or protrusions that could tear the liner or the protective sheets or films.

6. For pipes where sags exist in the pipe segment:

   a. Water in the sag is to be removed to avoid trapping water between the liner and the host pipe.

3.06 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer subject to sliplining operations.

B. The Contractor shall provide bypass pumping during the pipe lining/replacement process, if necessary.

1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the liner shall be included in the cost for pipe replacement by sliplining.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

1. Monitor status of flow and storage.
2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.
2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.
3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.
2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.07 BY-PASS PUMPING

A. Bypass pumping may not be necessary for installation of the machine spiral wound liner. The Contractor shall be responsible for deciding the need for flow diversion to allow successful liner installation.

B. The Contractor shall provide all sewage bypass as necessary for the proper installation of liner.

C. Sewage flow shall be pumped around segments during the installation and testing of spiral wound liner pipe, the televising of sewers and lateral service reinstatement.

1 The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the sewer segment(s) under construction.

2. Pumping equipment shall have the capacity to convey 100% of peak flows around the construction area.

3. A standby pump of the same capacity shall be required on site.

4. Open channels or trenches shall not be used to convey flow.

5. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

D. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer main being bypassed and inform them that they will be temporarily out of service.

E. The Contractor shall notify all property owners who discharge sewage directly into the sewer main being rehabilitated at least 48 hours in advance, giving the date, starting and estimated completion time for the work being conducted and any anticipated impact to the property owner.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.

2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.

3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

F. Temporary Blocking and Back-Ups of Sewers and Sewage

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways and streets does not occur.

a. In the event that such spillage or overflow does occur during the course, or as a result, of the Work, the Contractor performing the

Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

b. Upon elimination of the spillage or overflow, the Contractor shall clean up and disinfect the area.

c. Work to stop or contain such event is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage or overflows of sewage during the course of the Work or because of the Work, shall be the sole responsibility of the Contractor.

e. The Contractor shall be responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.08 INSTALLATION AND FIELD INSPECTION

A. Installation of machine spiral wound PVC liner pipe for rehabilitation of existing sewers shall be in strict accordance with the recommendations and instruction of the manufacturer.

B. Installation of machine spiral wound PVC liner pipe for rehabilitation of existing sewers shall comply with ASTM F 1741-18 except as modified herein.

C. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the liner.

3.09 CONSTRUCTION METHOD

A. Equipment used to perform the work shall be located away from buildings in order to minimize noise impact which under all circumstances shall be less than 70 dB unless otherwise allowed by the Construction Manager due to circumstances beyond the Contractor of pipelining subcontractor.

1. A silent engine compartment with the winch shall be provided to reduce machine noise.

B. During installation the winding machine shall perform the following operations simultaneously:

1. A continuous ribbed liner profile strip is supplied from a reel and fed down through the existing manhole to the winding machine positioned at the base of the manhole.

2. Joint lubricating sealant shall be placed into the primary lock of the self-interlocking edges of the ribbed profile.
3. An elastomeric adhesive, which prevents the liner from expanding prematurely during winding shall be applied to the secondary lock during manufacture of the ribbed profile
4. High tensile wire shall be inserted.
    a. The wire shall remain only temporarily and shall be pulled out during the expansion stage.
5. The winding machine winds the PVC strip into a liner pipe by interlocking the edges.
6. Winding shall continue until the full length of the deteriorated pipe between manholes has been lined.
7. The liner shall then be radially expanded by mechanical means, without the application of heat, until the liner makes contact with the inside wall of the existing pipe.

C. End seals between the liner pipe and the existing pipe shall be installed with a sealing material that is compatible with the liner pipe material.

D. The transition between the liner invert and the invert in the manhole base shall be rendered smooth to reinstate the sewer flow line.

3.10 SERVICE CONNECTIONS

A. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the sliplining system. The complete list of service laterals, included relevant footage and diameter of lateral, shall be submitted, prior to pipe lining, to the Construction Manager for information.

B. Use CCTV and a robotic cutter device to field locate existing service connections.

C. Once begun, pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the Construction Manager.

D. Upon completion of insertion of the new pipe, the Contractor shall complete the reconnection of all service laterals. Reconnection of the laterals on the segment must be completed within 8 hours of the start of service interruption to minimize any inconvenience to customers.

E. The Contractor shall reinstate all live junctions immediately after installation of the liner. Service connections may be reinstated by excavation or internally.

F. Confirm the number of service connections to be reinstated and complete work to bring them back on line.

1. Recover coupons at downstream manhole and remove.
2. All service lateral reinstatements shall be wire brushed to eliminate burrs and snags.

G. Existing sewer service laterals shall be internally reinstated to 100% of their pre-spiral wound liner flow diameter.

1. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages.

H. Do not reconnect services from abandoned or vacant lots, unless otherwise directed by the Construction Manager.

I. Show distance from nearest downstream manhole to reconnected service on record drawings.

J. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming.

K. Service connection openings shall be reinstated to 95 – 100% of their diameter and free from rough edges or protrusions.

L. All active laterals, taps, or side connections shall be reinstated from inside the rehabilitated pipe where possible.

1. In smaller diameter pipe in which man-entry is not possible, side connections must be reinstated internally by suitable, TV-monitored, robotic cutting equipment.
2. Cross-sections of the opening of the side connections must be reinstated by at least 95-percent of the original opening.
3. Reinstated lateral service openings shall be brushed smooth to the satisfaction of the Construction Manager.
4. Main-to-lateral connections shall be as watertight as possible to the satisfaction of the Construction Manager and verified as such via post CCTV inspection.

M. The cost for correcting deficiencies discovered shall be the responsibility of the Contractor.

3.11 POST INSTALLATION

A. Machine spiral wound PVC liner installation shall be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, pinholes, wrinkles and other deformities.

1. Defects and deformities may, at discretion of the Construction Manager, because for rejection of entire liner.
2. Contractor shall correct failed and defective liners
   a. Identified from post installation television inspection.
   b. Test reports for structural values
   c. Thickness
3. Method of repair, which may require field or workshop demonstration,

shall be approved by the Construction Manager prior to commencement of work.

4. Remove and replace pipe identified with defects or deformities that cannot be repaired to the satisfaction of the Construction Manager and/or the Manufacturer.

B. Both ends of the liner shall be cut smoothly 2 inches from the inlet and outlet points in the manhole.

1. Seal with an epoxy or resin mixture compatible with the liner system to provide a watertight seal.

2. Sealing material and installation method shall be submitted and approved by the Construction Manager prior to start of construction.

a. The profile strip manufacturer shall also be consulted for appropriate sealing material and installation method.

3. Hydraulic cements and quick-set cement products are not acceptable.

C. Where liners of any type are installed in two or more continuous manhole segments, the liner invert through the intermediate manholes shall be left intact.

1. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed liner.

2. Neat trimming of the liner edge where it touches the lip of the manhole bench.

3. Sealing between the new liner and pre-existing manhole channel.

D. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the Construction Manager.

E. All manhole drop connections will be reviewed on an individual basis.

1. Reinstate openings for all drop assemblies after relining mainline sewer.

2. Everywhere possible, outside drop assemblies shall be lined with a liner compatible with the mainline slipliner, for the full length of the drop assembly and bend.

3. Drop assemblies inside of manholes are not required to be relined, unless directed by the Construction Manager.

F. Each pipe segment lined shall be CCTV inspected as soon as practical after processing to assure complete curing.

1. Segments not fully conforming to these Specifications must be immediately brought to the Construction Manager attention with a proposed method of correction without cost to the Owner.

G. Manholes

1. Replacement: When a manhole is replaced, the replacement manhole

shall be equipped with a boot connection. The boot will allow a secure connection to spiral wound PVC pipe.

2. Sealing spiral wound PVC pipe in existing Manhole:

   a. The annular space between the spiral wound PVC pipe and the existing sewer line shall be sealed where the spiral wound PVC pipe enters or exits manholes.

   b. The pipe shall be allowed to relax and come to thermal equilibrium for a period of 24 hours before sealing.

   c. Seal the upstream manhole pipe connection, connect services to the spiral wound PVC pipe, and then seal the downstream manhole connection. Acceptable materials are urethane foam, oakum or low shrink grout.

   d. Foam sealant shall not protrude into the manhole and shall be finished over with a quick-set, non- shrink cement grout.

3.12 Final Acceptance

A. After installation of the liner, the Contractor shall, at the option of the Owner, either TV inspect the sewer line or conduct a low pressure test on the liner.

3.13 TESTING

A. Leakage Testing For Non-Pressure Piping

1. Non-pressure piping such as sewers shall be tested for excessive leakage in accordance with ASTM F1417.

2. Any leakage and defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

3.14 POST-INSTALLATION CCTV INSPECTION

A. Following installation of new pipelines between manholes where lining has occurred, CCTV inspection shall be carried out in accordance with the requirements of the Fulton County Manual for Internal Sewer Condition Assessment to establish that the lining has been installed as specified and all live junctions have been reinstated.

B. The finished lining shall be free of defects that would affect long term strength or hydraulic performance.

C. The finished video recording shall be continuous over the entire length of the sewer between two manholes and shall be completely free from visual defects.

D. The audio/video recording shall be prepared in the presence of the County's Inspector and provide the following:

1. An audio description to what is being viewed.

2. A continuous running footage indicator between manholes.

E. Prior to Final Acceptance the County shall be provided with one copy of the TV inspection report and video recording showing the entire length of gravity sewer being sliplined.

1. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness and distance between manholes.

2. Any lining found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

F. Should any portion of the inspection recording be of inadequate quality or coverage, as determined by the County, the Contractor will have the portion re-inspected and video inspected at no additional expense to the County.

3.15 CLEAN-UP/RESTORATION

A. After the spiral wound PVC liner installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.

b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.

c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.

d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements.

3.16 WARRANTY AND REPAIRS

A. Material Warranty:

1. A written guarantee of 20 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the liner pipe material including against breakdown of material effectiveness of structural repair elements.

    a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty:

1. The Contractor shall guarantee his work for a warranty period of 10 years from the date of final acceptance against any leakage, cracking, loss of bond or other discontinuity as identified.

2. The warranty shall cover the cost of repairing and/or replacing the installed spiral wound PVC liner and any freight to project site should the installed liner have any defects in material or workmanship.

    a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the Contractor of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

E. If required, Contractor and replacement pipe manufacturer representatives may participate in inspections to determine such deficiencies.

F. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

G. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

H. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

I. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

END OF SECTION

SECTION 33 01 30.74

UV CIPP SLIPLINING

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this Section shall include rehabilitating a full length of an existing sewermain, from manhole to manhole, by the trenchless method known as ultra violet cured-in-place-pipe (UV-CIPP) in accordance with these Specifications.

B. CIPP consists of installing a resin-impregnated fiberglass material tube (Liner) that when cured extends the full length of the original pipe and provides a structurally sound, smooth, joint-less and watertight pipe.

1.02 DEFINITIONS

A. Ultra Violet Cured-in-Place-Pipe is defined as a hollow cylinder consisting of a glass reinforced fabric tube impregnated with an ultra violet light sensitive resin.

B. The impregnated tube is cured by the application of ultra violet light.

C. The UV-CIPP is formed within an existing host pipe and takes the shape of and fits tightly to the pipe, all as defined in ASTM Standard F1743.

D. The definitions in ASTM Standard F1216, and ASTM F2019 shall also apply.

1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 23 of these Specifications

B. Action Submittals for Review and Approval:

1. Shop drawings, catalog data, and manufacturer's engineering and technical data.
2. Comprehensive Construction Sequencing Plan including:
    a. Comprehensive Construction Sequencing Plan
        1) Proposed access routes.
        2) Set up locations for lining installation.
        3) Wet out area (if required) including:
            a) Typical insertion and curing schedule/plan.
            b) Submit wet out, insertion and curing plan for each and every lining proposed.
            c) Submit minimum 48 hours (2 working days) prior to each installation.

3. Methodology for construction and restoration of existing sewer service connections.

4. Analysis of design criteria and calculations for CIPP thickness per ASTM F1216 full deteriorated condition.

   a. Submit complete data and design calculations for each lining:

      1) Include installation method statement for each lining including:

         a) Repair details for potential sewer defects in conjunction with manholes, joints, laterals and infiltration.

         b) Quality Control/Quality Assurances.

   b. Design calculations establishing the structural capabilities, chemical composition, thickness, curing period, assumptions and other mechanical properties of the liner system proposed.

   c. All calculations shall be submitted to the Construction Manager, in duplicate, for his review.

   d. Calculations shall be prepared and stamped by a Professional Engineer in the State of Georgia.

      1) Approval of the calculations shall not relieve the Contractor of any contractual obligations.

5. Curing temperature/monitoring system shop drawings

6. Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewerage flow and reconnection of sewer service connections, restoration of manhole base and provision for facilitating watertight junction of new pipe to existing and reconstructed manholes.

7. Shop drawings for end seals and pre-liners to be used and method of installation.

8. Proposed testing procedure including:

   a. Number, location and sampling methods.

   b. Proposed testing laboratory with qualifications, experience history and references.

9. Qualification requirements for the Contractor, Installer and personnel (See Item 1.05 Qualifications, this specification)

C. Informational Submittals:

1. Manufacturer's brochures giving a complete description of the product proposed, its physical and chemical composition, the resin or epoxy hardener, the recommended range of curing period, cool-down procedures and method of installation.

2. Third party testing results from previous installations of the product proposed for this project.

3. Manufacturer's technical literature and certificate demonstrating the materials to be used meet the referenced standards and the requirements of these specifications.
4. Proposed equipment and procedures for accomplishing the cured-in-place pipe lining work.
5. Manufacturer's printed installation instructions including:
    a. Installation method statement including:
        1) Details concerning curing methods.
        2) Inversion pressures necessary for proper installation.
        3) Minimum pressure required to hold tube tight against existing hostpipe.
        4) Maximum allowable pressure that will not damage tube.
        5) Type of insertion.
        6) Defect repair:
            a) Methods of repairing in conjunction with manholes.
            b) Joints.
            c) Laterals.
            d) Active infiltration.
            e) Quality control/quality assurance plan.
            f) Repair material test results.
6. Product data and Manufacturer's installation procedures for resin and catalyst system including but not limited to specifications, characteristics, properties and itemized exceptions/deviations to the Specification.
7. Certification of workmen trained for installing pipe by CIPP sliplining manufacturer.
8. Certified test reports on physical properties and chemical resistance of proposed resin.
9. Material Safety Data Sheets for all resins and other additives such as accelerants, colorants and lubricants utilized in the pipe lining process.
10. Manufacturer's Certificate of Compliance that resin material is appropriate for intended application and in conformance with the Specifications.
11. Annular space sealant.
12. Service connection fittings.

D. Project Submittals

1. The Contractor shall submit the following information during the project for the use of CIPP at a particular location:
    a. Field measurements.

b. Design wall thickness calculations.

1) Signed and sealed by a Professional Engineer registered in the State of Georgia and proficient in the design of CIPP systems.

2) Manufacturer certification of material to values used in calculations.

2. "Wet-out" Plan: for each proposed lining section

a. Method for "wet-out" or flexible tube.

b. Specific insertion and curing schedule.

3. Contractor's procedures and materials for installing the liner and renewing sewer services including time and duration of sewer service unavailability.

4. Sampling procedures and locations for obtaining representative samples of the finished liner.

E. The Contractor shall submit a daily written record.

1. The Construction Manager shall certify receipt of the daily record (in email format) noting any items and adding any observations with reference to claims for payment to the Contractor.

2. The Construction Manager may request a weekly submission in the form of progress report.

a. Construction Manager shall provide the Contractor a written request for a weekly progress report.

F. Pre- and post- upgrade CCTV inspection reports and video files.

G. Post upgrade reports and video files shall be made after liner installation and re-connection of all laterals and immediately prior to the commissioning stage.

1.04 QUALITY ASSURANCE

A. References

1. This Section contains references to the following documents. They are a part of this section to the extent referenced in this specification.

2. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.

3. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.

4. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.

Reference	Title
ASTM C581	*Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures Intended for Liquid Service.*
ASTM D543	*Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.*
ASTM D578/ ASTM D578M	*Standard Specification for Glass Fiber Strands.*
ASTM D618	*Standard Practice for Conditioning Plastics for Testing*
ASTM D638	*Standard Test Method for Tensile Properties of Plastics*
ASTM D790	*Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*
ASTM D1598	*Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure*
ASTM D2122	*Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings*
ASTM D2412	*Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading*
ASTM D2837	*Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.*
ASTM D2990	*Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics*
ASTM D3567	*Standard Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings.*
ASTM D3681	*Standard Test Method for Chemical Resistance of Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe in a Deflected Condition.*
ASTM D5813	*Standard Specification for Cured-in Place Thermosetting Resin Sewer Pipe*
ASTM F1216	*Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube*
ASTM F1743	*Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)*
ASTM F2019	*Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)*
NASSCO	Guideline for the use and handling of styrenated resins in cured-in-place-pipe, September, 2008

B. Manufacturer's Certification

1. Product manufacturers shall provide the Construction Manager with written certification that all products furnished comply with all applicable provisions of these Specifications.

C. Contractor's Certification

1. The Contractor must certify that the liner tube/resin composite system to be used is the exact system for which all submittals and certifications were made in the bid.

2. No substitutions will be allowed, and misrepresentations and/or omissions may be grounds for contract termination with the Contractor waiving any and all claims against the Owner for work performed or costs incurred.

1.05 QUALIFICATION REQUIREMENTS

A. Product manufacturer shall have minimum 10 years' experience in CIPP manufacturing including:

1. Manufacture of a minimum of 100,000 linear feet of CIPP.

2. References for 10 projects for CIPP with pipe diameters of similar size or greater to those found on the Contract Drawings.

3. Personal experience of the manufacturing manager with other manufacturing companies may be substituted in lieu of the current company experience.

4. The CIPP system must have a proven performance record. Documentation of performance record shall be submitted with the Contractor's bid. Failure to provide this documentation may be grounds for disqualification.

B. Contractor's Qualifications

1. Contractor shall have a minimum of 5 years' experience in the installation of Cured-in-Place-Pipe products.

a. Within the previous 5 years, the Contractor shall have successfully completed at least 30,000 linear feet in total utilizing CIPP trenchless technology in pipe diameter of similar size to those found on the Contract Drawings or greater.

b. The Contractor shall provide the names of the owners of such projects and contact information upon request.

c. Documentation of experience shall be submitted in the Contractor's bid. Failure to provide this documentation may be grounds for disqualification.

2. Personal experience of the Contractor's construction manager with other construction companies may be substituted in lieu of the current company experience.

a. Substitution after award requires approval of the Construction Manager.

3. Contractor's Installing Superintendent and foreman must have:

a. Minimum 3 years' active experience in commercial installation of CIPP liners.

b. Key personnel shall each have completed minimum 30,000 linear feet and 100 line sections of CIPP in gravity sewers.

c. Certified training on installing manufacturer's product approved by the manufacturer.

4. Demonstrated they have a manufacturer approved quality assurance program to standardize the materials, manufacture, wet out and installation of the specific CIPP product in place.

5. The superintendent for the job shall be on-site during all phases of the Work involving any pre- and post- installation video inspection, sewer cleaning insertion and processing of the CIPP.

6. Documentation of experience shall be submitted in the Contractor's bid.

a. Failure to provide this documentation may be grounds for disqualification.

1.06 TESTING

A. CIPP samples shall be prepared and physical properties tested in accordance with ASTMF1216 or ASTM F1743, Section 8. The flexural properties must meet or exceed the values listed in Table 1 of the applicable ASTM and the values used herein for design.

B. Thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87½% of the design thickness.

C. Inspection

1. Visual inspection of the CIPP shall be in accordance with ASTM F1743, section 8.6. Two (2) sets of post installation videos, labeled and audio keyed to the Contract Drawings and associated logs, shall be submitted to the Construction Manager **within 24 hours of the inspection.**

1.07 DELIVERY, STORAGE AND HANDLING

A. Packaging, handling and shipping shall be done in accordance with the manufacturer's instructions.

1. The Contractor shall be responsible for the delivery, storage, and handling of products.

a. Keep products safe from damage

b. Promptly remove damaged products from the work site at the Contractor's expense.

1) Dispose of all damaged items in accordance with current applicable local, state and federal regulations.

c. Replace damaged products with undamaged products acceptable to the manufacturer and Construction Manager.

2. No products shall be shipped to the job site without the approval of the

Construction Manager.

B. Resin shall be shipped directly to wet-out facility from resin manufacturer unless otherwise approved by the Construction Manager.

C. Store UV light cured liners in a light-proof, cool environment to prevent premature curing.

D. The tube shall be handled with such care as to avoid cuts, tears or abrasions and in a manner to minimize deleterious stretching during all phases of the delivery and installation process. Special care shall be taken to roller convey, pull, lift, or pressurize the tubes to limit stretching and other potential deleterious effects as recommended by the manufacturer.

E. All materials shall be accompanied by test reports certifying that the materials conform to the ASTM standards listed herein.

1. Materials shall be shipped, stored, and handled in a manner consistent with written recommendations of the manufacturer.

2. The liner wet-out report must be provided for liner material and resin type.

a. The ratio of resin and fiberglass must be provided by the manufacturer.

F. Any liner damaged in shipment shall be replaced as directed by the Construction Manager. Any liner showing a split or tear or has been mishandled shall be marked as rejected and removed at once from the work.

1.08 REGULATORY REQUIREMENTS

A. The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR 1910.146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational Safety and Health Act of 1970.

2. Construction Safety Act of 1969, as amended.

3. Applicable state and local codes and standards.

4. To the extent applicable, requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.

2. Personnel involved shall have current training certificates.

3. Entry permit is required prior to entry.

1.09 WARRANTY AND REPAIRS

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the replacement pipe material including against breakdown of material effectiveness of structural repair elements.

a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty:

1. The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance against any leakage, cracking, loss of bond or other discontinuity as identified.

2. The warranty shall cover the cost of repairing and/or replacing the installed CIPP liner and any freight to project site should the installed liner have any defects in material or workmanship.

a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the Contractor of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

E. If required, Contractor and replacement pipe manufacturer representatives may participate in inspections to determine such deficiencies.

F. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract

G. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

H. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

I. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

1.10 RESPONSIBILITY FOR OVERFLOWS OR SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system.

B. In the event that the Contractor's work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the designated Construction Manager in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor, including the legal, engineering and administrative expenses of the County in defending such fines and claims.

PART 2 - PRODUCTS

2.01 GENERAL

A. The cured-in-place pipe material shall be fabricated from materials which, when cured, will be suitable for the environment intended.

1. The liner shall be resistant to exposure to the following:

a. Internal exposure to sewage gases containing normal levels for domestic sewage of hydrogen sulfide, carbon monoxide, carbon dioxide, methane, traces of mercaptan, kerosene, saturation with moisture and dilute sulfuric acid.

b. External exposure to soil bacteria and any chemical attack which may be due to materials in the surrounding ground.

B. The net inside diameter of the reconstructed/lined sewer shall be as large and smooth as possible to maintain the lined pipe's final capacity as close as possible to its original capacity.

C. Final product must not deteriorate, corrode or lose structural strength in any manner that will preclude the pipe from meeting the expected design life.

D. The Contractor shall be fully responsible for the design of the CIPP (liner) and shall save and hold harmless the Owner and Engineer from any and all costs or damages directly or indirectly related to the structural design of the CIPP.

E. Prior to design and ordering of the liner, the internal dimensions of the existing sewer mains shall be verified to insure that the lining utilized will be of appropriate dimension.

2.02 GLASS FIBER LINER TUBES

A. All materials shall be commercially available products from manufacturers acceptable to the Owner.

B. Glass Fibers

1. The glass fibers shall be corrosion resistant E-CR
2. Each lot of glass fibers liner shall be inspected for defects and tested in accordance with applicable sections of ASTM F2019.

C. Liner Tube

1. Any materials not approved by the Construction Manager prior to installation into the piping shall be rejected and shall be removed and replaced with approved materials at the Contractor's expense.
2. The liner shall have an impervious internal and external coating material to protect the resin from ultra violet light exposure and from contamination during shipping and installation.
3. The fiberglass liner shall be saturated with the appropriate resin using the resin bath or vacuum suction impregnation methods and allow the least amount of air entrapment.
4. Manufacture/construct the UV-CIPP using materials and methods that when installed:
    a. Provides a jointless and continuous structurally sound liner.
    b. Able to withstand all imposed static and dynamic loads on a long-term basis.
5. The impregnation of the resin into the glass fiber tube must be performed at the manufacturer's factory.
    a. No on-site wet-out of the tube will be allowed.
    b. The liner shall be designed specifically to meet this Contract's requirements.
6. The liner shall be sized such that when installed it will tightly fit the internalcircumference of the host pipe.
7. The manufacturer shall test raw materials and liner material at various stages of manufacturing.
8. Every finished liner shall be sampled and tested for flexural modulus and strength, modulus of elasticity and wall thickness.
    a. The results shall be provided to the Construction Manager.
9. The liner shall be seamless so that homogeneous properties are attained throughout the length and circumference.
10. The inner and outer membranes shall be certified styrene gas barriers.
11. All liners shall be packaged in special shipping containers and UV protection foil,
    a. Allowing storage of the resin impregnated liner for up to 6 months, withno need for refrigeration.

D. The liner thickness shall be designed in accordance with ASTM F1216 and the following criteria:

1. The structural performance of the cured-in-place pipe must be adequate to accommodate all internal and external loads (live and dead) over its service life.
2. The physical properties used in the design submittal shall be clearly identified. These physical properties shall be the basis for the acceptance of submittals of field samples and the acceptance of the final product.
3. Design Life: 50 Years
4. Pipe Diameters: Per Contract Drawings
5. Ovality: 2%
6. Maximum Deflection: 5%
7. Host Pipe Condition: Fully deteriorated
8. External Water: Ground water shall be actual depth or at least 5 feet below grade.
9. Physical Properties:
   a. Tensile Strength: 20,000 psi - Test Method ASTM D790
   b. Flexural Strength: 20,000 psi - Test Method ASTM D790
   c. Short Term Flexural Modules: 1,000,000 psi - Test Method ASTM D790
   d. Long Term Flexural Modules: 600,000 psi - Test Method ASTM D790
10. Reduction Factor: 50%
11. k Enhancement Factor: 7
12. Soil Modules: 1,000 psi
13. Prism Load: Soil density equal or greater than125 pcf
14. Highway Live Load: AASHTO H-25
15. Safety Factor: 2 minimum
16. Minimum Thickness: The liner thickness of each pipe segment shall be determined by the Contractor and submitted per Paragraph 1.05 of this Section. The minimum CIPP design thicknesses are listed below.

6”- 10” Diameter	3 mm
12” – 15” Diameter	6 mm
18” - 24” Diameter	7 mm

a. The nominal liner wall thickness shall be constructed to the nearest 0.5mm increment.

17. Poisson's ratio: 0.3.

18. Liner shall be watertight.

19. Detailed design calculations for all external loading conditions shall be submitted for review and approval.

a. The CIPP shall be designed as per ASTM F1216, Appendix X1.3.1 for the Fully Deteriorated Pressure Pipe condition.

b. These detailed calculations shall provide the input data as well as the actual calculations for Equations X1.1, X1.3, and X1.4 of Appendix X1. of the latest edition of ASTM F1216.

c. The design submittal shall also clearly identify the physical properties used for design.

E. Resin:

1. All Resin must be able to cure by Ultraviolet light.

2. A corrosion resistant vinyl ester resin system may be used that, when properly cured within the tube composite, meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein and those which are to be utilized in the design of the CIPP for this Project.

3. The resin shall produce a CIPP which will comply with the structural and chemical resistance requirements of this Specification.

4. General purpose, unsaturated, polyester, epoxy, isophtalic neopentyl glycol or thermosetting vinyl ester resin including:

a. Catalyst system, initiators or hardeners providing specified cured physical strengths and properties.

b. Compatible with reconstruction inversion process.

5. Resistant to municipal wastewater environment including:

a. Immersion in septic sewage at temperatures up to 75 degrees F.

6. PET resins, resin fillers, resin additives and resin enhancement agents are prohibited.

a. Only neat resins are acceptable.

b. Old resins and reworked resins are prohibited regardless of whether or not they are mixed with new resin.

7. Chemical resistance of resin system shall have been tested by resin manufacturer in accordance with ASTM D543.

a. Exposure to chemical solutions listed below at temperatures of up to 75 degrees F shall be conducted for a minimum period of 1 month and shall result in a loss of not more than 20 percent of initial structural properties.

1) Minimum Chemical Solution Concentration, ASTM F1216:

a) Tap Water, pH 6 to 9: 100 percent.
b) Nitric Acid: 5 percent.
c) Phosphoric Acid: 10 percent.
d) Sulfuric Acid: 10 percent.
e) Gasoline: 100 percent.
f) Vegetable Oil: 100 percent.
g) Detergent or Soap: 0.1 percent.

8. Produce cured tube resistant to shrinkage, non-corroded or oxidized and resistant to abrasion from solids, grit, and sand in wastewater.
9. Bond between tube layers shall be strong and uniform.
10. Layers, after cure, shall be saturated with resin.
11. The resin color shall not interfere with visual inspection of cured liner.

2.03 ULTRA VIOLET LIGHT CATALYST SYSTEM

A. When inserting the curing equipment in the liner, care shall be taken to not damage the inner film material.

B. Approved UV light systems shall have the ability to record specific parameters during the curing process to ensure the liner is properly cured.

C. The recording parameters shall include:

1. Project name.
2. Line section.
3. Date and time.
4. Curing speed.
5. Light source working & wattage.
6. Inner air pressure.
7. Inner temperatures.
8 Length of liner.

2.04 SOURCE QUALITY CONTROL

A. At time of manufacture, each lot of liner shall be inspected and certified to be free of defects.

B. Mark inside of tube in at least one location per set up.

1. Mark shall include manufacturer of liner, at regular intervals, not to exceed 5 feet, along full length.

C. CIPP samples for testing shall be of tube and resin system similar to that proposedfor actual construction.

1. CIPP samples with and without plastic coating shall meet these chemical testing requirements.
2. CIPP Field Samples:
    a. Submit test results from field installations of the same resin system and tub materials as proposed for the actual installation.
    b. Test results must verify that CIPP physical properties specified have been achieved in previous field applications.

D. Retention Factor - The retention factor for the design shall be a default value of 50% or a factor calculated from ASTM D2990 testing data.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed in accordance with manufacturer's written instructions and recommendations.

B. All work shall be completed by workmen skilled in their trade.

C. All reconstruction of existing gravity sewer mains using an approved CIPP product and installer shall be performed in strict accordance with this Specification and the latest revision of ASTM F1216.

D. Where discrepancies exist, or any latitude is either inferred or interpreted between this specification and ASTM product and process standards, this Specification shall govern.

3.02 PREPARATION

A. The following installation procedures shall be adhered to unless otherwise approved by the Construction Manager.

1. Carry out all operations in accordance with all Federal, State, and local safety laws, regulations, standards, policies and procedures including those promulgated by OSHA and those recommended by the manufacturer.
    a. Particular attention is drawn to those safety requirements involving entering confined spaces (follow OSHA requirements).
        1) The Contractor shall take additional precautions to secure the work area and insure the safety of everyone in or around the curing apparatus.
        2) Before utilizing this method, the Contractor shall submit a copy of the Contractor's standard operating procedures addressing safety issues for this methodology to the Construction Manager.
2. The Contractor shall bypass wastewater around the sewer segment or

sewer segments designated for lining.

a. Service connection effluent may be plugged only after proper notification to the affected properties.

b. Individual's sewer service shall not be interrupted for more than 8 hours.

1) If proposal is to interrupt service for more than 8 hours alternative means of providing service during construction will be required.

3. Do not install liner if ground water temperatures and/or ambient temperatures are excessive for the manufacturer's recommended installation procedures.

4. Where practicable, liners may be installed in continuous runs through manholes:

a. Where there are two or more continuous sewer segments.

b. Or to connect several short segments with a continuous lining.

5. If a road/lane must be closed to traffic, the Contractor shall furnish a detailed traffic control plan and all labor and equipment necessary.

a. No separate payment will be made for traffic control.

b. It shall be an incidental part for CIPP installation.

3.03 PRE-INSTALLATION PROCEDURE

A. Complete the following activities unless otherwise approved by the Construction Manager.

1. Perform operations in accordance with OSHA Standards.

2. Before Work commences:

a. Required pre-installation submittals shall be approved by Construction Manager, including:

1) Traffic management plan/measures.

2) Safe pedestrian passage.

3) Provision of vehicular access to property.

4) Bypass/diversion pumping.

5) Emergency measures/contingent plans.

b. Submit an Installation Access Plan including:

1) Access manhole location(s).

2) Site plan sketch showing dimensions of access within work limits and utilities.

3) Approximate installation rate (ft/day).

4) Appropriate excavation/backfill/resurfacing procedures

including permits according to Georgia Department of Transportation and governing agency standards.

B Installation Responsibilities.

1. It shall be the responsibility of the Contractor to field locate and designate all access points, open and make accessible for the work based on the Contract Drawings.
2. The Contractor shall arrange for access to water hydrants for cleaning and other work related items requiring water.

3.04 PRE-INSERTION CLEANING

A. Prior to entering access areas, such as manholes, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state or federal safety regulations.

B. Cleaning of Host Pipeline

1. Sewers shall be cleaned of all debris, roots and other materials that would inhibit proper insertion of CIPP.
   a Pipeline shall be cleaned with hydraulically powered equipment, high velocity jet cleaners or mechanically powered equipment.
   b Heavy cleaning of sewers shall be performed if roots are present which require the use of mechanical brushes or dragging devices or, if in the judgment of the Construction Manager, the pipe is more than 25% full of debris.
   c The pipe shall be cleaned to the satisfaction of the Construction Manager.
   d See NASSCO Recommended Specifications for Sewer Collection System Rehabilitation as required for the CIPP lining operation.
2. Utilizing high-pressure jet cleaning equipment, several passes may need to be completed to assure that all debris is removed from the pipe to the satisfaction of the Construction Manager.
3. Debris Disposal
   a All debris cleaned from the pipe shall be removed and disposed of at a dumpsite designated by the Owner at no additional cost to the Owner.
   b Debris shall not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.
   c Debris removed from sewer during cleaning shall be transported in watertight containers and disposed of in accordance with local, State, and Federal Regulations.
4. Provision and Usage of Water

a. The Owner shall make available all water required to perform this work.

b. The Owner shall provide a fire hydrant meter at no cost to the Contractor beyond the normal security deposit for use on the Project.

c. Contractor shall coordinate connection and usage limits and withdrawal locations with the Owner prior to construction.

d. The Contractor shall pay for all the water used based on the meter readings.

C. Existing Dimensions

1. After cleaning, the Contractor shall measure the I.D. of the existing pipe at the two (2) locations.

2. Prior to ordering of the liner, the Contractor shall:

a. Verify the internal dimensions of the existing sewer mains to insure that the lining utilized will be of appropriate dimension.

b. CCTV inspect and record ensuring the host pipe is free of debris and stable enough to line.

3.05 PRE-INSTALLATION VIDEO INSPECTION

A. Pipelines shall be inspected via CCTV in conformance with the Fulton County Manual for Internal Sewer Condition Assessment.

B. Prior to installation of the CIPP, but not more than 48-hours prior to such installation, the section of sewer designated for CIPP shall be televised its full length using a remote television camera specifically designed for that purpose.

C. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed-circuit television.

D. Utilizing a color video inspection system with data recording capabilities, the entire pipe section to be lined shall be recorded in a digital format and two (2) copies produced.

1. The interior of the pipe shall be carefully inspected to determine the location of any conditions, which may prevent the proper installation of the CIPP and it shall be noted so that these conditions can be corrected.

2. Electronic files, including a suitable log, shall be submitted to the Construction Manager.

3. Logs shall include date, line size, length, manhole numbers, project number, direction of camera travel, direction of flow and all observed defects or comments.

4. For each service connection the log shall include:

a. The distance from manhole.

b. Its radial location (e.g. 9:00 or 2:00 o'clock).

c. Street address or parcel identification.

d. Distance from mainline to cleanout.

5. Videos between manhole segments shall be continuous and no breaks or "blink-outs" in the video shall be observed. The videos shall be in digital flash drive format.

6. The full cross-sectional area of the pipe shall be visible during video inspection except where misalignment of the sewer that may result in standing water in bellies or sags

7. The pre-installation video files shall be turned over to the Construction Manager prior to pipe lining.

E. The television camera used for this purpose shall be operative in one hundred percent moisture conditions.

1. Lighting for the camera shall be sufficient to yield a clear picture of the entire periphery of the pipe.

2. The camera, television monitor and other components of the video system shall be capable of producing a five hundred line resolution picture.

3. The camera's rate of travel shall not exceed 20 feet per minute.

4. At each service connection, the camera shall come to a complete stop and the service shall be panned so that the entire cross sectional area of the service can be inspected.

5. The footage meter count shall be clearly visible.

6. If for any reason the camera becomes disabled inside the sewer and cannot further proceed, the Contractor will be responsible for retrieving the camera at no additional cost to the Owner.

F. Identification and Pre-measurement of Lateral Connections

1. A 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe.

2. At each connection the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8 to 12 inches of the lateral connection.

3. The Contractor shall be responsible for determining if the connection is active or inactive.

4. For each service connection determined by the Contractor to be active, the Contractor shall determine the condition of the service connection to the host pipe, make his recommendation for lateral connection repair and record both items in his log.

G. CCTV inspection additional requirements shall include the following:

1. Preconstruction video recordings shall be available for viewing by the Construction Manager before construction begins and throughout the project.
2. Video recordings shall be submitted to the Owner via a flash drive and shall remain property of the Owner. Contractor may retain the duplicate copy for his use.
3. All flows tributary to the reach of sewer being inspected are to be completely by-passed around the reach during pre-construction inspection if necessary and required by the Owner.
4. Should any portion of the inspection video be of inadequate quality or coverage, as determined by the Construction Manager, the Contractor shall have the portion re-inspected and video recorded at no additional expense to the Owner.

H. Line Obstructions

1. The host sewer pipe shall be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40% that may hinder or prevent the installation of the insertion of the liner system
2. When service connections protrude into existing pipe more than ½ inch, as measured from inside pipe wall, remove protruding portion of service connection to within ½ inch of inside pipe wall.
3. If pre-installation inspection reveals an obstruction such as a dropped joint, or a collapse that will prevent the lining installation process and that cannot be removed by conventional sewer cleaning or pipe or root cutting equipment, the Contractor may be required to make a point repair excavation to uncover and remove or repair the obstruction.
4. Such excavation shall be approved in writing by the Construction Manager prior to the commencement of the work and shall be considered as a separate pay item.
5. The Contractor shall remove, grind or take other precautions necessary to address sharp edges or protrusions that could tear the liner or the protective sheets or films.
6. For pipes where sags exist in the pipe segment:
    a. Water in the sag is to be removed to avoid trapping water between the liner and the host pipe.

3.06 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer subject to sliplining operations.

B. The Contractor shall provide bypass pumping during the pipe lining/replacement process, if necessary.

1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the liner shall be included in the cost for pipe replacement by sliplining.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

1. Monitor status of flow and storage.
2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.
2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.
3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.
2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.07 BY-PASS PUMPING

A. The contractor shall provide all sewage bypass as necessary for the proper installation of liner.

B. Sewage flow shall be pumped around segments during the installation and testing of cured-in-place pipe, the televising of sewers and lateral service reinstatement.

1 The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the sewer segment(s) under construction.

2. Pumping equipment shall have the capacity to convey 100% of peak flows around the construction area.

3. A standby pump of the same capacity shall be required on site.

4. Open channels or trenches shall not be used to convey flow.

5. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

C. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer main being bypassed and inform them that they will be temporarily out of service.

D. The Contractor shall notify all property owners who discharge sewage directly into the sewer main being rehabilitated at least 48 hours in advance, giving the date, starting and estimated completion time for the work being conducted and any anticipated impact to the property owner.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.

2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.

3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

E. Temporary Blocking and Back-Ups of Sewers and Sewage

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways and streets does not occur.

a. In the event that such spillage or overflow does occur during the course, or as a result, of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

b. Upon elimination of the spillage or overflow, the Contractor shall clean up and disinfect the area.

c. Work to stop or contain such event is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage or overflows of sewage during the course of the Work or because of the Work, shall be the sole responsibility of the Contractor.

e. The Contractor shall be responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.08 ULTRA VIOLET LINER INSTALLATION

A. General

1. Field verify diameters and lengths before manufacturing and cutting liner tolength.

2. The tube shall be fabricated to a size that, when installed, will neatly fit the internal circumference of the host pipe designated for CIPP. Allowance shall be made for the circumferential stretching during insertion of the tube.

3. After curing of the resin is completed, the hardened CIPP shall extend from manhole to manhole of the section designated providing a structurally sound, corrosion resistant, watertight conduit that excludes exfiltration and infiltration, is tight-fitting within the host pipe and is free of voids or annular spaces between the CIPP and the host pipe walls.

4. All terminations into manhole walls shall be watertight at the time of final inspection.

5. No annular space shall be visible between the CIPP and manhole wall. In the event that an annular space is present, it shall be completely filled with epoxy or other suitable material to the satisfaction of the Construction Manager.

6. Install in accordance with ASTM F1216, Section 7 or ASTM F1743, Section 6

a. Active infiltration must be removed prior to insertion of the liner.

B. Resin Impregnation (Wet-Out)

1. Tube shall be impregnated with resin either by the resin bath or vacuum suction methods under controlled conditions.

a. Resin bath impregnation must be performed at the manufacturer's factory.

b. Vacuum suction impregnation facility location must be designated

prior to CIPP installation.

c. No onsite wet-out of the tube will be allowed.

d. If requested, allow Construction Manager to inspect materials and procedures used to impregnate the tube.

e. If Contractor uses an alternative method of resin impregnation, method shall produce the equivalent results.

1) An alternative resin impregnation method shall be documented to Construction Manager's satisfaction that saturation of CIPP is sufficient.

f. Handle resin impregnated tube to retard or prevent settling until it is ready for insertion.

2. Resin must be uniformly distributed throughout the tube.

a. Use roller system to uniformly distribute resin throughout tube.

3. Volume:

a. Resin shall fill voids in tube material at nominal thickness and diameter. No air spaces or pockets will be allowed.

b. Adjust by adding excess resin to change resin volume because of polymerization and to allow for migration of resin into crack and joints in host pipe.

4. Complete wet-out process control sheet for every lining completed. Control sheet shall provide the following information:

a. Liner manufacturer.

b. Liner diameter.

c. Number of layers.

d. Resin manufacturer.

e. Resin amount.

f. Resin type.

g. Batch number.

h. Catalyst and accelerator name/type.

i. Hardener name/type.

j. Mixing ratios.

k. If vacuum suction method use: pressure of impregnation process.

l. Wet-out start time and date.

C. Insertion

1. CIPP installation shall be in accordance with applicable ASTM F2019 and manufacturer's specifications.

2. The Contractor and Manufacturer shall provide all appropriate transport, handling and protection equipment to deliver the impregnated tube to the

project site.

a. All materials should be protected from the weather and exposure to UV light during the manufacture, storage, transport and installation.

3. All fabricating and Contractor testing shall be carried out under cover and no materials shall be exposed to the weather until they are ready to be inserted.

4. Each liner shall be accompanied by suitable documentation indicating:

   a. Time and date of manufacture.

   b. Fiberglass thickness.

   c. Length of liner.

   d. Resin types.

   e. Resin content.

   f. Catalyst.

   g. Relevant batch numbers.

5. Liner protection: Prior to inserting the liner, a plastic slip/rub sheet, 10 mil thick, shall be pulled and laid flat into the host pipe such that it protects the liner from damage as the liner is pulled in.

6. Liner Insertion

   a. Insert the liner through an existing manhole or approved access point.

   b. Fully extend to the next designated manhole or termination point.

   c. Pulling speed shall not exceed 15 ft/min.

   d. Exercise care that no axial stretching occurs so that there is no damage to the tube during the pulling phase.

7. The tube shall be positioned in the pipeline using the method specified by the manufacturer.

   a. Exercise care not to damage the tube as a result of installation.

8. Liner Inflation

   a. Liner shall be inflated per manufacture's recommended inflation process.

   b. Pressurize the tube to achieve and maintain a tight fit (no gap) against the host pipe throughout the curing process.

      1) End plugs or packers shall be used to cap each end of the liner to prepare for pressurizing.

      2) The end caps shall be secured with straps or by other means to prevent them from being expelled.

   c. Once working inflation pressures are reached the liner shall be inspected by integrated CCTV on the curing light assembly

checking for proper fit and expansion of the liner.

d. The curing light train and CCTV camera shall be installed and directed through the entire length of the tube during which a detailed CCTV inspection is performed of the uncured tube.

e. Any defects, such as water bubbles, shall be addressed before the curing begins.

f. The light train is the activated and moved back along the length of the tube to effect the curing of the tube into a UV-CIPP.

9. The liner ends shall be the full size of the host pipe and shall be tightfitting to the end of the host pipe.

a. No wrinkles are acceptable at the termination of the liner.

b. No leaking from the liner/host pipe interface will be acceptable.

10. The light cure train shall be fitted with suitable monitors to gauge the cure achieved throughout the length of the liner.

a. The speed of cure shall be as per the manufacturer's requirements.

11. The inner tube protective membrane shall be removed after the liner has been cured.

12. Complete installation process control sheets for every lining completed. Control sheet shall provide the following information:

a. Date and time.

b. Liner length.

c. Pressure required to inflate tube and hold tight until curing process complete.

d. Time curing process started.

e. Curing time.

f. Time curing process ended.

g. Light source and wattage.

h. Exothermic (curing) Temperatures.

i. Time cutting ends started.

j. Time cutting laterals started.

k. Number of laterals cut.

D. Curing

1. The Contractor shall be responsible for the thorough curing of the liner to achieve the specified results.

a. The curing process shall be performed in accordance with the manufacturer's recommendations.

2. Curing Speeds – Initial curing speeds shall start off at a sufficient speed to ensure the first 15 feet of liner is cured properly, ramping up to working speed to properly cure the remainder of liner per manufacturer's protocol.
3. The same process shall be adhered to during the last 15 feet of liner
4. Contractor shall extend, at their expense, curing time to achieve a hard, sound liner demonstrating the specified mechanical and chemical properties, if required.
5. Integrated camera
    a. The integrated CCTV camera on the light assembly shall inspect post curing operations, fit of liner and any problems that may occur during the curing process.

3.09 SAMPLE TESTING

A. The Construction Manager, may, at his discretion, direct the Contractor to collect samples of the cured CIPP for laboratory determination of flexural strength, flexural modulus and wall thickness for each test sample during the execution of this Contract.
    1. These three individual analyses shall comprise one completed test.
    2. The tests shall be used to verify that the installed CIPP meets these Specifications.
        a. CIPP thickness shall be measured in accordance with ASTM D5813.
        b. Flexural properties shall be determined per ASTM D790.

B. All samples shall be collected per the sampling protocols set forth in ASTM F1216.

C. For sewers 15-inch and larger, plate samples may be taken and cured in the same manner as the installed CIPP.

D. For each sample taken, the Contractor shall cut and deliver a 1-inch wide representative sample (taken at least 2 inches from the end of the specimen) to the Construction Manager.
    1. The sample delivered to the Construction Manager shall be labeled, dated and removed from any restraining mold.

E. All testing shall be performed by an independent, ASTM-certified testing laboratory of the Owner's designation and at the Owner's expense.

F. The Contractor shall have the finished liner samples taken from manhole cutoffs,

service coupons, etc.

1. A minimum of one 12-inch long restrained sample shall be taken from each liner segment installed or as directed by the Construction Manager.
2. Physical samples removed for testing shall be individually labeled and logged to record the following:
    a. Owner's Project number and title.
    b. Sample number.
    c. Segment number of line as noted on plans.
    d. Date and time of sample.
    e. Name of Contractor.
    f. Location and by whom tested.
    g. Results of test.
    h. Street name and address.
3. Send one (1) sample from each liner segment installed to test in accordance with ASTM standards for:
    a. Flexural Modulus,
    b. Flexural Strength
    c. Wall thickness shall be conducted, a minimum of three samples per project shall be tested.
    d. Any liner that does not meet the specified 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 Construction Manager at no additional cost to the Owner.
        1) The Construction Manager's decision on how to correct deficient CIPP installations shall be final.
    e. If tests do not meet the minimum values:
        1) Additional samples originally not sent for testing may be required to be tested, as directed by the Construction Manager.
        2) Contractor bears all costs associated with additional testing.
        3) Payment to the Contractor shall be withheld pending the Owner's acceptance of the CIPP test results.

Property	ASTM Test	Minimumm
Flexural Strength	D790	20,000 psi
Flexural Modulus	D790	1,000,000 psi

Thickness	D2122 (per F2019)	Contract requirement

G. Resin Sampling:

1. Wet-out facility resin mixing equipment shall have a valve downstream of the mixing function and immediately upstream of application of mixed resin of tube where resin samples may be drawn.
2. Batch mix facilities, if any, shall provide sampling of mixed batch.
3. Submitted “wet-out” schedule may not be modified without 24-hour notice to Construction Manager.
4. Resin samples shall be drawn at times determined by Construction Manager.

H. Field thickness testing:

1. Perform prior to conducting laboratory tests.
2. Take a wall thickness measurement in accordance with ASTM D2122
3. Make a minimum of four measurements, evenly spaced, on each test specimen.
   a. Calculate average thickness using measured values.
4. Average thickness shall be equal or greater than required design thickness.
5. Failure of thickness test shall be grounds for rejection for CIPP liner.

I. If properties tests do not meet the minimum physical and thickness requirements, the CIPP shall be repaired or replaced at the Contractor’s expense.

J. All curing, cutting and identification of samples shall be witnessed by the Construction Manager.

3.10 ACCEPTANCE

A. Laboratory Testing: one sample shall be sent to an independent laboratory and tested.

1. Preparation and testing standards shall be performed in accordance with the approved submittals.
2. Failure of any test can be grounds for rejection of the CIPP liner.
3. At the direction of the Construction Manager a second sample shall be tested.

B. Destructive Testing: Where test results of samples from the 12-inch long pipe section are lower than required values, at the direction of the Construction Manager, Contractor shall cut samples form liner along length ofpipe.

1. The size and shape of the samples shall be determined by Construction Manager.

2. The Contractor shall repair the CIPP liner and host pipe at no additional cost to the Owner.

3. Failure of test shall be grounds for rejection for the CIPP liner.

C. Resin Sampling: Construction Manager drawing the samples will arrive unannounced and shall be afforded immediate access to the equipment.

1. Resin sample shall be sent to the independent laboratory and tested.

2. Testing standards shall be performed in accordance with approved submittals.

3. Failure of any test can be grounds for rejection for the CIPP liner.

D. Low-pressure air testing or hydrostatic exfiltration test: Acceptance based on successful completion of this test as specified herein.

E. The Contractor shall submit to the Construction Manager, for acceptance and approval:

1. Two (2) copies of unedited post-installation videos

2. Associated certified test reports for each sewer main segment within 10 working days of the liner installation.

3. No more than one sewer main segment shall be included on a post-installation Inspection recording or curing report.

F. It is the intent of these specifications the completed liner, with all appurtenances, to be essentially equivalent in final quality and appearance to new sewer pipe installation.

1. The conditions of the existing host pipe will be taken into consideration.

G. Where, in the opinion of the Construction Manager, a defect in the CIPP liner requires removing a section of the CIPP liner, the Contractor shall make all repairs as directed by the Construction Manager and shall install a segmental liner, compatible with the CIPP liner, to accomplish a continuous finished liner.

1. No separate measurement and payment will be made for such defect repair or for the post-repair segmental liner.

3.11 SERVICE CONNECTIONS

A. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the sliplining system. The complete list of service laterals, included relevant footage and diameter of lateral, shall be submitted, prior to pipe lining, to the Construction Manager for information.

B. Use CCTV and a robotic cutter device to field locate existing service connections.

C. Once begun, pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the Construction Manager.

D. Upon completion of insertion of the new pipe, the Contractor shall complete the reconnection of all service laterals. Reconnection of the laterals on the segment must be completed within 8 hours of the start of service interruption to minimize any inconvenience to customers.

E. The Contractor shall reinstate all live junctions immediately after installation of the liner. Service connections may be reinstated by excavation or internally.

F. Confirm the number of service connections to be reinstated and complete work to bring them back on line.

1. Recover coupons at downstream manhole and remove.
2. All service lateral reinstatements shall be wire brushed to eliminate burrs and snags.

G. Existing sewer service laterals shall be internally reinstated to 100% of their pre-CIPP flow diameter.

1. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages.

H. Do not reconnect services from abandoned or vacant lots, unless otherwise directed by the Construction Manager.

I. Show distance from nearest downstream manhole to reconnected service on record drawings.

J. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming.

K. Service connection openings shall be reinstated to 95 -100% of their diameter and free from rough edges or protrusions.

L. All active laterals, taps, or side connections will be reinstated from inside the rehabilitated pipe where possible.

1. In smaller diameter pipe in which man-entry is not possible, side connections must be reinstated internally by suitable, TV-monitored, robotic cutting equipment.
2. Cross-sections of the opening of the side connections must be reinstated by at least 95-percent of the original opening.
3. Reinstated lateral service openings shall be brushed smooth to the satisfaction of the Construction Manager.
4. Main-to-lateral connections shall be as watertight as possible to the satisfaction of the Construction Manager and verified as such via post CCTV inspection.

M. The cost for correcting deficiencies discovered shall be the responsibility of the Contractor.

3.12 POST INSTALLATION

A. UV-CIPP installation shall be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, pinholes, wrinkles and other deformities.

1. Defects and deformities may, at discretion of the Construction Manager, because for rejection of entire liner.
2. Contractor shall correct failed UV-CIPP and defective UV-CIPP
   a. Identified from post installation television inspection.
   b. Test reports for structural values
   c. Thickness
3. Method of repair, which may require field or workshop demonstration, shall be approved by the Construction Manager prior to commencement of work.
4. Remove and replace pipe identified with defects or deformities that cannot be repaired to the satisfaction of the Construction Manager and/or the Manufacturer.

B. Both ends of the cured Liner shall be cut smoothly 2 inches from the inlet and outlet points in the manhole.

1. Seal with an epoxy or resin mixture compatible with the liner/resin system to provide a watertight seal.
2. Sealing material and installation method shall be submitted and approved by the Construction Manager prior to start of construction.
   a. Tube manufacturer shall also be consulted for appropriate sealing material and installation method.
3. Hydraulic cements and quick-set cement products are not acceptable.

C. Where liners of any type are installed in two or more continuous manhole segments, the liner invert through the intermediate manholes shall be left intact.

1. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed liner
2. Neat trimming of the liner edge where it touches the lip of the manhole bench.
3. Sealing between the new liner and pre-existing manhole channel.

D. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the Construction Manager.

E. All manhole drop connections will be reviewed on an individual basis.

1. Reinstate openings for all drop assemblies after relining mainline sewer.
2. Everywhere possible, outside drop assemblies shall be lined with a liner compatible with the mainline slipliner, for the full length of the drop

assembly and bend.

3. Drop assemblies inside of manholes are not required to be relined, unless directed by the Construction Manager.

F. Each pipe segment lined shall be CCTV inspected as soon as practical after processing to assure complete curing.

G. Manholes

1. Replacement: When a manhole is replaced, the replacement manhole shall be equipped with a boot connection. The boot will allow a secure connection to CIPP

2. Sealing CIPP in existing Manhole:

a. The annular space between the CIPP and the existing sewer line shall be sealed where CIPP enters or exits manholes.

b. The pipe shall be allowed to relax and come to thermal equilibrium for a period of 24 hours before sealing.

c. Seal the upstream manhole pipe connection, connect services to the CIPP, and then seal the downstream manhole connection. Acceptable materials are urethane foam, oakum or low shrink grout.

d. Foam sealant shall not protrude into the manhole and shall be finished over with a quick-set, non- shrink cement grout.

H. Each pipe segment lined shall be CCTV inspected as soon as practical after processing to assure complete curing.

1. Segments not fully conforming to these Specifications must be immediately brought to the Construction Manager attention with a proposed method of correction without cost to the Owner.

3.13 POST-INSTALLATION CCTV INSPECTION

A. Following installation of new pipe liners between manholes where lining has occurred, CCTV inspection shall be carried out in accordance with the requirements of the Fulton County Manual for Internal Sewer Condition Assessment to establish that the lining has been installed as specified and all live junctions have been reinstated.

B. The finished lining shall be free of defects that would affect long term strength or hydraulic performance.

C. The finished video recording shall be continuous over the entire length of the sewer between two manholes and shall be completely free from visual defects.

D. The audio/video recording shall be prepared in the presence of the Construction Manager and provide the following:

1. An audio description to what is being viewed.
2. A continuous running footage indicator between manholes.

E. Prior to Final Acceptance the Construction Manager shall be provided with one copy of the TV inspection report and video recording showing the entire length of gravity sewer being sliplined.

1. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness and distance between manholes.
2. Any lining found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

F. Should any portion of the inspection recording be of inadequate quality or coverage, as determined by the County, the Contractor will have the portion re-inspected and video inspected at no additional expense to the Owner.

3.14 INSPECTIONS

A. The materials and processes must be reasonably available for pre-installation, installation, and post-installation inspections. Areas which require inspection include (but are not limited to) the following:

1. Materials used in the tube should exhibit sufficient transparency to allow visual inspection to assure the quality of resin-impregnation.
2. After completion of the lining process and reinstatement of service connections, the installation shall be inspected with a 360° integral lighthead camera.
    a. This post-installation television inspection is to take place within 24 hours after completion of each section.
    b. No Work shall be accepted that fails this post-installation television inspection.
    c. Post installation videos shall be provided to the Owner within 24 hours after their completion.
    d. Post construction videos shall be submitted to the Owner before final invoices, including retainage, are released.
3. All workmanship and materials shall meet the standards of the industry.
    a. The finished CIPP shall be continuous over the length of pipe between two manholes and shall be an impermeable, joint-less conduit, free from visual defects such as foreign inclusions, dry spots, pin holes, lifts or delamination.
    b. Wrinkles in the CIPP, (other than minor, longitudinal pressure wrinkles) will not be acceptable.
    c. The Construction Manager shall determine as to the acceptability of pressure wrinkling with that decision being final.

d. In the event the finished liner does not fit tightly against the host pipe at its termination point(s), the space between the liner and the host pipe shall be made watertight, utilizing manhole end seals, hydro-tite gaskets or approved equal.

3.15 CLEAN-UP/RESTORATION

A. After the CIPP liner installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.

b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.

c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.

d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements.

END OF SECTION

SECTION 33 01 30.75

FUSIBLE PVC SLIPLINING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sliplining of existing gravity sanitary sewers.
2. Reconnection of existing service connections.
3. CCTV inspection

B. Refer to Section 33 32 00, PVC Pipe and Fittings, for additional requirements.

1.02 DEFINITIONS

A. Sliplining: Sewer rehabilitation by which the lining unit pulls a new fusible PVC pipe through an existing pipe.

1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 23 of these Specifications:

1. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings. Include manufacturer's recommendations for handling, storage, joint welding and repair of pipe and fittings damaged.
2. Methodology for construction and restoration of existing sewer service connections.
3. Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewerage flow and reconnection of sewer service connections, restoration of manhole base and provision for facilitating watertight junction of new pipe to existing and reconstructed manholes.
4. Certification of workmen trained for fusible PVC pipe fusion and installation.
5. Pre and post upgrade CCTV inspection reports and video files. Post upgrade reports and videos shall be made after pipe installation and re-connection of all laterals and immediately prior to the commissioning stage.

B. The following information shall be submitted by pipe and fitting suppliers:

1. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.
2. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.
3. Pipe and fitting product data indicating conformance with this Specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.
4. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this Specification and applicable pipe and fitting standards specified herein.

C. The following information shall be submitted by Fusion Providers.

1. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this specification.
2. Documentation of conformance with this Specification and applicable standards, including written documentation regarding any intended variance from this Specification and applicable standards.
    a. This will include fusion joint warranty information and recommended project specific fusion parameters including criteria logged and recorded by data logger.

D. The following AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:

1. Fusion reports for each fusion joint performed on the project, including joints that were rejected.
2. Submittals of the Fusion Technician's joint reports are required as requested by Construction Manager.
3. Specific requirements of the Fusion Technician's joint report shall include:
    a. Pipe or fitting size, DR and pressure class rating.
    b. Fusion equipment size and identification.
    c. Fusion technician identification.
    d. Job identification number.
    e. Fusion number.
    f. Fusion joining parameters.
    g. Ambient temperature.

1.04 QUALIFICATIONS

A. The Contractor shall be certified as a fully trained and licensed installer of the pipe lining system.

B. Fusible PVC pipe jointing shall be performed by a Fusion Technician fully qualified by the pipe manufacturer to install fusible PVC pipe of the type(s) and size(s) being used.

1. The Fusion Technician shall be trained in the use of butt-fusion equipment and recommended methods for new pipe connections.

a. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the fusible PVC pipe.

b. Training shall be performed by a qualified representative.

2. Qualification shall be current as of the actual date of fusion performance on the Project.

C. Contractor shall hold the County and Engineer harmless in any legal action resulting from patent infringements.

D. Contractor or sliplining subcontractor shall have:

1. Minimum experience of 150,000 L.F. of sliplining existing gravity sanitary sewer pipe and replacing with fusible PVC pipe within the last three years.

E. Acceptable manufacturers

1. Ipex
2. Underground Solutions
3. Approved equal

1.05 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section, the Contractor shall comply with the latest edition of the Standard Specifications for Fulton County together with the latest adopted editions of the Regional and Fulton County Supplement Amendments, especially concerning the reconstruction of manholes and cleanouts.

1.06 QUALITY ASSURANCE

A. References

1. This Section contains references to the following documents. They are a part of this section to the extent referenced in this specification.
2. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
3. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.

4. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.

5. This document references American Society for Testing and Materials (ASTM) standard specifications, which are made a part hereof by such reference and shall be the latest edition and revision.

6. It is incumbent upon the Contractor to have a working familiarity with the following ASTM Standards:

   a. ANSI/AWWA C110/A21.10 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

   b. AWWA C605 Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

   c. AWWA C900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in. (100mm Through 1500mm), for Water Distribution

   d. AWWA M23 AWWA Manual of Supply Practices PVC Pipe-Design and Installation, Second Edition

   e. ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

   f. ASTM D1784 Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

   g. ASTM D1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

   h. ASTM D2152 Test Method for Degree of Fusion of Extruded Poly vinyl Chloride (PVC) Pipe and Molded Fittings by Acetone Immersion

   i. ASTM D2241 Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)

   j. ASTM D2665 Polyvinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

   k. ASTM D3034 Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings

   l. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

   m. ASTM F679 Standard Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings

   n. ASTM F1057 Standard Practice for Estimating the Quality of Extruded Polyvinyl Chloride (PVC) Pipe by the Heat Reversion Technique

   o. ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

p. UNI-B-6 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

q. UNI-PUB-08 Tapping Guide for PVC Pressure Pipe

r. PPI TR-2 PVC Range Composition Listing of Qualified Ingredients

1.07 REGULATORY REQUIREMENTS

A. The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR 1910.146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational Safety and Health Act of 1970
2. Construction Safety Act of 1969, as amended
3. Applicable state and local codes and standards
4. To the extent applicable, requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.
2. Personnel involved shall have current training certificates.
3. Entry permit is required prior to entry.

1.08 DELIVERY AND OFF-LOADING

A. Transportation, handling, and storage of the PVC pipe and fittings shall be as recommended by manufacturer.

B. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Construction Manager.

C. Each pipe shipment shall be inspected prior to unloading to check if the load has shifted or otherwise been damaged.

1. Notify the Construction Manager immediately if more than immaterial damage is found.
2. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.

D. Pipe shall be loaded, off-loaded, and otherwise handled in accordance with AWWA M23 and all of the pipe supplier's guidelines shall be followed.

E. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut or gouge the pipe are strictly prohibited.

F. During removal and handling, make sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.

G. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces.

1. Care shall be taken to insure that pipe is not dropped or damaged.
2. Pipe shall be carefully lowered, not dropped, from trucks.

H. If new pipe become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Construction Manager at the Contractor's expense, before proceeding further.

1.09 HANDLING AND STORAGE

A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the Work.

1. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area.
2. Limits of the acceptable length of pipe shall be determined by the Construction Manager.

B. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the Construction Manager.

C. Pipe lengths should be stored and placed on level ground.

1. Pipe shall be stored at the job site in the unit packaging provided by the manufacturer.
2. Caution shall be exercised to avoid compression, damage, or deformation to the ends of the pipe.
3. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.

E. The pipe shall be shaded or otherwise shielded from direct sunlight. .

1. Covering of the pipe which allows for temperature build-up is strictly prohibited

2. Pipe shall be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

F. Pipe shall be stored and stacked per the pipe supplier's guidelines. .

1.10 RESPONSIBILITY FOR OVERFLOWS OR SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system.

B. In the event that the Contractor's work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill and notify the Owner and Construction Manager in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor, including the legal, engineering and administrative expenses of the County in defending such fines and claims.

PART 2 – PRODUCTS

2.01 FUSIBLE PVC PIPE AND FITTINGS

A. General

1. All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784.
2. Sizes of the insertions to be used shall be such to renew the sewer to greater flow capacity.
3. The pipe shall be homogenous throughout and shall be free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters or other deleterious faults.

B. Fusible PVC Sewer Piping

1. Fusible PVC pipe shall conform to AWWA C900, ASTM D2241 or ASTM D1785 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.
2. Pipe shall be manufactured with 100% virgin resin. Pipe shall also have 0% recycled plastics content and shall not consist of any rework compound including that obtained from the manufacturer's own production using the same formulation.
3. Fusible PVC pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

4. Fusible PVC pipe shall be manufactured in a standard 40-foot nominal length or custom lengths as specified in the Drawings.
5. Fusible PVC pipe shall be green in color for wastewater use.
6. Pipe shall be marked as follows:
    a. Nominal pipe size.
    b. PVC.
    c. Dimension Ratio (DR), Standard Dimension Ratio (SDR) or Schedule.
    d. AWWA pressure class or standard pressure rating for non-AWWA pipe as applicable.
    e. AWWA standard designation number or pipe type for non-AWWA pipe as applicable.
    f. Extrusion production-record code.
    g. Trademark or trade name.
    h. Cell Classification 12454 and/or PVC material code 1120 shall also be included.

C. Fusion Joints

1. Unless otherwise specified, fusible PVC pipe lengths shall be assembled in the field with butt-fused joints.
2. The Contractor shall follow the pipe supplier's written guidelines for this procedure.
3. All fusion joints shall be completed as described in this Specification.

2.02 DIMENSIONS AND RATIOS:

A. The minimum wall thickness of the fusible PVC pipe shall be DR 18 throughout.

B. Fusible PVC pipe shall be of Ductile Iron Pipe Size (DIPS).

2.03 TESTING

A. Fusible PVC pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900 and applicable sections of ASTM D2241.

1. Testing priority shall be in conformance with AWWA C900.

B. Contractor shall furnish samples and material tests for compliance with this Specification from an independent laboratory to verify the required physical properties and characteristics of supplied materials in accordance with the applicable ASTM Specification.

1. A certificate shall be furnished by the manufacturer, upon request, for all material furnished under this Specification.

2. Fusible PVC pipe that does not meet any of the requirements of this Specification will be rejected.

3. The Owner shall pay for tests on pipe material which meets specification requirements. Contractor shall pay for failed tests and re-testing of failed materials

2.04 WINCH UNIT

A. The winch shall be of the constant tension type but shall be fitted with a direct reading load gauge to measure the winching load which must automatically be maintained at a constant tension at a set tonnage reading.

B. The winch, which shall be hydraulically operated to provide the constant tension throughout the lining operation, shall supply sufficient cable in one continuous length so that the pull may be continuous between approved winching points.

C. The winch, cable and cable drum must be provided with safety cage and supports so that it may be operated safely without injury to persons or property.

D. The Contractor shall provide a system of guide pulleys and bracing at each manhole to minimize cable contact with the existing sewer between manholes.

E. The supports to the trench shoring in the insertion pit shall remain completely separate from the winch boom support system and shall be so designed that neither the pipe nor the winch cable shall be in contact with them.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed in accordance with manufacturer's written instructions and recommendations.

B. All work shall be completed by workmen skilled in their trade.

C. Where discrepancies exist, or any latitude is either inferred or interpreted between this specification and ASTM product and process standards, this Specification shall govern.

3.02 INSTALLATION RESPONSIBILITIES

A. It shall be the responsibility of the Contractor to field locate and designate all access points open and accessible for the work based on the Contract Drawings.

B. The Contractor shall arrange for access to water hydrants for cleaning, and other work related items requiring water.

3.03 CLEANING

A. Prior to entering access areas, such as manholes, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state or federal safety regulations.

B. Cleaning of Pipeline

1. Sewers shall be cleaned of all debris, roots and other materials that would inhibit proper insertion of the slipliner pipe.

a. Pipeline shall be cleaned with hydraulically powered equipment, high velocity jet cleaners or mechanically powered equipment.

b. Heavy cleaning of sewers shall be performed if roots are present which require the use of mechanical brushes or dragging devices or, if in the judgment of the Construction Manager, the pipe is more than 25% full of debris, the pipe shall be cleaned to the satisfaction of the Construction Manager.

2. Utilizing high-pressure jet cleaning equipment, several passes may need to be completed to assure that all debris is removed from the pipe to the satisfaction of the Construction Manager.

3. Debris Disposal

a. All debris cleaned from the pipe shall be removed and disposed of at a dumpsite designated by the Owner at no additional cost to the Owner.

b. Debris will not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.

4. Provision and Usage of Water

a. The Owner will make available all water required to perform this work.

b. The Owner will provide a fire hydrant meter at no cost to the Contractor beyond the normal security deposit for use on the Project.

c. Contractor shall coordinate connection and usage limits and withdrawal locations with the Owner prior to construction.

d. The Contractor shall pay for all the water used based on the meter readings.

C. Existing Dimensions

1. After cleaning, the Contractor shall measure the I.D. of the existing pipe at two (2) locations.

2. Prior to ordering of the liner pipes:

a. Verify the internal dimensions of the existing sewer mains to insure that the pipe utilized will be of appropriate dimension.

b. CCTV inspect and record ensuring the host pipe is free of debris and stable enough to line.

3.04 SEWER SERVICE CONNECTIONS

A. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the sliplining system. The complete list of service laterals, included relevant footage and diameter of lateral, shall be submitted, prior to pipe lining, to the Construction Manager for information.

B. Use CCTV and a robotic cutter device to field locate existing service connections.

C. Once begun, pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the Construction Manager.

D. Upon completion of insertion of the new pipe, the Contractor shall complete the reconnection of all service laterals. Reconnection of the laterals on the segment must be completed within 8 hours of the start of service interruption to minimize any inconvenience to customers.

E. The Contractor shall reinstate all live junctions immediately after installation of the slipliner pipe. Service connections may be reinstated by excavation or internally

F. Confirm the number of service connections to be reinstated and complete work to bring them back on line.

1. Recover coupons at downstream manhole and remove.
2. All service lateral reinstatements shall be wire brushed to eliminate burrs and snags.

G. Existing sewer service laterals shall be internally reinstated to 100% of their pre-lining flow diameter.

1. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages.

H. Do not reconnect services from abandoned or vacant lots, unless otherwise directed by the Construction Manager.

I. Show distance from nearest downstream manhole to reconnected service on record drawings.

J. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming.

K. Service connection openings shall be reinstated to 95 – 100% of their diameter and free from rough edges or protrusions.

L. All active laterals, taps, or side connections will be reinstated from inside the rehabilitated pipe where possible.

1. In smaller diameter pipe in which man-entry is not possible, side connections must be reinstated internally by suitable, TV-monitored, robotic cutting equipment.
2. Cross-sections of the opening of the side connections must be reinstated by at least 95-percent of the original opening.
3. Reinstated lateral service openings shall be brushed smooth to the satisfaction of the Construction Manager.
4. Main-to-lateral connections shall be as watertight as possible to the satisfaction of the Construction Manager and verified as such via post CCTV inspection.
5. The annular space between the original host sewer pipe and the liner upstream and downstream of the lateral connection shall be sealed. Acceptable materials for sealing are urethane foam and oakum or low shrink grout.

M. The cost for correcting deficiencies discovered shall be the responsibility of the Contractor.

3.05 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer subject to slip lining operations.

B. The Contractor shall provide bypass pumping during the pipe lining/replacement process, if necessary.

1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the pipe shall be included in the cost for pipe replacement by sliplining.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

1. Monitor status of flow and storage.
2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.
2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.
3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.
2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.06 BY-PASS PUMPING

A. The contractor shall provide all sewage bypass as necessary for the proper installation of liner.

B. The Contractor shall bypass pump sewage flows around the segment being rehabilitated while the work is being performed. A detailed bypass plan shall be submitted to the Construction Manager for approval before any work taking place.

C. Sewage flow shall be pumped around segments during the installation and testing of the slipliner pipe, the televising of sewers and lateral service reinstatement.

1. The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the sewer segment(s) under construction.
2. Pumping equipment shall have the capacity to convey 100% of peak flows around the construction area.
3. A standby pump of the same capacity shall be required on site.
4. Open channels or trenches shall not be used to convey flow.

5. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

D. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer main being bypassed and inform them that they will be temporarily out of service.

E. The Contractor shall notify all property owners who discharge sewage directly into the segment being rehabilitated at least 48 hours in advance, giving the date, starting and estimated completion time for the work being conducted and any anticipated impact to the property owner.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.

2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.

3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

F. Temporary Blocking and Back-Ups of Sewers and Sewage

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so to prevent overflows and spillage onto public or private property and into storm sewers, waterways, and streets.

a. In the event that such spillage or overflows do occur during the course, or as a result, of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

b. Upon elimination of the spillage or overflow, the Contractor shall clean up and disinfect the area.

c. Work to stop or contain such events is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time, and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage, or overflows of sewage during the course of the Work or because of the Work shall be the sole responsibility of the Contractor.

e. The Contractor is responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.07 PRE-INSTALLATION CCTV INSPECTION

A. Pipelines shall be televised (CCTV) in conformance with the Fulton County Manual for Internal Sewer Condition Assessment.

B. Prior to installation of the fusible PVC pipe, but not more than 48-hours prior to such installation, the segment of sewer designated for sliplining shall be televised its full length using a remote television camera specifically designed for that purpose.

C. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed-circuit television.

D. Utilizing a color video inspection system with data recording capabilities, the entire pipe section to be lined shall be recorded in a digital format and two (2) copies produced.

1. The interior of the pipe shall be carefully inspected to determine the location of any conditions, which may prevent the proper installation of the liner pipe and it shall be noted so that these conditions can be corrected.
2. Electronic files, including a suitable log, shall be submitted to the Construction Manager.
3. Logs shall include date, line size, length, manhole numbers and project number, direction of camera travel, direction of flow and any observed defects or comments.
4. For each service connection the log shall include:
    a. The distance from manhole.
    b. Its location (e.g. 9:00 or 2:00 o'clock).
    c. Street address or parcel identification.
    d. Distance from mainline to cleanout.
5. Videos between manhole segments shall be continuous and no breaks or "blink-outs" in the video shall be observed. The videos shall be in digital flash drive format.
6. The full cross-sectional area of the pipe shall be visible during video inspection except where misalignment of the sewer may have resulted in standing water in bellies or sags
7. The pre-installation video (copy) shall be turned over to the Construction Manager prior to pipe lining.

E. The television camera used for this purpose shall be operative in one hundred percent moisture conditions.

1. Lighting for the camera shall be sufficient to yield a clear picture of the entire periphery of the pipe.

2. The camera, television monitor and other components of the video system shall be capable of producing a five hundred line resolution picture.
3. The camera's rate of travel shall not exceed 20 feet per minute.
4. At each service connection, the camera shall come to a complete stop and the service shall be panned so that the entire cross-sectional area of the service is inspected.
5. The footage meter count shall be clearly visible.
6. If for any reasons the camera becomes disabled inside the sewer and cannot further proceed, the Contractor will be responsible for retrieving the camera at no additional cost to the Owner.

F. Identification and Pre-measurement of Lateral Connections

1. A 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe.
2. At each connection the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8 to 12 inches of the lateral connection.
3. The Contractor shall be responsible for determining if the connection is active or inactive.
4. For each service connection determined by the Contractor to be active, the Contractor shall determine the condition of the service connection to the main, make his recommendation for lateral connection repair and record both items in his log.

G. CCTV inspection conditions shall include the following:

1. Preconstruction video shall be available for viewing by the Construction Manager before construction begins and throughout the project.
2. Video shall be submitted to the County via a flash drive and shall remain property of the County. Contractor to retain the second copy for his use.
3. All flows tributary to reach of sewer being inspected are to be completely by-passed around the reach during preconstruction inspection if necessary and required by the County.
4. Should any portion of the inspection be of inadequate quality or coverage, as determined by the Construction Manager, the Contractor shall have the portion re-inspected and video recorded at no additional expense to the County.

3.08 FUSION PROCESS

A. General

1. Fusible PVC pipe shall be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this Specification and pipe supplier’s guidelines.

2. Fusible PVC pipe shall be fused by qualified fusion technicians, as documented by the pipe supplier.

3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.

4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

    a. Heat Plate - Heat plates shall be in good condition with no deep gouges or scratches.

        1) Plates shall be clean and free of any debris or contamination.

        2) Heater controls shall function properly. Cord and plug shall be in good condition.

        3) The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused per the pipe supplier's guidelines.

    b. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi.

        1) Jaws shall be in good condition with proper inserts for the pipe size being fused.

        2) Insert pins shall be installed with no interference to carriage travel.

    c. General Machine - Overview of machine body shall yield no obvious defects, missing parts or potential safety issues during fusion.

    d. Data Logging Device – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used.

        1) Datalogging device operations and maintenance manual shall be kept with the unit at all times.

        2) If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

    e. Other equipment specifically required for the fusion process shall include the following:

        1) Pipe rollers shall be used for support of pipe to either side of the machine

        2) A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures and/or windy weather, per the pipe supplier's recommendations.

        3) An infrared (IR) pyrometer for checking pipe and heat plate temperatures.

4) Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

5) Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

B. Joint Recording

1. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.

2. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe.

3. The software shall register and/or record the parameters required by the pipe supplier and these specifications.

4. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

3.09 CONSTRUCTION METHOD

A. Installation guidelines from the pipe supplier shall be strictly followed for all installations.

B. Where fusible PVC pipe is installed by pulling in tension, the recommended Safe Pulling Force established by the pipe supplier shall not be exceeded.

C. Equipment used to perform the work shall be located away from buildings in order to minimize noise impact which under all circumstances shall be less than 70 dB unless otherwise allowed by the Construction Manager due to circumstances beyond the control of the Contractor or pipelining subcontractor.

1. A silent engine compartment with the winch shall be provided to reduce machine noise.

D. The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the fusible PVC pipe from damage during installation.

E. Lubrication may be used as recommended by the manufacturer.

1. Under no circumstances shall the pipe be stressed beyond its elastic limit.

2. The winch line must be centered in the existing pipe to be lined with an adjustable boom.

F. Line Obstructions: It is the responsibility of the Contractor to clear the line of obstructions, solids, dropped joints, or collapsed pipe that would prevent insertion or damage the liner during insertion.

1. The host sewer pipe shall be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40% that may hinder or prevent the installation of the slipling system.

2. When service connections protrude into existing pipe more than ½ inch, as measured from inside pipe wall, remove protruding portion of service connection to within ½ inch of inside pipe wall.

3. If pre-installation inspection reveals an obstruction such as a dropped joint, or a collapse that will prevent the lining installation process and that cannot be removed by conventional sewer cleaning or pipe or root cutting equipment, the Contractor may be required to make a point repair excavation to uncover and remove or repair the obstruction.

4. Such excavation shall be approved in writing by the Construction Manager prior to the commencement of the work and will be considered as a separate pay item.

5. The Contractor shall remove, grind or take other precautions necessary to address sharp edges or protrusions that could tear the slipliner pipe or the protective sheets or films.

6. For pipes where sags exist in the pipe segment:

   a. Water in the sag is to be removed to avoid trapping water between the slipliner pipe and the host pipe.

G. Excavation: Insertion pits shall be only at locations shown on the Drawings. If additional insertion pits are required, the Construction Manager shall approve the insertion pits and their locations prior to starting this work. The insertion pit size shall be no larger than is necessary.

1. The pit shall be sloped as required by the manufacturer or supplier. The sides of the pit must be supported and conform to OSHA requirements.

2. The pit shall be wide enough to install the liner without damage.

3. Ground water pumping or well pointing shall be the responsibility of the Contractor.

4. After insertion of the slipliner pipe, the trench surrounding the slipliner pipe or surrounding the slipliner pipe and the top of the host pipe shall be filled with suitable properly compacted material.

   a. Sand stabilized with cement, crushed stone or flowable fill may be used. Backfill shall be compacted as noted on the Plans.

H. Insertion of the fused slipliner pipe: The fusible PVC slipliner pipe shall be installed by pulling.

1. During insertion, precautions shall be taken to protect the slipliner pipe from scratches and gouges. The slipliner pipe shall be protected from ragged edges of the broken host sewer pipe.

I. The installed slipliner pipe shall be allowed to relax and cool following installation in accordance with the manufacturer's recommended time, but not less than four (4) hours, prior to any reconnection of service lines, sealing of the annulus or backfilling of the insertion pit.

J. Following the relaxation period, the annular space may be sealed. Sealing shall be made with materials approved by the Construction Manager and in such a manner as to form a smooth, uniform, watertight joint.

3.10 POST INSTALLATION

A. Fusible PVC pipe installation shall be free from visual defects and other deformities.

1. Defects and deformities may, at discretion of the Construction Manager, be cause for rejection of entire slipliner.
2. Contractor shall correct failed and/or defective liner pipe.
    a. Identified from post installation television inspection.
    b. Test reports for structural values
3. Method of repair, which may require field or workshop demonstration, shall be approved by the Construction Manager prior to commencement of work.
4. Remove and replace pipe identified with defects or deformities that cannot be repaired to the satisfaction of the Construction Manager and/or the manufacturer.

B. Both ends of the slipliner pipe shall be cut smoothly 2 inches from the inlet and outlet points in the manhole.

1. Seal with an epoxy or resin mixture compatible with the slipliner pipe to provide a watertight seal.
2. Sealing material and installation method shall be submitted and approved by the Construction Manager prior to start of construction.
    a. Pipe manufacturer shall also be consulted for appropriate sealing material and installation method.
3. Hydraulic cements and quick-set cement products are not acceptable.

C. Where slipliners of any type are installed in two or more continuous manhole segments, the slipliner pipe invert through the intermediate manholes shall be left intact.

1. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed slipliner pipe.
2. Neat trimming of the slipliner pipe edge where it touches the lip of the manhole bench.
3. Sealing between the new slipliner pipe and pre-existing manhole channel.

D. Portions of any piece of liner pipe material removed during installation shall be available for inspection and retention by the Construction Manager.

E. All manhole drop connections will be reviewed on an individual basis.

1. Reinstate openings for all drop assemblies after relining mainline sewer.
2. Everywhere possible, outside drop assemblies shall be lined with a liner compatible with the mainline slipliner pipe, for the full length of the drop assembly and bend.
3. Drop assemblies inside of manholes are not required to be relined, unless directed by the Construction Manager.

F. Each pipe segment lined shall be CCTV inspected as soon as practical after processing

1. Segments not fully conforming to these Specifications must be immediately brought to the Construction Manager attention with a proposed method of correction without cost to the Owner.

3.11 TESTING

A. Leakage Testing For Non-Pressure Piping

1. Non-pressure piping such as sewers shall be tested for excessive leakage in accordance with ASTM F1417.
2. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

B. Circularity Tests

1. Where required by the Construction Manager, pipes may be tested at ground surface for circularity before installation and welding commences.
2. Circularity will be checked by pulling a closed cylindrical mandrel through the polyethylene pipe.
3. The mandrel's outside dimension shall be sized to permit no more than 5.0 percent deflection.
4. The percent deflection shall be established from the base inside diameter of the pipe.
    a. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well.
5. The mandrel shall be approved by the Construction Manager prior to use.
6. The mandrel shall be at least three times the diameter of the pipe in length and not greater than inside diameter of pipe minus 2 millimeters.
7. Lines that permit safe entry may allow other deflection test options, such as direct measurements.
8. Pipes will be rejected which have greater than 5% deformation due to thermal softening.

C. Hydrostatic Leakage Testing For Pressure Piping

1. Hydrostatic leakage testing shall comply with ASTM F2164. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

3.12 POST-INSTALLATION CCTV INSPECTION

A. Following installation of new pipe liner between manholes where sliplining has occurred, CCTV inspection shall be carried out in accordance with the requirements of the Fulton County Manual for Internal Sewer Condition Assessment.

B. The finished video shall be continuous over the entire length of the sewer between two manholes and shall be completely free from visual defects.

C. The audio/video recording shall be prepared in the presence of the Construction Manager and provide the following:

1. An audio description to what is being viewed.
2. A continuous running footage indicator between manholes.

D. Prior to Final Acceptance the Owner shall be provided with one copy of the TV inspection report and video recording showing the entire length of gravity sewer being tested.

1. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness and distance between manholes.
2. Any pipe found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

E. Should any portion of the inspection recording be of inadequate quality or coverage, as determined by the County, the Contractor shall have the portion re-inspected and video recorded at no additional expense to the County.

3.13 PIPE JOINING

A. The fusible PVC pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint in strict accordance with the manufacturer's instructions and ASTM D2657.

B. Threaded or solvent-cement joints and connections are not permitted.

C. All equipment and procedures used shall be used in strict compliance with the manufacturer's instructions and recommendations.

D. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of fusible PVC pipe and/or fusing equipment.

E. The butt-fused joint shall be true alignment and shall have uniform roll-back beads resulting from the use of proper temperature and pressure.

F. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe.

G. All joints shall be subject to acceptance by the Construction Manager prior to insertion.

1. All defective joints shall be cut out and replaced at no cost to the Owner.
2. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site.
3. Where authorized by the Construction Manager, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.
4. Any joint more than 1/8-inch high shall be trimmed to be smooth with the pipe prior to installation.

H. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Construction Manager and/or his representative shall be discarded and not used.

I. Terminal sections of pipe that are joined within the insertion pit shall be connected with Central Plastics Electrofusion Couplings or connectors with tensile strength equivalent to that of the pipe being joined.

3.14 MANHOLES

A. Replacement: When a manhole is replaced, the replacement manhole shall be equipped with a boot connection. The boot will allow a secure connection to the fusible PVC pipe.

B. Sealing fusible PVC Pipe in existing Manhole:

1. The annular space between the slipliner and the existing sewer line shall be sealed where the liner enters or exits manholes.
2. The pipe shall be allowed to relax and come to thermal equilibrium for a period of 24 hours before sealing.
3. Seal the upstream manhole liner connection, connect services to the liner, and then seal the downstream manhole connection. Acceptable materials are urethane foam, oakum or low shrink grout.
4. Foam sealant shall not protrude into the manhole and shall be finished over with a quick-set, non- shrink cement grout.

3.15 CLEAN-UP/RESTORATION

A. After the fusible PVC liner installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.
    a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.
    b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.
    c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.
    d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements

3.16 FINAL ACCEPTANCE

A. After installation of the slipliner pipe, the Contractor shall, at the option of the Owner's Representative, either TV inspect the sewer line or conduct a low pressure test on the liner.

3.17 WARRANTY

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the slipliner pipe material.
    a. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty

1. The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance and shall cover the cost of repairing and/or replacing the installed slipliner pipes and any freight to project site should the installed slipliner pipe have any defects in material or workmanship.

2. In addition to the standard pipe warranty, the fusing contractor shall provide in writing a three-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that requires remaking defective butt fusion, saddle fusion or electrofusion joints. The warranty shall also include freight to project site, formation, installation and pressure testing.

3. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the Contractor and/or the fusion installer of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. No bell clamps or wrap around corsets are allowed as a means of repair on new pipelines.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and replacement pipe manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

I. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

J. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

END OF SECTION

SECTION 33 01 31

FIBERGLASS REINFORCED POLYESTER MANHOLE LINERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fiberglass Reinforce Polyester (FRP) Manhole Liners

1.02 SUBMITTALS

A. Complete product data and engineering data, including shop drawings, shall be submitted to the Construction Manager in accordance with the requirements of Section 01 33 23 of these Specifications.

1. Manufacturer's brochures giving a complete description of the product proposed, its physical properties and chemical composition, the thermosetting resin or epoxy hardener, the recommended range of curing temperature, period of cure, cool-down procedures, method of installation, repair and field quality control.

2. Design calculations establishing the structural capabilities, chemical composition, thickness, curing temperature and period, assumptions, and other mechanical properties of the liner system proposed, signed and sealed by a Professional Engineer licensed in the state of Georgia.

B. The Contractor shall submit complete shop drawings of the manhole lining system(s) to demonstrate compliance with these Specifications, materials and detailed installation procedures.

1. Testing procedures and quality control procedures shall also be submitted.

C. Certifications that the lining system was manufactured in accordance with these Specifications and the applicable ASTM standards shall be submitted with each material shipment..

1.03 QUALITY ASSURANCE

A. References

1. This section contains references to the following documents. They are a part of this section to the extent referenced in this specification.

2. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.

3. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.

4. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.

B. Standards

1. ASTM D695 – Test Method for Compressive Properties of Rigid Plastics

2. ASTM D790 – Test Method for Flexural Properties of Non-Reinforced 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 D3753 – Standard Specification for Glass-Reinforced Polyester Manholes and Wetwells.

1.04 DELIVERY, STORAGE AND HANDLING

A. Unloading

1. Contractor shall inspect manhole liners upon arrival to jobsite, ensuring that manhole liners have arrived undamaged. Manufacturer shall be notified of any damage immediately upon discovering.

2. Furnish equipment and facilities for unloading, handling, distributing and storing manhole liners.

3. Make equipment available at all times for use in unloading. Do not drop, impact or dump the fiberglass manhole liners.

4. Any liner dropped or dumped will be subject to rejection without additional justification.

B. Storage

1. Stored manhole liners shall be kept safe from damage.

2. Contractor shall avoid storing manhole liners on rocks, uneven ground or other surface that may cause point loading or damage to the liner.

3. Manholes liners with a height-to-diameter ratio greater than 2:1 shall be stored in horizontal position, prior to use.

4. Manhole liners shall not be stacked upon one another.

C. Handling

1. Handle manhole liners carefully to prevent shock or damage.

2. Manholes liners shall not be dropped or impacted in a manner that may be detrimental to the manhole liner.

3. Manhole liners may be lifted using a forklift or nylon/textile sling wrapped around the main body of the liner.

4. Manhole liners may also be lifted by inserting a 4" x 4" timber of sufficient length to span the liner opening and attaching cable to midpoint of timber or by attaching a nylon/textile sling around the center of the liner.
5. Use of chains or cables in contact with the liner surface is prohibited.
6. Manholes liners shall be unloaded from trucks one at a time.
7. Do not use liners damaged in handling.

1.05 REGULATORY REQUIREMENTS

A. The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR 1910.146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational Safety and Health Act of 1970
2. Construction Safety Act of 1969, as amended
3. Applicable state and local codes and standards
4. To the extent applicable, requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.
2. Personnel involved shall have current training certificates.
3. Entry permit is required prior to entry.

1.06 WARRANTY AND REPAIRS

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the liner material including against breakdown of material effectiveness of structural repair elements.

B. Workmanship Warranty:

1. The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance against any leakage, cracking, loss of bond or other discontinuity as identified.
2. The warranty shall cover the cost of repairing and/or replacing the installed FRP liner and any freight to project site should the installed liner have any defects in material or workmanship.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. The FRP liner shall be repairable at any time during the life of the structure, with the same type of liner materials used in the original installation, including repair or lining of the upper chimney portion where grade adjustments have been made. Repair/lining materials shall be of the type that will bond to the original liner materials.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and FRP liner manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

PART 2 - PRODUCTS

2.01 GENERAL

A FRP manhole liner shall be manufactured from commercial grade polyester resin or vinyl ester resin with fiberglass reinforcements.

B. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems.

C. The manhole liner shall be a one piece unit manufactured to meet or exceed all specifications of ASTM D3753.

2.02 MATERIALS AND WORKMANSHIP

A. Resin Systems

1. The resins used shall be a commercial grade unsaturated polyester resin, or vinyl ester resin or other suitable polyester.

2. Resins shall be suitable for the service environment intended(i.e. domestic sanitary wastewater).

B. Additives

1. Additives, when used, shall produce a laminate that is inert to the service environment.

2. All particulate additives used in filament wound components shall be pre-blended with resin using a high shear mixer to assure complete wetting of particulate surfaces.

   a Pre-blending of particulate additives shall result in a homogeneous colloidal mixture with additives evenly dispersed and suspended throughout the resin prior and during use.

3. Manhole liner components manufactured using the filament winding process shall contain no sand.

4. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to meet the requirements of the ASTM D3753 standard.

5. The resulting reinforced-plastic material must meet the requirements of this Specification.

C. Reinforcing Materials

1. The reinforcing materials shall be commercial Grade “E” type glass in the form of continuous roving and chop roving, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.

D. Interior Surfacing Material

1. The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inch thick.

2. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5 inch to maximum length of 2.0 inch and shall be applied uniformly to an equivalent weight of 3 oz/ft.

3. Each pass of chopped roving shall be well rolled prior to the application of additional reinforcement.

4. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inch.

5. The interior surface shall be resin rich with no exposed fibers.

6. The surface shall be free of crazing, de-lamination, blisters larger than 0.5-inch in diameter, and wrinkles of 0.125-inch or greater in depth.

7. Surface pits shall be permitted if they are less than 0.75-inch in diameter and less than 0.0625-inch deep.

8. Voids that cannot be broken with finger pressure and are entirely below the resin surface shall be permitted if they are less than 0.5-inch in diameter and less than 0.0625-inch thick.

9. Indentations or other shape imperfections that will not affect performance are allowed.

E. Exterior Surface

1. Exterior surface shall be coated with 0.125-inches of gel coat as an additional water barrier.

2. Gel coat shall be pigmented gray as an additional UV inhibitor.

3. The exterior surface shall be relatively smooth with no sharp projections.

4. Handwork finish is acceptable if enough resin is present to saturate all fibers and eliminate fiber show.

5. The exterior surface shall be free of blisters larger than 0.5-inch in diameter, de-lamination or fiber show.

6. Indentations or other shape imperfections that will not affect performance are allowed.

F. Repairs: All fiberglass laminate repairs are subject to meeting the requirements of ASTM D3753 and this Specification.

2.03 MANUFACTURE AND CONSTRUCTION

A. Acceptable Manufacturer

1. Manufacturer shall have 10-years of experience in the manufacture of fiberglass manholes for use in domestic or industrial sanitary sewer applications.

2. Acceptable manufacturer shall have a quality control program that is currently ISO 9001 certified.

3. Manufacturer shall be L.F. Manufacturing, Inc. or approved equal.

B. Manhole cylinders, manway reducers, and connectors shall be produced from fiberglass-reinforced polyester or vinyl ester resin using a combination of chop and continuous filament winding process.

C. Wall Construction Procedure

1. After inner layer has been applied the manhole liner wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition.

2. Each layer of glass laminate shall be mechanically roller compacted to remove entrapped air and thoroughly saturate the glass laminate with resin prior to adding another layer of glass reinforcement.

3. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one piece unit.

4. Seams shall be fiberglass laminated on the inside and the outside using the same glass-resin jointing procedure.

5. Field joints shall be performed by the manufacturer, its agent or qualified third-party.

D. Ribs

1. When used, ribs may be manufactured as a solid construction or with fiberglass laminate applied over a structural or non-structural form.

2. The resulting structure shall meet the requirements of ASTM D3753.

E. Assembly segments

1. Individual fiberglass components of manhole liner shall be joined by fiberglass-reinforced laminate overlay.
2. The resulting structure shall meet the all loading and soundness requirements of ASTM D3753.

F. Height Adjustment

1. Fiberglass manhole liners shall be height adjustable using an internal adjustment ring.
2. Riser sections cut for height adjustment shall be rejoined by fiberglass-reinforced laminate, MacWrap or approved equal.
3. Fiberglass manholes shall maintain all loading and soundness characteristics required by ASTM D3753 after height adjustment has occurred.

G. Interior Access

1. No steps shall be required with the installation of FRP manhole liners.
2. All manhole liners shall be designed so that a ladder or step system can be supported by the installed manhole liner.

H. Manway Reducer

1. Manway reducers shall be concentric or eccentric with respect to the centerline of the manhole riser section, as designated by the Owner.

I. Ring and Cover Support Platform:

1. Top of cone/reducer shall have a fiberglass support platform upon which concrete grade rings may be installed to accept a typical cast iron or composite ring.
2. For H-20 traffic loading, a 4-inch (minimum) thick concrete grade ring shall be required. Outside diameter of grade rings, for H-20 loading, shall exceed outside diameter of fiberglass support plate by a minimum of 1 inch on all sides.
3. The manhole liner shall provide an area for which grade rings or bricks can be installed to accept a typical metal or composite ring and cover and have the strength to support a traffic load without damage to the manhole liner.
4. Grade rings, ring and cover shall be placed over fiberglass neck (chimney) and onto fiberglass support plate in a manner that evenly distributes loading.
5. No loading shall be placed onto fiberglass neck.

J. Marking and Identification

1. Each manhole shall be marked on the inside and outside with the following information:
   a Manufacturer's name or trademark.
   b Manufacturer's factory location.
   c Manufacturer's serial number.
   d Total manhole depth.

2.04 DIMENSIONS

A. Diameters

1. Manhole liner diameter shall meet the requirements of the project Specifications and shall be measured in accordance with ASTM D3753 Section 8.3.
2. Tolerance of inside diameter shall be +/- 1% of required liner diameter.

B. Length

1. Manhole length shall be measured from lowest bench elevation to rim elevation and be sufficient to allow for 12 inches of concrete grade rings, plus ring height.

C. Wall Thickness

1. Design thickness shall be sufficient to withstand all dead and live loads imposed on the manhole for the project conditions.
2. Manholes subject to highway traffic loading, as indicated on the Drawings, shall meet the requirements of AASHTO H20 as described in ASTM D3753. Wall thickness shall be 1/4" minimum.

2.05 MANHOLE DESIGN

A. Load Rating

1. The complete manhole liner shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM D3753 8.4 (See note[1]).
2. To establish this rating the complete manhole liner shall not leak, crack, or suffer other damage when load tested to 40,000 lbs and shall not deflect vertically downward more than 0.25 inch at the point of load application when loaded to 24,000 lbs.

B. Stiffness

1. The manhole cylinder shall have the minimum pipe-stiffness values shown in the table below when tested in accordance with ASTM D3753 8.5 (See Note [1]).

LENGTH – FT.	F/AY – PSI

6 or less	0.75
6+ to 12	1.26
12+ to 20	2.01
20+ to 25	3.02
25+ to 35	5.24
35+	See Note[1]

Note[1] – For depths greater than 35-feet, pipe stiffness shall be extrapolated from shallower values or Manufacturer shall provide structural design method.

C. Soundness

1. In order to determine soundness, apply an air or water pressure test to the manhole test sample.
2. Test pressure shall not be less than 3 psig or greater than 5 psig.
3. While holding at the established pressure, inspect the entire manhole for leaks.
4. Any leakage through the laminate is cause for failure of the test.
5. Refer to ASTM D3753 8.6.

D. Chemical Resistance:

1. The fiberglass manhole and all related components shall be fabricated from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems.

2.06 PHYSICAL PROPERTIES

	Hoop Direction	Axial Direction
a. Tensile Strength(psi)	18,000	5,000
b. Tensile Modules(psi)	0.6×10^6	0.7×10^6
c. Flexural Strength(psi)	26,000	4,500
d. Flexural Modules(psi)	1.4×10^6	0.7×10^6
e. Compressive (psi)	18,000	5,000

2.07 TEST METHODS

A. All tests shall be performed as specified in ASTM D3753 latest edition, section 8. Test method ASTM D790 and test method ASTM D695.

2.08 QUALITY CONTROL

A. Each completed manhole liner shall be examined for dimensional requirements, hardness, and workmanship.

B. All required ASTM D3753 testing shall be completed and records of all testing shall be kept and copies of test records shall be presented to the Construction Manager upon formal written request within a reasonable time period.

2.09 CERTIFICATIONS

A. As a basis of acceptance, the manufacturer shall provide an independent certification which consists of a copy of the manufacturer's test report and accompanied by a copy of the test results stating that the manufacturer's fiberglass manhole has been sampled, tested and inspected in accordance with the provisions of this Specification and meets all requirements.

PART 3 - EXECUTION

3.01 INSTALLATION PROCEDURE:

A. Manhole liners shall not be installed until all required mainline sewer rehabilitation and/or other manhole work is completed.

B. The Contractor shall clean each manhole to be restored and shall dispose of any debris or resulting material in a manner and place acceptable to the Owner.

1. Cleaning shall be performed using a high-pressure jet wash at a minimum of 3,500 psi water pressure to remove all dust, biological growths, grease, oils or any other surface contaminants or coatings.
2. The Contractor shall conduct a visual inspection of each manhole after it is cleaned.
    a. All loose mortar and rubble of existing benches, walls and inverts shall be removed.
    b. Roots shall be removed by manually cutting them from inside the manhole.
3. The Contractor shall prepare the manhole as necessary by reshaping and repairing benches, inverts and walls where required including smoothing out irregular shaped corbel and chimney sections prior to inserting the liner.
4. The invert channel (where applicable and as directed by the Construction Manager) shall be coated with an appropriate quick-set grout in accordance with the manufacturer's instructions.

C. Alterations:

1. Contractor shall not alter the design or construction of manhole liner without notification of manufacturer and manufacturer's written consent.
2. Only manufacturer and its agents may alter design or construction of manhole liner.

D. Host Manhole:

1. Contractor shall confirm depth of the host manhole from rim to top of bench prior to excavation of host manhole cone.
2. Manhole liner length shall be of sufficient length to provide the proper rim elevation after being placed on host manhole's bench.

E. Removal of Host Manhole Cone:

1. Contractor shall remove host manhole cone (to sufficient depth for brick manholes) to expose the full diameter of the manhole.
2. Contractor shall ensure proper circumference clearance of manhole liner by lowering into host manhole prior to trimming liner to proper length.

F. Mapping of Host Manhole:

1. After Contractor has confirmed sufficient fit and length of manhole liner, Contractor shall measure the centerline location and outside diameters of all pipe penetrations
2. Contractor shall trim the manhole liner to sufficient length to reach the proper rim elevation.
3. Contractor shall take into consideration any concrete grade rings to be used.
4. Contractor shall trim manhole liner for all pipe penetrations at the proper centerline locations.
5. For steeply sloped bench surfaces, manhole liner may be trimmed to match bench slope.
6. For internal drop connections, Inserta-Tee connections (or equal) shall be used to seal around the incoming pipe.
7. Contractor may consider using masonry or carbide tipped cutters to cut and trim manhole liner.
8. Contractor shall use OSHA approved eye protection and dust mask while cuttingand trimming liner.

G. Grout Bulkhead

1. Contractor shall place a ring of uncured grout along the circumference of host manhole bench, and over crown of pipe penetrations at invert, of sufficient strength, width and thickness to provide a bulkhead seal along the bottom of the manhole liner.

H. Manhole Liner Installation:

1. Manhole liner shall be lifted by placing a textile sling around liner or by placing a 4"x4" timber of sufficient length to internally span across manway,attaching a sling to the timber and lifting.
2. Steel cables or chains shall not be wrapped around manhole liner for lifting and handling.
3. Contractor shall carefully lift manhole liner and lower liner into host manhole in a controlled manner.
4. Manhole liner shall be centered within the host manhole to create equal annular space around manhole liner.
5. Bottom edge of manhole liner shall be carefully pressed down into uncured grout ring on the bench.
6. Excess grout on interior of manhole liner shall be troweled smooth around circumference of liner to assure no gaps exist between bottom of manhole liner and the bench surface.
7. Small amounts of additional grout may be required to seal gaps around pipe penetrations at the invert.
8. Wooden wedges may be placed at the top of the annular space (three, recommended minimum) and evenly spaced to maintain a center position and prevent teetering of manhole liner during grouting.
9. Wooden wedges, if used, shall be placed by hand only and shall not be hammered into place. Internal drops shall be reconnected prior to annular grouting.

I. Unless shown otherwise on the Drawings and approved by the Construction Manager, concrete grout shall be used for backfill between the host manhole and the FRP manhole liner.

J. Annular Grouting:

1. Contractor shall allow grout bulkhead, at the bottom of manhole liner, to cure to sufficient strength to prevent flowing or yield due to annular grout pressure.
2. Annular grout shall be poured in lifts no greater than 12" around the manhole liner and distributed evenly prior to adding more grout.
3. Contractor shall ensure that equal pressure is maintained on all sides of manhole liner and that manhole liner is not subjected to unbalanced external grouting loads.
4. Annular grout shall have a compressive strength of 300 psi minimum.
5. Maximum height of uncured grout shall not exceed 20 vertical feet.
6. At 20 vertical feet, Contractor shall allow grout to cure prior to adding another stage of grout.

7. Grout shall be poured to the top of the host manhole riser.

K. Manhole Liner Backfill:

1. Any manhole liner extending above and beyond the host manhole shall be backfilled with select native material or #67 (¾ inch to 1 inch) crushed aggregate.
2. The material chosen shall be free of large lumps or clods which will not readily break down under compaction.
3. The Backfill material will be subject to approval by the Construction Manager.
4. Backfill material shall be placed in 12-inch lifts (max) and compacted to 95% Standard Proctor Density.
5. Backfill shall be distributed evenly around the manhole for each lift and compacted evenly prior to the following lift.
6. Care should be taken to prevent the placement of large clods, cobbles, frozen soil, and organic matter against the manhole liner.
7. The backfill around the excavated reducer section shall be stabilized sand or crushed stone.

L. Casting and Grade Rings:

1. Top of cone/reducer, shall be clean and free of debris prior to placing concrete grade rings onto manhole.
2. Concrete grade rings shall be carefully lowered over fiberglass neck (chimney) and onto top of cone in a controlled manner so as not to cause damage to manhole.
3. For AASHTO H20 traffic rated manholes, a 4-inch minimum thick concrete grade ring shall overhang shoulder of fiberglass grade ring platform by 1 inch.
4. Flexible grade rings (e.g. HDPE, rubber, etc) shall not be used on H20 traffic rated manholes.
5. Butyl mastic sealing material shall be placed between manhole, grade rings and cast iron ring to prevent the infiltration of ground water.
6. Cast iron ring and cover may be placed directly on top of cone for non-traffic rated manholes.

M. A complete watertight seal shall be provided at the pipe and manhole wall connections. The Contractor shall submit details of how watertight connections will be made to the Construction Manager for approval prior to performing any work.

N. Repairs:

1. Any damage to manhole liners shall be reported to the manufacturer.
2. All repairs shall be performed by manufacturer, its agent or qualified third-party with manufacturer's written consent.

3.02 Field Testing

A. Inflow/Infiltration Test:

1. Each manhole liner shall be visually inspected for inflow/infiltration.
2. Any inflow/infiltration that is in excess of project Specifications shall be corrected.

B. Vacuum Testing

1. All manholes shall be vacuum tested when ALL manhole rehabilitation is completed. Manholes shall not be tested until at least 7 days after installation of the manhole liner.
2. Vacuum testing shall be performed in accordance with ASTM C1244.
3. The Construction Manager shall be present for all testing. The Contractor shall notify the Construction Manager 48 hours prior to testing.
4. The Contractor shall submit test reports of the testing which include:
   a. Project name
   b. Manhole tested
   c. Testing data (vacuum pressure, duration of test, etc.)
   d. Statements of whether the manhole passed or failed the test.
   e. If applicable, test reports must be submitted citing the reason(s) for failure noted on the report.

C. Any manhole failing the test shall be repaired and retested immediately by the Contractor at no additional cost to the Owner.

3.03 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer affected by the manhole lining operations.

B. The Contractor shall provide bypass pumping during the manhole lining process, if necessary.

1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the manhole liner shall be included in the cost for pipe replacement by sliplining.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

1. Monitor status of flow and storage.
2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.
2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.
3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.
2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.04 BY-PASS PUMPING

A. The Contractor shall provide all sewage bypass as necessary for the proper installation of liner insert.

B. The Contractor shall bypass pump sewage flows around the manhole being rehabilitated while the work is being performed. A detailed bypass plan shall be submitted to the Construction Manager for approval before any work taking place.

C. Sewage flow shall be pumped around segments during the installation and testing of the manhole liner.

1. The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size.
2. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the manhole under construction.
3. Pumping equipment shall have the capacity to convey 100% of peak flows around the construction area.
4. A standby pump of the same capacity shall be required on site.
5. Open channels or trenches shall not be used to convey flow.
6. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

D. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer main being bypassed and inform them that they will be temporarily out of service.

E. The Contractor shall notify all property owners who discharge sewage directly into the manhole being rehabilitated at least 48 hours in advance, giving the date, starting and estimated completion time for the work being conducted and any anticipated impact to the property owner.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.
2. After completing the necessary work on the manhole to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.
3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

F. Temporary Blocking and Back-Ups of Sewers And Sewage

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways, and streets does not occur.
    a. In the event that such spillage or overflows do occur during the course of or as a result of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.
    b. Upon elimination of the spillage or overflow, the Contractor is to clean up and disinfect the area.
    c. Work to stop or contain such events is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time, and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage, or overflows of sewage during the course of the Work or because of the Work shall be the sole responsibility of the Contractor.

e. The Contractor is responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.05 INSPECTION AND TESTING

A. Field Acceptance

1. Field acceptance of manhole lining shall be based on the Construction Manager's field inspection and evaluation of the appropriate installation.

2. If the Construction Manager has to enter the manhole to inspect the work, the Contractor shall provide forced air ventilation, gas monitors, harnesses, lights, confined space entry, etc. for the Construction Manager to enter the manhole and perform the inspection in strict and complete accordance with OSHA requirements at no additional cost to the Owner.

B. Finished Lining Systems

1. There shall be no groundwater infiltration or other leakage, active or previously active, through the manhole walls, benches, inverts or pipe connections at the manhole after it has been lined.

2. If leakage is detected, it shall be eliminated with an appropriate cement mortar, grout or sealant as recommended by the manufacturer and approved by the Construction Manager at no additional cost to the Owner.

3. Injection grouting may be required to stop leaks around and/or in invert channels, pipe connections and benches.

4. The Construction Manager's decision on defective linings shall be final.

5. If any lining is found to be defective after it has been installed or during the warranty period, it shall be repaired or replaced in a manner satisfactory to the Construction Manager and at no additional cost to the Owner.

C. Payments

1. Payments will not be made for the installed lining until:

a. The manhole passes the vacuum test.

3.06 CLEAN-UP/RESTORATION

A. After the FRP manhole liner installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.
    a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.
    b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.
    c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.
    d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements.

END OF SECTION

SECTION 33 01 32

EPOXY MANHOLE LINERS

PART 1 – GENERAL

1.01 SUMMARY

A. The work to be done under this section includes all labor, materials, and services necessary to structurally rehabilitate and leak proof manholes. Work included, but not limited to, follows:

1. Clean and sanitize the interiors of the manhole.
2. Inspect the interiors of the manhole for extent of required repairs.
3. Structural repair and restoration of the manhole invert channels, benches, walls, chimneys, including the removal of any unsound material if necessary.
4. Application of water-stopping grout to stop active leaks.
5. Cleaning and preparatory patching of manhole surfaces receiving cementitious restoration and/or chemical coatings, including removal of spalling or unsound material.
6. Application of corrosion-resistant chemical coatings over the restored manhole surfaces to protect against future deterioration.

1.02 SUBMITTALS

A. Complete product data and engineering data, including shop drawings, shall be submitted to the Construction Manager in accordance with the requirements of Section 01 33 23 of these Specifications.

B. Submit manufacturer's product data including chemical composition, physical properties, surface preparation, repair, application, curing, and field quality control.

C. The Contractor shall submit complete shop drawings of the manhole lining system(s) to demonstrate compliance with these Specifications, materials and detailed installation procedures.

1. Testing procedures and quality control procedures shall also be submitted.

D. Certifications that the lining system was manufactured in accordance with these Specifications and the applicable ASTM standards shall be submitted with each material shipment.

1.03 QUALITY ASSURANCE

A. REFERENCES

1. This Section contains references to the following documents. They are a part of this section to the extent referenced in this specification.
2. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly.
3. In the event of a conflict between the requirements of this Section and those of the referenced documents, the requirements of this Specification shall prevail.
4. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.
5. This document references American Society for Testing and Materials (ASTM) standard specifications, which are made a part hereof by such reference and shall be the latest edition and revision.
6. It is incumbent upon the Contractor to have a working familiarity with the following ASTM Standards:

Reference	Title
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C293	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C811	Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacings
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1244	Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers —Tension
ASTM D624	Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D756	Standard Practice for Determination of Weight and Shape Changes of Plastics under Accelerated Service Conditions
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D1042	Standard Test Method for Linear Dimensional Changes of Plastics Under Accelerated Service

Reference	Title
ASTM D1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM D2370	Standard Test Method for Tensile Properties of Organic Coatings
ASTM D2371	Standard Test Method for Pigment Content of Solvent-Reducible Paints
ASTM F2414	Standard Practice for Sealing Sewer Manholes Using Chemical Grouting
ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
ASTM D3574	Standard Test Methods for Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM G23	Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
TT-S-00227E	Interim Federal Specification: Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, And Glazing In Buildings And Other Structures)

B. All components of the repair/liner system which include those for active leak control, crack repairs, flexible joint sealants, repair mortar and protective liners shall be provided by the same manufacturer.

C. MANUFACTURER'S CERTIFICATION

1. Product manufacturers shall provide the Construction Manager with written certification that all products furnished comply with all applicable provisions of these Specifications.

1.04 REGULATORY REQUIREMENTS

A. 146 (permit-required confined-space regulations).

B. All work and testing shall comply with the applicable Federal codes, including:

1. Federal Occupational The work of this Section shall comply with the current versions, with revisions, of OSHA 29 CFR 1910.Safety and Health Act of 1970
2. Construction Safety Act of 1969, as amended
3. Applicable state and local codes and standards
4. To the extent applicable, requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

C. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. No confined space entry will be permitted without the development and implementation of a confined space entry plan.

1. Plan shall be in accordance with OSHA standards.
2. Personnel involved shall have current training certificates.
3. Entry permit is required prior to entry.

1.05 WARRANTY AND REPAIRS

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the liner material including against breakdown of material effectiveness of structural repair elements.

B. Workmanship Warranty:

1. The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance against any leakage, cracking, loss of bond or other discontinuity as identified.
2. The warranty shall cover the cost of repairing and/or replacing the installed Epoxy liner and any freight to project site should the installed liner have any defects in material or workmanship.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. The Epoxy liner shall be repairable at any time during the life of the structure, with the same type of liner materials used in the original installation, including repair or lining of the upper chimney portion where grade adjustments have been made. Repair/lining materials shall be of the type that will bond to the original liner materials.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and FRP liner manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

I. Repair/lining system materials shall be of the type that will bond to the original liner materials.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials shall be designed, manufactured and intended for manhole rehabilitation and the specific application in which they are used.

B. Each material shall be designed for application to SSD (Surface Saturated Dry), but not wet surfaces or surfaces with actively running water, without degradation of the final product or the bond between the product and the wet well surface.

C. All materials, systems, and application processes shall be subject to approval by the Construction Manager prior to installation.

D. Protective coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions.

1. When requested, the Contractor shall provide the Construction Manager with the names of not less than 10 successful applications of the proposed manufacturer's products that comply with these requirements.

E. Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, name of manufacturer, all of which shall be plainly legible at the time of use.

F. The cured surfacing thickness shall be smooth, even (without ridges or bumps) and continuous with proper sealing connections to any non-rehabilitated areas.

G. Chemical sealants or grouts used to seal active manhole leaks, patch holes or cracks, fill voids and to otherwise prepare the manhole surface for lining shall be suitable for sewer system service and chemically resistant to any chemicals or vapors normally associated with domestic sewerage installations.

2.02 PRODUCT REQUIREMENTS

A. Active Leak Control

1. Hydraulic Cement

a. Hydraulic cement shall be rapid set (1-minute) high density, reinforced mortar compound designed for use as a structural patching, leak stopper and water plug, which is capable of instantly stopping running water and/or seepage through concrete or masonry walls and floors.

b. Hydraulic cement shall contain no metallic fillers, will not shrink or oxidize.

c. Hydraulic cement shall be designed for an ultra-quick reaction and sets in 60 to 90 seconds, depending upon the temperature of the mixing water and the surface onto which it is applied, and the mass.

d. The lining compounds shall contain no VOCs.

e. Technical Properties

1)	Type	Hydraulic cement (polymer modified)
2)	Compress Strength	5,500 psi (28 days)
3)	Flexural Strength	950 psi (28 days)
4)	Bond Strength	880 psi (28 days)
5)	Shrinkage	<0.01%

f. Acceptable Products

1) Epoxytec Mortartec Hydrxx-1

2) Approved equal

2. Chemical Grout.

a. Chemical grouts shall conform to the requirements of ASTM F2414.

b. Low viscosity liquid resin that reacts with water and expands to form a closed cell, watertight foam.

1)	Type	Hydrophilic, water-activated polyurethane grout.

c. Technical Properties

1)	Tensile Strength	ASTM D3574	450 psi
2)	Tensile Elongation	ASTM D3574	350%
3)	Shrinkage	ASTM D1042/D756	<2%
4)	Tear Resistance	ASTM D3574	21 lbs/inch
5)	Initial Reaction Time	@ 73^{o} F	30 seconds
6)	Full Rise	@73^{o} F	110 seconds

d. Acceptable products

1) Prime Flex 900 XLV as manufactured by Prime Resins.

2) Or approved equal.

B. Crack Repairs

1. Compound used for crack repairs shall be a two-component moisture insensitive, highly adhesive, chemical resistant, 100% solids, high strength epoxy paste and reinforced structural-grade epoxy.

2. Compound shall be non-sag patching material designed for cracks and small spalls and shall contain no solvent.

3. Compound shall bond to concrete, steel, wood, brick, some plastics and most construction materials.
4. Compound shall be moisture insensitive and may be used on damp surfaces (SSD).
5. Setting time shall be approximately 3 hours at 75ºF.
6. Technical Properties

a.	Gel time (60g Mass)	ASTM C811	14 minutes
b.	Tack Free Cure	ASTM D2371	3 hours
c.	Working Time		30 minutes
d.	Compressive Strength (7day)	ASTM D695	6,118 psi
e.	Compressive Modulus (7 day)	ASTM D695	105,800 psi
f.	Bond Strength (14 day)	ASTM D882	1,635 psi

7. Acceptable Products
   a. Epoxytec CPP Gel: Crack Injection
   b. Approved equal.

C. Flexible joint sealants

1. Polyurethane joint sealant shall be two component, aliphatic, chemically curing, 100% solid urethane sealant formulated as a high build coating/ joint sealing system for vertical and overhead use.
2. Once cured, the material shall form a high quality elastomeric sealant.
3. Joint sealants shall be suited for indoors or outdoors with use on concrete, wood and most construction materials.
4. Joint sealants shall produce a flexible, long-lasting sealant with adhesion, cohesion, and elasticity that resists deterioration caused by weathering, stress, movement, water, oils, and many chemicals.
5. Provides corrosion protection and chemical resistance.
6. Technical Properties

a.	Hardness, Shore A	ASTM C920	45
b.	Artificial Weathering	ASTM G23-89	No elastomeric property changes
c.	Freeze/Thaw (no damage)	ASTM C666	300 cycles
d.	Bond Durability	ASTM C920-87	No failure after 25% extension
e.	Tensile Strength	ASTM D412	240 psi
f.	Ultimate Elongation	ASTM D412	800%
g.	Recovery	TT-S-00227E	96%
h.	Weight Loss	TT-S-00227E	4.75%

i.	Tear Resistance	ASTM D624-86	44 lbs/in
j.	Service Temperature		-40°F to 170°F
k.	Initial Cure (80°F)		5 hours
l.	Final Cure (80°F)		48 hours

7. Acceptable Products
   a. Epoxytec Uroseal 45V
   b. Approved equal

D. Repair Mortar

1. Repair mortar shall be a single component, high strength, rapid set Portland cement based repair material for repairing concrete or masonry structures. The material may be applied by hand trowel or spray application to a minimum thickness of 1/8 inch. The repair mortar shall have the following minimum requirements.
   a. Compressive Strength of 7,000 psi (ASTM C109)
   b. Bond Strength of 2,200 psi (ASTM C882)
   c. Flexural Strength of 1,500 psi (ASTM C293)
   d. Approved manufacturers include Epoxytec, Sauereisen, A.W. Cook, Madewell Products Corp., or approved equal.

E. Protective Lining

1. The protective lining shall be a two-component, 100% solids, high build, spray- or trowel- applied, structural grade epoxy system.
   a. Formulated specifically for rehabilitation and lining of sanitary sewer collection systems (manholes, cylindrical lift stations, pipe, etc).
   b. Designed with high moisture tolerance, H_2S resistance and sealed I&I barrier protection.
   c. Blended with reinforcing agents and various fibers, when cured, the liner shall create reinforcement lining as a fiber-reinforced-polymer (FRP), with high strength and flexural properties for partially or fully deteriorated manholes.
   d. The lining compounds shall contain no VOCs.
2. The lining shall be suitable for application as a single coat or multi-coat system.
   a. Maximum build-up per coat shall be 3/8” (375 mils) without sag per coat, depending on temperature.
3. Minimum Coverage
   a. One-gallon (231 cu.in.) of neat epoxy shall yield:
      1) @ 1/16” (~60 mils), product yields 26 sq.ft.
      2) @ 1/8” (125 mils), product yields 12.8 sq.ft.

3) @ 1/4" (250 mils), product yields 6.4 sq.ft.

4. The material shall be capable of sprayed ultra-high build, up to 1/4" (250 mils) per pass.

5. Technical Properties

a.	Type	Hybrid FRP (epoxy/epoxide)	
b.	Solids by Volume	ASTM D2697	100%
c.	Solvent (VOC)	ASTM D3960	none
d.	Adhesion Strength	ASTM D4541	substrate failure
e.	Adhesion Strength	ASTM D4541	2,000 psi (steel)
f.	Water Absorption	ASTM D1653	< 0.1 g/sq. m.
g.	Tensile Strength	ASTM D638	7,800 psi
h.	Flexural Modulus	ASTM D790	580,000 psi
i.	Flexural Strength	ASTM D790	7,000 psi
j.	Compressive Strength	ASTM D695	12,000 psi
k.	Elongation	ASTM D2370	3%
l.	Complete Cure		24 hours (77^{o}F)
m.	Temperature Exposure (wet)		32^{o}F – 180^{o}F
n.	Temperature Exposure (dry)		5^{o}F – 180^{o}F

6. Acceptable Products
   a. CPP Sprayliner by Epoxytec
   b. Approved equal

PART 3 – EXECUTION

3.01 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every property connected to the segment of sewer subject to sliplining operations.

B. The Contractor shall provide bypass pumping during the manhole lining process, if necessary.

1. The pumps and bypass lines shall be of adequate capacity and size to handle all flows including peak wet weather flow.

C. All costs for bypass pumping, tanking and all other private service flow management required during installation of the liner shall be included in the cost for pipe replacement by sliplining.

D. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

E. When it is necessary to shut down a private sewer service line, notify the Construction Manager at least 1 week in advance to shut down. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by the Construction Manager.

1. Place door hangers minimum 48 hours prior to shut down.

F. When service lateral need to be disconnected from main for more than 8 hours, lateral shall be positively drained or pump down.

1. Monitor status of flow and storage.
2. Pump lateral more frequently where flows exceed storage capacity of lateral or Contractor provided temporary storage.

G. If service lateral cannot be positively drained or pumped down or disconnection of service is anticipated being 8 hours or longer,

1. Contractor shall provide temporary living accommodations for resident at no additional cost to Owner or resident.
2. Temporary living quarters accommodations shall be approved by Construction Manager and coordinated through resident and Owner's Customer Support Representative.
3. Alternatively, Contractor may supply a temporary bypass pumping system to keep the lateral operational.

H. Notify building occupants when work is complete and uninterrupted service restored.

I. Commercial sewer services shall be maintained at all times while the business is open.

1. No sewage from the services or main line shall be discharged on the ground or in waterways.
2. Holding pits or tanks are not allowed unless permitted by Federal, State, and local authorities having jurisdiction.

3.02 BY-PASS PUMPING

A. The Contractor shall provide all sewage bypass as necessary for the proper installation of liner/repair system.

B. The Contractor shall bypass pump sewage flows around the manhole being rehabilitated while the work is being performed. A detailed bypass plan shall be submitted to the Construction Manager for approval before any work taking place.

C. Sewage flow shall be pumped around segments during the installation and testing of the manhole liner.

1. The flow shall be intercepted at the upstream end of the segment and shall be pumped through temporary piping of adequate size.
2. The flow shall be discharged into a manhole on the downstream side of the segment, thus by-passing the manhole under construction.
3. Pumping equipment shall have the capacity to convey 100% of peak flows around the segment.
4. A standby pump of the same capacity shall be required on site.
5. Open channels or trenches shall not be used to convey flow.
6. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

D. The Contractor shall be required to contact all residential and commercial customers whose service lines connect to the sewer segment being bypassed and inform them that they will be temporarily out of service.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.
2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.
3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

E. The Contractor shall notify all property owners who discharge sewage directly into the manhole being rehabilitated at least 48 hours in advance, giving the date, starting and estimated completion time for the work being conducted and any anticipated impact to the property owner.

1. The Contractor shall also advise those customers against water usage until the mainline is back in service.
2. After completing the necessary work on the main line to allow its reuse, the Contractor shall advise those customers that the sewer main is back in service.
3. The Contractor shall maintain a high degree of professionalism, both in workmanship and appearance, at all times.

F. Temporary Blocking and Back-Ups of Sewers and Sewage.

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so to prevent overflows and spillage onto public or private property and into storm sewers, waterways, and streets.
    a. In the event that such spillage or overflows do occur during the course of or as a result of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

b. Upon elimination of the spillage or overflow, the Contractor is to clean up and disinfect the entire affected area.

c. Work to stop or contain such events is to be deemed EMERGENCY in nature and sufficient justification for total mobilization of resources, the use of overtime or double time, and any other reasonable measures to assure correction of the problem without delay.

d. Damages arising from blockages, back-ups, spillage, or overflows of sewage during the course of the Work or because of the Work shall be the sole responsibility of the Contractor.

e. The Contractor is responsible for paying all fines imposed for overflows or spills during construction.

2. Should a condition arise that the Contractor cannot restore service within 8 hours of service interruption, the Contractor shall make provisions for pumping all flows within the service interruption area at no cost to the Owner.

3.03 DELIVERY AND HANDLING

A. The materials shall be delivered to the job site in original unopened packaging and clearly labeled with the manufacturer's identification and printed instructions.

B. The Contractor shall handle and store all material and shall dispose of all wastes in accordance with applicable regulations.

C. The Contractor shall keep products safe from damage.

D. The Contractor shall promptly remove damaged products from the job site and replace damaged products with undamaged goods.

3.04 SURFACE PREPARATION

A. Manhole liners shall not be installed until all required mainline sewer rehabilitation and/or other manhole work is completed

B. Prior to entering manholes, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state or federal safety regulations.

C. Surface preparation of the substrate must be completed immediately prior to utilizing any repair material and/or coating/lining material that will require bonding to the substrate.

1. Re-inspection and/or subsequent surface preparation shall be required should conditions change after initial preparation.

D. All manhole surfaces shall be thoroughly cleaned and made free of all foreign materials and contaminants that would interfere with adhesion of repair and coating/lining materials.

E. Surfaces shall be free of contaminants and loosely adhering or unsound concrete, and shall provide a dry, sound, uniform substrate suitable for the application of repair and coating/lining materials.

F. Surface preparation must achieve a clean and sound substrate in accordance with SSPC-SP13/NACE No. 6 “Surface Preparation of Concrete.”

1. Cleaning shall be performed using a high- pressure jet wash at a minimum of 3,500 psi water pressure to achieve acceptable surface preparation free from all biological growths, foreign material, existing coatings or paint, waxes, form release agents, curing compounds, efflorescence, sealers, salts, laitance, oil, grease, sludge, dirt, grit, dust, existing coatings, roots, and all other debris or contaminants.
2. The Contractor shall immediately notify the Construction Manager of any coatings that cannot be removed and, upon the approval of the Construction Manager, shall coarse sand the area(s) to rough up the surface sufficient to obtain and insure adequate bonding of the liner/repair materials.
3. Roots shall be removed by manually cutting them from inside the manhole.
4. Protrusions such as from sharp irregularities, fins, bulges, or concrete spatter shall be removed during surface preparation.
5. Unsound voids and other defects that are at or near the surface shall be exposed during surface preparation.
    a. All loose, unsound or defective concrete, mortar, brick, grout shall be removed.
    b. All concrete that is not sound shall be removed and so that only sound concrete remains.
6. Surface preparation shall yield sound alkaline concrete with minimum pH 9. Manufacturer shall be consulted for acceptable ranges.
7. A minimum ICRI profile of CSP 4 or higher shall be achieved.
8. When oil and grease, and/or soluble ionic materials such as chlorides, ferrous salts, and sulfates that remain on or within the substrate after cleaning or are still present, approved cleaners such as detergent, degreaser, or other chemical remover shall be used integrally with the high-pressure cleaning water if conditions dictate.
    a. Continue to clean and rinse with water until contaminants are removed, including the cleaners.

G. The Contractor shall conduct a visual inspection of each manhole after it is cleaned.

1. All active hydrostatic leaks shall be plugged or sealed with an appropriate grout compatible with the lining as specified herein below. Injection grouting may be required to seal active leaks including existing leaks in invert channels and benches. All loose mortar and rubble of existing benches, walls and inverts shall be removed.

H. The Contractor shall prepare the manhole as necessary by reshaping and repairing benches, inverts and walls where required including smoothing out irregular shaped corbel and chimney sections prior to any spray application.

I. All interior surfaces shall be prepared as recommended by the lining system manufacturer. Minimum requirements of the Specification are as follows:

1. All cracks and voids must be repaired and filled with suitable non-shrinking cements, sealants or grouts, including all voids between existing sewer pipes and manhole walls as specified herein below. All patch repairs shall be smooth and even with the manhole wall.
2. All voids around existing manhole rungs, steps and anchors shall be filled.
3. All surfaces shall be suitably prepared for the required bonding of the liner as recommended by the manufacturer and acceptable to the Construction Manager.

J. Prior to lining, the Construction Manager shall inspect and approve the surface preparation work.

1. The Contractor shall notify the Construction Manager when the manholes are ready for inspection.
2. The manhole lining shall be completed immediately after the Construction Manager's inspection or the manhole may need to be re-cleaned prior to spraying to remove accumulated debris on walls and benches

K. The Contractor shall all dispose of any debris or resulting material in a manner and place suitable to the Owner.

3.05 ACTIVE LEAK CONTROL

A. When leaks are not readily identifiable upon cleaning operation, use blowers to dry interior for positive identification of leaks and weeping areas.

B. Hydraulic Cement

1. The work shall consists of hand applying a dry quick-setting cementitious mix designed to instantly stop running water or seepage in all types of concrete and concrete structures.
   a. The Contractor shall apply material in accordance with manufacturers' recommendations.
2. The area to be repaired shall be clean and free of all debris.
3. Undercut all areas on which the hydraulic cement will be applied.
4. Preparation shall include enlarging small cracks and holes and avoiding V-shaped cuts.
5. Proper applications shall not require any special mixing of product or special curing requirements after application.

6. When mixing with a power tool, blend at relatively low speed and blend only the sufficient amount of material that can be placed within working time.
7. Place a generous amount of the dry quick-setting material to the active leak, with a smooth fast motion, maintaining external pressure, repeat until leak is stopped.
8. Press firmly the dry material or pre-mixed paste into place, maintaining the same amount of pressure until the material begins to harden and the leak is stopped.
9. Contractor may pre-mix with water, and allow initial set-up (gel-up) to accelerate the stiffness and then apply while still paste-like and pliable. Do not add water once it begins to set.
10. Continue until all active leaks cease. If areas have too much pressure or volume of water for hydraulic cement to be effective, chemical grout shall be used.

C. Chemical Grout

1. Chemical grouting applications shall include sealing a structure from infiltration/inflow prior to application of a coating or lining or other rehabilitation component or using the grout for sealing an entire section of the structure (usually due to water/soil voids or water table).
2. Application of materials shall be by injection method only.
3. Grout conditions shall be adjusted for catalyzing the reaction, inhibiting the reaction, lowering the freezing temperature the grout solution, adding fillers, providing strength or for inhibiting root growth according to the instructions of the grout manufacturer and in the specified quantities as recommended by the grout manufacturer.
4. Mixing and handling of all the chemical grout materials shall be in strict accordance with manufacturer's recommendations.
5. The Contractor shall first seal with concrete repair materials herein specified, all voids and cracks.
6. Injection holes shall be drilled through the structure at locations as per industry standards or where designated by the Construction Manager or repair need.
    a. Grout shall be injected with the proper pump and pressures as with suitable ports and packers, if required.
    b. Injection pressure shall not cause damage to the structure or surrounding surface.
    c. Grout shall be injected through the lowest holes first until rejection or grout is visible at the next port or on the surface.
    d. This procedure shall be repeated until the structure is sealed.
7. Grout travel shall be verified by observation of grout to defects or adjacent injection holes.
8. Provide additional injection holes, if necessary to ensure grout travel.

9. All excess chemical grout must be removed from the surface via mechanical grinding means and top patched with “Hydraulic cement” or “Specialty barrier protection” epoxy.

10. Chemical grout, shall be injected through the lowest holes first, working the material higher until the areas is sealed. Additional holes may be required to verify that the material has encompassed the entire outside of the manhole.

11. The injection holes shall be cleaned and patched as recommended by the manufacturer.

3.06 CRACK REPAIRS

A. Preparation shall include enlarging small cracks and holes and avoiding V-shaped cuts.

B. Follow material manufacturer technical data sheets (PDS) and application guidelines.

C. For shallow, wide or superficial crack repairs, or for cracks where epoxy can travel easily, inject a bead into cracks and keep material under pressure.

1. Remove access and clean with putty knifes.

2. Allow to cure.

D. For deeper injection needs, or narrow injection install the entry ports along crack. Seal the remainder of the crack from the surface, ensuring material won’t escape while under pressure.

1. Entry ports (also called port adapters) can be any tube like device that provides for the successful transfer of the epoxy resin under pressure into the crack.

2. Port spacing shall be 8 in. on center, with increased spacing at wider cracks.

3. Start the injection at the widest Section of a crack. Vertical cracks are typically injected from the bottom up.

a. Continue the injection under pressure until refusal or until travel to next port is visible.

b. Shaving or grinding off ports, then patching over ports may be required. Remove access and clean with putty knifes.

c. Allow to cure.

3.07 GENERAL CONCRETE REPAIR

A. Repair Mortar

1. Prior to the application of the repair mortar the walls shall be prepared with leaks and cracks repaired in accordance with Paragraph 3.07 through 3.09 above.

a. Patching, repointing, filling, and repairing non-leaking holes, cracks, and spalls in concrete, shall be achieved through the use of materials specifically recommended by the manufacturer for this use, which have been formulated for vertical or overhead use.

b. These materials shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents, nor shall it promote the corrosion of steel.

2. Repair mortar shall be applied to all sections of the manhole including the bench, the walls, the chimneys and invert channels.

3. The repair mortar shall be mixed according to the manufacturer's specifications.

4. Application may be by use of a hand trowel or by pump spraying.

a. Apply material to a minimum uniform thickness of 3/8 inch.

b. Trowel or brush to a finish that is consistent with Concrete Surface Profile (CSP) cards 3-5 from the International Concrete Repair Institute (ICRI).

c. All applications shall be made as recommended by manufacturer's technical data sheets and/or application guidelines, utilizing proper equipment onto specified surfaces.

5. Follow mixing, application and handling instructions as written per materials product technical data sheets and SDS. Follow instructions as published by the material manufacturer, including all instruction sheets and/or PDS.

6. Surfaces to be applied, must be rinsed and soaked to achieve saturated-surface-dry (SSD), when required, necessary for the cementitious repair materials to bond and cure properly.

7. Once applied, take precautions to allow materials to remain moist and not over-dry while curing. Cover from direct sunlight, and/or keep moist coverings to prevent drying, loss of moisture and cracking.

8. For product requiring water addition, stay within manufacturer's recommended water-to-cement (w/c) ratio. Do not over use water to avoid a smooth finish while ensuring high mechanical properties while curing.

9. The mortar kits that come pre-proportioned (such as the specified epoxy-modified-mortar), must remain pre-portioned with no water added.

10. Either commence spraying or hand applying.

a. If spraying, ensure material can be sprayed and utilize recommended equipment.

b. If spraying, material must be back-troweled.

c. The mortar shall harden quickly without any need for special curing. Execute finishing work by trowel immediately after applying or disbursing onto the substrate.

11. When troweling or back-troweling, make sure to create surface texture with trowel technique, a slight broom-finish is recommended to ensure surface profiling for acceptance of Structural Epoxy to adhere optimally.
    a. Except for the epoxy-modified-mortar specified, do not press hard and do not create an exaggerated finish, to avoid a loss of strength at the peaks and excessive material waste of coating material due to excess texturing.
    b. Some surface roughness can occur with a trowel-finish, if done so intentionally to not create a smooth finish.
    c. Most reparative cementitious solutions herein specified obtain early strength for a quick-return and/or recoat window for top coating. Check PDS for allowable time frames.
    d. Once initially cured, and before applying any coating/lining system materials, refer to material specifications for post-cure preparation and readiness instructions.

3.08 FLEXIBLE JOINT SEALING (INCLUDING MANHOLE CHIMNEY JOINT)

A. The work consists of hand applying or dispersing from a nozzle, an elastomeric material into movement or control joints where flexibility is required. This could also be naturally occurring movement induced cracks and other movement joints.

B. The certified applicator shall apply material in accordance with manufacturers' recommendations.

C. Execution

1. The area to be sealed must be clean and free of all debris.
2. Undercut all areas on which the elastomeric material will be applied.
3. Preparation shall include enlarging small cracks and avoiding V-shaped cuts.
4. Surface conditioner shall be used to clean and provide surface wetness and adhesion promoting facilitation.
    a. Apply a thin layer of surface conditioner by brush or roller to all inside edges of the crack or joint.
    b. Material must not be applied thin, apply and back roll, back brush without pooling, excessive wetness, as thin as possible.
    c. Material will evaporate quickly and leave behind a slight surface tackiness.
    d. Refer to surface conditioner PDS for recommended dry times and recoat windows prior to apply joint elastomeric material specified.

D. After surface conditioner dries, mix and apply.

1. For horizontal joints, a backing rod can be utilized if needed. Keep depth a minimum 3/8" (0.375 inch).
    a. Mix and pour material into joint.
    b. Allow to cure.
2. For vertical or overhead joint, apply paste-like mixed material by hand tools, such as trowel, spatula, or putty knife into the crack or joints.
    a. Allow to cure according to manufacturer's guidelines, refer to PDS.

3.09 EPOXY LINING

A. Execution

1. Manhole lining shall not be installed until all required mainline sewer rehabilitation and/or other manhole work is completed.
2. A complete watertight seal shall be provided at the pipe and manhole wall connections. The Contractor shall submit details of how watertight connections will be made to the Construction Manager for approval prior to performing any work.
3. Application procedures shall conform to the recommendations of the Structural Epoxy manufacturer, including material handling, mixing, safety, and application equipment.
4. If layering, top coating or additional coats of the Structural Epoxy shall occur as soon as the prior coat becomes initially set (dry-to-touch), to avoid long exposure time for subsequent surface contamination.
    a. Additional surface preparation procedures will be required if in between coats, surface contamination occurs.
5. Follow all published manufacturer recommended application methods, including best practices guidelines, PDS, and design guideline standards.
6. If spraying, the Contractor must be certified to spray by the manufacturer, verifying training and that the spray equipment is approved by the coating manufacturer.
    a. Equipment shall be high pressure, heated plural component spray systems specifically designed to accurately ratio and condition the specified Structural Epoxy.
    b. Equipment specifications must be approved prior to use.
    c. Apply at a minimum thickness of 125 mils DFT (0.125 inches).
        1) The minimum thickness must be a uniformed thickness from peak (of the surface profile) to ensures that the highest point(s) of the blast profile or deteriorated substrate are fully covered at the design thickness.
        2) If material is filling valleys, this material will not serve for maximum film build. Therefore, should the profile or

economics support utilizing a resurfacer first, consider before applying Structural Epoxy.

3) Structural Epoxy shall be applied with layering and overlapping patterns, whereas thinner initial tack coat(s) can serve as base coat(s), while allowing gelling (slight solidifying) of the initial layers in order to build subsequent higher build layers on top before reaching final thickness. This serves for better initial contact and wetting onto the surface for optimal adhesion, and barrier layering to assist with mitigation of outgassing and other transmission that may induce pinholing.

7. If trowel-applied, properly mix and apply materials to all specified surfaces by hand-applied methods with trowel or trowel-type tools.

   a. Combine 2 gallons kits, Part B to Part A of the packaged, proportioned material, mix with a medium-speed, high power drill mixer for five (5) to eight (8) minutes until a homogenous blend is achieved. Make sure to allowing mixer to properly mix side walls and bottom of container.

   b. Apply at a minimum thickness of 125 mils DFT (0.125 inches).

      1) The minimum thickness must be a uniformed thickness from peak (of the surface profile). This ensures that the highest point(s) of the blast profile or deteriorated substrate are fully covered at the design thickness. If material is filling valleys, this material will not serve for maximum film build. Therefore, should the profile or economics support utilizing a resurfacer first, consider before applying Structural Epoxy.

      2) Optional finishing: For aesthetics and knocking down trowel marks, allow product to start initial gel (circa 30 - 40 minutes at 77^{o}F) and spray with light amount of water and rub down to create a smooth, uniform finish. Should material be soft, allow longer initial set up.

8. Allow 24 hours (77^{o}F) to cure prior to returning to service for full immersion.

3.10 MANUFACTURER'S SERVICES

A. The Contractor shall require the protective coating manufacturer to furnish a qualified technical representative, certified by NACE or SSPC, to visit the site for technical support as may be necessary to resolve field problems attributable or associated with the manufacturer's products

B. The Contractor shall require material coating manufacturer to furnish the following services:

1. The manufacturer's representative shall be available to provide on-site instruction on the proper surface preparation, use, mixing, application and curing of the coating systems for the wet well to be rehabilitated under this Contract.

2. A site visit must be made after surface preparation and before any protective coatings are applied.

3. The manufacturer's representative shall verify that surface preparation is acceptable before the application of any repair mortars or protective linings.

3.11 INSPECTION AND TESTING

A. Field acceptance

1. Field acceptance of manhole lining shall be based on the Construction Manager's field inspection and evaluation of the appropriate installation and curing test data.

2. The lining shall provide a continuous monolithic surfacing with uniform thickness throughout the manhole interior.

3. If the thickness is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the Owner.

4. If the Construction Manager has to enter the manhole to inspect the work, the Contractor shall provide forced air ventilation, gas monitors, harnesses, lights, confined space entry, etc. for the Construction Manager to enter the manhole and perform the inspection in strict and complete accordance with OSHA requirements at no additional cost to the Owner.

B. Preparation of Test Samples

1. Samples shall be taken of the installed liner each day that the lining is installed in the following manner:

Number of Manholes Lined in One Day	Number of Samples Taken
1-5	1
6-10	2
11- 15	3
16 or more	4

2. Samples shall be taken at equally spaced intervals throughout the workday. The frequency of tests may be increased by the Construction Manager and performed by the Contractor at no additional cost to the Owner when the required tests indicate that the installed lining does not meet the Specification.

C. Strength & Bonding Testing Procedures

1 Samples shall be cube samples. A minimum of six (6) cubes shall be taken for each sample testing.

2 The samples shall be tested in accordance with the applicable ASTM standards to verify that the installed liner meets the compressive strength

requirements specified herein and the lining manufacturer's published product data.

3 Tests shall include 7-day and 28-day strength tests (3 cubes for each time period per sample).

4 Shrinkage and bond strength tests shall be performed on each batch or lot of material shipped to the Contractor.

5 Testing shall be performed by an independent laboratory with all associated costs paid by the Contractor.

6 The test results shall be submitted to the Construction Manager immediately when available and no later than 30 days after lining installation.

D. Vacuum Testing

1. All manholes shall be vacuum tested when ALL manhole rehabilitation is completed. Manholes shall not be tested until at least 7 days after installation of lining.

2. Vacuum testing shall be performed in accordance with ASTM C1244.

3. The Construction Manager shall be present for all testing. The Contractor shall notify the Construction Manager 48 hours prior to testing.

4. The Contractor shall submit test reports of the testing which include: the project name, manhole tested, testing data (vacuum pressure, duration of test, etc.) and whether the manhole passed or failed the test. Test reports must be submitted citing the reason for failure noted on the report.

5. Any manhole failing the test shall be repaired and retested immediately by the Contractor at no additional cost to the Owner.

3.12 FINISHED LINING SYSTEMS

A. There shall be no groundwater infiltration or other leakage (active or previously active) through the manhole walls, benches, inverts or pipe connections at the manhole after it has been lined.

B. If leakage is detected, it shall be eliminated with an appropriate cement mortar, grout or sealant as recommended by the manufacturer and approved by the Construction Manager at no additional cost to the Owner.

C. Injection grouting may be required to stop leaks around or in invert channels, pipe connections and benches.

D. The Construction Manager's decision on defective lining shall be final.

E. If any lining is found to be defective after it has been installed or during the warranty period, it shall be repaired or replaced in a manner satisfactory to the Construction Manager and at no additional cost to the Owner.

F. Payment shall not be made for the installed lining until:

1. The manhole passes the vacuum test.

3.13 CLEAN-UP/RESTORATION

A. After the Epoxy manhole liner installation work has been completed and all testing accepted by the Construction Manager, the Contractor shall clean up the work area.

1. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

a. The debris and liquids shall be disposed of properly in accordance with all applicable laws.

b. The local municipality may furnish a letter to the landfill stating the Contractor is authorized to dispose of the non-hazardous materials.

c. Debris and liquids type and quantities are to be tracked in the daily Contractor diary.

d. Hauling and disposal costs will be borne by the Contractor.

B. All surfaces which have been disturbed by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the Contractor's operations.

C. Suitable materials and methods, acceptable to the Owner, shall be used for such restoration.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

E. The cost for correcting damage resulting from the Contractor's actions shall be the responsibility of the Contractor.

F. Refer to Section 33 30 00, Sewer and Accessories, for additional requirements.

END OF SECTION

SECTION 33 05 10

ABANDONMENT OF SANITARY SEWERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Abandonment in place of existing sanitary sewers, manholes, and force mains.

1.02 UNIT PRICES

A. Measurement for grout fill and abandonment of existing gravity sewers is on a linear foot basis for each diameter of sewer being abandoned. Measurement will be along the centerline of the sewer from centerline to centerline of manholes.

B. Measurement for grout fill and abandonment of sanitary sewer manholes is by each manhole abandoned in conformance with this Section.

C. Payment will be full compensation for all material, equipment, and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, pipes and all incidentals.

D. No separate payment will be made for plugging and abandoning sanitary sewer force mains. Include the cost of such abandonment in related work.

E. Acceptability of grout material is based on achieving an average strength of at least 75 psi as defined in Paragraph 2.01B.1.

1.03 DEFINITIONS

A. Abandonment. Sanitary sewer abandonment consists of demolition and removal of any portion of manholes existing within the specified depth of the surface, and the abandonment in place of sewer lines and manholes as specified in this Section.

B. Flowable Fill. Flowable fill (abandonment grout) shall be a controlled low-strength material consisting of a fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. The long-term hardened strength shall be within a specified range.

C. Ballast. Large aggregate either replaced with the voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at the same time as the flowable fill

placement.

D. Backgrouting. A secondary stage pressure grouting to ensure that voids have been filled within the abandoned sewer. Back grouting will only be required at critical locations indicated on the Drawings or if there is evidence of incomplete flowable fill placements.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of all sections and provisions of these specifications.

B. Flowable fill mix design report:

1. Flowable fill type and production method.
2. Use of ballast. Provide percentage of ballast of the total placement and size limits for the ballast if fill is intended to be used with ballast.
3. Aggregate gradation of fill. The aggregate gradation of the mix (excluding ballast) shall be used as a pilot curve for quality control during production.
4. Fill mix constituents and proportions including materials by weight and volume, and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.
5. Fill densities and viscosities, including wet density at the point of placement.
6. Initial time of set.
7. Bleeding and shrinkage.
8. Compressive strength.

C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.

D. Experience record for the proposed crew, showing a minimum of 5 similar projects using the proposed or similar equipment and methods.

E. At least 60 days prior to commencing any abandonment activities, submit a plan for abandonment, describing the proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of the work.

PART 2 – MATERIALS

2.01 FLOWABLE FILL

A. Design Mix Criteria. Provide design of one or more mixes to meet the design criteria and conditions for placement. Present the information required by Paragraph 1.04B in the mix design report including the following:

1. Cement: ASTM C150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.
2. Fly ash: ASTM C618 Class C or F. Volume and weight per cubic yard of fill. Provide minimum Fly ash content of 200 pounds per cubic yard.
3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.
4. Aggregate gradation: 100 percent passing the 3/8 inch sieve and not more than 10 percent passing the #200 sieve. The mix design report shall define a pilot gradation based on the following sieve sizes 3/8-inch, Nos. 4, 8, 16, 30, 50, 100 and 200. Do not deviate from the pilot gradation by more than +/-10 percentage points for any sieve for the production material.
5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, at least 30 percent of natural aggregate shall be added as necessary to provide workability.
6. Admixtures: Use admixtures meeting ASTM C494 and ASTM Cl07 as needed to improve pumpability, to control time of set, and reduce bleeding.
7. Fluidifier: Use a fluidifier meeting ASTM C397 as necessary to hold the solid constituents in suspension. Add a shrinkage compensator if necessary.
8. Performance additive: Use a flowable fill performance additive, such as Darafill or approved equal, to control the fill properties.

B. Flowable Fill Requirements

1. Unconfined compressive strength: minimum 75 psi at 56 days as determined based on an average of three tests for the same placement. Present at least three acceptable strength tests for the proposed mix design in the mix design report.
2. Placement characteristics: self-leveling.
3. Shrinkage characteristics: non-shrink.
4. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C940.
5. Minimum wet density: 90 pounds per cubic foot.

2.02 BALLAST

A. Ballast material: natural rock or concrete pieces with a minimum size equal to at least 10 times the maximum aggregate size of the flowable fill and a

maximum size of 24 inches. The maximum dimension shall not be more than 20 percent of the minimum dimension of the space to be filled.

B. Ballast composition: free of any regulated waste material.

2.03 PLUGS FOR FORCE MAINS

A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM Cl 107, Grade B or C.

B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with the pipe being abandoned.

PART 3 – EXECUTION

3.01 PREPARATION

A. Have fill mix design reports and other submittals required by Paragraph 1.04 accepted by the Owner's Representative prior to start of placement. Notify the Owner's Representative at least 24 hours in advance of grouting with flowable fill.

B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at a pressure that will not distort or imperil any portion of the work, new or existing.

C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess the condition of the pipe. Locate previously unidentified connections, which have not been redirected and reconnected as a part of this project, and report them to the Owner's Representative. During placement of the fill, compensate for any irregularities in the sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and any other substances that may degrade performance of the fill. Do not leave sludge or other debris in place if filling more than 2 percent of the placement volume. Dispose of waste material in compliance with Section 01 74 00 – Cleaning and Waste Management.

E. Remove free water prior to starting fill placement.

3.02 EQUIPMENT

A. Mix flowable fill in an automated batch plant and deliver it to the site in ready-mix trucks. Performance additives may be added at the placement site if

required by mix design.

B. Use concrete or grout pumps capable of continuous delivery at the planned placement rate.

3.03 DEMOLITION OF ABANDONED SANITARY SEWER MANHOLES, PIPELINE STRUCTURES AND FORCE MAINS PRIOR TO ABANDONMENT

A. Remove manhole frames and covers and any castings from other existing pipeline structures. Deliver these castings to the Owner's storage yard. Alternatively, salvaged castings may be used upon approval by the Owner's Representative for construction of new manholes on this project.

B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to a minimum depth of 4 feet below finished grade. The structure may be removed to a greater depth, but not deeper than 18 inches above the crown of the abandoned sewer.

C. If the adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to the manhole in preparation for filling the manhole.

D. Excavate overburden from force mains to be abandoned at the locations indicated on the Drawings. Cut the existing force main, if necessary, to provide an end surface perpendicular to the axis of the pipe and suitable for the plug to be installed. Remove any force main piping material remaining outside of the segment to be abandoned.

3.04 INSTALLATION

A. Abandon sewer lines by completely filling the sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within the depth of structures left in place.

B. Place flowable fill to fill the volume between the manholes as completely as practicable. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.

C. Have the filling operation performed by experienced crews with equipment to monitor density of the flowable fill and to control pressure.

D. Temporarily plug sewer lines which are to remain m operation during pouring/pumping to keep the lines free of flowable fill.

E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain the flowable fill in the lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

F. Place flowable fill under pressure flow conditions into a properly vented open

system until flowable fill emerges from the vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill the sewer from the downstream end, to discharge at the upstream end.

G. Inject flowable fill through replaced ballast using grouting equipment and a series of grout pipes discharging at the bottom of the placement, allowing the fill to rise through the ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at the same time as flowable fill is placed. Do not fill with ballast more than 50 percent of the volume at any level to prevent nesting and void formation.

H. Remediate placement of flowable fill which does not fill voids in a sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of the fill by using pressure grouting either from inside the sewer or from the surface.

I. Plug each end of force mains being abandoned.

J. Force main abandonment

1. Clean the inside surface of force mains at least 12 inches from the ends, as necessary, to achieve a firm bond and seal the grout plug or manufactured plug to the pipe surface. Similarly, clean and prepare the exterior pipe surface if a manufactured cap is to be used.
2. When using a grout plug, place a temporary plug or bulkhead approximately 12 inches inside the pipe. Fill the pipe end completely with dry-pack grout mixture.
3. When using a manufactured plug or cap, install the fitting, as recommended by the manufacturer's instructions, to form a watertight seal.

K. Backfill to the surface, above the pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with these specifications.

L. Collect and dispose of excess flowable fill material and other debris in accordance with all sections of these specifications.

3.05 FIELD QUALITY CONTROL

A. Provide batch plant tickets for each truck delivery of flowable fill. Note on the tickets addition of admixtures at the site.

B. Check flow characteristics and workability of the fill as the placement

proceeds.

C. Obtain at least three test cylinders for each placement area for determination of 56 day compressive strength and bleeding. The acceptance of the placement will be based on the average strength of the three tests.

D. Record the volume of ballast together with the flowable fill placement for the same space to demonstrate that voids have been filled.

3.06 PROTECTION OF PERSONS AND PROPERTY

A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.

B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to the work.

END OF SECTION

SECTION 33 05 13.13

MANHOLE ADJUSTMENT

PART 1– GENERAL

1.01 SUMMARY

A. Manhole adjustment.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials shall be as specified in Section 33 30 00 of these Specifications.

PART 3 – EXECUTION

3.01 GENERAL

A. Final manhole cover level shall be flush with final road surface.

B. For outfalls, manhole cover level shall be approximately 24 inches above ground level unless otherwise directed by the Construction Manager.

C. Safety: Pay particular attention to the requirements for confined space entry and the use of gas monitors and ventilation systems.

3.02 ADJUSTING UP TO 3 INCHES

A. Remove manhole cover and clean all rust and debris from seating areas with wire brush or other abrasive means to ensure seating areas are completely clean.

B. Take measurements to determine exact height of risers to be used.

C. Add appropriately sized steel risers to ring to raise cover up to 3 inches in height. If using plastic risers, use combinations of 1-inch or 1½ -inch risers.

D. Replace manhole cover.

3.03 ADJUSTING GREATER THAN 3 INCHES AND LESS THAN 12 INCHES

A. Remove manhole cover and clean all rust and debris from seating areas with wire brush or other abrasive means to ensure seating areas are completely clean.

B. Take measurements to determine exact height of adjustment required.

C. Check for utility locates. If there are any missing utility locates, do not excavate, contact the Construction Manager immediately.

D. For any excavation work around utilities, perform hand digging until all marked utilities have been exposed and secured.

E. For manholes located in paved areas, saw cut a 60-inch by 60-inch square around manhole cover.

F. Excavate all material up to a minimum of 10 inches deep around manhole within 60-inch by 60-inch square area.

G. Remove manhole frame and cover to expose cone.

H. Add an appropriate number of pre-cast concrete spacers to cone.

I. If brick layers are found, remove brick and replace with pre-cast concrete spacers.

J. Use at least ¾-inch of non-shrink grout between spacers.

K. Replace manhole frame and seal with at least ¾-inch non-shrink grout.

L. For roadways, backfill using crusher run or other approved material. Compact in 6-inch layers using mechanical tamper, compacted up to 10 inches below ground surface.

3.04 ADJUSTING FOR 12 INCHES AND GREATER.

A. Remove manhole cover and clean all rust and debris from seating areas with wire brush or other abrasive means to ensure seating areas are completely clean.

B. Take measurements to determine exact height of adjustment required. Determine what combination of manhole risers, pre-cast concrete spacers, and steel or plastic riser rings will be utilized to achieve required adjustment. Obtain approval from Engineer prior to initiating adjustment work.

C. Check for utility locates. If there are any missing utility locates, do not excavate, contact the Construction Manager immediately.

D. For any excavation work around utilities, perform hand digging until all marked utilities have been exposed and secured.

E. For manholes located in paved areas, saw cut a 60-inch by 60-inch square around manhole cover.

F. Excavate all material around manhole within 60-inch by 60-inch square area to the depth required for the adjustment, using the method of trench stabilization

recommended for the specific soil types, depth, and general site conditions per reference material provided as part of the competent person certification.

G. Remove manhole frame, cover, and cone to expose manhole.

H. Add an appropriate number of manhole risers and pre-cast concrete spacers.

I. Seal all joints on the inside with non-shrink grout. Use at least ¾-inch of non-shrink grout between spacers.

J. If brick layers are found, remove brick and replace with pre-cast concrete spacers.

K. Replace manhole frame and seal with at least ¾-inch non-shrink grout.

L. For roadways, backfill using crusher run or other approved material. Compact in 6-inch layers using mechanical tamper, compacted up to 10 inches below ground surface.

3.05 GENERAL CLEAN UP AND RESTORATION

A. In paved areas, after final backfill and compaction, coat the vertical wall faces of the cut pavement with a solution of Portland cement and water mixed to a consistency of heavy paint.

B. Fill the top 10 inches of the excavation with Class “A” high early strength Portland cement that has been dyed to match the surrounding pavement.

C. Before leaving the job site, the area should be thoroughly cleared of all surplus material, debris and tools.

D. Submit completed work order form.

END OF SECTION

SECTION 33 05 23

BORE AND JACK CASINGS

PART 1 – GENERAL

1.01. SUMMARY

A. The work covered by this Section includes furnishing all labor, materials and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the Drawings.

B. Work shall include, but not limited to: bore and receiving pits excavation, sheeting, shoring, plating and safety barriers for the protection of workers, traffic, and the general public.

1. In general, the work shall include carrier pipe, steel pipe casing, excavation, backfill, restoration of site, sheeting, grout, brickwork, earth augers, jacking machine, welder and other accessories necessary for a complete installation as specified or directed.

C. Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards.

1. Latest revisions of all standards are applicable.
2. If requested by the Construction Manager, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

1.02. SUBMITTALS

A. Submit shop drawings, product data, and experience in accordance with the requirements of Section 01 33 23 of these Specifications.

B. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data as follows:

1. Shop drawings for casing pipe showing sizes and connection details.
2. Design mixes for concrete and grout.
3. Casing Spacers.

C. Experience Submittals

1. Boring and jacking casings is deemed to be specialty contractor work.
2. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by the General Conditions.

a. A minimum of five continuous years of experience in steel casing construction is required of the casing installer.

b. Evidence of this experience must be provided with the shop drawings for review by the Construction Manager.

D. The Contractor shall submit for approval, all working drawings and schedules of procedure proposed to be followed in the execution of boring and jacking operations.

1. Schedules shall set forth the sequence of the various operations together with the time proposed to begin and complete the phases of the work.

1.03. STORAGE AND PROTECTION

A. All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the Construction Manager.

PART 2 – PRODUCTS

2.01. CASING PIPE

A. Steel Pipe:

1. Pipe shall be new and unused.
2. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi.
3. The steel plate shall meet the chemical requirements of ASTM A139, Grade B.
4. The thicknesses of casing shown in Table 1 below are minimum thicknesses.
   a. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking.
   b. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.
5. The diameters of casing shown in Table 1 below and shown on the Drawings are minimum.
   a. Larger casings, with the Construction Manager's approval, may be provided at no additional cost to the Owner, for whatever reasons the Contractor may decide, whether they be casing size availability, line and grade tolerances, soil conditions, etc.

TABLE 1				
Pipe Diameter, inches	Bell OD Inches	Casing Diameter, inches	Wall Thickness, inches	
			Under Highways	Under Railroads
6	9.19	16	0.250	0.250
8	11.33	18	0.250	0.375
10	13.56	20	0.250	0.375
12	15.74	22	0.375	0.375
14	21.43	28	0.375	0.375
16	23.70	30	0.375	0.406
18	25.82	32	0.375	0.406
20	29.88	36	0.375	0.469
24	34.34	42	0.500	0.469
30	38.30	48	0.500	0.500

2.02. CASING SPACERS

A. Shell

1. Material: Minimum 14 gauge T-304 stainless steel.
2. Surfaces to be treated to reduce chemical reactivity.

B. Risers

1. Material: Minimum 10 gauge T-304 stainless steel.
2. Height shall be such that the pipe does not float within the casing.

C. Fasteners

1. Material: T-304 Stainless steel.

D. Liner

1. Material: PVC.
2. Thickness: 0.09-inch.
3. Hardness: 85-90 durometer.

E. Runners

1. Tensile Strength (ASTM D638): Minimum 3,500 psi.
2. Width: Minimum 2 in.
3. Runners shall be attached to stainless steel risers which shall be properly welded to the shell.
4. The height of the runners shall be such that the pipe does not float within the casing.

F. Casing spacers shall be as manufactured by:

1. Cascade Waterworks Manufacturing Company.
2. Pipeline Seal and Insulator, Inc.
3. Advance Products and Systems, Inc.
4. Or approved equal.

2.03. CASING END SEALS

A. The ends of the casing shall be sealed with brick bulkheads using brick and mortar.

2.04. GROUT

A. Grout may be used for filling the void between the casing pipe and the carrier pipe.

B. Cement shall conform to ASTM C 150, Type I or Type II.

C. Grout shall have a minimum compressive strength of 100 psi attained within 24 hours.

2.05. CARRIER PIPE

A. Carrier pipes shall meet requirements as specified in Sections 33 30 00, 33 31 00, 33 32 00 and 33 33 00 of these Specifications.

2.06. SURFACE SETTLEMENT MARKERS

A. Surface settlement markers within pavement areas shall be P.K. nails.

B. Surface settlement markers within non-paved areas shall be wooden hubs.

2.07. EQUIPMENT

A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.

B. Jacks for forcing the casing pipe through the roadbed shall have a jacking head constructed in such a manner as to apply uniform pressure around the ring of the pipe.

C. The pipe to be jacked shall be set on guides, braced together to properly support the section of the pipe and direct it to the proper line and grade. In general roadbed material shall be excavated just ahead of the pipe.

D. On casing pipe for pipelines over 60 feet in length, the installation equipment shall include a steering head and a grade indicator.

E. The steering head shall be controlled manually from the bore pit.

F. The grade indicator shall consist of a water level attached to the casing which would indicate the elevation of the front end of the casing or some other means for grade indication approved by the Construction Manager.

PART 3 – EXECUTION

3.01. GENERAL

A. The Contractor shall proceed with the work in such a manner as will permit regular transaction of business by the roadway owner and/or property owner without delay or danger of life or property and shall place necessary barricades, warning signs, signal lights, and if necessary, watchmen for the protection of the public.

B. All excavated material will be placed near the top of the working pit and disposed of as required. Use of water or other fluids will be permitted only to the extent necessary for lubrication. Jetting will not be permitted.

C. Contractor shall jack a steel casing pipe as indicated on the approved design, using a special earth auger machine. The casing shall be jacked to the line and grade indicated on the approved design.

D. All jacking/augering operations must be performed in compliance with the rules and regulations of the Fulton County Department of Transportation, Georgia Department of Transportation or other authorities having jurisdiction.

E. Any sheeting placed for the jacking/auguring operation must be completely removed by the Contractor prior to backfill.

F. When the bore pit excavation and/or jacking/auguring operation occurs along existing rights-of-way, care must be taken to ensure all work is performed within the right-of-way, or arrangements must be made with the owner of the affected private property to permit any encroachment on the private property.

G. All such arrangements shall be made in writing and a copy provided to the Construction Manager prior to beginning the excavation.

H. The Contractor shall be fully responsible for protecting against surface subsidence, damage or disturbance to adjacent property and facilities from his construction methods.

1. If loose material is encountered and cave-ins occur or are anticipated, all jacking/augering shall be suspended, shoring provided, and all voids filled or pressure grouted.
2. Supplemental measures and alternative methods must receive the Owner's approval before jacking/augering operation re-commences.
3. Any settlement or upheaval of the existing roadway pavements during the boring and jacking operation, and throughout the warranty period for the overall project, shall be repaired/restored by the Contractor immediately upon notification by the Owner of the pavement failure.

I. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor.

1. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site.
2. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.

J. Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing.

1. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable.
2. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.

K. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.

L. Casing Design: Design of the bore pit and required bearing to resist jacking forces is the responsibility of the Contractor.

1. The excavation method selected shall be compatible with expected ground conditions.
2. The lengths of the casing shown on the Drawings are the minimum lengths required.
3. The length of the casing may be extended for the convenience of the Contractor at no additional cost to the Owner.
4. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20 foot length may be necessary.

M. Roadway Crossings

1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the roadway right-of-way.
2. Work along or across the roadway department rights-of-way shall be subject to inspection by such roadway department.
3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the roadway, street or its connections.
4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the roadway department.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight.
6. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.

3.02. MAINTAINING TRAFFIC AND PUBLIC SAFETY

A. All working operations of the Contractor, his subcontractors, and/or their agents or employees must be subordinated to the free and unobstructed use of the highway and structures encountered in the execution of jacking and boring operations.

B. The Contractor shall proceed with the work in such a manner as will permit regular transaction of business by commercial operations adjacent to the project site without delay or danger to persons or property, permit free access to and from private residences, and will allow the safe flow of traffic and pedestrians around the work site.

C. The Contractor shall employ the use of barricades, barriers, warning signs, signals, lights, and if necessary, watchmen, for the protection of the general public.

D. The Contractor, when directed by Construction Manager, shall suspend all operations relating to boring and jacking until necessary safety precautions have been met.

3.03. GROUNDWATER CONTROL

A. The Contractor shall control the groundwater throughout the construction of the casing.

B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering.

1. Should settlement or displacement be detected, notify the Construction Manager immediately and take such action as necessary to maintain safe conditions and prevent damage.

C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress.

1. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum.

2. Dewater into a sediment trap and comply with requirements specified in Section 31 25 00 of these Specifications.

3.04. SAFETY

A. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.

C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, “Safety Requirements for Construction of Tunnel Shafts and Caissons”.

3.05. SURFACE SETTLEMENT MONITORING

A. Provide surface settlement markers, placed as specified and as directed by the Construction Manager.

1. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20 foot intervals and offset 10 feet each way from the centerline.

2. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing.

3. Tie settlement markers to bench marks and indices sufficiently removed as not to be affected by the casing operations.

B. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Construction Manager.

1. In the event settlement or heave on any marker exceeds 1 inch, the Contractor shall immediately cease work and using a method approved by the Construction Manager and the authority having jurisdiction over the project site, to take immediate action to restore surface elevations to that existing prior to start of casing operations.

C. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation.

1. The following schedule shall be used for obtaining and recording elevation readings:

a. All settlement markers, once a week;

b. All settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Construction Manager's direction if settlement is identified.

c. Make all elevation measurements to the nearest 0.01 foot.

D. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.

E. Report any settlement and horizontal movement immediately to the Construction Manager and take immediate remedial action.

3.06. BORING AND JACKING

A. Shaft

1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored.

a. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.

2. The shaft shall be rectangular and excavated to a width and length required for ample working space.

a. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions.

b. Keep preparations dry during all operations. Perform pumping operations as necessary.

3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work.

a. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the Construction Manager due to soil conditions.

B. Jacking Rails and Frame

1. Whenever possible, the pipe shall be jacked from the low or downstream end. At each end of the casing pipe, the void between the carrier pipe and casing shall be sealed with brick and mortar.

2. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking

rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.

3. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.

4. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

C. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wet boring.

D. Auger the hole and jack the casing through the soil simultaneously.

E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed. Any voids which develop during the installation operation shall be filled with pressure grout.

F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration.

1. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe.

2. Make all investigations and determine if the soil conditions are such as to require the use of a shield.

G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation.

H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Construction Manager, or removed and replaced at Contractor's own expense.

I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise.

1. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures.

2. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.

J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.

K. Once the jacking procedure has begun, it shall be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.

L. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.

M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.

N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously.

1. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off or removed, as designated by the Construction Manager.

O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, the excavation of all working pits and backfill requirements of Section 31 23 00 are included under this Section.

P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.

Q. Grout backfill shall be used for unused holes or abandoned pipes.

R. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

3.07. VENTILATION AND AIR QUALITY

A. Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

3.08. ROCK EXCAVATION

A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the Construction Manager, cannot be removed through the casing, the Construction Manager may authorize the Contractor to complete the crossing by a method established in a change order.

B. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the Owner.

3.09. INSTALLATION OF PIPE

A. After construction of the casing is complete and has been accepted by the Construction Manager, install the carrier pipe in accordance with the Drawings and Specifications.

B. Care shall be exercised at all times to maintain tight, fully seated joints in the carrier pipe. The carrier pipe shall be fully supported by pre-fabricated casing spacers when feasible.

C. Check the alignment and grade of the casing and prepare a plan to set the carrier pipe at proper alignment, grade and elevation, without any sags or high spots.

D. The carrier pipe shall be held in the casing pipe by one of the following methods:

1. The carrier pipe shall be held in the casing pipe by the use of hardwood blocks spaced radially around the pipe and secured together so that they remain firmly in place.

a. The spacing of such blocks longitudinally in the casing pipe shall not be greater than 10 feet or as recommended by the pipe manufacturer.

2. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1 inch.

a. Provide a minimum of two casing spacers per nominal length of pipe. Casing spacers shall be attached to the pipe at maximum 9 to 10 foot intervals or as recommended by the pipe manufacturer.

E. Fill the void between the carrier pipe and casing pipe with grout. Measures shall be taken by the Contractor to prevent floatation and other movement of the pipe as the grout is filling the void.

F. At each end of the casing pipe, the void between the carrier pipe and casing shall be sealed with 4 inches of brick and mortar.

3.10. SHEETING REMOVAL

A. Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

3.11. FREE BORING

A. Where permitted and directed by the Construction Manager, the Contractor shall use a special earth auger machine to install the pipe by the free bore method.

1. The allowed free bore method will be dry auger boring, without jetting, sluicing, or wet boring.

B. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside diameter plus 1 inch, whichever is greater.

1. If the annular space between the earthen hole and the carrier pipe exceeds six inches, the Contractor shall fill such space either by pressure grouting or pumping in a flowable fill to eliminate possible settlement.

C. The Contractor shall be responsible for any settlement of the surface (roadway, driveway, or otherwise) caused by the free bore construction activities.

D. Where ordered to use the free bore method to install a segment of pipe, the Contractor may elect to install the pipe by the conventional bore and jack casing method instead.

E. If the Contractor elects to free bore and an acceptable installation does not result for any reason, the Contractor shall install a casing pipe by the bore and jack method at no additional cost to the Owner.

F. At no time shall free bores in excess of forty (40) feet and for pipe larger than 12-inch be permitted.

G. The Contractor may elect to free bore other portions of the project in lieu of open cut installation. However, no additional payment for free bore will be made if the Contractor exercises this option.

3.12. DIRECTIONAL DRILLING

A. Where ordered by the Construction Manager, the Contractor shall install the pipe by directional drilling.

B. The directional drilling method consists of drilling a small diameter pilot hole within the designated tolerances followed by enlargement of the hole to accommodate the ductile iron carrier pipe to be installed.

C. The Contractor shall provide all materials and equipment required, including but not limited to drilling equipment, water pumps, hoses, fittings, storage tanks, filters, hay bales, silt fences, drilling fluids including containment, collection, cleaning and disposal of, fuel and lubricants, bentonite and related mixing equipment, hydrostatic testing equipment and materials, side booms, cranes, backhoes, trucks, and other equipment or materials necessary to load and unload pipe, and to support and smoothly transition the pipe while being pulled into the reamed hole.

D. The Contractor shall submit to the Construction Manager a detailed installation plan including operational sequences, details of the guidance or grade and alignment control system, and a plan and profile of the bore path.

1. The bore path shall ensure that the pipe joints do not deflect more than 50 percent of the manufacturer's recommended maximum deflection for the ductile iron pipe.

E. The drilling operation shall be conducted in a manner to eliminate the discharge of water, drilling mud, and cuttings to areas not involved in the construction process.

1. The Contractor shall immediately contain and clean-up any inadvertent returns.
2. The Contractor shall also provide equipment and procedures to maximize the recirculation and reuse of drilling mud to minimize waste disposal.
3. Proper disposal of water, drilling fluids, drilling mud, cuttings and muck is the Contractor's responsibility.

F. Ductile iron pipe and fittings, inspection and testing shall be as specified in Section 33 33 00.

END OF SECTION

SECTION 33 30 00

SEWER AND ACCESSORIES

PART 1 – GENERAL

1.01. SCOPE

A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02. QUALIFICATIONS

A. If requested by the Construction Manager, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least ten years.

1.03. SUBMITTALS

A. Complete product data and engineering data including shop drawings shall be submitted to the Construction Manager in accordance with the requirements of Section 01 33 23 of these Specifications.

B. When requested, the Contractor shall furnish the Construction Manager with lists, in duplicate, of all pieces of pipe and fittings received on the Project, including copies of shipping documents from the manufacturer and/or supplier.

C. Said lists shall indicate the serial or mark number, weight, class, length, size, and description of each typical piece received.

D. The Contractor shall submit, in conjunction with the construction progress schedule, a schedule of deliveries for materials. The Contractor shall coordinate material shipments with the Owner and the material suppliers.

1.04. TRANSPORTATION AND HANDLING

A. The Contractor shall maintain communication with the material suppliers and the Construction Manager as necessary, to keep informed as to scheduled shipment, and upon delivery of materials, the Contractor shall proceed without delay to unload such materials.

B. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at

all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

C. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

D. Lined pipe shall be handled and transported with such care as to prevent damage to linings.

E. Upon receipt of materials from the manufacturer, the Contractor shall make an inspection of such materials.

F. Check and certify the bill of lading, noting any discrepancies.

G. Obtain a proper memorandum signed by the agent of the carrier for any shortage in the shipment or for any damaged materials received.

H. All bills of lading and any memorandum for shortage or damage of material in the shipment shall be promptly submitted to the Construction Manager.

I. The Contractor shall be responsible for distribution of all materials as required to complete the Work.

J. Materials delivered to the Contractor shall be in the custody of the Contractor from the time of receipt by the Contractor of such materials from the carrier until final acceptance of the completed Work.

K. The Contractor shall be responsible for any loss or damage to materials.

1.05. STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas. Inform Owner and Construction Manager of the location, street address, of the storage area.

B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings, valves and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing.

C. Pipe shall not be stacked higher than the limits recommended by the manufacturer.

D. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipes in adjacent tiers.

E. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

F. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

G. All tools, materials, machinery and equipment required for the Work may be stored in a compact, neat, stock-piled manner adjacent to the work site, in a suitable location, and in such a manner as to cause the least inconvenience to the affected property owners, ensure traffic safety, and so as not to endanger the general public in any way.

H. All active, existing fire hydrants must be kept unobstructed and accessible at all times.

I. All water and gas valves, and underground power and telephone manholes must be left uncovered by such storing of materials.

1.06. QUALITY ASSURANCE

A. Product manufacturers shall provide the Construction Manager with written certification that all products furnished comply with all applicable provisions of these Specifications. All materials which fail to conform to these Specifications shall be rejected.

B. If ordered by the Construction Manager, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

C. After delivery to the site, any materials which have been damaged in transit or are unsuitable for use in the Work shall be rejected and removed from the site.

PART 2 – PRODUCTS

2.01. GENERAL

A. For gravity sewer installations with no live load, located below grade and not along streams or river banks, the standard pipe shall be green DR 25 PVC for pipe sizes 8-inch to14-inch and depths 3 feet to 8 feet.

B. For gravity sewer installations with no live load, located below grade and located along stream and river banks, the standard pipe shall be HDPE Ductile Iron Pipe Size (DIPS) DR17 for diameters 8-inch to 48-inch and depths 3 feet to 11 feet.

C. For gravity sewer installations with live loads HS20/25, or pipe located at a depth of 9 feet or greater and not along stream and river banks, the standard pipe shall be green DR18 PVC for pipe sizes 8-inch to 60-inch.

D. For pressure pipe applications (force mains) regardless of depth and live load requirements and not along river banks and streams the standard pipe shall be green DR18 PVC for diameters 8-inch to 60-inch.

2.02. DUCTILE IRON SEWER PIPE (DIP)

A. See Specification Section 33 33 00, Ductile Iron Pipe.

2.03. PVC SEWER PIPE

A. See Specification Section 33 32 00, PVC Pipe and Fittings.

2.04. HDPE SEWER PIPE

A. See Specification Section 33 31 00, HDPE Pipe and Fittings.

2.05. VALVES

A. Isolation valves for sewer force mains shall be eccentric plug valves.

B. See Specification Section 33 30 65, Plug Valves.

2.06. VALVE BOXES (VB) AND EXTENSION STEMS

A. All buried valves shall be equipped with valve boxes and covers.

1. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5 ¼ inch inside diameter.
2. Valve box covers shall weigh a minimum of 13 pounds.
3. The valve boxes shall be adjustable to 6 inches up or down from the nominal required cover over the pipe.
4. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut.
5. Ductile or cast iron extensions shall be provided as necessary.
6. Covers shall have “SEWER VALVE” or “SEWER” cast into them.
7. Valve boxes shall be manufactured in the United States.

B. All valve boxes shall have a concrete collar, minimum 9 inches thick.

1. The collar shall be square or round and sized 24 inches square or 24 inches in diameter.
2. Precast collars may be used, provided that they are grouted in place to the valve box.
3. The box is to be flush with finished grade.
4. The edge of the valve box is to be ½-inch above the edge of the concrete collar.

C. Where the depth of cover is more than 5-feet, the Contractor shall provide suitable, permanently installed valve stem extensions and guides which have been approved by the Construction Manager prior to fabrication and placement.

1. All valves shall be furnished with Type 316 stainless steel extension stems, as necessary, to bring the operating nut to within 24-inches of the top of the valve box.
2. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut.
3. The coupling and square wrench nut shall be welded or pinned to the extension stem and shall have a centering ring.
4. Extension stems shall be minimum 1-inch diameter.
5. Extension stems shall be equal to Trumbull Industries, M & H Valve, or Penn-Troy Manufacturing/Troy Valve.

2.07. VALVE MARKERS (VM)

A. The Contractor shall provide a concrete valve marker as detailed on the Drawings for each valve installed outside paved areas.

1. The markers shall be Class A concrete of DOT specifications, 4 inches square by 5 feet long, and shall be of the same construction as that of highway right-of-way markers.
2. The words "SEWER VALVE" shall be cast vertically into the marker beginning 2 inches from the top of the marker.
2. There shall also be a 1-¼ inch brass plug cast into the marker 1inch below the letter "E" of the word "VALVE", which shall be stamped in the field by the Contractor, after installation, with the distance, in feet, from the valve marker to the valve box.
4. The markers shall be installed as close to the right-of-way line opposite the valve as is possible, with the brass plug facing the valve.
5. The marker shall be located so as to avoid damage by traffic.
6. The top of the marker shall generally be set 24 inches above finished grade. The marker may be somewhat lower in areas where it may be considered obtrusive, such as lawns, however, at no time shall the marker be installed at less than 18" above finished grade.
7. Valve markers shall be in accordance with County standards.
8. In addition to concrete valve marker where street curbs are installed a saw cut ½ inch deep "V" notch on top of curb adjacent to water valve location is required.

2.08. PRECAST CONCRETE SECTIONS

A. Precast concrete sections shall meet the requirements of ASTM C478 and ASTM C76, latest revision, Class II, Wall B, Type II Portland cement.

B. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.

C. Reinforcing steel shall conform to ASTM A615, including supplementary requirements, and shall be Grade 60 except that bars to be welded shall be Grade 40 or ASTM A706.

D. Pre-cast concrete sections shall have a minimum 28-day cure time before delivery to the site.

E. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter, or 8 inches minimum, whichever is larger. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.

F. The minimum inside diameter of manholes shall be 48 inches with an opening of 24 inches at the top of the cone.

G. Transition slabs which convert bases larger than four feet in diameter to four-foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.

H. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant.

1. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch.

2. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.

I. In flood plains and locations vulnerable to high rates of inflow and infiltration, manholes shall be lined on the inside with a protective liner approved by the Owner.

J. Drop manholes, manholes with a force main discharge connection and any other manholes that are susceptible to large amounts of hydrogen sulfide shall be lined on the inside with a protective liner approved by the Owner.

K. The manhole table shall have a flow channel made to conform in shape and carrying capacity to that of the sewers.

L. Eccentric manhole cones are required for manhole frame and covers.

2.09. GRADE RINGS:

Commented [MB1]: See Standard Sheet 105

A. Composite Manhole Ring.

B. EJ Infra-Riser or approved equal.

C. Material: Composite of recycled rubber, nylon fiber and polyurethane prepolymer.

D. Density: 64.2 lbs/cu. ft., ASTM D3574, Test A.

E. Durometer Hardness: 77A +/- 5 points, ASTM D2240.

F. Tensile Strength: 304 psi (not less than 145 psi), ASTM D412.

2.10. BRICK AND MORTAR:

A. Brick shall be whole and hard burned, conforming to ASTM C32 Grade MS.

B. Mortar shall be made of one part Portland cement and two parts clean sharp sand.

C. Cement shall be Type 1 and shall conform to ASTM C150. Sand shall meet ASTM C144.

2.11. MANHOLE STEPS:

A. Reinforced Plastic Steps:

B. Manhole steps of polypropylene molded around a steel rod shall be equal to # PS-1 or #PS-1-PF of M.A. Industries. Inc.

C. ASTM C478, Section 16 Manhole Steps and Ladders.

D. Manhole steps shall only be installed where specified.

2.12. SAFETY PLATFORMS

A. Safety platforms are required on all manholes equal to or greater than 20 feet in depth.

B. Safety platforms shall only be installed where specified.

2.13. RUBBER BOOTS:

A. All pipes entering a manhole must be sealed by a rubber boot

B. Provide preformed rubber boots and fasteners equal to A-Lok, Z-Lok, Kor-N-Seal or Press Seal Gasket Corporation.

C. Boots may be mechanically attached to the manhole or cast into the walls of the manhole.

2.14. CASTINGS:

A. The manhole cover shall be factory imprinted to read: FULTON COUNTY SEWER

B. Cast Iron Castings - Paved Areas (Non-bolted):

1. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections.
2. No casting will be accepted which weighs less than 95 percent of the design weight.
3. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking.
4. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
5. Manhole frames and covers shall be as shown on the Standard Details.
6. All frames and covers shall have machined horizontal bearing surfaces.
7. All manholes located in paved areas shall have standard frames and covers except where specifically shown otherwise on the Drawings.
8. Only solid manhole covers may be used for sanitary sewers.

C. Cast Iron Castings - Paved Areas (Bolt Down):

1. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections.
2. No casting will be accepted which weighs less than 95 percent of the design weight.
3. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking.
4. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
5. Manhole frames and covers shall be as shown on the Standard Details.
6. All frames and covers shall have machined horizontal bearing surfaces.
7. All manholes located in paved areas shall have standard frames and covers except where specifically shown otherwise on the Drawings.

8. Watertight covers in paved areas shall be bolt down type and shall be equipped with four 1/2 inch stainless steel bolts and a 1/8 inch red rubber or rubber O ring gasket.
9. Covers shall be rotatable and interchangeable.
10. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole.
11. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.
12. Only solid manhole covers may be used for sanitary sewers.

D. Cast Iron Castings - Unpaved Areas

1. For all manholes located in unpaved areas, manhole cover and frame shall be manufactured from ductile iron in accordance with ISO 1083.
2. Covers and frames shall be hinged and incorporate a 90 degree blocking system to prevent accidental closure. The hinge box shall include a self-cleaning, dual wiper infiltration plug.
3. Covers shall be one man operable using standard tools and shall be capable of withstanding a test load of 120,000 lbs.
4. Frames shall be circular with a 24” clear opening and shall include a 360º mechanically attached, C-shaped elastomer seating gasket for infiltration control and traffic shock.
5. Covers and frames must have at least five years of successful history in a minimum of five thousand installations and be manufactured by an ISO 9000 certified manufacturer.
6. The frame depth shall not exceed 4 inches, and the flange shall incorporate bedding slots, bolt holes and lifting eyes.
7. All components shall be black coated. Frame weight: 73 lbs. Cover weight: 122 lbs. Total weight 195 lbs.

E. Composite Castings

1. All composite moldings shall consist of a thermosetting resin matrix blended and/or combined with reinforcing fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structure(s).
    a. The thermosetting resin matrix shall be a polyester, vinyl ester, or a blend of these.
    b. The moldings shall be true to pattern in form and dimension and free from cracks, pores, knit-lines, or other defects in locations affecting their strength and value for the service intended.
    c. Before the moldings are removed from the molding operation, they shall be thoroughly deflashed and cleaned at the parting lines, holes, notches and all exposed edges.
2. Composite frames must have a wall thickness of at least 0.75 inches in sections exposed to traffic and potential traffic wheel impact.

3. If using a lock, bolt, or latch, these must be independent of the method used to open the cover to ensure the cover can be opened in the event of lock failure.

4. Molding Process

   a. Covers and frames shall be compression molded under high pressures (>0.5 tons/sq inch of x-y surface area) and high temperatures (>200 degrees F).

   b. Metal reinforcements or metal hinges molded within the composite shall not be permitted. Small non-stress bearing pieces of metal may be encapsulated.

   c. Composite covers and frames shall be molded in the USA.

5. Testing and performance requirements

   a. Testing shall be performed in accordance with the following inspection criteria unless otherwise specified.

      1) The manufacturer/supplier shall be responsible for carrying out all of the required tests and inspections.

      2) All testing shall be conducted in the United States.

      3) The manufacturer/supplier shall maintain complete records of all such tests and inspections.

      4) All testing shall be paid for by the manufacturer/supplier.

   b. All covers shall be capable of withstanding a minimum traffic load of 40,000 lbs, tested in accordance with AASHTO M-306

      1) The Supplier of covers shall submit a test report from an accredited independent testing laboratory. The test report shall document a successful proof load test of 40,000 lbs. for 60 seconds using a 9-inch x 9-inch plate.

      2) There shall be no cracks or permanent deformation greater than 1/8 inch.

      3) The test report shall fully disclose the AASHTO M-306 test procedures and type of test equipment used and be illustrated with pictures showing the test plate, equipment used and pictures of the top and bottom of the lid.

   c. Load test:

      1) A load of 40,000 lbs shall be concentrated on a 9"x 9" block with rubber or fiber backing pad for one minute.

      2) During the load testing process, visible cracks or delamination will be cause for rejection (popping noises during this test are normal for composites and do not indicate failure).

      3) When load is removed, Permanent Set (Deflection) of more than 1/8 inch measured at center of load area will be cause for rejection.

4) All testing shall be conducted on a NIST calibrated and Certified load test machine.

d. Ultraviolet resistance:

1) ASTM G 154 Cycle I for 1000 hrs.

2) Specimens shall be tested for ultimate flexural strength (ASTM D790), retaining at least 75% of control values for load and deflection at failure.

e. Coefficient of Friction:

1) Shall be greater than 0.6 when tested in accordance to ASTM C 1028.

f. Notched Izod Impact:

1) Composite raw material impact results shall be greater than 5 ft.-lbs/inch when tested in accordance to ASTM D256.

6. Components for locking systems below the cover exposed to the sewer environment shall be made of noncorrosive materials such as nonmagnetic, 316 stainless steel or a polymer.

7. Covers shall be the types and shall be imprinted as shown on the plans or standard details.

8. Markings

a. Covers and Frames shall have the following molded into the substrate of the cover:

1) Name (or Abbreviation) Molder

2) Country of Origin

3) Molding Date

4) Indication that Material is Non-metallic

9. The covers shall be black in color and have the words SANITARY SEWER molded into the lid in 1-¾ inch raised letters.

10. The covers shall be secured to the frames with four type 316 socket head cap screws. The cap screws shall be coated with a resin-bonded, thermally cured, dry-film lubricant, black in color.

11. The coating shall be 1 mil thick and have a coefficient of friction of 0.05 - 0.10. Cap screws shall be retained to cover by type 316 stainless tooth-lock washers.

12. The frames shall be molded with four stainless threaded inserts to receive the coated stainless steel cap screws. The frame shall have a groove for a neoprene gasket.

13. All covers shall be capable of withstanding a fatigue analysis in accordance with EN 124-1: 2015 for a C250 rating.

a. The Supplier shall submit a test report from an independent testing laboratory which has been accredited by the American Association for Laboratory Accreditation.

b. The test report shall document no cracks being present after subjected to 100,000 cycles of 20,682 lbs. (92KN), applied by a 9-inch x 9-inch square plate.

14. All covers shall be capable of passing a water infiltration test in accordance with FACTA Specification for Fabricated Access Covers current edition.

a. The Supplier of covers shall submit a test report from an accredited independent testing laboratory.

b. The cover shall be tested in a specially designed fixture where it is face-down with 3.94 inches of water above it for 24 hrs.

c. After the test period, leakage shall not exceed 0.169 oz/minute.

15. Warranty

a. Material Warranty: A written guarantee of 20 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the cover and frame material.

b. Workmanship Warranty: The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance and shall cover the cost of replacing the cover and frame and freight to project site should the cover and frame have any defects in material or workmanship.

c. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

d. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

16. Frames and covers shall be manufactured by Composite Access Products (CAP) or approved equal.

2.15. MISCELLANEOUS ACCESSORIES

A. Manhole Riser Rings

1. All final grade adjustment of manhole cover and frame assemblies shall be completed with riser rings. The contractor shall utilize flat and sloping units to match the required slope and or grade of the structure.

2. All adjustment for matching road grade shall be made utilizing a molded indexed slope ring.

3. The complete riser ring system utilizing shall consist of the riser rings, sealed to the manhole structure, to the cover and frame, and to one another by means of an approved butyl sealant.

4. The manhole adjusting rings shall be molded from high-density polyethylene as defined in ASTM Specification D-4976.

5. The adjustment rings shall be molded from 100% recycled material.

6. The plastic rings shall be manufactured utilizing the injection molding process as defined by SPE (Society of Plastic Engineers).

7. The adjustment rings shall be tested to assure compliance with impact and loading requirements per the ASSHTO Standard Specification for Highway Bridges.

8. Installation shall be per manufacture's recommendations only.

9. The annular space between the individual rings and cone basin and the rings and cover frame shall be sealed per manufacturer's instruction utilized with ASTM C990 approved butyl sealant.

10. Warranty

    a. Material Warranty: A written guarantee of 30 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the riser ring material.

    b. Workmanship Warranty: The Contractor shall guarantee his work for a warranty period of 3 years from the date of final acceptance and shall cover the cost of replacing the riser rings and freight to project site should the riser rings have any defects in material or workmanship.

    c. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

    d. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

11. All riser rings shall be as manufactured by LADTECH, Inc. or approved equal.

B. Flexible Adapter Couplings:

1. Couplings for pipe sizes 15 inches in diameter and less shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leak-proof and root-proof up to 4.3 psi. The adapter manufacturer shall provide all stainless steel clamps and required accessories.

2. Couplings shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

2.16. ELECTRONIC MARKERS

A. Electronic markers shall be buried with utilities to serve as a locating device.

B. Electronic markers shall be the "Ball" type for a depth up to 4 feet and the "Full Range" type for depths greater than 4 feet.

C. Each marker shall be color coded in accordance with APWA standards and produce an industry specific frequency.

D. Each marker shall contain a passive antenna that requires no internal power source.

E. Markers shall be of water resistant polyethylene shells and impervious to minerals, chemicals and underground temperature extremes.

F. Electronic markers shall be compatible with 3M Dynatel 1420 EMS-iD Marker Locator. Contractor shall supply one Marker Locator for use during installation and shall turn over Locator to County upon project completion.

G. Markers shall be equal to 3M EMS 1423 XR/ID for wastewater service.

2.17. CONCRETE

A. Concrete shall have a compressive strength of not less than 3000 psi with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5 inches.

B. For job mixed concrete, submit the concrete mix design for approval by the Construction Manager.

C. Ready mixed concrete shall be mixed and transported in accordance with ASTM C94.

D. Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

2.18. RETAINER GLANDS

A. All restrained ductile iron pipe and fittings shall be manufactured restrained joint as specified in Section 33 33 00. Retainer glands shall only be installed on MJ valves and where allowed by Construction Manager.

B. Retainer glands shall be provided at all mechanical joints, including fittings, valves, hydrants and other locations as shown on the Drawings.

C. Anchorage: Where retainer glands are installed or allowed by Construction Manager, the valves, plugs, caps, tees and bends deflecting 11 ¼ degrees or more shall be provided with one of the following two forms of restraint:

1. Retainer glands plus concrete thrust blocking (3,000 psi concrete thrust block sized to withstand line pressures of 300 psi and soil bearing pressures of 2,000 psf)

2. Retainer glands plus rodding to concrete thrust collar (3,000 psi concrete collar and tie rods sized to withstand line pressures of 300 psi and soil bearing pressures of 2,000 psf)

D. Retainer glands for ductile iron pipe shall be manufactured in the U.S.A and equal to:

1. Megalug Series 1100, as manufactured by EBAA Iron.

2. Uni-Flange Series 1400, as manufactured by Ford Meter Box Company,

3. Stargrip Series 3000, as manufactured by Star Pipe Products,
4. Sigma One LOK Series SLD as manufactured by Nappco-Sigma.
5. Or approved equal.

2.19. DETECTION TAPE

A. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket.

B. Tapes shall be color coded in accordance with APWA color codes with the following legends: “CAUTION WASTEWATER MAIN BURIED BELOW”.

1. Color is green for wastewater mains and the color may be solid or striped.
2. Tape shall be permanently printed with no surface printing allowed.
3. Tape width shall be a minimum of 2 inches when buried less than 10 inches below the surface.
4. Tape width shall be a minimum of 3 inches when buried greater than 10 inches and less than 20 inches.

C. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape or approved equal.

2.20. SPECIAL COATINGS

A. Applications

1. Below grade (buried) or where little to no surface preparation can be performed on piping or structural steel.

B. Coating Materials

1. Petrolatum based mastic or wax based wrapping tapes
2. Coating System Manufacturer
   a. Carboline
      1) First Coat - Carbowrap Priming Paste
      2) Finish Coat - Tape A, B, or C (temp. dependent)
   b. Denso
      1) First Coat - Denso Paste
      2) Finish Coat - Densyl Tape
   c. Trenton
      1) First Coat - Waxtape Primer
      2) #1 Wax Tape

PART 3 – EXECUTION

3.01. EXISTING UTILITIES AND OBSTRUCTIONS

A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner.

B. The Contractor shall call the Utilities Protection Center (UPC) (800-282-7411) as required by Georgia law (O.C.G.A. §§ 25-9-1 through 25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.

C. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Georgia law.
2. Field utility locations are valid for only ten days after original notice. The Contractor shall ensure, at the time of any excavation that a valid utility location exists at the point of excavation.
3. Expose the facility to verify its true location and grade for a distance of at least 200 feet in advance of pipeline construction to verify its true location and grade.
4. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
5. Avoid utility damage and interruption by protecting it with means or methods recommended by the utility owner.
6. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any.
7. The Contractor shall provide the Construction Manager an updated copy of the log bi-weekly, or more frequently if required.

D. Conflict with Existing Utilities:

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed sewer does not permit safe installation of the sewer by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility.
    a. The Contractor may change the proposed alignment of the sewer to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement and complies with regulatory agency requirements after a written request to and subsequent approval by the Construction Manager.

b. Where such relocation of the sewer is not approved by the Construction Manager, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed sewer does not permit the crossing without immediate or potential future damage to the utility, main, service, or the sewer.

a. The Contractor may change the proposed grade of the sewer to avoid vertical conflicts if the changed grade provides minimum required capacity, maintains adequate cover and complies with regulatory agencies requirements, after written request to and subsequent approval by the Construction Manager.

b. Where such relocation of the sewer is not approved by the Construction Manager, the Contractor shall arrange to have the utility, main, or service relocated.

E. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

F. Water, Sewer and Storm Drain Separation:

1. Sewers shall be laid least 10 feet laterally edge to edge from existing or proposed water mains.

a. Where the sewer crosses a water main, the top of sewer pipe must be at least 18 inches below the bottom of the water main.

b. Where 18 inches clear vertical separation cannot be maintained, the sewer pipe shall be mechanical joint DIP.

c. Where possible, a full joint of sewer pipe shall be centered over the water main. Any deviation shall be requested in writing to the Construction Manager.

2. Where sewer lines cross under storm drains, the sewer shall be laid such that the top of the sewer is at least 12 inches below the bottom of the storm drain. Where the vertical separation is less than 12 inches, the sewer pipe shall be mechanical joint DIP.

3. No water main shall be permitted to pass through or come in contact with any part of a manhole.

4. There shall be a minimum 5 feet horizontal separation between parallel gravity and/or force mains

3.02. CONSTRUCTION ALONG HIGHWAYS, STREETS, AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets, and roadways in accordance with the applicable regulations of, and permits issued by, the Georgia Department of Transportation, Fulton County, and the City having jurisdiction, with reference to construction operations, safety, traffic control, road maintenance and repair.

B. The Contractor shall prepare a Traffic Control Plan and submit the plan to the Construction Manager at least 14 days prior to on-site work.

C. The Traffic Control Plan shall include all anticipated lane closures, placement of traffic control devices, barricades, lights, flagmen etc. to clearly show how traffic flow and safety will be maintained throughout the Project.

D. Traffic Control:

1. The Contractor shall:
    a. Provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices,
    b. Provide qualified flagmen where necessary to direct traffic. Flagmen shall be certified by a Georgia DOT approved flagman training program.
    c. Take all necessary precautions for the protection of the work and the safety of the public.
2. Construction traffic control devices and their installation shall be in accordance with the current Manual on Uniform Traffic Control Devices for Streets and Highways.
3. Placement and removal of construction traffic control devices shall be coordinated with the Georgia Department of Transportation, Fulton County and the City having jurisdiction, a minimum of 48 hours in advance of the activity.
4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities.
    a. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted.
    b. Construction traffic control devices shall be removed immediately following their useful purpose.
    c. Traffic control devices used intermittently, such as “Flagmen Ahead”, shall be removed and replaced when needed.
5. Existing traffic control devices within the construction work zone shall be protected from damage.
    a. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations.
    b. Original locations shall be measured from reference points and recorded in a log prior to relocation.
    c. Temporary locations shall provide the same visibility to affected traffic as the original location.
    d. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.
6. Construction traffic control devices shall be maintained in good repair, and shall be clean and visible to affected traffic for daytime and nighttime

operation. Traffic control devices affected by the construction work zone shall be inspected daily.

7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background.

   a. Construction sign panels shall meet the minimum reflective requirements of the Georgia Department of Transportation, Fulton County and the City having jurisdiction.

   b. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.

8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual on Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location.

   a. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

E. Construction Operations:

1. Perform all work along highways, streets and roadways to minimize interference with traffic.

2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.

3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

5. Construction operations shall include cleanup and utility exploration.

F. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off the pavement in a timely manner.

G. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

H. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences, property corners, cultivated trees and shrubbery, manmade improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

I. Maintaining Highways, Streets, Roadways and Driveways:

1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.

2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates.

   a. The edges of running plates shall have asphalt placed around their periphery to minimize vehicular impact.

   b. The backfill above the pipe shall be compacted, as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.

4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.03. PIPE DISTRIBUTION

A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.

B. Pipe may not be strung along the project within existing highway rights-of-way, unless specifically directed to do so by the Construction Manager, and only then after receiving permission from the road authority which has jurisdiction.

C. No pipe shall be strung further along the route than 500 feet beyond the area in which the Contractor is actually working without written permission from the Owner.

D. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.

E. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities.

F. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.

G. No distributed pipe shall be placed inside drainage ditches.

H. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04. LOCATION AND GRADE

A. The Drawings show the alignment and grade of the sewer and the position of manholes and other appurtenances. The slope shown on the profile is the slope of the invert of the pipe.

B. Prior to clearing and grubbing, construction staking shall be performed. The Construction Manager will provide a temporary bench mark along the sewer main route and at all other locations where the alignment of the sewer changes significantly

C. From the information on the Drawings and the survey points found on the Project site, the Contractor shall perform all surveys necessary for the establishment of the horizontal and vertical alignment of the sewer.

D. Construction Staking

1. The base lines for locating the principal components of the Work are shown on the Drawings.
    a. Base lines shall be defined as the line to which the location of the sewer is referenced, including but not limited to, edge of pavement, road centerline, property line, right-of-way or survey line.
    b. The Contractor shall be responsible for performing all survey work required for constructing the sewer, including the establishment of base lines and any detail surveys needed for construction.
        1) This work shall include the staking out of permanent and temporary easements to insure that the Contractor is not deviating from the designated easements.
2. The level of detail of survey required shall be that which the correct location of the sewer can be established for construction and verified by the Construction Manager.
    a. Where the location of components of the sewer are not dimensioned, the establishment on the location of these components shall be based upon scaling these locations from the Drawings with relation to readily identifiable land marks such as survey reference points, power poles, manholes, etc.

E. Reference Points:

1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Construction Manager.
2. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way.
    a. The location of the reference points shall be recorded in a log with a copy provided to the Construction Manager for use prior to his verifying reference point locations.

b. Distances between reference points and the manhole centerlines shall be accurately measured to the nearest 0.01 foot.

3. The Contractor shall give the Construction Manager reasonable notice that reference points are set. The reference point locations must be verified by the Construction Manager prior to commencing clearing and grubbing operations.

F. Cut Sheets:

1. Cut sheets shall be utilized for basis of payment and confirming that the profile is as shown on the Drawings.

2. Prior to beginning installation of any section of the gravity sewer, prepare cut sheets from field run ground elevations and submit them to the Construction Manager for approval.

3. The survey, from which cut sheets are prepared, may be performed prior to or after clearing and grubbing operations. The surveyor shall obtain an elevation on each bench mark shown on the Drawings and provide this information to the Construction Manager.

4. No installation of the sewer shall commence prior to approval of the cut sheets.

5. Submittal of cut sheets shall be in accordance with Section 01 33 23 of these Specifications.

6. Cut sheets shall provide the station (to the nearest 1 foot) and the elevation (to the nearest 0.1 foot) at maximum 100 foot intervals, plus at each change in slope of the ground and at each manhole centerline.

7. The cut sheet shall also show the invert elevation of the sewer at the corresponding sewer station.

8. From a straight line interpolation of the data, the Contractor shall calculate and record the station of each point where there is a change in the cut brackets indicated on the Bid form.

9. The Contractor shall calculate and record the length of the sewer between each change in cut bracket.

10. The Contractor shall also indicate the pipe material and class as well as the type of bedding.

11. The slope of the sewer shall also be indicated between manholes.

12. At least one offset hub or temporary bench mark shall be provided at each manhole. Its elevation and the resulting cut from the hub to the manhole invert shall also be shown on the cut sheets.

G. Multiple construction sites shall not be permitted without written authorization from the Construction Manager for each site. As a minimum, cut sheets between construction sites shall be submitted and approved before multiple construction sites will be permitted.

H. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for

the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.

I. Construction Verification Survey allowance: The Construction Verification Survey cash allowance is solely for the use of the Owner for verification of the Contractor's reference points, centerlines and work performed.

J. The presence of this cash allowance in no way relieves the Contractor of the responsibility of installing reference points, centerlines, temporary bench marks, providing as-built drawings, or verifying that the work has been performed accurately.

3.05. LAYING AND JOINTING PIPE AND ACCESSORIES

A. Force mains, valves and appurtenances shall be installed before the installation of the subbase course or paving or any other utilities except gravity sewer lines.

B. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.

C. Pipe Installation:

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work.

   a. All pipe, fittings and valves shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to sewer materials and protective coatings and linings.

   b. Under no circumstances shall sewer materials be dropped or dumped into the trench.

2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Construction Manager, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.

4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be left in the pipe at any time.

5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

6. Pipe laying shall commence at the lowest manhole unless otherwise directed and proceed upstream without interruption. Pipe shall be laid so

that the spigot ends (if any) point in the direction of flow to prevent bedding material from entering the joint.

7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.

8. Provide electronic marker for all force mains.

   a. Electronic markers shall be installed in an interval of every 100 linear feet and as needed to establish a change in direction or as directed by the Construction Manager.

   b. Electronic marker shall be equal to 3M Dynatel 1423 XR/ID and shall be compatible with 3M Dynatel 1420 EMS-ID Marker Locator System.

D. Alignment and Gradient:

1. Lay pipe straight in alignment and gradient or follow true curves, where shown on the Drawings, as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

3. The Contractor shall check the invert elevation at each manhole and the pipe invert elevation at least three times daily, start, mid-day and end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the pipe is being constructed at minimum slope.

4. The Contractor shall check the horizontal alignment of the sewer at the same schedule as for invert elevations.

E. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible as determined by the Construction Manager.

F. Do not leave unjointed pipe in the trench overnight. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress.

G. Backfill and compact the trench as soon as possible after laying and jointing is completed.

H. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Construction Manager.

I. Joint Assembly:

1. Joints shall be assembled in accordance with the manufacturer's recommendations,

2. Suitable means shall be used to force the spigot end of the pipe into the bell without damage to the pipe and its jointing materials and without disturbing the previously laid pipe and joints.

3. The Contractor shall inspect each pipe joint within 1,000 feet on either side of main line valves to insure 100 percent seating of the pipe spigot, except as noted otherwise.
4. Each restrained joint shall be inspected by the Contractor to ensure that it has been “homed” 100 percent.
5. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.

J. Cutting Pipe:

1. Whenever a pipe requires cutting to fit the line or bring it to the required location, the work shall be performed in a manner so as to leave a smooth end at right angles to the axis of the pipe. Jointing of a field cut pipe shall be made in accordance with the manufacturers’ instructions.
2. Only push-on or mechanical joint pipe shall be cut.
3. Cut ductile iron pipe using an abrasive wheel saw.
4. Cut PVC and HDPE pipes using a suitable saw as recommended by the pipe manufacture.
5. Remove all burrs and smooth the end before jointing.
6. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location.

K. Lining Repair: Repair linings and recoat spigot ends of cut pipe with lining and bituminous coating as herein before specified in of this Section and as specified below:

L. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.

M. Remove oil and lubricants used during field cutting.

N. Lining shall be stripped back a minimum of 1 inch from the spigot end into well adhered lined areas.

O. Roughen 1 to 2 inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.

P. Apply lining repair material in the number of coats required to match the thickness requirements as herein before specified in this Section and in accordance with the manufacturer's recommendations.

Q. The open end of uncompleted pipe lines shall be provided with a temporary stopper carefully fitted so as to keep dirt, animals, and other substances from entering. This stopper shall be maintained in position at all times when pipe laying is not actually in progress.

R. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Construction Manager.

3.06. VALVE AND FITTING INSTALLATION

A. All valves shall be set accurately and carefully to the lines and grades given on the Drawings, or as directed, and shall be joined to the pipe utilizing such approved joints as herein before specified.

B. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks.

C. Defective valves shall be corrected or held for inspection by the Construction Manager. Valves shall be closed before being installed.

D. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.

E. Valves shall be installed in the closed position.

F. A valve box shall be provided on each underground valve.

G. They shall be carefully set, centered exactly over the operating nut and truly plumbed.

H. The valve box shall not be in direct contact with the bonnet of the valve and shall be supported in such a manner as not to transmit shock, stress, or load directly to the valve.

I. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut.

J. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe.

K. Extension stems shall be installed where depth of bury places the operating nut in excess of 24-inches beneath finished grade so as to set the top of the operating nut 24-inches below finished grade.

L. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Construction Manager.

M. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

N. A valve marker shall be provided for each underground valve.

O. Unless otherwise detailed on the Drawings or directed by the Construction Manager, valve markers shall be installed 6-inches inside the right-of-way or easement, and buried to a depth of 30-inches.

P. In addition to a concrete valve marker where street curbs are installed, a saw cut ½" deep "V" notch on top of curb adjacent to the water valve location is required.

Q. A precast concrete vault shall be installed for 24-inch valves and larger.

3.07. SPECIAL COATINGS

A. Surface Preparation

1. Remove loose scale, rust, dirt, excessive moisture, or frost from the surface in accordance with SSPC SP-2 (Hand Tool Cleaning).

B. Application

1. All surfaces shall be hand rubbed or brushed with a priming paste recommended by the CSM. Sharp projections such as threads, irregular contours, or badly pitted areas shall receive a liberal amount of priming paste to ensure maximum protection of metal throughout.
2. On irregular shaped surfaces, i.e., nuts, bolts, flanges, valves, etc., the Contractor shall use either of the following systems recommended by the CSM.
    a. Apply recommended mastic by hand in sufficient quantity to build an even contour over entire surface. The Contractor shall pay particular attention to ensure that folds and air pockets within the mastic layer are thoroughly pressed out prior to subsequent application of tape. OR
    b. An extra layer of tape shall be cut and carefully molded around sharp projections, nuts, bolts, etc., before final application of tape, in order to meet specified system thickness.
3. Tape shall be spirally wrapped with a 55 percent overlap and sufficient tension and pressure to provide continuous adhesion without stretching the tape. Edges of tape must be continuously smoothed and sealed by hand during wrapping. On vertical application, contractor shall begin at bottom and proceed upward creating a weatherboard overlap.
4. System Thickness
    a. Smooth contours shall have a minimum thickness of 50 mils while nuts, bolts, and sharp projections shall be 100 mils.
5. Tape

a. Number and types of tape wraps shall be in accordance with the CSM's written instructions.

3.08. MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

A. Construct manholes at locations and as shown on the Drawings.

B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.

C. All manholes shall have a minimum of 12 inches #57 stone bedding.

D. Grade Rings:

1. Apply a continuous strip, 5/16 inch – 3/8 inch thick, of polyurethane joint sealer/adhesive on the top surface of the concrete structure or brick course. Place on a diameter 1 inch smaller than the outside or inside diameter of the adjustment riser.

2. Position the riser in place, ensuring it is centered over the top surface of the concrete structure or brick course of the manhole structure.

3. Apply a second continuous strip 5/16 inch – 3/8 inch thick of polyurethane joint sealer/adhesive on the top surface of the riser 1” smaller than the outside or inside diameter of the frame.

4. Center the frame of the manhole over the structure opening. Place bottom of frame onto adjustment riser. Press down, applying firm pressure to the frame to create a tight seal with the sealant and adjustment riser.

E. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4 inch thick, on the inside and outside of manhole.

F. Pipe Connections: Seal the connection between the pipe and the manhole as follows:

1. Pipe 36 Inch Diameter and Less: Connect pipe to precast concrete manholes by a rubber boot provided in a cored or precast hole of the proper diameter.

2. Pipe 42 Inch Diameter and Larger: Construct manhole collars as shown on the Drawings after the pipe has been sealed into the manhole.

3. If rubber boots are damaged, replace Type I boots with a new boot and repair Type II boots by constructing a manhole collar.

4. If preformed openings must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting.

G. Inverts: Form channels as shown on the Drawings, rounded, and troweled smooth. Maintain consistent grade through the invert.

1. Inverts shall be constructed with the same radius as the effluent pipe.
2. Invert walls shall be constructed to a height corresponding to the spring-line of the influent and effluent pipes with smooth rounded walls.
3. All inverts must be grouted 360 degrees around rubber boots.
4. Inverts formed with a half pipe are NOT allowed.

H. Top Elevations:

1. Where manholes are constructed in paved areas the top surface of the frame and cover shall conform to the crown and grade of the existing adjacent pavement.
2. Adjustment to final grade in paved areas shall be provided by means of brick coursing not to exceed four (4) common brick (12 inches maximum) in height with Portland cement joints.
3. Where manholes are constructed in non-pavement areas the frame shall be factory cast into the concrete cone. The top surface of the frame and cover shall have bolt-down lids with a watertight gasket.
4. Manholes in wooded or unmaintained areas shall be a minimum of 24 inches above ground level unless otherwise shown on the Drawings or directed by the Construction Manager. .
5. Manholes in maintained grassy areas may be flush with the ground.
6. Manholes on sloped ground in un-maintained areas shall be a minimum of 24 inches above ground level on the uphill side of the manhole unless otherwise shown on the Drawings or directed by the Construction Manager.

I. Drop Connections: Manholes requiring drop connections are shown on the Drawings

1. Construct drop connections of mechanical joint Class 350 DIP and diameter size as the upstream sewer and in accordance with the details shown on the Drawings.
2. All outside 90 degree elbows shall have a thrust block poured below the elbow.

J. Frames and Covers:

1. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry
2. Unless frame and cover is at grade, the frame shall be cast into the cone section.

K. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.

L. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the precast concrete manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole,

the Contractor shall verify the elevation of the sewer installed at the manhole. Should the elevation differ from that shown on the Drawings, the Contractor shall take the following corrective action:

1. If the sewer is laid at negative grade, the Contractor shall remove and reinstall the sewer at the correct grade at no additional cost to the Owner.
2. If the sewer is laid at a grade less than that shown on the Drawings, thus reducing the sewer's capacity, the Owner may require the sewer to be removed and re-laid at the correct grade at no additional cost to the Owner. As a minimum, the grade to the next upstream manhole shall be adjusted such that the next upstream manhole shall be set at the correct elevation.
3. If the sewer is laid at a grade greater than that shown on the Drawings, and if the Contractor can show that there are no conflicts with upstream existing utilities or obstructions, the Contractor shall adjust the grade of the next upstream manhole such that the next upstream manhole shall be set at the correct elevation.
    a. If such an adjustment, in the Construction Manager's opinion, is substantial, the grade adjustment shall be spread over multiple sections of the sewer.
    b. If such an adjustment, in the Construction Manager's opinion, significantly reduces the sewer's capacity, the Construction Manager may require the Contractor to remove and relay that portion of the sewer laid at the improper grade.

M. Doghouse Manholes

1. For doghouse manholes, the existing pipe shall not be cut without authorization of the Construction Manager.
2. The Construction Manager must be present when existing pipe is cut for the doghouse or cut-in manholes.

N. Steps

1. The uppermost step shall be built into the concrete not over 12 inches below the top of the manhole dome/cone and these steps shall be continued in alignment downward along the interior vertical side of the manhole to a point no lower than the crown of the largest sewer.
2. Spacing of steps shall not exceed 12 vertical inches.
3. Steps shall not descend over any pipe connection into the manhole, unless approved by the Construction Manager.
4. Steps shall only be installed where specified.

O. Manholes shall be constructed such that their walls are plumb.

P. Manhole Cores

1. The Contractor shall be responsible for performing manhole cores.

2. The core must not be backfilled until approved by e Construction Manager.
3. Failure, for any reason, to have the Construction Manager approve the core will cause all work to be halted until the cored manhole is excavated and the rubber boot exposed.
4. Cores for future development or future tie-ins are only allowed when installed with a rubber boot, one full joint of 6-inch ductile iron, HDPE or PVC pipe, based on bury depth conditions, and a mechanical joint plug.
5. A miscored manhole section shall be replaced unless a variance has been approved by the Construction Manager. A miscore is defined as:
   a. Cored into the barrel section joint.
   b. Cored into the poured table.
   c. Offset or misdirection of core.
6. A minimum of 12 inches separation is required between all manhole cores.

Q. Pre-Cast Barrel

1. All lift holes shall be fully sealed with grout and troweled smooth inside and out.
2. All joints shall be grouted inside and out.

3.09. THRUST RESTRAINT

A. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements specified in Article 2.14 of this Section. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

B. Concrete Collars: Construct collars as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements specified in Division 3 of these Specifications.

3.10. INSPECTION AND TESTING FOR GRAVITY SEWER

A. The Construction Manager will make periodic job site visitations without advance notice to the Contractor. However, it is the responsibility of the Contractor to contact the Construction Manager during each phase of the installation for inspections and/or re-inspections.

B. The Construction Manager will visually inspect the project for acceptable system installation such as invert work, gravel, pipe type, grout, etc.

C. Final approval of a project will not be granted by the Owner until all inspections are conducted with no defects noted and all appropriate documents have been received and accepted by the Construction Manager.

D. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments. When requested by the Construction Manager, flush out lines and manholes before final inspection.

E. Alignment: Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

F. Pipe joints for sewers 30-inches in diameter and larger shall be air tested individually. The joint tester assembly shall be placed over the joint and shall pressurize the joint area to 4 psi. The pressure shall not drop more than 2 psi in 10 seconds. The joint tester assembly shall be equal to Cherne Industries, Inc.

G. Watertightness: All sewers constructed shall be tested for watertightness to the maximum extent feasible. Infiltration tests and exfiltration tests shall be performed on all new sewers constructed as indicated below, except for those new sewers constructed which have active services tied into it as the pipe is being installed. In such cases the watertightness of the sewers less than or equal to 24-inches shall be based on a visual inspection, and for sewers 30-inches and larger based on the individual joint test as specified herein. All visible leaks, including those found via television inspection, shall be repaired.

1. Infiltration Tests:

    a. Install suitable weirs in manholes selected by the Construction Manager to determine the leakage of ground water into the sewer. The maximum length of line for each infiltration test shall be 3,000 feet.

    b. Measure leakage only when all visible leaks have been repaired and the ground water is two feet above the top of the pipe.

    c. Install weir for a minimum of four hours before measuring flow.

    d. If leakage in any section of the sewer line exceeds 100 gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by the Construction Manager.

    e. After repairs are completed, re-test for leakage.

    f. Furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage tests.

    g. Weirs shall be V-notch type equal to Pollard (800) 437-1146.

2. Exfiltration Tests: Use when groundwater is less than two feet above the top of the pipe.

    a. Low-Pressure Air Test: Only sewer diameters less than or equal to 24 inches.

    b. Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted.

    c. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air.

d. At the Contractor's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using inflatable balls pulled through the line from manhole to manhole.

e. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test.

f. If a 1.0 psi drop does not occur within the test time, then the line has passed the test.

g. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs, and retest the line.

h. Minimum test time for various pipe sizes and types is as follows:

Nominal Pipe Size, inches	T (Time Min/100) Feet
	DIP, PVC [1]
6	5.7
8	7.6
10	9.4
12	11.3
15	14.2
18	17.0
21	19.8
24	22.8

[1] Source: ASTM F1417

3. Required test equipment, including inflatable balls, braces, air hose, air source, timer, rotameter as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of $\pm$ two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.

4. Low Pressure Air Testing:

   a. At the option of the Owner, low pressure air testing may be performed in lieu of infiltration/exfiltration test.

   b. Testing shall be performed in accordance with Uni-Bell PVC Pipe Association Publication UNI-B 06 - "Recommended Low-Pressure Air Testing of Installed Sewer Pipe."

5. The Contractor shall keep records of all tests made. Copy of such records will be given to the Construction Manager. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the Construction Manager.

6. The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly

secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

H. Deflection Test:

1. Test PVC gravity sewer for excessive deflection by passing a mandrel through the pipe. Deflection of the pipe shall not exceed the following:

Nominal Pipe Diameter (inches)	Maximum Allowable Deflection
≤ 12	5%
15 to 30	4%
> 30	3%

2. The mandrel size shall be based upon the maximum possible inside diameter for the type of pipe being tested, taking into account the allowable manufacturing tolerances of the pipe.

   a. The mandrel shall have an odd number of legs, or vanes, with a quantity of such equal to or greater than nine. The legs of the mandrel shall be permanently attached to the mandrel.

   b. A mandrel with variable sizes shall not be allowed.

   c. The mandrel shall be constructed of steel aluminum or other material approved by the Construction Manager, and shall have sufficient rigidity so the legs of the mandrel will not deform when pulling through a pipe.

   d. The mandrel dimensions shall be checked by the Construction Manager before use by the Contractor.

3. Excavate and install properly any section of pipe not passing this test. Re-test until results are satisfactory.

4. This test shall be performed twice:

   a. Once within the first 30 days of installation, and

   b. Once during final inspection, but no sooner than 30 days after pavement and backfill is done, at the completion of the contract.

I. Closed Circuit Television: The interior of the gravity sewers shall be subjected to a post-installation televised inspection.

J. The audio/video tape shall provide an audio description to what is being viewed; provide a continuous running footage indicator between manholes and be prepared in the presence of the Construction Manager.

K. Prior to Final Acceptance the Owner shall be provided with one copy of the TV inspection report and video file showing the entire length of gravity sewer being tested.

L. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness and distance between manholes.

M. Any pipe found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced.

N. Manholes: Prior to testing manholes for watertightness, all lift holes shall be plugged with a non-shrink grout, all joints between precast sections shall be properly sealed and all pipe openings shall be temporarily plugged and properly braced.

1. Vacuum Tests: The manhole, after proper preparation as noted above, shall be vacuum tested prior to backfilling.

a. The test head shall be placed at the inside of the top of the cone section and the compression head inflated to 40 psi to effect a seal between the vacuum base and the manhole structure.

b. Connect the vacuum pump to the outlet port with the valve open. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off.

c. With the valves closed, the time in seconds shall be measured for the vacuum to drop to 9 inches.

d. The manhole shall pass if the time in seconds is greater than that specified in the table below.

e. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn.

f. Retesting shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be equal to that as manufactured by P.A. Glazier, Inc.

Minimum Test Times for Various Manhole Diameters and Depths			
	Diameter (feet)		
Depth (feet)	4	5	6
8	20	28	33
10	25	33	41
12	30	39	49
14	35	48	57
18	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

3.11. INSPECTION AND TESTING FOR FORCE MAIN

A. Prior to acceptance of the force main, the Contractor shall test the force main in accordance with the requirements of these Specifications.

B. Force mains shall be subjected to a minimum test pressure equal to 150 percent of the total dynamic head or 100 psi, whichever is greater, for a minimum of two hours. The test shall be performed using potable water.

1. Use of a fire Hydrant requires a fire hydrant meter to be rented from the local water authority.

C. The entire force main pressure test must be witnessed and approved by the Construction Manager or his representative. The test shall be performed from the check valve to the discharge manhole. No leakage will be allowed.

D. To schedule a test, the Contractor shall notify the Construction Manager at a minimum of 48 hours in advance.

E. The Construction Manager will determine the test pressure and gauge location.

F. Contractor shall remove, valve off, or otherwise protect any equipment that might be damaged by the pressures used in the test. All piping shall be securely anchored prior to the test.

G. Pipe laid in trenches shall be backfilled. Joints, fittings and valves may be left exposed to be examined during the test.

H. Before applying the test pressure, all air shall be expelled from the pipe through installed air release valves. If combination air release valves are not available at high points, Contractor shall make necessary taps and insert plugs after the test has been completed. Prior approval must be obtained from Fulton County before making the taps.

I. The approval of the force main installation and pressure test by the Construction Manager shall become a part of the overall pump station/force main system approval.

J. Contractor shall bear the complete cost of the test including temporary plugging and blocking, water usage and the repair of all leaks.

K. If a section of the force main fails the pressure test Contractor will be required to pay a re-inspection fee as determined by the Construction Manager prior to each additional retest required.

3.12. PROTECTION AND RESTORATION OF WORK AREA

A. General:

1. Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

2. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.

3. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly.

   a. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed.

   b. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage.

   c. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

4. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.

5. The Construction Manager shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.

B. Man-Made Improvements: Protect, or remove and replace with the Construction Manager's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the work. Fences crossing easements shall be gated.

C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Construction Manager. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the Work except as absolutely necessary.

E. Protect trees that remain in the vicinity of the work from damage from equipment.

F. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system.

G. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman.

H. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor.

I. No stumps, wood piles, or trash piles will be permitted on the work site. The Contractor may chip and grind vegetation and spread over the disturbed area if approved by the County.

J. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.

K. Swamps and Other Wetlands:

1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.
2. All temporary construction or alterations to the original topography shall incorporate measures to prevent erosion into the surrounding swamp or wetland.
3. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.
4. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.
5. The Contractor shall not spread, discharge or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

END OF SECTION

SECTION 33 30 10

SEWER SERVICE CONNECTIONS

PART 1 – GENERAL

1.01 SCOPE

A. The work covered by this Section shall consist of furnishing and installing service connections to sewer mains and manholes, of the size and type shown on the Drawings and specified herein.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Connection of service lines or risers to sewer main shall be by means of standard tees, wyes or as indicated on the Drawings.

B. The cleanout shall be sealed with a threaded cap set in a service box.

C. Service pipe shall be of the same material and quality as the main sewer main.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of sewer service connection lines shall be in accordance with Section 33 30 00 of these Specifications.

B. Connections may enter the system either at a manhole, or at the main with wyes or tees.

C. All Service Connections entering a manhole must be cored and sealed with a rubber boot.

D. The minimum pipe size for tie-in to any manhole or main shall be 6-inch.

E. Bedding for service connections shall be the same as the sewer main.

F. Service connections shall be made at the top or from the side at 45 degrees of the sewer main using 6-inch diameter pipe as shown on the Drawings.

G. Under no circumstances shall service connections be made by knocking a hole in the sewer main or manhole, inserting the lateral pipe and sealing with grout.

H. The service connection shall extend from the sewer main to the edge of the permanent easement or right-of-way and be plugged with a vertical cleanout of the same material.

I. Cleanouts shall be installed on service laterals at the edge of the public right-of-way or easement, at changes in direction greater than 45-degrees and every 75 feet.

J. Riser connections shall be required when the sewer main is 10 feet or more below finished grade, unless otherwise directed by the Construction Manager. Clean out riser pipe shall terminate at 4 inches above ground surface.

K. If the service connection ends in rock, the Contractor shall excavate the rock an additional 10 feet beyond the plugged end.

L. Service Connection end locations shall be clearly marked by permanent markers approved by the County and shall be installed within the public right-of way or easement to facilitate locating of the sewer service lateral in accordance with the requirements of the Georgia Utility Facilities Protection Act.

1. Markers shall be a minimum 6 foot length 4 x 4 post painted safety day-glow green in conformance with OSHA Standards.

M. Service Connections shall be plugged with mechanical plug for low pressure air testing.

N. During the warranty or bonded period, the Contractor may add a Service Connection that was omitted by cutting out a section of the main and installing a full wye.

O. Record the location and elevation of the wye connection and cleanout on a copy of the Contract Drawings to be submitted as Record drawings and on the report form provided by the County.

END OF SECTION

SECTION 33 30 65

PLUG VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:

1. This Section specifies eccentric plug valves for services in the wastewater systems. Unless specified otherwise, the valves shall be manually operated.
2. Refer to Section 33 30 00 for additional requirements.

B. Type:

1. Plug valves shall be non-lubricated, resilient-seated, eccentric valves.
2. Valve pressure ratings, body flanges and wall thicknesses shall be in full conformance with ANSI B16.1, latest revision.
3. All valves furnished under this specification shall be suitable for installation in vaults or direct burial as specified. Unless otherwise specified, all valves shall conform to ANSI/AWWA C517.

C. Design and Performance Requirements:

1. Valve shall be able to withstand a 500 psi pressure test without being damaged.

1.02 REFERENCES

A. This section contains references to the following documents.

1. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
2. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
3. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).
4. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

5. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

B. References

1. ASTM A126 Class B "Gray Iron Castings for Valves, Flanges and Pipe Fittings"
2. ASME B16.1 "Pipe Flanges and Flanged Fittings"
3. AWWA C517 “Resilient-Seated Cast-Iron Eccentric Plug Valves”
4. AWWA C111 "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings"

1.03 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.
2. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
   a. Check marks (✓) shall denote full compliance with a paragraph as a whole.
   b. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
   c. The Construction Manager shall be the final authority for determining acceptability of requested deviations.
   d. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
   e. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
3. Affidavit of compliance, as required by AWWA C517.
4. Catalog information, sectional views showing internal details, dimensions, weights, and bills of material detailing construction materials for the each size and Type valve. This information shall be in sufficient detail to demonstrate compliance with this Section and any related specification.
5. Installation drawings depicting the arrangement of each valve.

B. Informational Submittals:

1. Procedures: Section 01 33 00
2. Submit detailed product data and descriptive literature to include dimensions and materials of construction.
3. Certified test records.
   a. Certification shall be by an officer of the manufacturing corporation.
4. Provide shop drawings to show installation arrangement of major component assemblies and instructions.
5. Manufacturer's Installation Certification Form 43 05 11-A specified in Section 01 99 90.

1.04 QUALITY ASSURANCE

A. Supplier shall have been manufacturing eccentric plug valves for a period of at least ten years. At the Construction Manager's request, supplier shall provide a list of installations involving equipment of similar size and application.

B. Valves and actuators shall be warranted by the manufacturer for defects in materials and workmanship for a period of two years (24 months) from date of final acceptance.

C. Each valve and actuator shall be assembled, adjusted and tested as a unit by the valve manufacturer.

1.05 FACTORY TESTS

A. Plug valves shall be subjected to hydrostatic and leakage tests in accordance with ANSI/AWWA C517.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Acceptable manufacturers are listed below. The manufacturer's standard product may require modification to conform to specified requirements:

1. DeZurik
2. Val-Matic
3. Or approved equal

B. All valves shall be manufactured in the U.S.A.

2.02 MANUFACTURE

A. General

1. Plug valves shall be non-lubricated, resilient-seated, eccentric valves.
2. Pressure ratings shall be 175 psi on valve sizes through 12-inch and 150 psi for 14-inch and larger.
3. Valve pressure ratings, body flanges and wall thicknesses shall be in full conformance with ANSI B16.1, latest revision.
4. Valves shall seal leak-tight against full rated pressure in both directions.
5. Valve seats shall be tested to provide leak tight shut-off to 175 psi for valves through twelve (12) inch with pressure in either direction.
6. In addition, every valve shall be given a certified hydrostatic shell test and seat test, with the plug open, to a pressure twice that of the pressure ratings specified above to demonstrate overall pressure integrity of the valve body. Test reports shall be available upon request by the Construction Manager.
7. Plug valves shall conform to the latest revision of ANSI/AWWA C517-05.
8. All materials shall be new.
9. Valves and operators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.
10. Plug valve and connecting pipe shall have the capability to be pigged without the use of special equipment.
11. A valve key for plug valves shall be provided to the Owner for each force main.

B. Body:

1. Bodies and covers shall be Cast Iron ASTM A126 Class B or Ductile Iron ASTM A536 Grade 65-45-12.
2. At a minimum, valves measuring 4 inches to 12 inches in diameter shall have 175 psig bodies, and valves measuring 14 inches and greater in diameter shall have 150 psig bodies.
3. Ports shall be rectangular and 100% port.
4. For specific installation locations where the Total Dynamic Head (TDH) plus the surge pressure exceeds the minimum pressure ratings above, Class 250 flat face flanged ends and a 400 psi (for 3-inch to 12-inch valves) or 300 psi (for 14-inch and greater valves) valve body shall be provided.

C. Plug:

1. Shall be solid one piece, Cast Iron ASTM A126 Class B or Ductile Iron ASTM A536 Grade 65-45-12.
    a. Two-piece plugs or plugs with internal cavities shall NOT be acceptable.
2. The plug shall have a cylindrical seating surface eccentrically offset from the center of the shaft.
3. Valves shall be furnished with resilient elastomer faced plugs, suitable for use with wastewater.
    a. Plug facing shall be composed of either EPDM or Neoprene.
    b. Plug facings composed of natural rubber, Viton, or Nitrile shall NOT be acceptable.
4. Plug shall not contact the seat until at least 90% closed.
5. Spherical shaped plugs are not acceptable.

D. Seats:

1. Valve seats shall be in accordance with AWWA C517, latest revisions.
2. Valve Seats on the body shall be 1/8" thick welded overlay of not less than 95% pure nickel.
    a. Seat shall be at least 1/2-inch wide, 1/8-inch thick through entire width and raised.
    b. The raised surface shall be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat.
3. Alternatively, valve seats shall be replaceable 316 stainless steel seats.
4. Seats composed of thermosetting epoxy or fusion bonded nylon shall NOT be acceptable.
5. Screwed-in seats shall NOT be acceptable.

E. Bearings:

1. Radial shaft bearings shall be permanently lubricated, sleeve-type, sintered, oil-impregnated bearings:
    a. Type 316 stainless steel for sizes 4-inch to 18-inch.
    b. ASTM A-743, Grade CF-8M for sizes 20-inch to 36-inch.
    c. Bronze in accordance with ASTM B-127.
    d. Non-metallic radial shaft bearings shall NOT be acceptable.
2. Thrust bearings/washers shall be composed of Type 316 stainless steel, Teflon, Nylon 11, or Nylatron.

F. Shaft Seals:

1. Adjustable packing shall be Acrylonitrile-Butadiene (NBR) multiple V-ring type, with a packing gland follower.
2. Packing gland shall permit inspection, adjustment or complete replacement of packing without disturbing any part of the valve or actuator assembly, except the gland follower.
3. Shaft seals shall be self-adjusting.
4. Non-adjustable packing or packing requiring actuator removal to replace the packing shall not be acceptable.
5. All shaft seal hardware shall be 316 stainless steel.

G. End Connections:

1. End connections shall meet or exceed the latest revisions of AWWA C517 and other applicable standards.
2. All buried valves shall have mechanical joint ends conforming to ANSI/AWWA C111/A21.11.
3. All exposed valves measuring 4 inches in diameter and larger shall have Class 125 flat face flanged ends, at a minimum, conforming to ANSI B16.1 or ANSI/AWWA C110/A21.10.

H. Interior Valve Lining

1. All interior ferrous surfaces of the plug valve that will have contact with wastewater, except the valve seating surfaces, shall be coated with a factory applied, fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision.
2. Coating shall be holiday-free with a minimum thickness of twelve (12) mils DFT.
3. Surfaces shall be clean, dry and free from rust, oil and grease before coating.

2.03 MANUAL OPERATORS

A. General:

1. Manual operators shall be designed in accordance with AWWA C517 and shall have a plug position indicator designating the opened and closed positions of the valve.

B. Manual Operators

1. All valves larger than 6-inch shall be installed with worm gear actuators. The actuator shaft and gear quadrant shall be supported on bronze bearings.
    a. Valves shall be equipped with traveling nut, self-locking type operators designed, manufactured and tested in accordance with AWWA C517.
    b. All gearing shall be enclosed in a cast iron housing with outboard seals to protect the bearings and other internal components.

c. The actuator shaft and gear quadrant shall be supported on permanently lubricated bronze bearings

2. Plug valves installed in valve vaults, except where indicated otherwise, shall have mechanical gear actuators with handwheel operators designed for submerged service.

   a. Actuator shall clearly indicate valve position for above-ground and valve vault installations.

   b. Actuator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.

   c. All exposed valve nuts, bolts, springs, washers and the like shall be Type 316 stainless steel.

3. Exposed valves 6 inches in diameter and smaller shall have manual lever operators, unless otherwise specified or noted on the Drawings.

4. Exposed valves 8 inches in diameter and larger shall be manually hand wheel operated through totally enclosed worm gear actuators, unless otherwise specified or shown on the Drawings.

5. Manual operators for plug valves mounted above 6 feet from the operating floor shall be equipped with worm gear chain wheel actuators.

6. All buried valves shall be provided with totally enclosed worm gear actuators, 2-inch square AWWA operating nuts, extension stems and valve boxes.

   a. Buried actuators shall be 90% grease filled.

   b. Input shaft and fasteners shall be stainless steel.

   c. Actuator mounting brackets shall be totally enclosed.

   d. Buried valve operators shall be extended to within 6 inches of grade.

7. Gear actuators shall be designed to produce the required operating torque with a maximum rim pull of 80 pounds on a hand wheel and with a maximum input of 150 foot-pounds on 2-inch operating nuts.

8. Actuator shall be capable of withstanding an over-torque without damage up to 300 foot-pounds for handwheel operators or up to 450 foot-pounds for 2-inch nut operators.

9. All valves shall be provided with mechanical travel stops for the open and close positions and shall rotate 90 degrees from fully open to fully close.

10. The seat end shall be clearly indicated on the valve exterior relative to half of the body containing the plug/seat interface.

C. Valves shall be either directly cast with, or provided with an attached corrosion-resistant nameplate, stating, at a minimum, the following:

1. Valve serial number

2. Manufacturer

3. Size

4. Maximum shutoff pressure
5. Design pressure rating.

2.04 PAINTINGS AND OTHER COATINGS

A. All valves, where not constructed of brass or bronze, or of finished steel, shall be coated at the point of manufacture in accordance with the AWWA Standard Specifications for Painting Ductile or Cast Iron Water Pipes and Fittings.

B. Resilient seated valves shall only be provided with a bonded epoxy coating.

C. Machined surfaces shall be given a suitable coating of grease or other protective material.

2.05 PRODUCT DATA

A. Affidavits of compliance with AWWA C517 shall be provided in accordance with Section 01 33 00.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Below grade plug valves shall be installed horizontally with right angle operators pointing up to allow operation from grade.

B. Valves shall be installed as specified and in accordance with manufacturer's written recommendations.

1. For horizontal installations, the plug valve shall be installed so that the plug face is pointing upwards when the valve is open and the plug face is facing the pump when the valve is closed.
2. For vertical installations, the plug valve shall be installed so that the plug face is pointing to the side when the valve is open and the plug face is pointing upwards when the valve is closed.

C. The installation and initial operation shall be certified on Form 43 05 11-A specified in Section 01 99 90.

3.02 TESTING

A. Test in accordance with Class B, AWWA C517 Section 5.2 testing requirements modified as follows:

1. The leakage test shall be performed at a pressure of 250 psi
2. The hydrostatic test shall be performed at a pressure of 500 psi
3. Proof of design tests shall be performed and certification of such proof of design test shall be provided to the Construction Manager.

B. Upon completion of installation, the valves shall be pressure tested to demonstrate a leak-free closure.

3.03 MANUFACTURER'S SERVICES

A. Plug valve supplier shall provide one (1) day of field/start-up services by the manufacturer's factory personnel.

END OF SECTION

SECTION 33 31 00

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 – GENERAL

1.01. SUMMARY

A. Section Includes:

1. High density polyethylene (HDPE) pipe and fittings.
2. Fusion joints.
3. Testing.

B. Pipe Description

1. Pipe Supplier shall furnish high density polyethylene (HDPE) pipe and fittings conforming to all applicable standards and procedures as referenced in this Specification, and meeting all applicable testing and material properties as described by the applicable standards referenced in this specification or as required within this specification.

1.02. GENERAL.

A. For gravity sewer installations with no live load, located below grade and along stream and river banks, the standard pipe shall be HDPE Ductile Iron Pipe Size (DIPS) DR17 for diameters 8-inch to 48-inch and depths 3 feet to 11 feet.

1.03. QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section to the extent referenced in this specification. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
2. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.
3. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.
4. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

5. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

6. It is incumbent upon the Contractor to have a working familiarity with the following ASTM Standards:

Reference	Title
ANSI/AWWA C901	*Polyethylene (PE) Pressure Pipe and Tubing, ¾-in. (19 mm) through 3 in. (76 mm), for Water Service*
ANSI/AWWA C906	*Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 65 in. (100 mm through 1,650 mm), for Waterworks*
ASTM C923	*Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals*
AWWA M55	*PE Pipe–Design and Installation*
ASTM D1603	*Standard Test Method for Carbon Black in Olefin Plastics*
ASTM D2321	*Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications*
ASTM D2774	*Standard Practice for Underground Installation of Thermoplastic Pressure Piping*
ASTM D3035	*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*
ASTM D3261	*Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*
ASTM D3350	*Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*
ASTM D4218	*Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique*
ASTM F585	*Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers*
ASTM F714	*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter*
ASTM F1055	*Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing*
ASTM F1290	*Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings*
ASTM F1417	*Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air*
ASTM F1962	*Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings*

Reference	Title
ASTM F2164	*Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure*
ASTM F2206	*Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE)*
ASTM F2620	*Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings*
ASTM F2786	*Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Gaseous Testing Media Under Pressure (Pneumatic Leak Testing)*
NSF/ANSI 61	*Drinking Water System Components–Health Effects*
PPI TR-4	*PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe*
PPI TR-46	*Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe*

B. Manufacturer Requirements

1. High density polyethylene (HDPE) pipe and fittings shall be manufactured in accordance with the following standards:
    a. ASTM D3035 – ½ in through 24-in pipe
    b. ASTM F714 – 3-in through 54-in pipe
    c. AWWA C901 – ¾-in. (19 mm) through 3 in. (76 mm) pipe and tubing
    d. AWWA C906 – 4 in. (100 mm) through 65 in. (1,650 mm) pipe and fabricated fittings
    e. ASTM D3261 – butt fusion fittings, saddles and flange adapters
    f. ASTM F1055 – electrofusion couplings and saddles.
    g. ASTM F2206 – fabricated fittings

C. Fusion Technician Requirements

1. Each Fusion Technician shall be separately qualified to make each type of fusion joint. Fusion joint types are butt fusion, saddle fusion and electrofusion.
    a. Qualification to make one type of fusion joint shall not qualify a Fusion Technician to make a different type of fusion joint.
2. Each Fusion Technician making butt fusion joints shall be qualified to make butt fusion joints in accordance with ASTM F2620.
    a. Qualification shall have occurred not more than 12 months before performing fusion joining on site in accordance with this Specification.

b. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.

3. Each Fusion Technician making saddle fusion joints shall be qualified to make saddle fusion joints in accordance with ASTM F2620.

a. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification.

b. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.

4. Each Fusion Technician making electrofusion fitting joints shall be qualified to make electrofusion fitting joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.

a. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification.

b. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure that are proved to be satisfactory by destructive testing in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.

D. Approved Suppliers

1. Pipe and fitting suppliers shall be approved by the Owner.

a. The following pipe manufacturers are approved:

1) WL Plastics,

2) Chevron Phillips Chemical Dricsopipe

3) Northern Pipe Products

4) JM Eagle

5) Or approved equal

b. The following fitting manufacturers are approved:

1) WL Plastics,

2) Chevron Phillips Chemical Dricsopipe

3) Northern Pipe Products

4) JM Eagle

5) Or approved equal

E. Contractor shall furnish samples and material tests for compliance with this specification from an independent laboratory to verify the required physical properties and characteristics of supplied materials in accordance with the applicable ASTM Specification.

1. A certificate shall be furnished by the manufacturer, upon request, for all material furnished under this specification.

2. Polyethylene plastic pipe and fittings that do not meet any of the requirements of this Specification will be rejected.

3. The Owner will pay for tests on pipe material which meets specification requirements. Contractor shall pay for failed tests and re-testing of failed materials

F. Warranty

1. Material Warranty

a. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the pipe and fittings material.

b. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

2. Workmanship Warranty

a. The Contractor shall guarantee the Work is free from defects in material and workmanship for a period of 3 years from the final acceptance.

b. The warranty shall cover the costs to repair or replace items including, but not be limited to, all gravity sewers, force mains, manholes, appurtenances, trenches, roadways, landscaping, other areas disturbed by the construction of the project and freight to project site, should these items have any defects in material or workmanship.

c. In addition to the standard pipe warranty, the fusing contractor shall provide in writing a three-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that requires remaking defective butt fusion, saddle fusion or electrofusion joints. The warranty shall also include freight to project site, formation, installation and pressure testing.

d. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the installer of warranty responsibility for the full warranty term.

3. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

4. No bell clamps or wrap around corsets are allowed as a means of repair on new pipelines.

5. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

6. If required, Contractor and pipe manufacturer representatives may participate in inspections to determine such deficiencies.

7. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

8. The Contractor shall be responsible for repairs to any trench settlements caused by leaking pipe, fittings, etc. He shall promptly furnish and place fill to original grade.

9. Should any leaks or trench settlement occur under the new pavement, the Contractor will be held responsible for the cost of all repairs, including pavement replacement.

10. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

11. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

12. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

G. Submittals

1. Complete product data and engineering data shall be submitted to the Construction Manager in accordance with the requirements of Section 01 33 23 of these Specifications.

2. The following information shall be submitted by pipe and fitting suppliers:

a. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.

b. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.

c. Pipe and fitting product data indicating conformance with this Specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.

d. Projected Initial and long term deflection calculations based on site conditions.

1) Deflection being defined as a decrease in the vertical diameter of a pipe.

2) The value ΔY (%) is the average long-term vertical deflection of the pipe and is the final expected change in vertical diameter divided by the nominal pipe diameter, expressed as a percentage.

e. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this Specification and applicable pipe and fitting standards specified herein.

3. The following information shall be submitted by Fusion Providers.

a. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this Specification.

b. Documentation of conformance with this Specification and applicable standards, including written documentation regarding any intended variance from this Specification and applicable standards.

1) This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.

c. The following AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:

1) Fusion reports for each fusion joint performed on the project, including joints that were rejected.

2) Submittals of the Fusion Technician's joint reports are required as requested by Construction Manager.

3) Specific requirements of the Fusion Technician's joint report shall include:

a) Pipe or fitting size and DR or pressure class rating

b) Fusion equipment size and identification

c) Fusion Technician Identification

d) Job Identification Number

e) Fusion Number

f) Fusion joining parameters

g) Ambient Temperature

PART 2 – PRODUCTS

2.01. PIPE AND FITTINGS

A. General

1. All pipe and fittings shall be manufactured in ductile iron pipe sizes (DIPS) in accordance with the following Standards.
    a. ANSI/AWWA C906 - “Polyethylene Pipe and Fittings, 4 in. (100 mm) through 63 in. (1,575 mm) for Water Distribution”.
    b. ASTM D3035 - “Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter”.
    c. ASTM F714 - “Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter”.
    d. ASTM F2619 - “Standard Specification for High Density Polyethylene (PE) Line Pipe”.
    e. ASTM F2206 - “Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock”.
    f. ASTM D3261 - “Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing”.
    g. ASTM F1055 - “Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing”.

B. PE4710 Pipe and Fitting Material (Compound):

1. Pipe and fittings shall be made from the resin meeting the requirements of the PPI material designation PE 4710.
2. PE4710 material (compound) shall conform to material requirements specified in ASTM F714 for pipe and ASTM D3261 for fittings as applicable for the pipe or fitting.
3. PE4710 material (compound) shall meet the requirements of ASTM D3350 and shall meet or exceed a cell classification of 445574 per ASTM D3350.
4. PE4710 material (compound) shall have a hydrostatic design stress (HDS) rating for water at 73°F (23°C) of not less than 1600 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.
5. PE4710 material (compound) shall have a hydrostatic design basis (HDB) rating at 140°F (60°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer for all force main, reclaimed water, and irrigation water service systems.
6. PE4710 pipe and fitting material (compound) in PE4710 pipe and fittings shall contain color and ultraviolet (UV) stabilizer meeting the requirements of Code C or E per ASTM D3350.
    a. Code C material shall contain 2 to 3 percent carbon black to provide indefinite protection against UV degradation when

material from the pipe is tested in accordance with ASTM D1603 or ASTM D4218.

b. Code E material used for coextruded OD color stripes or a coextruded ID color layer shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure.

c. Coextruded color PE compound material shall be PE4710 pipe material compound, varying only by color and UV stabilizer.

7. The pipe and fittings shall contain no recycled compound except for clean rework materials derived from pipe production by the same manufacturer.

8. Clean rework materials are acceptable as part of a blend with new material for the production of new pipe provided that the rework material is the same PE4710 material designation as the new material (compound) to which it is added.

9. Finished products containing rework material shall meet the requirements this Specification.

C. PE4710 Pipe

1. HDPE pipes shall have 125 Pressure Class Rating with DR 17.

a. The minimum pressure rating shall be 200 psi.

2. HDPE pipe shall have plain ends for butt fusion.

3. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions or other defects that may affect the wall integrity.

4. Permanent identification of piping service shall be provided by co-extruding longitudinal green, lavender or purple stripes into the pipe outside surface.

a. The striping material shall be the same material as the pipe material except for color.

b. Stripes printed or painted on the outside surface shall not be acceptable.

5. The nominal pipe diameter shall be specified on the Drawings. The DR (dimension ratio) and the pressure rating of the pipe shall be as noted on the Drawings.

6. HDPE pressure pipes may be deflected subject to approval by the Construction Manager.

a. The following table shows maximum deflection based upon the allowable strain of the pipe wall.

b. Potential flow restrictions, surge and other non-trench stability and pipe strain issues may reduce the values shown here per the Construction Manager's recommendations.

c. The bend radius multiplier determines the minimum radius of the pipe curvature and is calculated by multiplying the outside diameter of the pipe by the multiplier from the appropriate DR used.

d. Bending radius allowed by the manufacturer can vary. Verify the multiplier with the manufacturer. In no case shall the radius be less than 125% of the manufacturer's permitted multiplier

HDPE pipe Dimension Ratio (DR)	Allowable deflection (percent)	Bend Radius Multiplier
32.5	8.1	50
26.0	6.5	45
21.0	5.2	40
19.0	4.7	37.5
17.0	4.2	32.5
15.5	3.9	30
13.5	3.4	27.5
11.0	2.7	25

7. Nominal straight lengths of 3-inch and larger pipe shall be 40 feet or 50 feet.

8. Nominal coil lengths of 4-inch and smaller pipe shall be 500 feet. Longer or shorter coils such as 800 feet for 4-inch pipe, 1000 feet for 3-inch pipe, or 2000 feet for 2-inch or smaller pipe shall be acceptable.

   a. Pipe shall be black with a light reflective interior color to allow for easier/better viewing for television inspection.

9. Pipe shall be permanently marked using heated indent printing in accordance with ASTM F714 as applicable for the pipe size including:

   a. Nominal size and sizing system, such as DIOD

   b. DR 17

   c. Standard Designation, ASTM F714, material designation, and pressure rating or pressure class for water at 73°F.

      1) Marking the Standard Designation on the pipe shall serve as the manufacturer's certification that the pipe has been manufactured, sampled and tested and has been found to comply with the requirements of the standard.

      2) The ASTM D3035 or ASTM F714 pipe pressure rating for water at 73°F shall be "PE4710 PRXXX" where XXX = pressure rating in psi

      3) The AWWA C901 pipe pressure class for water at 73°F shall be "PE4710 PCXXX" where XXX = pressure class in psi.

4) The AWWA C906 pipe pressure class for water at 73°F shall be "PE3408 PCXXX[3]" where XXX = pressure class in psi.

d. Extrusion production-record code.

e. Manufacturer's Trademark or trade name.

D. PE4710 Fittings

1. PE4710 butt fusion, saddle fusion, electrofusion and fabricated fittings shall be manufactured from PE4710 material (compound) in accordance with this Specification.
2. All fittings shall be tested in accordance with AWWA C906.
3. PE4710 fittings shall comply with the following Standards:
   a. ASTM D3261 for molded butt fusion and saddle fusion fittings, flange adapters and MJ adapters.
   b. ASTM F2206 for fabricated butt fusion fittings.
   c. ASTM F1055 for electrofusion fittings.
4. PE4710 fittings shall comply with the marking requirements of the following Standards:
   a. ASTM D3261 for molded butt and saddle fusion fittings, flange adapters and MJ adapters.
   b. ASTM F2206 for fabricated butt fusion fittings
   c. ASTM F1055 for electrofusion fittings.
5. Fabricated Fittings
   a. Fittings shall be manufactured and tested in accordance with ASTM F2206 and so marked.
   b. Fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings.
   c. Fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.
   d. Fittings shall be tested in accordance with AWWA C906.
6. PE4710 fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.
7. Plain end butt fused fittings shall be used when joining polyethylene materials.
8. Saddles fittings for connecting laterals to the sewer shall be electrofusion or strap-on sewer saddles.

[3] Per AWWA C906, PE3408 marking and PE3408 PCXXX is required. Pipe may be manufactured using PE4710 material (compound) that is listed in PPI TR-4 as meeting PE3408 requirements.

a. Strap-on sewer saddles shall be used only where it is not possible to use electrofusion saddles.

b. The saddles shall be equipped for joining with a casketed hub, or plain outlet for mechanical couplings or electrofusion couplings joining.

9. Mechanical fittings shall be used only when joining polyethylene materials to different piping materials and approved by the Construction Manager.

10. The fittings shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions or other defects that may affect the wall integrity.

2.02. FUSION JOINTS

A. Unless otherwise specified, PE4710 pipe and fittings shall be assembled in the field with butt fusion, saddle fusion or electrofusion joints in accordance with the following Standards:

1. ASTM F2620 and the pipe manufacturer's recommended procedure (WL Plastics WL101) shall be observed for butt fusion and saddle fusion joints.

2. ASTM F1290 and the electrofusion fitting manufacturer's recommended joining procedure shall be observed for electrofusion joints.

B. Field butt fusion, saddle fusion and electrofusion joints shall be made by Fusion Technicians that are qualified in accordance with this Specification to make the specific fusion joint type.

C. Field fusion joints shall be recorded and documented in accordance with this Specification.

2.03. CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS

A. General

1. Connections shall be defined in conjunction with the linking of project piping, as well as the tie-ins to other piping systems.

B. Mechanical Fittings

1. Mechanical fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for, use with polyethylene pipe.

2. Acceptable mechanical fittings for use with PE4710 pipe and fittings shall be mechanical fittings that are qualified by the mechanical fitting manufacturer for use with HDPE pipe and fittings.

3. Mechanical fittings for use with HDPE pipe shall provide restraint against longitudinal separation that is inherent to the design of the joint.

4. Mechanical joints that do not provide restraint against pull-out or push-off are prohibited.

5. Mechanical connections to non-HDPE devices and appurtenances shall be by bolted flange adapter or MJ adapter.

6. Flange adapter and MJ adapter connections shall be assembled, installed and tightened in accordance with flange adapter or MJ adapter manufacturer's instructions.

7. Flange bolt tightening shall be in accordance with PPI TN-38.

8. Where PE4710 pipe is connected to gasketed mechanical/flange joint fittings or appurtenances, the connection shall be made by butt fusing a PE4710 MJ/flange Adapter to the PE4710 pipe and connecting the PE4710 MJ/flange Adapter to the mechanical joint/flange fitting or appurtenance.

C. Gasketed, Push-On Fittings

1. Gasketed push-on fittings shall be fitted with external mechanical restraints that span across the joint and are assembled in accordance with restraint manufacturer's instructions.

a. Thrust blocking does not provide acceptable restraint and is prohibited.

b. Where plain-end PE4710 pipe is assembled with push-on fittings, the PE4710 pipe end shall be fitted with electrofusion restraints so that external mechanical restraint may be secured to the PE4710 pipe.

D. Sleeve-Type Couplings

1. Sleeve-type mechanical couplings shall be manufactured for use with HDPE pipe, and shall be restrained as indicated on the Drawings and in these Specifications.

2. Unrestrained sleeve-type couplings are prohibited.

E. Expansion and Flexible Couplings

1. Expansion-type mechanical couplings are prohibited.

F. Connection Hardware

1. Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11, regardless of any other protective coating.

2.04. CONNECTIONS FOR NON-PRESSURE SEWER APPLICATIONS

A. General

1. The following connections are to be used in conjunction with tie-ins to other non-pressure sewer piping and structures, and shall be as indicated on the Drawings.

B. Sleeve-Type Couplings:

1. Sleeve-type mechanical couplings shall be manufactured for use with solid-wall non-pressure HDPE pipe, and may be restrained or unrestrained as indicated on the Drawings and in these specifications.

C. Connection Hardware

1. Bolts and nuts for buried service shall be made of non-corrosive high strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating.

D. Connection to Non-Pressure Manholes and Structures

1. Non-pressure PE4710 pipe and fittings shall be connected to manholes and other structures to provide a leak-free, properly graded flow into or out of the manhole or structure.

2. Connections to existing manholes and structures shall be as specified and shown on the Drawings.

a. For a cored or drilled opening provide a flexible, watertight connection that meets and/or exceeds ASTM C923.

b. For a knock out opening, provide a watertight connection (waterstop or other method) meeting the material requirements of ASTM C923 that is securely attached to the pipe with stainless steel bands or other means.

c. Grout opening in manhole wall with non-shrink grout. Pour concrete collar around pipe and outside manhole opening.

3. Connections to a new manhole or structure shall be as specified and shown on the Drawings.

a. A flexible, watertight gasket per ASTM C923 shall be cast integrally with riser section(s) for all precast manhole and structures.

b. Drop connections shall be required where shown on Drawings.

c. Grout internal joint space with non-shrink grout.

PART 3 - EXECUTION

3.01. DELIVERY AND OFF-LOADING

A. General

1. All piping shall be bundled or packaged for transportation by commercial carrier to the site.
2. Before off-loading, pipe shall be inspected for damage.
    a. Any pipe damaged in shipment shall be assessed and either accepted or rejected as directed by the Construction Manager.
    b. The pipe supplier shall be notified of rejected pipe within 7 days of delivery at the site.
    c. Rejected pipe shall be quarantined for disposition.
3. Each pipe shipment shall be checked for quantity and proper pipe size, color and type.
4. Pipe shall be off-loaded and handled in accordance with the pipe manufacturer's instructions and AWWA M55.

3.02. HANDLING AND STORAGE

A. Pipe lengths should be placed and stored on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer.

B. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

C. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal.

1. Care shall be exercised when handling the pipe so as not to cut, gouge, scratch or otherwise abrade the piping in any way.
2. Use of hooks, chains, wire rope or any other handling device which creates the opportunity to damage the surface of the pipe is strictly prohibited.

D. Covering or shading of PE4710 pipe and fittings against exposure to ultraviolet light from sunlight is not required.

3.03. FUSION PROCESS

A. General

1. Butt and saddle fusion of PE4710 pipe and fittings shall be in accordance with ASTM F2620 and the manufacturer's recommended joining procedure.
2. Electrofusion of PE4710 pipe and fittings shall be performed in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.
3. PE4710 pipe and fittings shall be fused by qualified fusion technicians, as documented by the fusion provider. Training records for qualified fusion technicians shall be available to Construction Manager upon request.

4. As each fusion joint is constructed, pressure, time and temperature parameters shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine. Joint data shall be submitted as part of the As-Recorded information, in accordance with this specification.

5. Butt fusion machines shall incorporate the following properties, including the following elements:

   a. Heat Plate – Heat plates and the non-stick coatings on heating surfaces shall be in good condition without heating surface gouges or scratches. The non-stick coating shall be intact, clean and free of any contamination. Heater controls and temperature indicators shall function properly, and electrical cords and connections shall be in good condition. The heat plate shall maintain a uniform and consistent temperature on all areas of the heating surfaces on both sides of the heat plate.

   b. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi for hydraulic fusion machines. Clamps shall be in good condition with proper inserts for the pipe size being fused.

   c. General Machine – Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

   d. Data Logger – The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the hand held wireless portion of the unit. Data logger operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

6. Other equipment specifically required for fusion processes shall include the following:

   a. Pipe rollers shall be used to support pipe to either side of the butt fusion machine and provide for vertical and lateral pipe alignment straight through the butt fusion machine.

   b. A protective enclosure that provides for full machine motion of the clamps, heat plate, fusion assembly and carriage shall be provided for fusion in inclement and/or windy weather. Pipe ends shall be covered or blocked where open pipe ends could allow prevailing winds to blow through the pipe.

   c. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

B. Joint Recording

1. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine that shall register and/or record the parameters required by the manufacturer and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

C. Any joint that extrudes more than 1/8-inch shall be trimmed to less than 1/8-inch before installation.

3.04. INSTALLATION

A. Bedding for HDPE pipes shall be minimum Class "B" as specified in Section 31 23 00 of these Specifications.

B. The PE4710 pressure pipe and fittings shall be installed such that PE4710 pipe curvature is not less than the minimum bending radius recommended by the pipe manufacturer.

C. Direct burial installation of PE4710 pressure pipe shall be in accordance with ASTM D2774 and the pipe manufacturer's recommendations.

D. Direct burial installation of PE4710 non-pressure pipe shall be in accordance with ASTM D2321 and the pipe manufacturer's recommendations.

E. Installation of PE4710 pipe by horizontal directional drilling shall be in accordance with ASTM F1962 or PPI TR-46 and the pipe manufacturer's recommendations.

F. Installation of PE4710 pipe by sliplining or insertion within a casing or host pipe shall be in accordance with ASTM F585 and the pipe manufacturer's recommendations.

G. Tracer Wire – All PE4710 piping shall be installed with a continuous, insulated TW, THW, THWN, or HMWPE insulated copper, 10 gauge or thicker wire for pipeline location purposes by means of an electronic line tracer.

1. The wires shall be installed along the entire length of the pipe.
2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

3.05. MAKING CONNECTIONS TO NON-PE4710 PIPING SYSTEMS

A. Approximate locations for non-PE4710 piping systems are shown on the Drawings or detailed in the specifications. Prior to making connections into existing piping systems, the Contractor shall:

1. Verify the actual field location, size, piping material and service of non-PE4710 piping systems.
2. Obtain all required non-PE4710 piping manufacturer(s) approved fittings (i.e., saddles, sleeve type couplings, flanges, tees, etc., as shown).
3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.
4. Have on hand pipe stoppers, blind flanges or other devices to seal a valve or appurtenance that fails to seal properly.
    a. When applied to pressure rated valves or appurtenances, all such devices shall be pressure rated equal to or greater than the

pressure rating of the valve or appurtenance to which they are attached.

B. Where PE4710 pipe connects in-line to unrestrained gasketed push-on piping, the end of the PE4710 pipe shall be anchored in-line within 10 feet of the connection to restrict longitudinal movement of the PE4710 pipe.

1. The PE4710 pipe shall be fitted with a PE4710 wall anchor or electrofusion flex restraints.

2. The PE4710 wall anchor or electrofusion flex restraints shall be encased in reinforced concrete that is sufficient to withstand Poisson effect longitudinal loads in accordance with AWWA M55 In-Line Anchoring..

C. Unless otherwise approved by the Construction Manager, new piping systems shall be completely assembled and successfully tested prior to making connections to non-PE4710 piping systems.

3.06. PIPE SYSTEM CONNECTIONS

A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's recommendations and as indicated on the Drawings.

B. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's recommendations.

3.07. TRACER WIRE TESTING

A. Upon completion of installation by direct burial, sliplining, directional boring or pipe bursting, the Contractor shall demonstrate that the tracer wire is continuous and unbroken through the entire run of the pipe.

1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of the Owner or Construction Manager.

2. If the wire is broken, the Contractor shall repair or replace it. Pipeline installation will not be accepted until the tracer wire passes a continuity test.

3.08. TESTING

A. General

1. Testing shall comply with all local building codes, statutes, standards, local jurisdiction, and laws.

2. Segments of the pipe may be tested separately in accordance with standard testing procedure, as approved by the Owner and Construction Manager.

3. **No leakage shall be allowed.**

B. Hydrostatic Leakage Testing For Pressure Piping

1. Hydrostatic leakage testing shall comply with ASTM F2164. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

2. Pneumatic (compressed air) leakage testing of PE4710 pressure piping is prohibited.

C. Leakage Testing For Non-Pressure Piping

1. Non-pressure piping such as sewers shall be tested for excessive leakage in accordance with ASTM F1417.

2. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

D. Circularity Tests

1. Where required by the Construction Manager, pipes may be tested at ground surface for circularity before installation and welding commences.

2. Circularity will be checked by pulling a closed cylindrical mandrel through the polyethylene pipe.

3. The mandrel's outside dimension shall be sized to permit no more than 5.0 percent deflection.

4. The percent deflection shall be established from the base inside diameter of the pipe.

   a. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well.

5. The mandrel shall be approved by the Construction Manager prior to use.

6. The mandrel shall be at least three times the diameter of the pipe in length and not greater than inside diameter of pipe minus 2 millimeters.

7. Lines that permit safe entry may allow other deflection test options, such as direct measurements.

8. Pipes will be rejected which have greater than 5% deformation due to thermal softening.

3.09 INSPECTION

A. Furnish to Owner copies of the Manufacturer's Sworn Certificate of Inspection and Testing of all HDPE pipe and HDPE fittings provided on the Work.

B. All HDPE pipe and fittings will be subject to inspection and approval by Construction Manager after delivery of material to the site. Do not use broken, cracked, misshaped, imperfectly coated, unsatisfactory, or otherwise damaged pipe or fittings.

C. Such inspection by Construction Manager does not relieve the Contractor of full responsibility for the material installed.

END OF SECTION

SECTION 33 32 00
PVC PIPE AND FITTINGS

PART 1 – GENERAL

1.01 SCOPE

A. This section specifies PVC pipe, PVC fittings and gaskets.

B. General:

1. Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable.

C. This Specification designates general requirements for DR 25 gravity and DR 18 pressure unplasticized polyvinyl chloride (PVC) plastic pipe with integral bell and spigot joints for the conveyance of wastewater.

1.02 QUALIFICATIONS

A. If requested by the Construction Manager submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

B. Acceptable manufacturers

1. J. M. Eagle
2. Approved equal

1.03 SUBMITTALS

A. Complete product data and engineering data shall be submitted to the Construction Manager in accordance with the requirements of Section 01 33 23 of these Specifications.

B. The following information shall be submitted by pipe and fitting suppliers:

1. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.
2. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.
3. Pipe and fitting product data indicating conformance with this Specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.
4. Projected Initial and long term deflection calculations based on site conditions.

a. Deflection being defined as a decrease in the vertical diameter of a pipe.

b. The value ΔY (%) is the average long-term vertical deflection of the pipe and is the final expected change in vertical diameter divided by the nominal pipe diameter, expressed as a percentage.

5. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this Specification and applicable pipe and fitting standards specified herein.

1.04 QUALITY ASSURANCE

A. Product manufacturers shall provide the Construction Manager with written certification that all products furnished comply with all applicable provisions of these Specifications.

B. If ordered by the Construction Manager, the pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

C. Upon request by the Construction Manager, the Contractor shall furnish samples for material tests by the Owner's independent laboratory demonstrating compliance with this Specification to verify the required physical properties and characteristics of supplied materials. The Owner shall pay for tests on pipe samples that meet specification requirements. Contractor shall pay for failed tests and re-testing of failed materials.

D. Hydrostatic Proof Testing

1. Each standard and random length of pipe is tested to two times the rated pressure of the pipe for a minimum of 5 seconds. The integral bell shall be tested with the pipe.

E. Quick Burst Test

1. Randomly selected samples tested in accordance with ANSI/UL 1285 shall withstand, without failure, the pressures listed below when applied for 60-70 seconds. This test is performed on pipe sizes less than 30".

F. Flattening Test

1. There shall be no evidence of splitting, cracking, or breaking when the pipe is tested as follows:

a. Specimens of pipe, a minimum of 6 in. (150 mm) long, shall be flattened between parallel plates in a suitable press until the distance between the plates is 40 percent of the OD of the pipe.

b. The rate of flattening shall be uniform and such that the compression is completed within 2 to 5 minutes. There shall be no evidence of splitting, cracking or breaking.

G. Drop Impact Test

1. A 6" length section of pipe shall be subjected to impact from a free falling Tup.

   a. 20-lb Tup A and flat plate holder B for 4-inch to15-inch".

   b. 20-lb or 30-lb Tup B and flat plate holder B for 18-inch to 36-inch

   c. In accordance with ASTM D2444, "Standard Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)".

PIPE SIZE (inch)	IMPACT (ft/lbs)
4	150
6 – 8	210
10 – 36	220

2. There shall be no visible evidence of shattering or splitting when energy is imposed.

TESTING REQUIREMENTS FOR AWWA C900

TEST	AWWA C900				
	80 psi	100 psi	125 psi	165 psi	235 psi
SHORT TERM BURST TEST (psi) less than 30"	255	315	400	535	755
EXTRUSION QUALITY OF PVC PIPEBY ACETONE IMMERSION TEST METHOD ASTM D2152	20 min	20 min	20 min	20 min	20 min
FLATTENING TEST Tests extrusion quality and ductilityunder slow loading conditions (Flattening Capability)	40% of OD between theplates within2-5 min	40% of OD between theplates within2-5 min	40% of OD between theplates within2-5 min	40% of OD between theplates within2-5 min	40% of OD between theplates within2-5 min
HYDROSTATIC PROOF TEST (each piece) (psi)	160	200	250	330	470

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE

A. General

1. PVC pipe shall be utilized where shown on the Drawings, specified or directed by the Construction Manager.

   a. For gravity sewer installations with no live load located below ground and not along streams banks and rivers the standard pipe shall be DR 25 PVC for pipe sizes 8-inch to 14-inch and depths 3 feet to 8 feet.

   b. For gravity sewer installations with live loads of HS20/25 or pipe located at a depth of greater than 8 feet and not along stream banks and rivers, the standard pipe shall be CIOD DR18 PVC (235 psi pressure class) for pipe sizes 8-inch to 60-inch.

   c. For pressure pipe applications (force mains) regardless of depth and live load requirements and not along river banks and streams, the standard pipe and fittings shall be CIOD DR18 PVC (235 psi pressure class) for diameters 8-inch to 60-inch.

   d. The pipe shall be colored green for in-ground identification as sewer pipe.

B. Materials

1. This pipe shall meet the requirements of AWWA Standard C900 “Polyvinyl Chloride (Pvc) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 Mm Through 1,500 Mm)”.

2. All pipe shall be made from quality PVC resin, compounded to provide physical and mechanical properties that equal or exceed cell class 12454 for pressure pipes and 12454 or 12364 for gravity pipes as defined in ASTM D1784.

C. Pipe

1. DR 25 Gravity pipes shall meet the requirements of the following Standards:

   a. ASTM D3034-21, “Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings” for pipes 4-inch through 15-inch.

   b. ASTM F679 “Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings”, PS115, for pipes 18-inch through 48-inch.

   c. ASTM D2321-20, “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” for depths of cover up to twelve feet and for pipe diameters up to fifteen.

   d. Pipe joints shall be integral bell conforming to ASTM D3212-20, “Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals”.

   e. Joint shall be tested in accordance with ASTM D3212 under 25 feet of head pressure and 22 inches Hg vacuum.

2. DR 18 pressure pipes shall meet the requirements of the following Standards:
    a. AWWA C900-16, “Polyvinyl Chloride (Pvc) Pressure Pipe And Fabricated Fittings, 4-in. Through 60-in. (100 Mm through 1,500 Mm)”.
    b. Pipe joints shall be integral bell conforming to ASTM D3139-19, “Standard Specification For Joints For Plastic Pressure Pipes Using Flexible Elastomeric Seals”.
    c. Pipe shall be of the 235 psi pressure class.
    d. The bell section shall be designed to be at least as hydrostatically strong as the pipe barrel and meet the requirements of AWWA C900 DR 18.
3. Gaskets for all pipes shall EPDM, NBR or SBR as selected by the Owner and shall conform to the requirements of ASTM F477-14(2021), “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”.
    a. Gaskets shall be factory assembled and securely locked in place to prevent displacement during assembly.
4. Standard laying lengths shall be 20 feet for all sizes.

D. Fittings

1. For sizes 8-inch and less in diameter, fittings shall be molded in one-piece with no solvent welded joints. Minimum socket depths shall be as specified in ASTM D 3034, Table 2.
2. For sizes 10-inch and larger in diameter, fittings shall be fabricated from pipe conforming to ASTM D 3034 using solvent welding.
3. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.

E. Thrust Restraint

1. Provide restraint at all points where hydraulic thrust may develop.
2. Where specified or as directed, plugs, caps, tees, and bends deflecting 11¼ degrees or more shall be restrained.
3. Restrained joint pipe and fittings shall be restrained, at a minimum, to the restraint lengths specified on the Drawings with one (1) of the following methods:
    a. Restrained joint pipe and fittings:
        1) Certa Lok as manufactured by Napco or approved equal.
    b. Restrained harnesses:
        1) Series 1900 for DR 18 235 psi CIOD pipes as manufactured by EBBA Iron or approved equal.

2) Series 2600 for CIOD fittings as manufactured by EBBA Iron or approved equal.

3) Harness shall conform to the following:

a) The combination of the restraint(s) and fasteners shall have a pressure rating to the full pressure rating of the pipe.

b) The restraint shall have a two to one safety factor.

c) The restraint shall be manufactured of ductile iron conforming to ASTM A536.

d) The restraint devices shall be coated with MEGA-BOND.

c. Split Restraint

1) Split Restraints shall be used for connecting to mechanical joints.

2) Series 19MJ00 for DR 18 CIOD 235 psi pipes as manufactured by EBBA Iron or approved equal.

F. Joints

1. Joints for PVC pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage, when tested in accordance with ASTM D 3212 for gravity pipes and ASTM D3139 for pressure pipes.

2. Gaskets shall meet the requirements of ASTM F477. The joint system shall be subject to the approval of the Construction Manager and shall be identical for pipe and fittings.

3. Gaskets shall be factory assembled and securely locked in place to prevent displacement during assembly.

4. Provisions must be made for expansion and contraction at each joint with an elastomeric gasket.

G. Joint Tightness

1. Two sections of pipe shall be assembled in accordance with the manufacturer's recommendations.

H. Pipe Stiffness:

1. Minimum "pipe stiffness" at 5% deflection shall be 364 psi for SDR 18 and 129 psi for DR 25 pipes, when tested in accordance with ASTM D2412, "External Loading Properties of Plastic Pipe by Parallel-Plate Loading".

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install PVC pipes in accordance with the requirements of the following:

1. Section 33 30 00 – Sewer and Accessories, Part 3.
2. Manufacturer's written recommendations.
3. Supplemental and applicable information from Uni-Bell PVC Pipe Association:
    a. Installation Guide for Gasketed-Joint PVC Pressure Pipe.

B. Bedding for PVC pipes shall be at a minimum Class "B" Bedding as specified in Section 31 23 00.

C. Tracer Wire – All PVC piping shall be installed with a continuous, insulated TW, THW, THWN, or HMWPE insulated copper, 10 gauge or thicker wire for pipeline location purposes by means of an electronic line tracer.

1. The wires shall be installed along the entire length of the pipe.
2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

3.02 TRACER WIRE TESTING

A. Upon completion of installation by direct burial, sliplining, directional boring or pipe bursting, the Contractor shall demonstrate that the tracer wire is continuous and unbroken through the entire run of the pipe.

1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of the Owner or Construction Manager.
2. If the wire is broken, the Contractor shall repair or replace it. Pipeline installation will not be accepted until the tracer wire passes a continuity test.

3.03 TESTING

A. Testing shall be in accordance with the requirements of the following:

1. Section 33 30 00 – Sewer and Accessories, Part 3.
2. Supplemental and applicable information from Uni-Bell PVC Pipe Association:
    a. Installation Guide for Gasketed-Joint PVC Pressure Pipe.
    b. UNI-B 06 - "Recommended Low-Pressure Air Testing of Installed Sewer Pipe."
3. The Contractor shall conduct the tests in the presence of the Construction Manager.
4. **No leakage shall be allowed for sewer force mains**.

B. Circularity Tests

1. Where required by the Construction Manager, pipes may be tested at ground surface for circularity before installation and welding commences.
2. Circularity will be checked by pulling a closed cylindrical mandrel through the polyethylene pipe.
3. The mandrel's outside dimension shall be sized to permit no more than 5.0 percent deflection.
4. The percent deflection shall be established from the base inside diameter of the pipe.
5. The mandrel shall be approved by the Construction Manager prior to use.
6. The mandrel shall be at least three times the diameter of the pipe in length and not greater than inside diameter of pipe minus 2 millimeters.
7. Lines that permit safe entry may allow other deflection test options, such as direct measurements.
8. Pipes will be rejected which have greater than 5% deformation due to thermal softening.

3.04 GUARANTEE

A. Material Warranty:

1. A written guarantee of 10 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the pipe and fittings material.
2. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty

1. The Contractor shall guarantee the Work is free from defects in material and workmanship for a period of 3 years from the final acceptance.
2. The warranty shall cover the costs to repair or replace items including, but not be limited to, all gravity sewers, force mains, manholes, appurtenances, trenches, roadways, landscaping, other areas disturbed by the construction of the project and freight to project site, should these items have any defects in material or workmanship.
3. In addition to the standard pipe warranty, where applicable, the fusing contractor shall provide in writing a three-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that requires remaking defective butt fusion, saddle fusion or electrofusion joints. The warranty shall also include freight to project site, formation, installation and pressure testing.
4. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the installer of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. No bell clamps or wrap around corsets are allowed as a means of repair on new pipelines.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and pipe manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. The Contractor shall be responsible for repairs to any trench settlements caused by leaking pipe, fittings, etc. He shall promptly furnish and place fill to original grade.

I. Should any leaks or trench settlement occur under the new pavement, the Contractor will be held responsible for the cost of all repairs, including pavement replacement.

J. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

K. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

L. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

3.05 INSPECTION

A. Furnish to Owner copies of the Manufacturer's Sworn Certificate of Inspection and Testing of all PVC pipe and PVC fittings provided on the Work.

B. All PVC pipe and fittings will be subject to inspection and approval by Construction Manager after delivery of material to the site. Do not use broken, cracked, misshaped, imperfectly coated, unsatisfactory, or otherwise damaged pipe or fittings.

C. Such inspection by Construction Manager does not relieve the Contractor of full responsibility for the material installed.

END OF SECTION

SECTION 33 33 00

DUCTILE IRON PIPE AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies ductile iron pipe, ductile fittings and gaskets.
2. Refer to Section 33 30 00 for additional requirements.

B. Definition:

1. Where cast iron pipe is specified, the term and symbol shall mean ductile iron pipe.

1.02 REFERENCES

A. This section contains references to the following documents.

1. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.
2. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
3. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).
4. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
5. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference Title

Reference	Title
ANSI B1.1	Unified Inch Screw Threads (UN, UNR, and UNJ Thread Forms)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings
ASTM A 193	High Tensile Alloy and Stainless Steel Bolts
ASTM A 194	Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A242	Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)
ASTM A716	Ductile-Iron Culvert Pipe
ASTM A746	Standard Specification for Ductile Iron Gravity Sewer Pipe
ASTM B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C150	Portland Cement
AWWA C104 (ANSI A21.4)	Cement-Mortar Lining for Ductile- Iron and Gray-Iron Pipe and Fittings for Water
AWWA C105 (ANSI A21.5)	American National Standard for Polyethylene Encasement For Ductile-Iron Pipe Systems
AWWA C110 (ANSI A21.10)	Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111 (ANSI A21.11)	Rubber-Gasket Joints for Ductile- Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115 (ANSI A21.15)	Flanged Ductile-Iron and Gray-Iron Pipe With Threaded Flanges
AWWA C116 (ANSI A21.16-09)	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
AWWA C150 (ANSI A21.50)	Thickness Design of Ductile-Iron Pipe
AWWA C151 (ANSI A21.51)	Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C153 (ANSI A21.53)	Ductile-Iron Compact Fittings, 3 In. Through 12 In. for Water and Other Liquids
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	Grooved and Shouldered Type Joints

1.03 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 23:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

a. Check marks shall denote full compliance with a paragraph as a whole.

b. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

c. The Construction Manage shall be the final authority for determining acceptability of requested deviations.

d. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

2. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. The following information shall be submitted by pipe and fitting suppliers

1. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.

2. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.

3. Pipe and fitting product data indicating conformance with this Specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.

4. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this Specification and applicable pipe and fitting standards specified herein.

PART 2 – PRODUCTS

2.01 GENERAL

A. Pipe design, materials and manufacture shall comply with the following documents:

Item	Document

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	
• Water or other liquid	AWWA C151
Gravity sewer pipe	ASTM A746
Joints	
• Rubber gasket	AWWA C111
• Threaded flange	AWWA C115
Fittings	
• Water or other liquid	AWWA C110/AWWA C153
Cement mortar lining	AWWA C104

B. All ductile iron pipe shall be marked in accordance with AWWA C151 and ductile iron fittings shall be marked in accordance with AWWA C110.

C. Acceptable Manufacturers

1. American Cast Iron Company
2. U.S. Pipe
3. Or approved equal

2.02 PIPE

A. All pipe shall be Class 50 (thickness class) for 16-inch and smaller, and Class 51 for 18-inch and larger, unless otherwise specified or shown on the Drawings.

B. Flanged pipe minimum wall thickness shall be equal to Special Class 53. Flanges shall be furnished by the pipe manufacturer.

C. All pipes shall have a minimum pressure rating as indicated in the following table and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Diameter	Minimum Pressure Class
4” through 20”	350
24” and greater	300

D. Unless otherwise specified, pipe shall have nominal laying lengths of 18 or 20 feet.

E. All pipe shall be manufactured in the United States of America.

F. Certificates of conformance with the foregoing Specifications shall be furnished with each lot of pipe supplied.

2.03 GASKETS

A. Unless otherwise specified, gasket stock shall be a synthetic rubber compound in which the elastomer is nitrile or neoprene.

1. The compound shall contain not less than 50 percent by volume nitrile or neoprene and shall be free from factice, reclaimed rubber and other deleterious substances.

B. Gaskets for flanges shall be the full face type.

1. Thickness shall be 1/16 inch for pipe 10 inches and less in diameter and 1/8 inch for pipe 12 inches and larger in diameter.

C. Gaskets shall, in addition, comply with AWWA C111 for push-on and mechanical joints and with AWWA C606 for grooved end joints.

D. Sufficient lubricant shall be furnished with each order of pipe to provide a thin coating on both the gasket and the spigot-end of the pipe.

1. Lubricant shall be NSF 61 approved and shall have no deleterious effect on the rubber gasket.
2. Lubricant shall be of such consistency that it can be easily applied to the pipe in either hot or cold weather, and shall satisfactorily adhere to either wet or dry pipe.
3. ONLY LUBRICANT FURNISHED WITH THE PIPE BY THE PIPE MANUFACTURER SHALL BE USED.

2.04 FITTINGS

A. Unless otherwise specified, fittings shall conform to AWWA C110 with a minimum rated working pressure of 250 psi.

B. Ends shall be flanged, restrained mechanical joint, restrained push-on, or grooved to suit the conditions specified.

C. The AWWA C153 compact ductile iron fittings in sizes 3 through 12 inches are an acceptable substitute for standard fittings unless otherwise specified.

D. In general, use flanged fittings with long radius elbows except where space limitations prohibit use of same.

E. Design of special flanged fittings, including wall castings, shall conform to dimensions and details as directed, indicated, or noted on the approved drawings.

F. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous outside coating.

G. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116.

H. Galvanized pipe fittings and PVC pipe fittings shall not be used as any part of the Fulton County Sewer System, nor shall it be used to join any appurtenances to the System.

2.05 JOINTS

A. Unrestrained Joints:

1. Push-On Joints:

a. Unrestrained joints, where specified, shall be the rubber ring compression, push-on type joint suitable for buried services.

b. Acceptable unrestrained joints shall be:

1) Fastite Joint as manufactured by American Cast Iron Pipe Company

2) Tyton Joint as manufactured by U.S. Pipe

3) Or approved equal.

c. This joint is not permitted on fittings or specials, unless otherwise specified.

d. Unless otherwise specified, joints shall have a maximum allowable deflection up to 5 degrees at specified pressures.

e. Gaskets shall comply with Paragraph 2.03.

f. Joint assembly and field cut joints shall be made in strict conformance with AWWA C600 and manufacturer's recommendations.

2. Mechanical Joints:

a. Where specified, mechanical joints for above or below ground services shall meet the requirements of ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.11/C111.

b. Mechanical joint glands shall be ductile iron.

c. Gaskets and bolts and nuts shall comply with paragraphs 2.03 and 2.05D, respectively.

B. Restrained Joints:

1. General:

a. Unless otherwise specified, restrained joints shall be flanged or grooved end for exposed service and restrained push-on for buried services.

b. Restrained joint pipe (RJP) on supports shall have bolted joints and shall be specifically designed for clear spans of at least 36 feet.

2. Push-On Joints:

a. Restrained push-on joints shall be as specified in paragraph 2.05A, modified for restraint.

b. Acceptable restrained push on Joints

1) Flex-Ring or Lok-Ring Joint as manufactured by American Cast Iron Pipe Company,

2) TR Flex or HP Lok Joint as manufactured by US Pipe

3) Clow “SUPER-LOCK”

4) Griffin “SNAP-LOK”

5) Or approved equal.

c. Restraining gasket joints shall be assembled with American Fast-Grip gaskets or US Pipe FIELD LOK gaskets and may be used for pipe 12-Inches in diameter or less.

d. Restrained joints shall be capable of being deflected after full assembly.

e. Joint assembly shall be in strict conformance with AWWA C600 and manufacturer's recommendations.

f. No field welding for manufactured restrained joint pipe assembly will be permitted.

g. No field cuts of restrained pipe are permitted without prior approval of the Construction Manager.

h. Where field cutting of restrained joint pipe is required, the joint shall be assembled with American Field Flex-Rings or US Pipe TR FLEX GRIPPER Rings.

3. Flange Joints:

a. Unless otherwise specified, flanges shall be ductile iron and shall be threaded-on flanges conforming to ANSI/AWWA A21.15/C115 or cast-on flanges conforming to ANSI/AWWA A21.10/C110.

b. Flanges shall be adequate for 250 psi working pressure.

c. Bolt circle and bolt holes shall match those of ANSI B16.1, Class 125 flanges and ANSI B16.5, Class 150 flanges.

d. Gaskets shall be as specified in Paragraph 2.03.

4. Thrust collars shall be welded-on ductile iron body type or split retainer gland type, as shown on the Drawings or directed by the Construction Manager, designed to withstand thrust due to 300 psi internal pressure on a dead end.

5. Anchorage:

a. All valves, caps, tees, bends deflecting 11 ¼ degrees or more and other fittings shall have two forms of restraint as one of the following:

1) Manufactured restrained joint plus concrete blocking (3,000 psi concrete thrust block sized to withstand line

pressures of 300 psi and soil bearing pressures of 2,000 psf)

2) Manufactured restrained joint plus rodding to concrete thrust collar (3,000 psi concrete collar and tie rods sized to withstand line pressures of 300 psi and soil bearing pressures of 2,000 psf)

6. Mechanical Joints:

a. Where specified, restrained mechanical joints shall be the positive restraint type.

b. Retainer glands on a mechanical joint may be used as a restrained joint only where retainer glands are specifically shown on the drawings, where specifically specified or where specifically identified and allowed by the Construction Manager.

1) Retainer glands shall be Megalug Series 1100, as manufactured by EBAA Iron, or Uni-Flange Series 1400, as manufactured by Ford Meter Box Company.

c. Locked mechanical hydrant tees, bends and adapters are an acceptable substitute for anchoring fire hydrants and valves to the pipe main.

C. Ball and Socket Flexible Joint Pipe:

1. Ball and socket flexible joint pipe shall be the boltless type and shall allow a maximum joint deflection of 15 degrees.

2. Each joint shall be provided with a retainer lock to prevent rotation after assembly.

3. Joints shall be the Flex-Lok Joint as manufactured by American Cast Iron Pipe Company, USIflex as manufactured by U.S. Pipe, or equal.

D. Bolts and Nuts:

1. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

2. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.

3. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.

4. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.

5. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8M. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8M.

6. Corrosion-resistant bolts and nuts for use with ductile iron joints shall be Type 316 stainless steel

E. Tapping Saddles: Tapping saddles are not allowed.

F. Pipe outlets shall be welded-on ductile iron pipe and shall be provided in lieu of tees or saddles on pipes with a diameter greater than or equal to 24-inches.

1. Outlets shall be plain end, push-on, mechanical or flanged joint, and shall meet the joint requirements stated in this Specification.
2. All welding, fabrication and outlet hole drilling shall be performed by the manufacturer of the parent pipe.
3. Outlets shall be free of burrs. Sizes shall be as indicated on the Drawings.
4. The outlets and parent pipe shall be minimum Class 53 ductile iron pipe for parent pipe 54-inches and smaller.
5. For pipe larger than 54-inches, parent pipe shall be Pressure Class 350.
6. Each welded outlet shall be rated for 250 psi working pressure and hydrostatically tested at 500 psi.
7. The maximum outlet diameters shall not exceed those listed in the table below:

Parent Pipe Diameter, Inches	Maximum Outlet Diameter, Inches
24	16
30	20
36	24
42	30
Parent Pipe Diameter, Inches	Maximum Outlet Diameter, Inches
48	30
54	30
60	30
64	30

2.06 PIPE COATING

A. The exterior of ductile iron pipe and fittings shall be coated with a layer of arc-sprayed zinc per ISO 8179.

1. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area.

2. A finishing layer of bituminous topcoat as specified in AWWA C151 shall be applied to pipe and fitting over the zinc.

3. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes – External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004- 06-01.”

B. Where corrosive soils or soils with electrical currents are encountered that may, or in the judgment of the Owner, cause a deleterious effect on the piping system, the piping system shall be wrapped with polyethylene in accordance with the manufacturers recommendations to a minimum distance of 20 lineal feet beyond such conditions.

1. All elements of the piping system shall be wrapped entirely in polyethylene tubbing and secured with polyethylene tape to completely prevent the entrance of foreign matter.

2. Such encasement shall be carried out in accordance with AWWA/ANSI C105/A21.5.

2.07 PIPE LINING

A. Cement Mortar Lining:

1. Pipe:

a. Cement mortar lining shall be to Standard thickness in accordance with ANSI/AWWA C104/A21.4.

2. Fittings:

a. Cement mortar lining shall be to Double thickness in accordance with ANSI/AWWA C104/A21.4.

3. Pipe and fittings shall be lined with 40 mil dry film thickness of Protecto 401 Ceramic Epoxy by Induron or equivalent. A seal coat over the ceramic lining is not required.

2.08 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 23:

1. Shop drawings.

2. Alignment drawings.

3. Certifications specified in the following documents:

a. ANSI A21.14, paragraph 14-4.2

b. ANSI A21.52, paragraph 52-4.2

c. ASTM A716, paragraph 4.2

d. AWWA C110, paragraph 10-5.3

e. AWWA C111, paragraph 11-7.1

f. AWWA C115, paragraph 15-4.2

g. AWWA C151, paragraph 51-5.2

h. AWWA C153, paragraph 53-6.3

i. AWWA C606, paragraph 4.1.1.1

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Piping runs specified on the Drawings shall be followed as closely as possible. Proposed deviations shall be submitted in accordance with Section 01 33 00.
2. Pipe shall be installed in accordance with AWWA C600.
3. Coatings and linings shall be inspected for damage during installation, and damage shall be repaired according to the coating manufacturer's recommendations.

B. Insulating Sections

1. Where a metallic nonferrous pipe or appurtenance is connected to ferrous pipe or appurtenance, an insulating section shall be provided.

C. Anchorage:

1. Anchorage shall be provided as specified. Calculations and drawings for proposed alternative anchorage shall be submitted in accordance with Section 01 33 00.

3.02 ACCEPTANCE TESTING

A. Gravity Sewer:

1. Infiltration and exfiltration tests as specified in Section 33 30 00.

B. Force Main

1. Hydrostatic pressure and leakage in accordance with Section 4 of AWWA C600 except that test pressures shall be as listed in Section 33 30 00 and no leakage will be allowed.

C. The Contractor shall conduct the tests in the presence of the Construction Manager.

3.03 GUARANTEE

A. Material Warranty:

1. A written guarantee of 20 years submitted to the County for the specific project shall be provided by the Manufacturer against any defects of the pipe and fittings material.
2. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.

B. Workmanship Warranty

1. The Contractor shall guarantee the Work is free from defects in material and workmanship for a period of 10 years from the final acceptance.
2. The warranty shall cover the costs to repair or replace items including, but not be limited to, all gravity sewers, force mains, manholes, appurtenances, trenches, roadways, landscaping, other areas disturbed by the construction of the project and freight to project site, should these items have any defects in material or workmanship.
3. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the installer of warranty responsibility for the full warranty term.

C. Deficiencies related to material and workmanship shall be repaired by Contractor to the satisfaction of the Construction Manager.

D. No bell clamps or wrap around corsets are allowed as a means of repair on new pipelines.

E. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

F. If required, Contractor and pipe manufacturer representatives may participate in inspections to determine such deficiencies.

G. If repairs are made, the Contractor/Manufacturer shall warrant the repaired work for the periods as specified above for material and workmanship in addition to the original warranty period required by the Contract.

H. The Contractor shall be responsible for repairs to any trench settlements caused by leaking pipe, fittings, etc. He shall promptly furnish and place fill to original grade.

I. Should any leaks or trench settlement occur under the new pavement, the Contractor will be held responsible for the cost of all repairs, including pavement replacement.

J. Within the guarantee period, where no loss of customer service or property damage is involved, the Contractor shall begin work on requested repairs or corrective measures with 24 hours following notification by Owner.

K. If property damage or loss of customer service is involved, the Contractor shall begin work with four (4) hours of notification by Owner.

L. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the Contract.

3.04 INSPECTION

A. Furnish to Owner copies of the Manufacturer's Sworn Certificate of Inspection and Testing of all ductile iron pipe and ductile iron fittings provided on the Work.

B. All ductile iron pipe and fittings will be subject to inspection and approval by Construction Manager after delivery of material to the site. Do not use broken, cracked, misshaped, imperfectly coated, unsatisfactory or otherwise damaged pipe or fittings.

C. Such inspection by Construction Manager does not relieve the Contractor of full responsibility for the material installed.

END OF SECTION