SOUTH BRYAN COUNTY SEWER FLOW DIVERSION TO RICHMOND HILL

PREPARED FOR:

BRYAN COUNTY BOARD OF COMMISSIONERS

T&H PROJECT NO.

J–27691.0057

ADDENDUM NO. 1 **NOVEMBER 18, 2022**

PART I – GENERAL:

This Addendum has been issued on behalf of Bryan County Board of Commissioners. The following information should be considered by prospective bidders in preparation of their proposals and are hereby incorporated into the Proposal Documents. Bidders shall be responsible for acknowledging receipt of this addendum in the Bid Form, Document 00313. Failure to do so will result in the proposal being considered non–responsive.

Part II – Pre-Bid Meeting:

Attached to this addendum are the Meeting Minutes and a Sign-In sheet from the non-mandatory Pre-Bid Meeting held on November 16th, 2022, at 11:00 am.

PART III – QUESTIONS AND CLARIFICATIONS:

QUESTIONS:

1. Question: Is it acceptable for bidder's bonding company to use their own form?
   Answer: Bid bond form can be found in the attachments of this addendum. No other bid bond form will be accepted.

2. Question: Bid Item #38 – Septic Tank / Dosing Pumps and Structures Removal and Disposal. Do you have any information on this?
   Answer: Please see sheet C1.8 for the location of the existing septic field and notes on removal of the septic field. Some language has also been included in the measurement and payment under Section 02731 – Wastewater Collection System.

PART IV – CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS:

1. **Section 00313 – BID FORM** has been revised. Delete and replace with the attached **Section 00313 – "Bid Form".** New Section 00313 includes new material quantities as well as bid items, and shall be marked as "revised per Addendum No. 1- November 18, 2022".

   a. Bidder must use the enclosed form. **NO OTHER FORM SHALL BE ACCEPTED.**

2. **Section 00411 – Bid Bond has been included with this Addendum**

3. **Section 02231 – Aggregate Base Course** has been revised. Delete part C and D of Section **1.3 Measurement and Payment**

4. **Section 02310 – Jack & Bore** has been revised. Delete part A and B of **Section 1.2 Measurement and Payment** in its entirety and replace with the following:

a. Payment for Jack & Bore Steel Casing will be made at the contract unit price on a linear foot basis for the different sizes bored. Payment shall include all items necessary to complete installation, including casing pipe, casing spacers and enclosure method. Such payment will include furnishing all equipment, labor, materials, excavation, installation, dewatering, backfilling, compaction, and all incidentals necessary to complete the work in an acceptable and workmanlike manner.

b. Jack & Bore FPVC Force Main Within Steel Casing – Payment will include mobilization, fusing of pipe, necessary pipe supporting means during fusion process, FPVC/HDPE to PVC connection couplings, other equipment and accessories required to install pipe within existing casing. Payment will also include labor, equipment, handling, security, storage, installation, and all other incidentals required to complete the work in an acceptable and workmanlike manner.

5. **Section 02559 – Horizontal Directional Drilling (HDD)** has been revised. Delete part A of **Section 1.19 Measurement and Payment** and replace with the following:

a. Horizontal Directional Drilling – Measurement will be made for pipe drilled as shown on the construction drawings at the pay line designations. Measurement for payment will be by linear feet in a horizontal plane. There shall be no separate measurement or payment for additional drilling or pipe lengths needed to start and terminate the borings or for abandoned bores. Extra pipe, if needed for connections, will be paid for at the unit price for Open Cut Installation. Payment will include all labor, materials, drilling equipment, fittings, joint restraints, accessories, excavation of any pits, dewatering, mucking, borrow, water supply necessary for drilling, handling of drilling mud, set–up, preparation of installation plan, preparation of IRCP, drilling operations, pipe jointing (fusion), tracer wire vacuum truck, mud motors, magnetic guidance system, pipe rollers, FPVC/HDPE to PVC connection couplings, clean up, restoration and any other necessary items to complete successful bore with satisfactory tests completed before payment is made.

6. **Section 02731 – Wastewater Collection System** has been revised. Delete part 14 of **Section 1.5 Measurement and Payment** and replace with the following as part 16:

a. Septic Tank / Dosing Pumps and Structures Removal and Disposal – Payment will be made at the contract lump sum price. Payment will include all labor, materials, equipment, dewatering, removal of electrical units, removal of pumps, removal of structures, and all incidentals necessary to remove the existing septic tank.

All other aspects of the project remain unchanged.

THOMAS & HUTTON

Sam Dodd, P.E.
Project Designer

End of ADDENDUM NO. 1

PRE – BID CONFERENCE MEETING MINUTES	**PROJECT NO:**	**J – 27691.0057**
PROJECT: SOUTH BRYAN COUNTY SEWER FLOW DIVERSION TO RICHMOND HILL	**ENGINEER:**	**SAMUEL DODD (THOMAS & HUTTON)**
	OWNER:	**BRAN COUNTY BOARD OF COMMISSIONERS**
LOCATION: BRYAN COUNTY, GEORGIA	**DATE/TIME:**	**NOVEMBER 16TH, 2022 11:00 AM**

Meeting Minutes

1. **Introductions** – The County staff and TH representatives state their names and roles on the project.

Kirk Croasmun – Bryan County Board of Commissioners
Samuel Dodd - Thomas & Hutton
Matthew Frazier – Thomas & Hutton

2. **Complete Sign–In Sheet**

Following the introductions and reminder to fill out sign–in sheet Mr. Dodd will discuss the following:

3. **Project Description**

a. Work will include the installation of approximately 9,000 LF of 12-inch diameter force main that will begin at the existing Warren Hill Rd Pump Station along Warren Hill Rd and connect to the existing gravity sewer manhole on Warren Hill Rd. Approximately 3,000 LF of 12-inch diameter force main will be installed, and it will connect to the existing Veterans Parkway Pump Station. Project includes other accessories and miscellaneous items as required and shown on the plans to complete a full and operational system.

4. **Project Location**

a. Work for this project will occur primarily along Warren Hill and Veterans Memorial Parkway. Force main installation will begin at the Warren Hill Rd Pump Station and continue within a utility easement within Raydient LLC Property (PIN: 049-003). Force main installation will end on the north end of Warren Hill Rd at the Richmond Hill Master Pump Station and connect into the existing 10" force main. The existing gravity sewer will convey sewer from the Belfast River Rd corridor to the Richmond Hill Master Pump Station.

5. **Permits**

a. Georgia EPD Sewer Extension
   i. Status: Approved

b. GSWCC Erosion Control
   i. Status: In Progress

c. Richmond Hill
   i. Status: In Progress

6. **GEFA Funding Requirements-**

a. The project is STATE funded through the Georgia Environmental Finance Authority (GEFA). Therefore, the successful low, responsive, responsible bidder must provide to the Owner written oath in accordance with O.C.G.A §36–91–21(e), certifying that the Contractor has not acted alone or otherwise to prevent or attempt to prevent competition in bidding or proposal for said project by any means whatsoever.

Furthermore, the oath shall certify that the Contractor during this process of procuring said work has not prevented or endeavored to prevent anyone from making a bid or proposal by any means whatsoever, nor caused or induced another to withdraw a bid or proposal for the work.

b. Specification Section 00112- Non-collusion Affidavit

c. Specification Section 00425- Affidavit Verifying Status For County Public Benefit

d. Specification Section 00426- Georgia Security and Immigration Compliance Act Affidavits

7. Key Dates

a. Bid Date: Bids will be opened on **Tuesday, November 29, 2022 at 2:00 p.m. EST** at which day/time bids will be received and publicly opened. Bids shall be submitted in two (2) separate sealed envelopes.

b. Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, state contractor license number (if applicable) and accompanied by the Bid security, entire bidding documents, except drawings, and other required documents. If the Bid is sent through the mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. Each bidder is responsible for seeing their bid is received by the Owner not later than the advertised time set for the opening of bids.

Each Bidder is responsible for seeing that his Bid is received by the Owner not later than the advertised time set for the opening of Bids.

c. Deadline for Questions: All questions and request for clarification must be received in writing no later than **5:00 p.m. on Monday, November 21st, 2022**. All questions about the meaning and intent of the bid documents must be submitted to the Engineer, Karen Sumulski with Thomas & Hutton, at 50 Park of Commerce Way, Savannah, GA 31405 or sumulski.k@tandh.com.

8. Owner's Right

a. The owner reserves the right to reject any or all bids, including without limitation to the right to reject any or all nonconforming, nonresponsive, unbalanced, or conditional bids, if it is in the owner's best interest to do so.

9. Written Word

a. Only the written word as contained in the Bid Documents, including any addenda that may be issued, shall be valid.

b. It is the bidders' responsibility to read and review all the Bid Documents, including addenda.

c. Statements made by the Engineer or Owner are for the sole purpose of calling the bidders' attention to items of importance in the Bid Documents.

d. All questions or requests for clarification must be submitted in writing. All responses will be made in the form of addenda to the bid documents.

10. Invitation to Bid

a. Each bid shall have bid security of not less than 5% of the sum of the base bid. The successful bidder shall provide a Performance Bond and a Payment Bond, each in the full amount of the contract price.

b. Bidders and all subcontractors shall be licensed in accordance with the provisions of the Georgia Contractor's Licensing Law.

c. The Contractor, or any subcontractor, submitting a bid for utility contracting, as defined in O.C.G.A. Section 43–14–2 to a utility system as defined in said section, shall conform to O.C.G.A. Section 43–14–8.2 et seq. with reference to Utility Contractor's Licenses and shall submit the bid with the license numbers, as issued by the Division of Utility Contractors, affixed on the outside of the bid envelope as provided by O.C.G.A. Section 43–14–8.2(h). Utility contracting means a proposal to perform utility work, the depth which exceeds five (5) feet, to a utility system as defined in O.C.G.A. Section 43–14– 2(17).

A utility contractor license will be required for this project.

d. Bidders shall be responsible for having their bid at the designated place for receiving bids no later than the time set for the bid opening. Once the bidding has been declared closed, all late bids, including bids improperly delivered, shall be rejected as being non–responsive.

11. Substitutions

a. Materials and products listed in the Bid Documents establish a standard of required function, dimension, appearance, and quality to be met by a proposed substitution.

b. Reference in the Bid Documents to the words 'or equivalent' and 'or approved equivalent' shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

c. Requests for substitutions must be submitted to the Engineer not later than **5:00 p.m. on Monday, November 21st, 2022**. Proof of equality of substitutions is the responsibility of the proposer. The Engineer's decision to approve or disapprove of the requested substitutions shall be final.

d. The Engineer shall include in an addendum the approved substitutions. Substitution requests not approved by the Engineer may be listed in an addendum at the Engineer's option.

12. Addenda

a. Interpretations or clarifications considered necessary by Engineer in response to questions shall be issued by Addenda issued to all plan holders. Only questions answered by formal written addenda will be binding.

b. It is the bidder's responsibility to determine, prior to submitting a bid, that all addenda issued have been received.

13. Bid Submittal

a. Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, state contractor license number (if applicable) and accompanied by the Bid security, entire bidding documents, except drawings, and other required documents. If the Bid is sent through the mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. Each bidder is responsible for seeing their bid is received by the Owner not later than the advertised time set for the opening of bids.

14. Bid Security

a. Bid Security in the form of either a cashier's check or Bid Bond shall be submitted with the Bid.

b. A Surety Company licensed to conduct business in Georgia, if used, must issue Bid Bond.

c. The Surety must have a minimum rating performance of "A" as stated in the most current publication of "Best Key Rating Guide, Property Liability."

d. Each bond must be accompanied by a "Power of Attorney" authorizing the attorney–in–fact to bind the Surety and certified to include the date of the Bond.

15. Performance and Labor/Material Payment Bond

a. The Contractor shall provide and pay the cost of Performance Bond and labor and material Payment Bonds.

b. Such bonds shall be in the full amount of the Contract Sum and issued by a Surety Company licensed to conduct business in Georgia.

c. The Surety must have a minimum rating performance of "A" as stated in the most current publication of "Best Key Rating Guide, Property Liability".

d. Each bond must be accompanied by a "Power of Attorney" authorizing the attorney–in–fact to bind the Surety and certified to include the date of the Bond.

e. Submittal of Performance Bond and Labor and Material Payment Bonds will be required after the Notice of Award is delivered to the Bidder.

16. Responsive Bid

a. All bid data, bid bond, and required forms must be submitted.

b. Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is qualified.

17. Safety & Job–Site Security

Contractor is responsible for complying with the Department of Labor and Safety Health Regulations for Construction. See Special Conditions.

18. Underground Facilities: The information shown with respect to existing Underground Facilities is based on information and data furnished by the owners of such Underground Facilities, but this information may not be complete. The Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data. The cost of all the following will be included in the Contract Price(s) and contractor shall have full responsibility for:

- Reviewing and checking all such information and data;
- Locating all Underground Facilities shown or indicated in the Contract Documents;
- Coordination of the Work with the owners of such Underground Facilities, during construction, and
- The safety and protection of all such Underground Facilities and repairing and damage thereto resulting from the Work.

19. Traffic Control: The Contractor shall be responsible for furnishing, installing, and maintaining all necessary automatic signals, barricades, concrete barriers, warning signs, traffic lanes, and other protective devices to control traffic. All devices and traffic control methods shall conform to the GDOT Manual of Traffic Control Devices for Streets and Highways.

20. Project Discussion and Questions

- Project Duration:
  - 270 Days to Substantial Completion
  - 300 Days to Final Completion
- SCADA upgrades will be included as an allowance for pump station along Belfast River Road. We will prepare an Addendum with allowances in the bid form to account for this.

SOUTH BRYAN COUNTY SEWER FLOW DIVERSION TO RICHMOND HILL
Pre-Construction Sign-In Sheet

Job #: J-27691..
11/16/2022 11:00 AM

Attendees:

	Name	Company	Address	Phone	Email
1	Samuel Dodd	Thomas & Hutton	50 Park of Commerce Way, Savannah, GA 31405	(912) 721-4347	dodd.s@tandh.com
2	Matthew Frazier	Thomas & Hutton	50 Park of Commerce Way, Savannah, GA 31405	(912) 721-4047	frazier.m@tandh.com
3	Caroline Peavy	Thomas & Hutton	50 Park of Commerce Way, Savannah, GA 31405	(912) 721-4343	peavy.c@tandh.com
4	Jay Tenney	C.A. Murren & Sons	2250 E. Victory Dr. Suite 107 Savannah GA 31404	9127047696	jtenney@camurren.com
	Nolan Young	Legacy water Group	10130 Bob Williams Pkwy Covington, GA 30014	802 390 2372	NYoung@legacywatergroup.com
5	STEVEN PEARLEY	SouthernCivilLLC	18525 US Hwy 17 Townsend, GA	912-429-4866	SPEARLEY@SouthernCivilLLC.com
	Mike McCullough	Griffin Contracting Inc	122 Pipemakers Circle, Ste 207 Pooler GA 31322	912.965.0111	Mike@GriffinContracting.com
6					

DOCUMENT 00411

BID BOND

BIDDER (Name and Address):

_____

_____

_____

SURETY (Name and Address of Principal Place of Business):

_____

_____

_____

OWNER (Name and Address):

Bryan County Board of Commissioners
66 Captain Matthew Freeman Drive, Suite 201
Richmond Hill, GA 31324

BID

BID DUE DATE: November 9, 2022

PROJECT:

Work includes construction of approximately 13,200 LF of 12–inch force main located in general between Warren Hill Road and Great Ogeechee Parkway and from along Veterans Memorial Parkway. Work shall consist of clearing, grubbing, erosion control, open–cut installation, horizontal directional drilling, jack and bore, installation of sewer metering station and any/all other appurtenances and incidentals for the successful installation and operation of the project.

BOND

BOND NUMBER: _____ DATE: _____
(Not later than Bid Due Date)

PENAL SUM: _____
(10% of Bid Sum)

IN WITNESS WHEREOF, Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

PENAL SUM FORM

BIDDER	**SURETY**
_____ (Seal) Bidder's Name and Corporate Seal	_____ (Seal) Surety's Name and Corporate Seal
By: _____ Signature and Title	By: _____ Signature and Title (Attach Power of Attorney)
Attest: _____ Signature and Title	Attest:_____ Signature and Title

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents and Contract Documents.

3. This obligation shall be null and void if:

   3.1 Owner accepts Bidder's bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents and Contract Document, or

   3.2 All bids are rejected by Owner, or

   3.3 Owner fails to issue a notice of award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by bidder and, if applicable, consented to by Surety when required by paragraph 5 hereof.)

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of and any and all defenses based on arising out of any time extension to issue notice of award agreed to in writing by Owner and Bidder, provided that the time for issuing notice of award including extensions shall not in the aggregate exceed 120 days from Bid Due Date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in paragraph 4 above is received by Bidder and Surety, and in no case later than one year after Bid Due Date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notice required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of the Bond conflicts with any applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "bid" as used herein includes a bid, offer or proposal as applicable.

INDEX TO

SECTION 02231 – AGGREGATE BASE COURSE

SECTION 02231

AGGREGATE BASE COURSE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

1.2 RELATED SECTIONS

A. Section 01025 – Measurement and Payment: Requirements applicable to unit prices for the work of this section.

B. Section 01400 – Quality Control.

C. Section 02204 – Earthwork

D. Section 02512 – Asphaltic Concrete Binder/Surface Courses

E. Section 02731 – Wastewater Collection System

1.3 MEASUREMENT AND PAYMENT

A. Aggregate Base Course: No separate measurement or payment for aggregate base course. All costs associated with aggregate base course will be included in the contract unit price for which it pertains.

B. Prime Coat: Bituminous prime coat will not be measured for separate payment. All costs connected with applying prime coat will be included in the unit price bid for Aggregate Base Course.

1.4 REFERENCES (LATEST REVISION)

A. ASTM C 131 – Resistance to Degradation of Small–Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.

B. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. ASTM D 3740 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.

D. ASTM D 6938 – In–Place Density and Water Content of Soil and Soil–Aggregate by Nuclear Methods (Shallow Depth).

E. ASTM E 329 – Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, 2021 Edition.

1.6 TESTING

A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).

B. In place density tests in accordance with ASTM D 6938.

C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.

D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.

E. Testing shall be Contractor's responsibility and performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Aggregate shall consist of processed and blended crushed stone. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material and shall be durable and sound. Coarse aggregate shall have a percentage of wear not to exceed 65% after 500 revolutions as determined by ASTM C 131. Coarse aggregate shall meet applicable requirements of Section 800, Coarse Aggregate of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, 2021 Edition. Material shall meet the following gradation requirements of Section 815.

Sieve Size	Percent by Weight Passing
2"	100
1–1/2"	97 – 100
3/4"	60 – 90
#10	25 – 45
#60	5 – 30
#200	4 – 11

B. Prime Coat: Shall consist of low viscosity liquid asphalt such as MC–30, MC–70, MC–250, RC–30, RC–70, or RC–250, conforming to Section 412 of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, 2013 Edition.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify subbase has been tested, is dry, and slopes and elevations are correct.

B. ON SITE OBSERVATIONS OF WORK: The Owner's Representative or Engineer will have the right to require any portion of the work be completed in their presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to the Owner. However, if the Contractor notifies the Owner such work is scheduled, and the Owner fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Owner, Engineer or Project Representative. Improper work shall be reconstructed, and all materials, which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

3.2 PREPARATION

A. Subbase shall be graded and shaped conforming to the lines, grades, and cross sections required and cleaned of all foreign substances prior to constructing base course. Do not place base on soft, muddy or frozen surfaces. Correct irregularities in subbase slope and elevation by scarifying, reshaping, and recompacting.

B. At the time of base course construction, subbase shall contain no frozen material.

C. Surface of subbase shall be checked by the Engineer or Project Representative for adequate compaction and surface tolerances. Ruts or soft yielding spots appearing in areas of subbase course having inadequate compaction, and areas not smooth or which vary in elevation more than 3/8 inch above or below required grade established on the plans, shall be corrected to the satisfaction of the Engineer or Project Representative. Base material shall not be placed until subbase has been properly prepared and test results have so indicated.

3.3 AGGREGATE PLACEMENT

A. Aggregate shall be placed with an acceptable spreader in accordance with Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, 2021 Edition Section 310 and in accordance with all terms included in these specifications. (Spreader shall contain a hopper, adjustable screed and designed so there will be a uniform, steady flow of material from the hopper. Spreader shall be capable of laying material without segregation across

full width of the lane to a uniform thickness and to a uniform loose density.) Spreaders are not required on curb and gutter road sections.

B. Level and contour surfaces to elevations and slopes indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

F. While at optimum moisture (± 1–1/2%), compact base course with rollers capable of obtaining required density. Vibratory, flatwheel, and other rollers accepted by the Engineer may be used to obtain required compaction. Rolling shall continue until base is compacted to 98% of the maximum laboratory dry density as determined by ASTM D 1557. In–place density of the compacted base will be determined in accordance with ASTM D 6938.

3.4 PRIME COAT

A. Bituminous material for the prime coat shall be applied uniformly and accurately in quantities of not less than 0.15 gallons per square yard nor more than 0.30 gallons per square yard of base course. All irregularities in the base course surface shall be corrected prior to application of prime coat. Clean the base course of all mud, dirt, dust, and caked and loose material

B. Do not apply prime to a wet surface nor when temperature is below 40°F in the shade. Do not apply prime when rain threatens nor when weather conditions prevent proper construction and curing of prime coat.

C. The primed base should be adequately cured before the binder or surface course is laid. In general, a minimum of 48 hours should be allowed for complete curing. Ordinarily, proper surface condition of the prime is indicated by a slight change in the shiny black appearance to a slightly brown color.

3.5 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with an acceptable 10–foot straight edge.

B. Scheduled Compacted Thickness: Within 3/8 inch.

C. Variation from Design Elevation: Within 3/8 inch.

D. Depth measurements for compacted thickness shall be made by test holes through the base course. Where base course is deficient, correct such areas by scarifying, adding base material and recompacting as directed by the Engineer.

3.6 FIELD QUALITY CONTROL

A. Section 01400 – Quality Assurance: Field inspection.

B. Density and moisture testing will be performed in accordance with ASTM D 1557 and ASTM D 6938.

C. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Tests:

1. Base Density and Thickness – One test per 5,000 square feet.

END OF SECTION

INDEX TO

SECTION 02310 – JACK AND BORE

SECTION 02310

JACK AND BORE

PART 1 – GENERAL

1.1 SECTION DESCRIPTION

A. This section includes materials, performance and installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install and complete required boring and jacking installations, or other trenchless methods for pipelines, as shown on the Drawings and as specified herein.

B. The provision of this section shall be the minimum standards for the installation of casing pipe by the boring and jacking method. Other types of trenchless methods may be acceptable and encouraged if the specific method is at least equal to the performance of typical jack and bores and is comparable in cost.

1.2. MEASUREMENT AND PAYMENT

A. Payment for Jack & Bore Steel Casing will be made at the contract unit price on a linear foot basis for the different sizes bored. Payment shall include all items necessary to complete installation, including casing pipe, casing spacers and enclosure method. Such payment will include furnishing all equipment, labor, materials, excavation, installation, dewatering, backfilling, compaction, and all incidentals necessary to complete the work in an acceptable and workmanlike manner.

PART 2 – PRODUCTS

2.1 CASING PIPE MATERIALS AND INSTALLATION

A. Casing shall be steel pipe conforming to the requirements of ASTM Designation A–139. The minimum casing pipe size and wall thickness shall be as shown herein. For sizes not included, or for special design considerations, approval shall be obtained from the Engineer of Record.

B. For crossing of state roads and rail roads, casing materials and installation shall conform to GADOT or SCDOT Standards, latest edition, or as minimum shall comply with the following table:

Minimum Steel Pipe Casing Dimensions
for D.I.P

Carrier Pipe	Steel Casing Pipe Size		Highway & DOT Bores < 200 L.F.		Highway & DOT Bores > 200 L.F.		Railroad Bores		
I.D. (Nom.)	Pressure System	Gravity System	Minimum Wall Thickness (in)	Weight Class	Minimum Wall Thickness (in)	Weight Class	Minimum Wall Thickness (in)		Weight Class
							Pressure	Gravity	
4	12	16	0.375	STD	0.500	XS	0.500	0.500	XS
6	16	20	0.375	STD	0.500	XS	0.500	0.500	XS
8	18	24	0.375	STD	0.500	XS	0.500	0.500	XS
10	20	24	0.375	STD	0.500	XS	0.500	0.500	XS
12	24	30	0.375	STD	0.500	XS	0.500	0.500	XS
16	30	36	0.375	STD	0.500	XS	0.500	0.532	XS
18	36	48	0.375	STD	0.500	XS	0.532	0.688	XS
24	38	48	0.375	STD	0.500	XS	0.532	0.688	XS
30	48	54	0.375	STD	0.500	XS	0.688	0.781	XS
36	54	60	0.375	STD	0.500	XS	0.781	0.844	XS

Minimum Steel Pipe Casing Dimensions for Fusible PVC

Carrier Pipe	Steel Casing Pipe Size		Highway & DOT Bores < 200 L.F.		Highway & DOT Bores > 200 L.F.		Railroad Bores		
I.D. (Nom.)	Pressure System	Gravity System	Minimum Wall Thickness (in)	Weight Class	Minimum Wall Thickness (in)	Weight Class	Minimum Wall Thickness (in)		Weight Class
							Pressure	Gravity	
4	**8**	16	0.375	STD	0.500	XS	0.500	0.500	XS
6	**10**	20	0.375	STD	0.500	XS	0.500	0.500	XS
8	**12**	24	0.375	STD	0.500	XS	0.500	0.500	XS
10	**16**	24	0.375	STD	0.500	XS	0.500	0.500	XS
12	**16**	30	0.375	STD	0.500	XS	0.500	0.500	XS
16	**20**	36	0.375	STD	0.500	XS	0.500	0.532	XS
18	**24**	48	0.375	STD	0.500	XS	0.532	0.688	XS
24	**30**	48	0.375	STD	0.500	XS	0.532	0.688	XS
30	**36**	54	0.375	STD	0.500	XS	0.688	0.781	XS
36	**42**	60	0.375	STD	0.500	XS	0.781	0.844	XS

2.2 CARRIER PIPES

A. Wastewater and water carrier pipes to be installed within the specified casings shall be equipped with restrained joint connections. Pipe and fittings shall comply with the applicable provisions of these Standards, with minimum Ductile Iron Pipe Class 51.

2.3 CASING INSULATORS

A. Non–corrosive casing insulators shall be used. The casing runner height shall be large enough so that it does not interfere with the pipe–restrained joints. Stainless steel nuts and bolts shall be used. Installation and spacing of casing insulators shall be as required by the manufacturer.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Casing pipes crossing under roadways/railroads shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum 36–inch depth of cover between the top of the casing pipe and the surface of the roadway. For casing pipe crossings under roadways/railroads, the Contractor shall comply with the regulations of said authority in regard to design, specifications, and construction. Casing installations shall be as specified in the State of Georgia or South Carolina Department of Transportation, "Utility Accommodation Guide", and for railroads the American Railway Engineering Association.

B. The boring and jacking operations shall be done simultaneously, with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add–on sections of casing pipe shall be full–ring welded to the preceding length, developing watertight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement, or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, end link seals are to be installed at each open end. Said end link seals shall be suitable for restraining the external earth load, while allowing internal drainage.

C. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The distance between the leading end of the first auger section and the leading end of the casing shall be as necessary to maintain a solid plug of spoil material inside the forward portion of the casing.

D. The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion not in the hole shall be replaced; however, if installed, the encasement pipe shall be abandoned in place, grouted full, and suitably plugged, and an alternate installation made. An alternate installation will also be required if the casing alignment or elevation substantially deviates from the plan locations, and results in the installation being unusable, as determined by the Project Engineer.

E. Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimensions necessary to perform the operation. Said excavations shall be adequately barricaded, sheeted, braced and dewatered as required, in accordance with the applicable portions of Section 02200, "Earthwork" and the above–stated regulations/specifications. Boring and jacking pits will normally be no closer than five (5) feet from the edge of pavement, with the permitting agency having final determination of the required setback distance.

END OF SECTION

INDEX TO

SECTION 02559 – HORIZONTAL DIRECTIONAL DRILLING (HDD)

SECTION 02559

HORIZONTAL DIRECTIONAL DRILLING (HDD)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. The work under this Section is horizontal directional drilling which shall include all work, materials, labor and related equipment necessary for the installation of a Fusible Polyvinylchloride (FPVC) pressure pipe, as shown on the Drawings and as specified herein. Services provided by the Contractor shall be performed in accordance with the current industry practice and these Specifications. The Contractor shall accomplish, but is not limited to, the following tasks:

1. Site preparation necessary for construction.

2. Transportation of all equipment, labor, and material to and from the project location.

3. Provide and assemble FPVC carrier pipe.

4. Erection and dismantling of drilling equipment at the project location.

5. Drilling of a small diameter pilot hole along the alignment.

6. Reaming the pilot hole to a diameter suitable for installation of the casing pipe.

7. Pulling the assembled casing and FPVC carrier pipe through the reamed hole along with a detector wire.

8. Hydrostatic testing of the FPVC pipe.

9. Disinfection and bacteriological testing of FPVC pipe before and after installation.

10. Removal of all equipment and materials upon completion of construction.

11. Cleanup and final restoration of all work areas.

B. Related Work:

1. Work associated with providing and installing FPVC pipe is specified in Section 02610 of these Specifications.

1.2 OBSERVATION:

The Contractor will provide and maintain instrumentation, which will accurately locate the pilot hole, measure drilling fluid flow discharge rate and pressure at all times. The Engineer will have access to these instruments and readings.

1.3 SUBMITTALS:

Shop drawings shall be submitted, as required by the contract documents, for the following:

1. **Installation Plan: At least 30 days prior to mobilizing equipment, Contractor shall submit detailed installation plan to the Engineer. The plan shall include a detailed plan and profile of the proposed bores and shall be plotted at a scale no smaller than 1–inch equals 20 feet vertical and horizontal.**

2. Details describing the proposed method of directional drilling. This shall include, but is not limited to, arrangement of equipment, location and size of drilling and receiving pits, methods of dewatering, method of removing spoils material, size and capacity of equipment, method of installing pipe, method of installing detection wire, pipe and seals, support segments, method of monitoring and controlling line and grade and provisions for protecting existing structures. Directional drilling work shall not proceed until shop drawings have been reviewed and accepted by the Engineer. If, in the opinion of the Engineer, modifications to the methods are necessary during construction, the Engineer may direct the Contractor to discontinue any directional drilling activities until proper drawings are submitted and accepted delineating such modifications.

3. Bentonite/drilling mud or other drilling fluid: product information, material specifications, handling procedures, pit lining material, material safety data sheet, special precautions required, and method of mixing and application.

4. Methods and material for joining ends of directionally drilled pipe segments.

5. A Georgia Registered Professional Engineer other than Thomas & Hutton Engineering Co. shall design the final casing (if applicable) and FPVC pipe wall thickness and shall submit the stamped design calculations to the Owner (assume the area between the casing and the FPVC pipe contains water).

6. Manufacturer's certificate documenting the pipe and fittings has been tested and meet the specifications.

7. Equipment: Contractor will submit specifications on directional drilling equipment used to ensure equipment will be adequate to complete the project. Equipment shall include, but not be limited to, drilling rig, mud system, mud motors (if applicable), down–hole tools, guidance system, and rig safety systems. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives the Contractor intends to use or might use will be submitted.

8. Material: Specifications on materials used shall be submitted to Engineer. Material shall include the pipe, fittings, and any other item to be an installed component of the project.

1.4 QUALITY ASSURANCE:

The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under

specifically covered conditions outlined in this specification or within any associated permit (i.e.: DEP, DOT, Etc.). Adherence to the specifications contained herein, or the Representative's acceptance on any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract. The HDD Contractor shall be responsible for the repair of all damage to private and/or public property (at no expense to the Owner and Engineer. Repair work shall meet all local and state rules and requirements.

1.5 QUALIFICATIONS:

A. The work shall be accomplished by trained workers with a minimum of three years of directional drill experience. The Contractor's on–site superintendent shall have a minimum of five years' experience. The Contractor shall have installed directionally drilled pipe at least as large as 12 inches in diameter and have performed crossings at least 1,000 feet in length.

B. A Georgia Registered Professional Engineer, other than Thomas & Hutton Engineering Co., shall design the final casing size and thickness and FPVC pipe wall thickness and shall submit the stamped design calculations to the Owner (assuming the area between the casing (if applicable) and the FPVC pipe contains water).

C. Experience: Each bidder shall submit a list of experience with their bid for the directional drilling Contractor (or Subcontractor) presenting similar experience on at least five projects involving road crossings of 12 inches or greater in the Contractor's qualification form.

D. Material and equipment shall be the standard product of a manufacturer who has manufactured them for a minimum of two years and who provides published data on the quality and performance of the product.

A subcontractor for any part of the work must have experience on similar work and, if required, furnish the Engineer with a list of projects and Owners or Engineers who are familiar with its competence.

All testing of piping shall be made by Contractor with equipment qualified by Owner, Engineer, or utility company and in the presence of Engineer, Owner and utility company. The Engineer or Project Representative reserves the right to accept or reject testing equipment.

1.6 REFERENCES:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between requirements of this section and those of listed documents, requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean documents in effect at the time of design, bid, or construction, whichever is earliest. If referenced documents have been discontinued by issuing organization, references to those

documents shall mean replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of document before it was discontinued.

REFERENCE	TITLE
ANSI/ASSE A10.16	Safety Requirements for Tunnels, Shafts and Caissons
ANSI/AWWA C200	Steel Water Pipe, 6 inches and larger
ANSI/AWWA C206	Field Welding of Steel Water Pipe
ANSI/AWWA C651	Disinfecting Water Mains
ANSI/AWWA C900	Polyethylene Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 60 inch
ANSI/AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 65 inch, for Waterworks
ASTM A53/A53M	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A139/ A139M	Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over)
ASTM A530/A530M	Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM A865	Specification for Threaded Couplings, Steel, Black, or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D2122	Standard Method of Determining Dimensions of Thermoplastic Pipe and Fittings

REFERENCE	TITLE
ASTM D2321	Standard Practice for Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity–Flow Applications
ASTM D2683	Standard Specification for Socket–Type Polyethylene Fittings for Outside Diameter–Controlled Polyethylene Pipe and Tubing
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials, or Pressure Design Basis for Thermoplastic Pipe Products
ASTM D3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR–PR) Based on Controlled Outside Diameter
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM F412	Standard Terminology Relating to Plastic Piping Systems
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR–PR) Based on Outside Diameter
ASTM F1962	Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings
ASTM F2620	Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

1.7 PRODUCT DELIVERY, STORAGE & HANDLING:

Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. Contractor shall repair any damage caused by the storage. Material shall be examined before installation and neither damaged nor deteriorated material shall be used in the work. Owner and Engineer have the right to reject defective or damaged material. If stored on private property, Contractor shall obtain permission from property owner and shall repair all damage caused by the storage.

1.8 SEQUENCING AND SCHEDULING:

Contractor shall arrange work so sections of mains between valves are tested, sterilized, pavement replaced, and the section placed in service as soon as reasonable after it is placed. Owner reserves the right to dictate sequence of construction.

1.9 ALTERNATIVES:

The intention of these specifications is to define acceptable methods and materials for installing FPVC Pipe by horizontal directional drilling and to produce the best system for Owner. If Contractor suggests alternative material, equipment or procedures will improve results at no additional cost, the Engineer and Owner will examine suggestion, and if it is accepted, it may be used. The basis upon which acceptance of an alternative will be

given is its value to Owner, and not for convenience of Contractor.

1.10 CALCULATIONS:

The Contractor shall submit final design calculations for Owner's and Engineer's review and acceptance within 90 days of receiving notice to proceed. Final design calculations shall support the Contractor's specific proposed means, methods, and products. Contractor's final design calculations shall be prepared and sealed by a Licensed Professional Engineer registered to practice in the State of Georgia and retained by the Contractor. Horizontal directional drilling shall not commence until the Contractor has received written acceptance of all design calculation submittals from Owner's and Engineer's.

At a minimum, design calculations shall demonstrate proposed pipe, equipment, and means and methods comply with requirements of this Section and have been designed based on the design borepath, and installation means and methods, for anticipated installation and handling, hydrostatic, earth, and live loads, installation temperature and site conditions. Design calculations shall address the considerations and guidelines presented in ASTM F1962.

Contractor shall supply copies of all other calculations required to support the required submittals for horizontal directional drilling. At a minimum, the following calculations should be included:

A. Maximum allowable pipe loading limits

B. Pullback load calculation based upon proposed drill path plan and profile.

C. Buoyancy effect calculations.

D. Effects of ballasting plan on pipe pullback forces.

E. Hydrofracture analysis. This should include a maximum annular pressure curve and the respective formation pressure versus depth based on proposed drill plan and profile.

F. Confirmation that design parameters do not exceed predicted installation stresses including factors such as tensile load, buckling and deformation.

1.11 GUARANTEE:

Contractor shall guarantee the quality of materials, equipment, and workmanship for a period of 18 months after final project acceptance. Defects discovered during period shall be repaired by Contractor at no cost to Owner. Contractor shall provide an 18–month guarantee.

1.12 WARRANTY:

Contractor shall supply to Owner a one (1) year unconditional warranty. Warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to project specifications.

Pipe manufacturer shall provide a warranty to Contractor stating the pipe conforms to these specifications and pipe shall be free from defects in materials and workmanship for a period of one (1) years from date of substantial completion of installation. Manufacturer's warranty shall be in a form acceptable to and for the benefit of Owner and shall be submitted by Contractor as a condition of final payment. Manufacturer's warranty to Contractor shall in no way relieve Contractor from its unconditional warranty to Owner.

Contractor shall warrant to Owner the methods used in the contract, where covered by patents or license agreements, are furnished in accordance with such agreements and prices included herein cover all applicable royalties and fees in accordance with such license agreements. Contractor shall defend, indemnify, and hold Owner and Engineer harmless from and against any and all costs, loss, damage or expense arising out of, or in any way connected with, any claim of infringement of patent, trademark, or violation of license agreement.

1.13 EXISTING UTILITIES:

All known utility facilities are shown schematically on plans and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown on plans will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position. Contractor will be held responsible for the cost of repairs to damaged underground facilities – even when such facilities are not shown on plans. Contractor shall contact all utility companies prior to beginning work and request an accurate field location of their respective utility lines. Contractor shall also be responsible for exposing ("potholing") existing utilities as required by utility owner to verify horizontal and vertical position of utility prior to start of bore operations. There will be no separate measurement or payment for any and all labor, equipment, or materials, or incidentals required to locate and expose existing utilities. These costs shall be considered a subsidiary obligation of the contract.

1.14 ENVIRONMENTAL PROTECTION:

Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Contractor shall place hay bales, or acceptable protection, to limit intrusion upon project area. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations including environmental condition stated in local, state and federal permits. Fuel may not be stored in bulk containers (greater than 25 gallons) within 200' of any water–body or wetland.

1.15 CONNECT NEW MAIN TO EXISTING SYSTEM:

Contractor shall furnish necessary pipe and perform all excavation, dewatering, shoring, backfilling, etc., necessary to make the connection of a new main to existing system to be or already installed by others. Contractor shall contact the utility a minimum of 72 hours in advance of construction. Contractor shall be responsible for coordinating construction with the utility.

1.16 DAMAGE TO EXISTING SYSTEM:

Damage to any part of existing system by Contractor or Subcontractors, which is repaired by Utility Owner's forces, or an acceptable Contractor shall be charged to the Contractor on basis of time and material, plus an overhead and administration charge using Utility's multiplier, or plus 30% for overhead and administration for an acceptable Contractor.

1.17 CONSTRUCTION RECORDS:

A. Daily Reports: The Contractor shall maintain daily activity reports throughout all horizontal directional drilling operations, including pipe installation. A sample daily report shall be submitted to Owner and Engineer for acceptance prior to the commencement of drilling operations. Daily reports shall be submitted within 24 hours of completion, and shall include, for each drill rod added or withdrawn, or every 30 feet during drilling, pre–reaming, and pullback:

1. Downhole tools and equipment in use.
2. Description of ground conditions encountered.
3. Description of drilling fluid.
4. Drilling fluid pumping rate.
5. Maximum and minimum downhole fluid pressures.
6. Drilling head location – at least every 10 feet along the bore path.
7. Drill stem torque.
8. Details and perceived reasons for delays greater than one hour other than normal breaks and shift changes.
9. Details of any unusual conditions or events.

B. Production and As–built Drawings: Contractor shall maintain at the construction site a complete set of field drawings for recording as–built conditions. Contractor shall plot as–built conditions on field drawings, including location in plan and elevation of drill string, reaming head, and installed pipe, at the completion of each production shift. Contractor shall compile and submit as–built data in accordance with Bryan County's standards. As–builts shall include all bores successful and failed.

C. Testing and Quality Control and Assurance Documentation: Contractor shall maintain records for all testing and quality control and assurance procedures. Following records shall be provided to Engineer on the day information is acquired by Contractor:

1. Manufacturer's field reports.
2. Test reports.
3. Fusions reports. For each weld, provide an electronic and printed report of the downloaded information.

1.18 EQUIPMENT REQUIREMENTS:

A. General: Directional drilling equipment shall consist of a directional drilling rig with sufficient capacity to perform bore and pullback of pipe, a drilling fluid mixer, delivery and recovery system of sufficient capacity to successfully complete crossing, a drilling fluid recycling system to remove solids from drilling fluid so fluid can be re–used, a magnetic guidance system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain system in good working order for the duration of this project.

B. Drilling System:

1. Drilling Rig: Directional drilling machine shall consist of a hydraulically–powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. Machine shall be anchored to the ground to withstand pulling, pushing and rotating pressure required to complete crossing. The hydraulically–powered system shall be self–contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull–back pressure during pull–back operations. The rig shall be grounded during drilling and pull–back operations. There shall be a system to detect electrical current from the drill string and an audible alarm, which automatically sounds when an electrical current is detected.

2. Drill Head: The drill head shall be steerable by changing its rotation and shall provide necessary cutting surfaces and drilling fluid jets.

3. Mud Motors (if required): Mud motors shall be of adequate power to turn required drilling tools.

4. Drill Pipe: Shall be constructed of high–quality 4130 seamless tubing, Grade D or better, with threaded box and pins. Tool joints should be hardened to 32–36 RC.

C. Guidance System: A Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate location of the drill head during drilling operation. The guidance shall be capable of tracking at all depths up to one hundred feet and in any soil condition, including hard rock. It shall enable driller to guide drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). Guidance system shall be accurate to approximately 2% of vertical depth of the borehole at sensing position at depths up to 100 feet and accurate within 3 feet horizontally.

Bore Tracking and Monitoring:

At all times during the pilot bore, Contractor shall provide and maintain a bore tracking system capable of accurately locating position of drill head

in the x, y, and z axis. Contractor shall record this data at least once per drill pipe length or every twenty–five (25) feet, whichever is most frequent.

1. Downhole and Surface Grid Tracking System: Contractor shall monitor and record x, y, and z coordinates relative to an established surface survey bench mark. The data shall be continuously monitored and recorded at least once per drill pipe–length or at twenty–five (25) feet, whichever is more frequent.

2. Deviations between recorded and design bore path shall be calculated and reported on the daily log. If deviations exceed plus or minus 5 feet (horizontal or vertical deviation) from the design path, such occurrences shall be reported immediately to Owner and Engineer. Contractor shall undertake all necessary measures to correct deviations and return to design line and grade.

3. Drilling Fluid Pressures and Flow Rates: Drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor. Pressures shall be monitored at the pump. These measurements shall be made during pilot bore drilling, reaming, and pullback operations.

Components: Contractor shall supply all components and materials to install, operate, and maintain the guidance system. This shall include, but not be limited to the following:

Probe and Interface
Computer, Printer and Software
DC Power Source, Current Control Box, and Tracking Wire

The Guidance System shall be a proven type such as Sharewell TruTracker MGS, or other proven guidance system, and shall be set up and operated by personnel trained and experienced with this system. Operator shall be aware of any geo–magnetic anomalies and shall consider such influences in the operation of guidance system.

D. Drilling Fluid (Mud) System:

1. Mixing System: A self–contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to "molecularly shear" individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be a minimum of 5000* gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.

2. Drilling Fluids: Drilling fluids shall be composed of clean water and bentonite clay. Water shall be from an authorized source with a pH of 8.5 – 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and bentonite clay shall be mixed thoroughly and be absent of any clumps or

clods. No additional material may be used in drilling fluid without prior acceptance from Engineer.

Bentonite mixture used shall have the minimum viscosities as measured by a March Funnel:

Rock, Clay	60 sec.
Hard Clay	40 sec.
Soft Clay	45 sec.
Sandy Clay	90 sec.
Stable Sand	80 sec.
Loose Sand	110 sec.
Wet Sand	110 sec.

* *Engineer to modify as necessary, dependent upon project size.*

These viscosities may be varied to best fit soil conditions encountered, as accepted by the Engineer.

3. Delivery System: The mud pumping system shall have a minimum capacity of 500* GPM and be capable of delivering drilling fluid at a constant minimum pressure of 1,200 psi. The delivery system shall have filters in–line to prevent solids from being pumped into drill pipe. Connections between the pump and drill pipe shall be relatively leak–free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. A berm, minimum of 12 inches high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and/or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.

   * *Engineer to modify as necessary, dependent upon project size.*

4. Drilling Fluid Viscosity:

   In the event inadvertent returns or returns loss of drilling fluid occurs during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, Contractor shall cease operations and notify Owner and Engineer. Owner and Engineer and Contractor shall discuss additional options and work will then proceed accordingly.

5. Drilling Fluid Recycling System: The drilling fluid recycling system shall separate sand, dirt and other solids from drilling fluid and render drilling fluid reusable. Spoils separated from the drilling fluid will be stockpiled for later use or disposal.

6. Control of Drilling Fluids:

   Contractor shall control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spillage. This includes any spillages or returns at entry and exit locations or at any intermediate point. All inadvertent returns or spills shall be promptly contained and cleaned up. Contractor shall maintain on–site mobile spoil removal equipment during all drilling, pre–reaming, reaming and pullback operations and shall be capable of quickly removing spoils. Contractor shall immediately notify Owner and Engineer of any inadvertent returns or spills and immediately contain and clean up the return or spill.

E. Other Equipment:

1. Pipe Rollers: Pipe rollers shall be of sufficient size to fully support weight of the pipe while being hydro–tested and during pull–back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

2. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of Engineer.

3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in preceding sections shall not be used unless accepted by Engineer prior to commencement of the work. Consideration for acceptance will be made on an individual basis for each specified location. Proposed device or system will be evaluated prior to acceptance or rejection on its potential ability to complete utility placement satisfactorily without undue stoppage and to maintain line and grade within tolerances prescribed by particular conditions of the project.

1.19 MEASUREMENT AND PAYMENT:

A. Horizontal Directional Drilling – Measurement will be made for pipe drilled as shown on the construction drawings at the pay line designations. Measurement for payment will be by linear feet in a horizontal plane. There shall be no separate measurement or payment for additional drilling or pipe lengths needed to start and terminate the borings or for abandoned bores. Extra pipe, if needed for connections, will be paid for at the unit price for Open Cut Installation. Payment will include all labor, materials, drilling equipment, fittings, joint restraints, accessories, excavation of any pits, dewatering, mucking, borrow, water supply necessary for drilling, handling of drilling mud, set–up, preparation of installation plan, preparation of IRCP, drilling operations, pipe jointing (fusion), tracer wire vacuum truck, mud motors, magnetic guidance system, pipe rollers, FPVC/HDPE to PVC connection couplings, clean up, restoration and any other necessary items to complete successful bore with satisfactory tests completed before payment is made.

PART 2 – PRODUCTS

Not used in this section.

PART 3 – EXECUTION

3.1 GENERAL:

A. Contractor shall take precautions to protect the pipe during handling and assembly. Chains, hooks, or cable slings shall not be used to handle the pipe.

B. Care shall be used to protect the pipe from scarring, gouging, or excessive abrasion.

C. If pipe is stacked, stacking height shall not exceed the manufacturer's recommendations. Manufacturer's recommendation shall be followed in unloading, storing and protecting pipe.

D. The directional drilling procedure shall include provisions to guard against electrical shock such as ground mats, ground cables, hot boots and gloves. In addition, the drilling equipment shall include an alarm system capable of detecting electrical current as it nears electrical lines.

E. Contractor shall confirm all necessary permits, easements, and/or rights–of–way have been secured before beginning work.

F. The directional drilling method shall have mechanical fluid assistance. Pneumatic, water jetting, or mechanical jack and bore methods are not acceptable.

G. Contractor may make changes to proposed vertical and horizontal alignment of the installation and location of entry and exit points, provided these changes are submitted in writing to Engineer, and received acceptance of Engineer prior to construction.

H. Horizontal Directional Drilling is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to adjacent creek or land areas involved during construction process. Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy–duty plastic sheeting with sealed joints to prevent migration of drilling fluids and/or ground water.

Contractor shall visit site and must be aware of the close proximity of structures on either side of crossing and provide Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting these structures.

The general work areas on entry and exit sides of crossing shall be enclosed by a berm to contain unplanned spills or discharge.

Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desilter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the

cleaning/separating operation without interference with drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by Contractor to extent necessary for disposal in off–site landfills. Water from dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal is subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

Equipment (graders, shovels, etc.) and materials (such as groundsheets, haybales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps, or spills.

Waste drilling mud and cuttings shall be dewatered, dried, and stockpiled so it can be loaded by a front–end loader, transferred to a truck, and hauled off–site to a suitable legal disposal site. The maximum allowed water content of these solids is 50% of weight.

Due to a limited storage space and environmental sensitivity at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

I. Drill Path Survey: Entire drill path shall be accurately surveyed with entry and exit stakes placed in appropriate locations within the areas indicated on drawings. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo–magnetic variations or anomalies.

J. Environmental Protection: Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel may not be stored in bulk containers within 200 feet of any water–body or wetland.

General work areas on entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

K. Safety: Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.

L. Pipe: Pipe shall be welded/fused together in one length, if space permits, with welds X–rayed prior to being placed in bore hole. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

3.2 JOINING FPVC PIPE AT ENDS OF DIRECTIONAL DRILLED SEGMENTS:

A. All joints at ends of directionally drilled line shall be fusion bonded to the installed pipe section. Mechanical couplings are not permitted. Fusion bonded joints shall provide leak free service at the specified test pressure. See details.

B. Fusion bonding shall be accomplished as specified in Section 02610 – Fusible Polyvinylchloride (FPVC) Pipe.

3.3 DRILLING FLUID:

A. During the drilling, reaming, or pullback operations, Contractor shall make adequate provisions for handling drilling fluids for cutting entry and exit pits. To the greatest extent practical, these fluids must not be discharged into any waterway. When the Contractor's provisions for storage of fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. Contractor shall conduct directional drilling operation in such a manner so drilling fluids are not forced though the sub–bottom into any waterway. After completion of the directional drilling work, entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

B. Pits at entry or exit point areas shall be constructed to completely contain the drill fluid and prevent its escape to any waterway or surrounding drainage system.

C. To the extent practical, Contractor shall maintain a closed loop drilling fluid system.

D. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system, which allows returned fluids to be reused.

E. As part of the installation plan specified herein before, Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escapes.

F. The composition of drilling fluid used shall be submitted to Engineer for acceptance prior to starting work. Fluids shall be inert and of no risk to the environment. No fluid will be accepted or utilized which does not comply with permit requirements and environmental regulations.

G. Drilling fluid shall remain in bore hole to increase stability of surrounding soil and to reduce drag on the pulled pipe.

H. Disposal of drilling fluid and all other spoils shall be the responsibility of Contractor at no additional cost to Owner and shall be conducted in compliance with all relative environmental regulations, right–of–way and work space agreements and permit requirements.

I. Drilling fluid returns at locations other than the entry and exit points shall be minimized. The Contractor shall immediately clean up any drilling fluid which inadvertently surfaces.

J. Excess drilling fluid shall be disposed of at a pre–permitted location found by Contractor. Contractor is responsible for transporting all excess fluids and other spoils to the disposal site and paying any disposal costs.

K. Drilling fluid shall not be discharged into sanitary or storm drain systems, ditches or waterways, nor allowed to enter any wetland area or creek.

3.4 SUBSURFACE CONDITIONS:

A. Anticipated subsurface conditions at the crossing are described in soil borings attached. Borings are being provided for information only and the Owner and Engineer assume no liability for them or their interpretation.

B. Contractor must use its own experience and judgment in interpreting this data to prepare a proposal and/or perform the work.

3.5 EXISTING UTILITIES:

A. The Contractor must exercise caution in regard to existing utilities, including:

1. Verify location of all underground utilities.
2. Exposing any utilities which are to be crossed.
3. Modify drilling practices or down hole assemblies to prevent damage to adjacent underground and above ground utilities and structures.

B. The Contractor shall provide sheeting as necessary to protect adjacent structures.

3.6 DRILLING WATER AND RESTORATION:

A. Potable water is available at a cost to the Contractor in accordance with current utility company rate structure. Cost of transporting water to construction site is an expense of the Contractor.

B. Upon completion of pipe installation, the drilling pit and receiving pit shall be backfilled to original grade.

C. Restoration of any disturbed area shall be completed in accordance with these specifications.

3.7 SUB–AQUEOUS DIRECTIONAL DRILLING:

A. The pipe shall be directionally drilled, as shown on plans. Equipment used to pull the pipe shall be of sufficient size for this project.

Pilot hole shall be drilled along path shown on Plan and Profile drawings to the following tolerances:

1. Vertical Location – Plus or minus 1 foot

2. Horizontal Location – Plus or minus 3 feet.

B. At the completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates referenced to drilled entry point, which accurately describes location of pilot hole. This information shall be plotted on a 1" = 50' scale plan with a 1" = 50' horizontal and 1" = 2' vertical profile scales, compatible to the Drawings. This "as–built" plan and profile shall be updated as the pilot bore is advanced. Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. Contractor shall grant Engineer access to all data and readout pertaining to position of the bore head and fluid pressures and flows. When requested, Contractor shall provide explanations of the position monitoring and steering equipment. Contractor shall employ experienced personnel to operate directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to position or inclination of pilot bores shall be withheld from the Engineer.

Each exit point shall be located as shown with an over–length tolerance of 5 feet and an alignment tolerance of 3 feet left/right with due consideration of the position of other exit points. Alignment of each pilot bore must be acceptable to the Engineer before pipe can be pulled. If pilot bore fails to conform to above tolerances, Engineer has the option to require a new pilot boring be made.

C. A suitable cutting head shall be used to bore the face of excavation. Overcut of the excavation shall be minimized.

D. Reaming operations shall be conducted to enlarge pilot hole after acceptance of the pilot bore. Number and size of such reaming operations shall be conducted at discretion of the Contractor.

E. Joining Pipe:

1. FPVC carrier or casing pipe shall be joined by thermal butt fusion as specified in Section 02610.

F. Pipe Layout and Pullback:

1. Entire pipe length shall be laid out, welded and tested in one complete unit before being pulled back through the drill hole. Line pullback shall be continuous. Pipe shall be continuously lubricated during pullback and shall be laid on rollers or other suitable apparatus to facilitate pulling the pipe.

2. If pipe or its protective coating is damaged, it shall be replaced at no cost to the Owner.

3. **If pipe is placed at an incorrect location or cannot be advanced due to an unknown obstruction, the pipe shall be abandoned in place by filling with flowable fill. The cost of abandoning pipe shall be at Contractor's expense.**

4. Pulling Loads: The maximum allowable pull exerted on FPVC pipelines shall be measured continuously and limited to maximum allowed by pipe manufacturer, so pipe or joints are not overstressed.

5. Torsion and Stresses: A swivel shall be used to connect pipeline to drill pipe to prevent torsional stresses from occurring in the pipe.

6. Pipeline Support: The pipelines shall be adequately supported during installation to prevent overstressing or buckling.

7. Contractor shall at all times handle FPVC pipe in a manner which does not overstress the pipe. Vertical and horizontal curves shall be limited so stresses do not exceed 50% of yield stress for flexural bending of the FPVC pipe. If pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced at Contractor's expense. Contractor shall take appropriate steps during pullback to ensure the FPVC pipe will be installed without damage.

A. Contractor shall bleed all air out of the line.

3.8 OMITTED

3.9 SWABBING:

The purpose of swabbing a new pipeline is to conserve water while thoroughly cleaning pipeline of all foreign material, sand, gravel, construction debris and other items not found in a properly cleaned system. Prior to pressure testing of a new pipeline, swabbing shall be utilized as specified on the construction plans for each project.

All new water, wastewater, force, and reclaim mains greater than 12" I.D. (with exceptions to smaller pipe lines as deemed necessary by Engineer) shall be hydraulically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from main.

If swabbing access and egress points are not provided in design drawings, it will be Contractor's responsibility to provide temporary access and egress points for the cleaning, as required.

Passage of cleaning poly swabs through system shall be constantly monitored, controlled and all poly swabs entered into system shall be individually marked and identified so the exiting of poly swabs from the system can be confirmed.

Cleaning of the system shall be completed in conjunction with, and prior to, initial filling of system for its hydrostatic test.

CONTRACTOR shall insert flexible polyurethane foam swabs (two pounds per cubic foot density) complete with rear polyurethane drive seal, into the first section of pipe. Swabs shall remain there until the pipeline construction is completed. Engineer shall be present for the swabbing process including swab insertion and retrieval.

The line to be cleaned shall only be connected to existing distribution system at a single connection point.

Locate and open all new in–line valves beyond point of connection on pipeline to be cleaned during the swabbing operation.

At receiver or exit point for the poly swab, CONTRACTOR is responsible for creating a safe

environment for collection of debris, water and swab. Considerations shall be made for protecting surrounding personnel and property and safe retrieval of the swab.

Cleaning and flushing shall be accomplished by propelling the swab down pipeline to exit point with potable water. Flushing shall continue until the water is completely clear and swab(s) is/are retrieved.

After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with Section 3.12.

3.10 ON–SITE OBSERVATIONS OF WORK:

A. Engineer or Project Representative shall have the right to require any portion of work be completed in their presence. Any work covered up after such instruction shall be exposed by the Contractor for observation. However, if Contractor notifies Engineer or Project Representative such work is scheduled, and they fail to appear within 72 hours, Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. All improper work shall be reconstructed, and all materials which do not conform to requirements of specifications, shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

B. Contractor shall give Engineer or Project Representative a minimum of 72 hours' notice for all required observations or tests.

C. It will also be required of Contractor to keep accurate, legible records of the location of all lines, valves, fittings, and appurtenances. These records shall be prepared in accordance with record drawing requirements of these Specifications. Final payment to the Contractor will be withheld until all such information is received and accepted. A disclaimer by the surveyor preparing As–Built drawings concerning location of underground lines will not be acceptable.

3.11 SAFETY:

A. Provide all necessary bracing, sheeting, 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 existing structures or roadbeds.

B. Observe all applicable regulations of the authorities having jurisdiction over this site.

C. Perform all activities in accordance with Occupational Safety and Health Act of 1970 (PL–596), as amended through January 1, 2004, applicable regulations of Federal Government, OSHA 29 CFR 1926 and applicable criteria of ANSI A10.16, "Safety Requirements for the Construction of Tunnel Shafts and Caissons".

3.12 TESTING:

A. Pressure and Leakage Tests:

1. Contractor shall test pipelines installed under this Contract in accordance with these specifications prior to acceptance of pipeline by Engineer and Owner. All field tests shall be made in the presence of Engineer and Owner. Except as otherwise directed, all pipelines shall be tested. Unless accepted otherwise by Engineer, all fusible or butt weld joints shall be tested, including MJ adapter fittings associated with the new construction. All piping to operate under liquid pressure shall be tested in sections of appropriate length. If possible, PVC and D.I.P. test sections shall be left exposed during the pressure test for visual leakage observation. For these tests, Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required. If Contractor chooses to pressure test against an existing water main/valve, the new water main must be disinfected prior to connection to existing line. Engineer will not be responsible for failure of the pressure test due to existing valve leaking. Engineer may elect to specify suitable pressure gauges for these tests. If not, Contractor will furnish suitable pressure gauges, calibrated by an accepted testing laboratory, which increments no greater than 2 psi. Gauges used shall be of such size so pressures tested will not register less than 10% or more than 90% of the gauge capacity. All valved sections shall be hydrostatic tested to insure sealing (leak allowance) of all line valves. All HDD over 100 LF shall be air pressure tested (above ground) @ 5 PSI for a period of 15 minutes, prior to insertion. There shall be no pressure loss allowed.

2. Unless it has already been completed, section of pipe to be tested shall be filled with potable water and air shall be expelled from the pipe. Reclaimed water may be utilized for filling new reclaimed water or wastewater force main installations. If blow offs or other outlets are not available at high points for releasing air, the Contractor shall provide 1 inch (minimum taps and blow–off valves at the 12:00 position), as necessary. The cost of constructing blow–off valves and plugging them, after a successful pressure test, shall be included in unit price bid amount for pipe.

3. Hydrostatic testing shall consist of a 150 psig test pressure, based on elevation of the highest point of line or section under tests. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to Engineer. The pump, pipe connection and all necessary apparatus shall be furnished by Contractor and shall be subject to acceptance by Engineer.

4. Maximum duration for pressure test, including initial and final phase of the test, shall not exceed eight (8) hours. If test is not completed due to leakage, equipment failure, etc., depressurize the test section, and then allow it to "relax" for at least eight (8) hours before bringing test section up to test pressure again.

5. *Initial Phase of Pressure Testing*: First, all air must be removed from the test section. The pressure test shall be completed after line is backfilled. If possible, all flanged or mechanical joint valves and fittings shall be left exposed to check for visible leaks. If possible all PVC and D.I.P. test sections shall be left exposed to check for visible leaks. Initially, the pressure within test section should be raised to approximately 160 psi and then allowed to be idle (no additional make–up water/pressure to be injected), for

approximately 3 hours. During this 3–hour period, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional make–up water/pressure shall be applied to test section during this 3–hour stabilization period unless the line pressure drops below 140 psi. In this case, make–up water/pressure shall only be applied to the test section to maintain a minimum of 140 psi (during the 3–hour stabilization period).

6. *Final Phase of Pressure Testing*: Final phase of the pressure test shall involve applying make–up water/pressure to achieve an "initial test pressure" of 150 psi (minimum)/155 psi (maximum). The test section is then allowed to be idle (no make–up water/pressure is added) for a period of 2 hours. After this 2–hour period, make–up water/pressure is applied and measured to re–establish the "initial test pressure". Quantity of water utilized to re–pump the line shall be measured and compared to allowable quantities as determined by table below. If actual make–up water quantity is equal or less than allowable amount, the pressure test passes. If actual make–up water quantities are greater than allowable amount, the pressure test fails (see table below).

Allowable Make Up Amount

Nominal Pipe Size (in)	Make–up Water Allowance (GAL/LF of pipe), 2–hour test
6	0.003
8	0.005
10	0.0065
12	0.0115
14	0.014
16	0.0165
18	0.0215
20	0.0275
22	0.035
24	0.044
26	0.05
28	0.0555
30	0.0635
32	0.0715
34	0.081
36	0.09
42	0.115
48	0.135
54	0.157

7. In the event a section fails to pass tests, Contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and replace defective pipe, valve, fitting or joint. Visible leaks shall

be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary until test requirements are complied with. All testing shall be performed at the Contractor's expense.

8. If, in the judgment of Engineer, it is impracticable to follow foregoing procedures exactly for any reason, modifications in procedure shall be made with acceptance by Engineer; but, in any event, Contractor shall be responsible for ultimate tightness of piping within above requirement. Re–disinfection shall be required if the line is de–pressurized for repairs prior to tying in.

B. Locate Wire:

Two locate wires shall be provided on all installations. For HDD projects, locate wire shall be 12 AWG high strength copper–clad carbon steel with 45 mils (min) insulation. The external color shall be either blue for water, green for wastewater, purple for reuse, or black for raw water. Locate wire shall be brought to grade within a valve box or locate station box at all "entry point locations" and "exit point locations. " For HDD projects, there is no maximum length or interval between locate wire stations. The testing and report requirements within these specifications shall be required except as modified herein. If both locate wires break or are not continuous (from end to end), Contractor shall, at Contractor's expense, provide soft–digs for portions of the main with 12–feet or less cover (every 25 LF along main) to confirm as–built data. This soft–dig data shall be recorded on the as–built record drawings as specified here–in.

3.13 SITE RESTORATION:

Following drilling operations, Contractor will demobilize equipment and restore the worksite to its original condition. All excavations will be backfilled and compacted to 95 percent of original density. Landscaping will be the responsibility of Contractor.

3.14 RECORDKEEPING AND AS–BUILTS:

Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to Engineer at completion of project. As–built drawings shall be completed by a professional surveyor and certified as to accuracy by Contractor.

END OF SECTION

INDEX TO

SECTION 02731 – WASTEWATER COLLECTION SYSTEM

Paragraph	Title	Page

PART 3 – EXECUTION

SECTION 02731

WASTEWATER COLLECTION SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Sewer Pipes.

B. Manholes.

C. Connect to existing system.

D. All necessary appurtenances to collect the wastewater and deliver it to the existing system.

E. Force Main

1.2 RELATED SECTIONS

A. Section 02204 – Earthwork.

B. Section 02667 – Water Distribution System.

1.3 OPTIONS

A. The specifications describe several materials. Where manufacturers and models of equipment are named in the specifications, it is intended these are to describe quality and function required. Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by the Engineer and Owner as equivalent to those specified.

1.4 REFERENCES (Latest Revision)

A. ASTM A 139 – Electric–Fusion (Arc) Welded Steel Pipe (NPS 4 and Over).

B. ASTM A 377 – Index of Specifications for Ductile Iron Pressure Pipe.

C. ASTM A 615/A 615 M – Deformed and Plain Carbon – Steel Bars for Concrete Reinforcement.

D. ASTM A 746 – Ductile Iron Gravity Sewer Pipe.

E. ASTM C 39/C 39M – Compressive Strength of Cylindrical Concrete Specimens.

F. ASTM C 443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

G. ASTM C 478 – Circular Precast Reinforced Concrete Manhole Sections.

H. ASTM C 890 – Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

I. ASTM C 891 – Installation of Underground Precast Concrete Utility Structures.

J. ASTM C 913 – Precast Concrete Water and Wastewater Structures.

K. ASTM D 714 – Evaluating Degree of Blistering of Paints.

L. ASTM D–1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

M. ASTM D 2241 – Poly (Vinyl Chloride) (PVC) Pressure–Rated Pipe (SDR Series).

N. ASTM D 2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity–Flow Applications.

O. ASTM D 2774 – Underground Installation of Thermoplastic Pressure Piping.

P. ASTM D 2794 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

Q. ASTM D 3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

R. ASTM D 3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

S. ASTM D 3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

T. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

U. ASTM D–6938 – In–Place Density and Water Content of Soil and Soil–Aggregate by Nuclear Methods (Shallow Depth).

V. ASTM E 96 – Water Vapor Transmission of Materials.

W. ASTM E 329 – Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

X. ASTM F 477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

Y. ASTM F 1417 – Installation Acceptance of Plastic Non–Pressure Sewer Lines Using Low–Pressure Air.

Z. ASTM G 154 – Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for UV Exposure of Nonmetallic Materials.

AA. AWWA C 110 – Ductile-Iron and Gray-Iron Fittings

BB. AWWA C 111 – Rubber–Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

CC. AWWA C115 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

DD. AWWA C 150 – Thickness Design of Ductile Iron Pipe.

EE. AWWA C 151 – Ductile Iron Pipe, Centrifugally Cast, for Water.
FF. AWWA C 153 – Ductile-Iron Compact Fittings

GG. AWWA C–500 – Metal–Seated Gate Valves for Water Supply Service.

HH. AWWA C–509 – Resilient–Seated Gate Valves for Water Supply Service.

II. AWWA C 600 – Installation of Ductile Iron Water Mains and their appurtenances.

JJ. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches through 60 inches, for Water Transmission and Distribution.

KK. ACI 318 – Building Code Requirements for Structural Concrete.

1.5 MEASUREMENT AND PAYMENT

A. Measurement – Items listed in the proposal shall be considered as sufficient to complete work in accordance with plans and specifications. Any portion of work not listed in the bid form shall be deemed to be a part of item it is associated with and shall be included in costs of unit shown on bid form. Payment for unit shown on the bid form shall be considered satisfactory to cover cost of all labor, material, equipment, and performance of all operations necessary to complete work in place. The unit of measurement shall be unit shown on bid form. Payment shall be based upon the actual quantity multiplied by unit prices. Where work is to be performed at a lump sum price, the lump sum shall include all operations and elements necessary to complete work.

B. Payment

1. Sewer Metering Station – Payment will be made at the contract lump sum price for "Meter Station – Complete" and as shown on the drawings. The payment will include cost of dewatering, excavation, precast structure, meter, fittings, restraints, and any necessary adapters to connect to pipe. Payment will also include removal and disposal of unsuitable material, installation of geotextile, bedding, backfilling with select suitable material, compaction, testing, material, labor, accessories, and incidentals required to make the installation. Satisfactory tests must be completed before payment is made.

2. Force Mains – Shall be paid for at the contract unit price per linear foot installed for the various pipe sizes and pipe materials. Payment will include the pipe, polyethylene tube encasement, excavation, removal and disposal of unsuitable material, installation, geotextile, bedding, electronic ball markers, backfilling with select unsuitable material, compaction, testing, tracing wire, and warning tape. Satisfactory tests must be completed before payment it made.

3. Trench Wall Supports – No separate payment will be made for bracing and sheeting.

4. D.I.R.J. Fittings – Payment for ductile iron restrained joint fittings for ductile iron and plastic pipe will be paid for on the basis of the unit price per each ductile iron fitting installed. Fittings shall be AWWA Specification C-153 for

mechanical joint compact fittings. Payment includes furnishing and installing the fittings, gaskets, necessary adapters to connect to valves, joint restraints, and all other appurtenances necessary to install fittings on the force main.

5. Stone Bedding – No separate measurement or payment will be made for stone bedding. The cost of stone bedding shall be included in the overall cost of the pipe. The force main shall be bedded as shown in the details. The Contractor shall notify the Engineer in writing if additional stone is required beyond that shown in the detail, including the locations requiring additional bedding and estimated quantities of materials. No payment for additional bedding shall be made without approval from Owner and Engineer.

6. Sand Backfill– No separate measurement or payment will be made for sand backfill. The cost for sand backfills and geotextile shall be included in the overall cost of the pipe. The force man shall be backfilled as shown in the details. The Contractor shall notify the Engineer in writing if additional backfill is required beyond that shown in the details and estimated quantities of material. No payment for additional backfill shall be made without approval from Owner and Engineer.

7. Service Connection – Payment will be made at the contract unit price. Payment shall include the fitting, plug, and marking stake.

8. Metal Detector Tape – No separate payment will be made for tape. Cost of furnishing and placing metal detector tape shall be included in the contract unit price for installing force main pipe.

Note: Wire on all pipes shall be required in Georgia after January 1, 2001.

9. Tracer Wire – No separate payment will be made for wire. The cost of furnishing and placing tracer wire shall be included in the contract unit price for installing force main pipe.

10. Combination Air/Vacuum Release Valve in Pedestal Assembly- Payment will be made at the contract unit price and will include furnishing and installing the air/vacuum release valve assembly, pedestal assembly, plug valve, piping, tee, tapping saddle/ sleeve, backfilling, compacting, and clean–up.

11. Plug Valve in Manhole – Payment will be made at the contract unit price for each size. Payment will include furnishing and installing the valve, manhole structure, frames, covers, pipe supports, backfilling, compacting, grassing, clean up and all other incidentals to complete the job.

12. Remove and Replace Asphalt Pavement – Payment will be made at the contract unit price per square yard. Payment will include all labor, materials, equipment, and incidentals necessary to remove existing base and asphalt paving, disposal of removed materials in an appropriate disposal site, backfilling, grading, compaction of base, installation of binder/surface courses and tack coat in accordance with plans, details,

and specification. Payment shall also include testing, traffic marking/striping, and all incidentals to complete the roadway paving.

13. Remove and Replace Dirt Road – Payment will be made at the contract unit price per square yard. Payment will include all labor, materials, equipment, and incidentals necessary to remove existing earthen drive in order to install proposed force main and restore the driveway to pre-construction conditions or better as per detail shown in the construction plans.

14. Connect Force Main to Existing Manhole – Payment will be made at the contract unit price for each pipe size connected. For precast structures payment shall include cost of dewatering, excavation, coring, furnishing and installing flexible sleeve, installing and connecting pipe to sleeve, backfilling, compaction, clean–up, and all work necessary to complete the connection. For brick structures, payment shall include cost of dewatering, excavation, cutting a hole, installing and grouting in pipe, backfilling, compaction, cleanup, and all work necessary to complete the connection.

15. Connect Force Main to Existing Force Main – Payment will be made at the contract unit price for each pipe size connected to various existing pipe sizes. Payment shall include cost of dewatering, excavation, connecting new force main to existing force main, backfilling, compaction, clean-up, and all work necessary to complete the connection.

16. Horizontal Directional Drilling – Measurement will be made for pipe drilled as shown on the construction drawings at the pay line designations. Measurement for payment will be by linear feet in a horizontal plane. There shall be no separate measurement or payment for additional drilling or pipe lengths needed to start and terminate the borings or for abandoned bores. Extra pipe, if needed for connections, will be paid for at the unit price for Open Cut Installation. Payment will include all labor, materials, drilling equipment, fittings, joint restraints, accessories, excavation of any pits, dewatering, mucking, borrow, water supply necessary for drilling, handling of drilling mud, set–up, preparation of installation plan, preparation of IRCP, drilling operations, pipe jointing (fusion), tracer wire vacuum truck, mud motors, magnetic guidance system, pipe rollers, FPVC/HDPE to PVC connection couplings, clean up, restoration and any other necessary items to complete successful bore with satisfactory tests completed before payment is made.

1.6 QUALITY ASSURANCE

A. Contractor will furnish the Engineer and Owner a description of <u>all</u> material before ordering. Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.

B. Where ductile iron pipe is indicated on the plans, or required by Engineer, it shall be used.

C. Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of two years and provides published data on their quality and performance.

D. A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with its competence.

E. If Contractor wishes to furnish devices, equipment, structures, and systems not designed by Engineer, these items shall be designed by either a Professional Engineer registered in the project state or by someone Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.

F. Testing shall be by a testing laboratory which operates in accordance to ASTM D 3740 or E 329 and shall be acceptable to Engineer prior to engagement. Mill certificates of tests on materials made by manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests, spot checked by an outside laboratory, and furnishes satisfactory certificates with name of entity making test.

G. Infiltration, line and grade of sewer, pump performance, and hydrostatic tests on force mains shall be made by Contractor with equipment qualified by Engineer and in the presence of Engineer. Engineer or Project Representative reserves the right to accept or reject testing equipment.

1.7 PRODUCT DELIVERY, STORAGE & HANDLING

A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. If stored on private property, Contractor shall obtain permission from property owner and shall repair any damage caused by the storage. Material shall be examined before installation. Neither damaged nor deteriorated material shall be used in the work.

1.8 JOB CONDITIONS

A. Installation of the wastewater collection system must be coordinated with other work on site. Generally, wastewater pipes will be installed first and shall be backfilled and protected so subsequent excavating and backfilling of other utilities does not disturb them. Contractor shall replace or repair any damaged pipe or structure at no additional expense to the Owner.

1.9 SEQUENCING AND SCHEDULING

A. Contractor shall arrange the work so sections of sewers between manholes are backfilled and tested, lateral sewers connected, pavement replaced, and placed in service as soon as reasonable after installation.

1.10 ALTERNATIVES

A. The intention of these specifications is to produce the best system for the Owner. If the Contractor suggests alternate material, equipment or procedures will improve results at no additional cost, Engineer and Owner will examine suggestion, and if

accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to Owner, and not for Contractor's convenience.

1.11 GUARANTEE

A. Contractor shall guarantee quality of materials, equipment, and workmanship for 12 months after acceptance of the completed Project. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

1.12 EXISTING UTILITIES

A. All known utility facilities are shown schematically on the construction drawings, and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position. Contractor will be held responsible for cost of repairs to damaged underground facilities, even when such facilities are not shown on the drawings.

B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 1–800–282–7411 (GA) or 811.

1.13 TESTING

A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).

B. In place density tests in accordance with ASTM D 2922.

C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.

D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48–hours' notice prior to taking any tests.

E. Testing shall be Contractor's responsibility and shall be performed at the Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

PART 2 – PRODUCTS

Materials used in the work shall be those named in Bid Form. In multiple type bids, selection of material types will be at the opinion of Owner. Materials and products used shall conform to one of the following:

2.1 SEWER PIPE

A. PVC Pipe (4"–15" Gravity Sewer) – Shall be polyvinyl chloride plastic (PVC) and shall meet all requirements of ASTM D 3034 SDR 26, except for depths less than 3 feet where ductile iron pipe must be installed. All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber gasket. Pipe sizes and dimensions shall be as shown below. All pipe shall be green or white in color with factory marked homing lines. Fittings shall meet the same specification requirements as pipe.

Nom. Size	Outside Diameter		Min. Wall Thickness SDR–26
	Average	Tolerance	
4	4.215	± 0.009	.162
6	6.275	± 0.011	.241
8	8.400	± 0.012	.323
10	10.500	± 0.015	.404
12	12.500	± 0.018	.481

Tests on PVC Pipe – Pipe shall be designed to pass all tests at 73 ° F. (± 3° F.).

B. PVC Pipe (16" – 64" Gravity Sewer) – Shall be polyvinyl chloride plastic (PVC) and shall meet all requirements of AWWA C900 with a minimum DR of 18, except for depths less than 3 feet where ductile iron pipe must be installed. All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber gasket. Pipe sizes and dimensions shall conform to AWWA C900. All pipe shall be green or white in color with factory marked homing lines. Fittings shall meet the same specification requirements as pipe.

Tests on PVC Pipe – Pipe shall be designed to pass all tests at 73 ° F. (± 3° F.).

B. Ductile Iron – Shall conform to AWWA C 150, AWWA C 151 and ASTM A 746. All pipe shall be Pressure Class 350 unless otherwise noted. All ductile iron pipes and fittings shall be bituminous coated on the outside and lined with Protecto 401 Ceramic Epoxy or equivalent on inside.

1. Coating on the outside shall be an asphaltic coating approximately 1 mil thick. Finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to sun, and shall be strongly adherent to the iron. All ductile iron fittings shall be bituminous coated on the outside and lined with Protecto 401 Ceramic Epoxy or equivalent on inside.

   Coating on the outside shall be an asphaltic coating approximately 1 mil thick. Finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to sun, and shall be strongly adherent to the iron.

   Protecto 401 Ceramic Epoxy or equivalent interior lining shall conform to ASTM E 96, ASTM D 714, ASTM D 2794, and ASTM G 53. Interior of the fitting shall receive 40 mils nominal dry film thickness of epoxy. Lining application, inspection, certification, handling, and surface preparation of area to receive the protective coating shall be in accordance with manufacturer's specifications and requirements.

2. Protecto 401 Ceramic Epoxy or equivalent interior lining shall conform to ASTM E 96, ASTM D 714, ASTM D 2794, and ASTM G 53. Interior of the pipe shall receive 40 mils nominal dry film thickness of epoxy. Lining application, inspection, certification, handling, and surface preparation of area to receive the protective coating shall be in accordance with manufacturer's specifications and requirements.

2.2 JOINTS – GRAVITY SYSTEM

A. Joints for Ductile Iron Pipe – Shall be slip–on rubber equivalent to "Fastite," "All–tite," or "Tyton."

B. Joints for PVC Pipe – Shall be integral wall bell and spigot with a rubber ring gasket. Joints shall conform to ASTM D 3212 and gaskets to ASTM F 477.

2.3 FORCE MAIN

A. P.V.C. – All pipe shall be green in color with factory marked homing lines. Pipe with diameter less than 4 inches shall conform to all requirements of ASTM D 2241, SDR 26, Class 160. Pipe 4 inches through 18 inches shall conform to all requirements of AWWA C900 with CI outside diameter, minimum DR of 18, Pressure Class of 235 p.s.i. Joints shall be in accordance with ASTM D 3139.

B. Ductile Iron pipe shall be in accordance with Paragraph 2.1–B and conform to ASTM A 377. Push–on–Joints shall be slip–on rubber equivalent to "Fastite," "All–tite," or "Tyton." Flanged joints shall conform to AWWA C 115. Gaskets shall conform to AWWA C 111.

C. Thrust blocking shall be sized as detailed on the construction drawings of 3,000 p.s.i. concrete. Blocking shall be provided at all bends deflecting 11–1/4° degrees or more and bear directly against the undisturbed trench wall.

D. Restrained Joints – Restrained joints for pipe, valves and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push–on type joints equivalent to "Lok–Ring," "TR Flex," or "Super Lock" and shall have a minimum rated working pressure equal to the item restrained with a minimum safety factor of 2:1. Joints shall be in accordance with the applicable portions of AWWA C–111. Manufacturer of joints shall furnish certification, witnessed by an independent laboratory, stating joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.

E. Fittings:

1. Fittings for Ductile Iron or Plastic Pipe – Shall be ductile iron, manufactured in accordance with AWWA C–153. They shall be cement lined in accordance with AWWA C–104. Fittings shall be designed to accommodate the type of pipe used.

2. Fittings for Flanged Pipe – Shall be manufactured in accordance with AWWA C–110, Class 125 flanges.

3. Fittings for Plastic Pipe – Less than 4 inches shall be PVC with ring tite rubber joints conforming to ASTM D–3139.

2.4 CASING

A. Casing pipe shall be steel conforming to ASTM A 139, yield point of 35,000 p.s.i., of the diameter shown on drawings at each crossing. The minimum wall thickness shall be 0.25 inches.

2.5 CASING SPACERS

A. Casing spacers shall be bolt on style with a shell made in two sections of a minimum 14 gauge T–304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner. All nuts and bolts shall be T–304 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. The combined height of supports and runners shall keep carrier pipe a minimum of 0.75–inches from casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or accepted equivalent.

2.6 MANHOLES

A. Masonry – Shall be new whole brick of good quality laid in masonry mortar or cement mortar made of one part Portland cement and two parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to locations and details shown on the plans.

B. Precast Concrete – Shall be reinforced concrete constructed in accordance with ASTM C 478 and details shown on the plans "Precast Concrete Manholes." Coarse aggregate shall be granite stone. The joints shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O–Ring or equivalent to Type A or B "Tylox" conforming to ASTM C 443. Mastic shall be equivalent to "Ram–nek" with primer. Primer shall be applied to all contact surfaces of manhole joint at the factory in accordance with manufacturer's instructions.

C. Frames and Covers – Shall be cast iron equivalent to the following:

Neenah Foundry Co. R–1668 Type "C" Lid

D. Manhole Steps – Shall be equivalent to M.A. Industries, Type PS–1 or PS–2–PF. Steps shall be installed at the manhole factory and in accordance with recommendations of step manufacturer. Manholes will <u>not</u> be acceptable if steps are not installed accordingly.

E. Pipe Connections – Shall have flexible watertight joints at sewer main point of entry into the manhole. The joint shall be an EPDM or polyisoprene sleeve equivalent to "Kor–N–Seal."

F. Coatings – New manholes shall have all interior surfaces coated with a factory applied acrylic polymer–base coating and sealant. The coating shall be ConSeal CS–55 manufactured by Concrete Sealants, New Carlisle, Ohio or an accepted equivalent. The coating shall be applied in three coats to achieve a total dry film thickness of at least 3.5 mils in accordance with manufacturer's recommendations.

Surfaces shall be cleaned of all dust, form oils, curing compounds and other foreign matter prior to the coating application.

New or existing manholes requiring a force main tie–in and the next downstream manhole shall be coated with 125 wet film mils of Raven 405 ultra-high build epoxy or an accepted equivalent. The interior surfaces shall be cleaned and prepared according to manufacturer's recommendations.

2.7 TEES AND WYES

A. Gravity sewer tees and wyes shall be four or six inches and same diameter as the run of pipe. They shall be of same material as the sewer main.

B. Wyes for cleanouts shall be of same material as the lateral pipe.

2.8 LATERALS AND CLEANOUTS

A. Shall be Ductile Iron Pipe conforming to paragraph 2.1–B, with push–on joints or Polyvinyl Chloride pipe with bells and rubber gaskets for jointing, conforming, to Paragraph 2.1–A, PVC Pipe.

B. Cleanout Access Box shall be equivalent to U.S. Foundry USF 7623 in pavement or Genova Products 4–inch Schedule 40 PVC–DWV Cleanout Fitting with threaded plug out of pavement.

2.9 STONE BEDDING

A. Shall be graded crushed granite with the following gradation:

Square Opening Size	Percent Passing
1 inch	100%
3/4 inch	90 to 100%
3/8 inch	0 to 65%
No. 4	0 to 25%

2.10 SAND BEDDING AND BACKFILL

A. Shall be clean sand free from clay and organic material. Not more than 10% shall pass the No. 100 sieve.

2.11 BORROW

A. Where it is determined sufficient suitable material is not available from the site to satisfactorily backfill pipe to at least two feet above top of pipe, Contractor shall furnish suitable sandy borrow material to accomplish requirements. Material shall not have more than 60% passing the No. 100 sieve, nor more than 20% passing a No. 200 sieve.

2.12 AIR RELEASE VALVE

A. Shall be designed for sewage service. The valve shall be constructed of a cast iron body, stainless steel or bronze trim, and stainless steel float. The inlet shall be 2 inches, 5/16 inch orifice, and a venting capacity of 35 c.f.f.a.m. The working pressure shall be 0 to 50 p.s.i. It shall conform to detail shown on the drawings.

B. Pedestal assembly shall be Channell Model Signature Series Pedestal Housing P/N SPH 1420, Green Color, with anti-insect vents. Included with the assembly shall be interior s.s. post with s.s. hardware and s.s. locking hasp with brass lock.

2.13 METAL DETECTOR TAPE

A. Will be installed above all pipe. Tape shall consist of 0.35 mils thick solid foil core encased in a protective plastic jacket resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong enough so layers cannot be separated by hand. Total composite thickness shall be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum 3 inch width and a tensile strength of 35 lbs. per inch.

A continuous warning message indicating "sewer line" repeated every 16 inches to 36 inches shall be imprinted on the tape surface. Tape shall contain an opaque color concentrate designating color code appropriate to the line being buried (Sewer Line – Green).

Note: Wire on all pipes shall be required in Georgia after January 1, 2001.

2.14 TRACER WIRE

A. Will be used over all force main lines. Tracer wire shall be #12 AWG High–Strength Copper Clad Steel (HS–CCS) Conductor, insulated with 30 mil High Density Polyethylene (HDPE) Insulation, and rated for direct burial. Insulation color shall meet APWA color code standards for identification of buried utilities.

B. Wire connectors shall be designed for direct burial and moisture resistance. Connectors shall be equivalent to 3M DBR/Y–6 Direct Bury Splice Kit.

2.15 CHECK VALVES

A. Shall be designed for sewage service. The valve shall be cast iron and bronze fitted. The valve shall be a spring and lever type with neoprene seat and O–Ring seals on a stainless steel valve pin, for pipes 3 inches and larger in diameter. For check valves smaller than 3 inches, the valve shall be a fully ported 150 p.s.i. rated ball check valve with a corrosion resistant phenolic base and a rubber seat. Check valve shall be of full waterway design for quiet operation and with a flow area through the valve equal to or exceeding flow area of pipe to which it is installed.

2.16 GATE VALVES

A. Two Inches and Larger – Shall be cast iron or ductile iron body, bronze mounted, double disc or resilient wedge design, with non–rising stems, conforming to AWWA C 500, C 509, or C 515. Valves shall have ends to match the pipe to which they are

attached. Attachment to plastic pipe shall be made by special adapters. Valves shall have a working pressure of 200 p.s.i. and be tested at 400 p.s.i.

Valves shall be furnished with "O" ring packing. One "O" ring shall be located above the thrust collar and one below. Thrust collar shall be permanently lubricated and have an anti–friction washer on top of the thrust collar.

B. Smaller than 2 inches – Shall be all brass, ball valve type. The pressure rating shall be 175 p.s.i.

C. Valve Boxes – Underground valves shall be installed in acceptable valve boxes. Valve boxes shall have a suitable base that does not damage valve or pipe, and shaft extension sections to cover and protect the valve and permit easy access and operation. The box, cover, and extensions shall be cast or ductile iron having a crushing strength of 1,500 pounds per linear foot.

2.17 PLUG VALVES

A. Shall be fully ported and of the same diameter as pipes to which they are attached. They shall have semi–steel bodies, all metal plugs, stainless steel bearings, and be equivalent to DeZurik 100% port eccentric (PEF) valves, lever operated. All valves 6 inches and larger shall be equipped with gear actuator and 2" operating nut for below ground installation and gear actuator and handwheel for above ground installation.

2.18 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered by Contractor.

PART 3 – EXECUTION

3.1 CONSTRUCTION OBSERVATION

A. The line, grade, deflection, and infiltration of sewers and force mains shall be tested by Contractor under the direction of Engineer. Engineer or Project Representative will have the right to require any portion of work be completed in their presence. If work is covered up after such instruction, it shall be exposed by Contractor for observation. However, if Contractor notifies Engineer such work is scheduled and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. All improper work shall be reconstructed. All materials not conforming to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours' notice for all required observations or tests.

It will also be required by Contractor to keep accurate, legible records of the location of all sanitary lines, service laterals, manholes, force mains, valves, bends, and appurtenances. These records will be prepared in accordance with "Record

Data and Drawings" paragraph in the Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

3.2 LOCATION AND GRADE

A. Line and grade of sewers and position of all manholes and other structures are shown on the drawings. Grade line as given on the profile or mentioned in these specifications means invert or inside bottom of pipe. Price for trenching shall include trench for depth below this line necessary to lay sewer to grade, but measurements for payment will be made only to grade line. Master control lines and bench marks have been provided by the Engineer. The Contractor shall be responsible for proper locations and grades of sewers.

3.3 SEWER EXCAVATION

A. Contractor shall perform all excavations of every description and of whatever substance encountered to the depth shown on the plans or specified for all sewers, manholes, and other appurtenances. All excavations shall be properly dewatered before installations are made, by the use of well points, pumping, or other methods accepted by Engineer. Trenches shall be excavated in conformance with the Occupational and Safety Health Administration's (OSHA) Regulations.

Where the character of soil is unsuitable for pipe bedding as determined by Engineer or Geotechnical Consultant, additional excavation will be authorized. Engineer or Geotechnical Consultant shall determine the depth needed for additional bedding and whether material will be sand or stone. The unsuitable material shall be disposed of at Contractor's expense in a proper manner. Bottom of all trenches shall be rounded to conform to the bottom of pipe, to afford full bearing on pipe barrel. Excavation in excess of depths and widths required for sewers, manholes, and other structures shall be corrected by pouring subfoundations of 3,000 p.s.i. concrete and half cradle at the Contractor's expense.

B. Trenches shall not be excavated more than 400 feet in advance of pipe laying.

3.4 TRENCH WALL SUPPORT

A. Bracing and Sheeting – The sides of all trenches shall be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by soil conditions encountered, to protect adjoining property and for safety. Where shown on drawings or where directed by Engineer, the Contractor must install solid sheeting to protect adjacent property and utilities. Sheeting shall be steel or timber and Contractor shall submit design data, including the section modulus of members and arrangement for bracing at various depths, to Engineer for review before installing sheeting. It shall penetrate at least 3–feet below the pipe invert. Contractor shall ensure support of pipe and its embedment is maintained throughout installation and ensure sheeting is sufficiently tight to prevent washing out of the trench wall from behind sheeting.

B. Sheeting Removal – Sheeting shall be removed in units and only when backfilling elevation has reached the level necessary to protect pipe, adjoining property, personnel, and utilities. Removal of sheeting or shoring shall be accomplished in a manner to preclude loss of foundation support and embedment materials. Fill

voids left on removal of sheeting or shoring and compact all materials to required densities.

C. Movable Trench Wall Supports – Do not disturb installed pipe and its embedment when using movable trench boxes and shields. Movable supports should not be used below top of pipe zone unless acceptable methods are used for maintaining the integrity of embedment material. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compacting embedment.

D. When sheeting or shoring cannot be safely removed, it shall be left in place. Sheeting left in place shall be cut off at least 2 feet below the surface. No separate payment shall be made for bracing and sheeting except where shown on drawings or authorized by the Engineer.

3.5 LAYING PIPE

A. All sewer pipe shall be laid upgrade with spigots pointing downgrade and in accordance with ASTM D 2321. The pipe shall be laid in a ditch prepared in accordance with Paragraph 3.3 "Sewer Excavation." When sewer is complete, the interior surface shall conform on bottom accurately to grades and alignment fixed or given by Engineer. Special care shall be taken to provide a firm bedding in good material, select borrow, stone backfill or 3,000 p.s.i. concrete, as authorized, for length of each joint and 1/2 of the circumference. Holes shall be provided to relieve bells from bedding strain, but not so large to allow separation of the bell from barrel by settlement after backfilling. All pipe shall be cleaned out, and left clean. Every third joint shall be filled around immediately after being properly placed.

B. Jointing – Comply with manufacturer's recommendations for assembly of joint components, lubrication, and making joints. When pipe laying is interrupted, secure piping against movement and seal open ends to prevent the entrance of water, mud, or foreign material.

C. Placing and Compacting Pipe Embedment – Place embedment materials by methods that will not disturb or damage the pipe. Work in and tamp haunching material in area between the bedding and underside of pipe before placing and compacting remainder of embedment in pipe zone. Do not permit compaction equipment to contact and damage the pipe. Use compaction equipment and techniques compatible with materials used and location in the trench. Before using heavy compaction or construction equipment directly over the pipe, place sufficient backfill to prevent damage, excessive deflections, or other disturbance of the pipe.

D. Rock or Unyielding Materials in Trench Bottom – If ledge rock, hard pan, shale, or other unyielding material, cobbles, rubble, debris, boulders, or stones larger than 1.5–inches are encountered in the trench bottom, excavate a minimum depth of 6–inches below pipe bottom and replace with proper embedment material.

E. Vertical Risers – Provide support for vertical risers as commonly found at service connections, cleanouts, and drop manholes to preclude vertical or lateral movement. Prevent the direct transfer of thrust due to surface loads and settlement, and ensure adequate support at points of connection to main lines.

F. Exposing Pipe for Making Service Line Connections – When excavating for a service line connection, excavate material from above the top of main line before removing material from sides of pipe. Materials and density of service line embedment shall conform to specifications for the main line.

G. Cleanouts and access boxes shall be installed as shown on the construction drawings. Install concrete collar around access box as shown on detail.

H. Manhole Connections – Use flexible water stops, resilient connectors, or other flexible systems acceptable to the Engineer making watertight connections to manholes and other structures. Fill annular space between pipe and precast concrete on inside of manhole with non–shrink grout.

I. Jacking and Boring – Steel casing of diameter shown on the plans shall be jacked and bored in location indicated. Joints between sections of the steel casing shall be of a continuous weld made by a certified welder. Jacking and boring shall be in accordance with Georgia Department of Transportation Standard Specifications. Carrier pipe shall be installed as shown on the detail. After carrier pipe has been installed, ends of the casing shall be sealed using a rubber enclosure and stainless steel straps or brick and mortar.

Where work involves a highway, a Resident Engineer of the State Department of Transportation shall be notified 3 days before crossing is started. Where work involves a railroad, the work shall conform to requirements of AREA specifications. Division Superintendent of the Railroad shall be notified 3 days prior to beginning work. Before commencing work within the right–of–way of railroads or highways, Contractor shall verify Owner has obtained required permits.

3.6 SEPARATION BETWEEN WATER & SANITARY SEWER

A. Parallel Installation:

1. Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm sewer, or sewer manhole. The distance shall be measured edge–to–edge.

2. When conditions prevent a horizontal separation of 10 feet, water main may be laid closer to a sewer (on a case–by–case basis) provided the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation where bottom of water main is at least 18 inches above top of sewer. It is advised the sewer be constructed of materials and with joints equivalent to water main standards of construction and be pressure tested to assure water–tightness prior to backfilling.

B. Crossing:

1. Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of water main and top of sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

2. When conditions prevent a vertical separation of 18 inches, the sewer passing over or under water mains shall be constructed of materials and with joints equivalent to water main standards of construction and shall be pressure tested to assure water–tightness prior to backfilling.

3. When water mains cross under sewers, additional measures shall be taken by providing:

   a. a vertical separation of at least 18 inches between bottom of the sewer and top of water main;

   b. adequate structural support for sewers to prevent excessive deflection of joints settling on and breaking the water mains;

   c. length of water pipe be centered at the point of crossing so joints will be equidistant and as far as possible from sewer; and

   d. both sewer and water main shall be constructed of water pipe and subjected to hydrostatic tests, as prescribed in this document. Encasement of the water pipe in concrete shall also be considered.

3.7 BACKFILLING

A. All trenches and excavation shall be backfilled immediately after pipes are laid therein, unless other protection of the pipe line is directed. Backfilling material shall be selected and deposited with special reference to the future safety of pipes. Except where special methods of bedding and tamping are provided for, clean earth or sand shall be solidly tamped about pipe up to a level at least 2 feet above top of pipes, and shall be carefully deposited to uniform layers, each layer solidly tamped or rammed with proper tools to not injure or disturb the pipeline. Remainder of the trench backfilling shall be carried on simultaneously on both sides of pipe in such a manner preventing injurious side pressure. The material used shall be selected from excavations anywhere on site if any of this soil is suitable. Backfill material shall be clean and free of rock, organic and other deleterious matter.

Under traffic areas, the top 24 inches of backfill material shall be compacted to a density of not less than 98% of maximum laboratory density at optimum moisture. Below the 24–inch line and to and including area around pipe, density shall not be less than 95% of maximum laboratory density at optimum moisture. In non–traffic areas, the backfill material shall be compacted to a density of not less than 90% of maximum laboratory density at optimum moisture unless otherwise accepted by Engineer. Compaction tests shall be conducted in accordance with ASTM D 6938 by an independent testing laboratory. Tests are to be taken at the direction of Engineer.

Whenever trenches have not been properly backfilled, or if settlement occurs, they shall be refilled, smoothed off and finally made to conform to the ground surface. Backfilling shall be carefully performed, and original surface restored to the full satisfaction of Engineer immediately after installation.

Where thermoplastic (PVC) pipe is installed, Contractor shall take precautions in accordance with ASTM D 2321, during backfilling operations so not to create excessive side pressures, or vertical or horizontal deflection of the pipe nor impair flow capacity.

3.8 MANHOLES

A. Manholes shall be constructed where shown on the drawings or where directed by Engineer. The channel in bottom of manholes shall be smooth and properly rounded. Special care must be exercised in laying the channel and adjacent pipes to grade. Manhole top elevations shall be greater than or equal to the 50–year flood elevation, unless watertight covers are provided. Tops of manholes outside of roads shall be built to grades 1–inch above ground surface in developed areas and 6 inches above ground surface in undeveloped areas unless otherwise shown on the plans. Manholes in roads shall be built to grades designated by the Engineer. Manhole sections with either honeycomb defects; exposed reinforcing; broken/fractured tongue or groove; or cracked walls will be subject to rejection by Engineer for use on the project. When mastic sealant is used, improperly applied primer will also be cause for rejection.

No leaks in any manhole will be acceptable. All repairs made from inside the manhole shall be made with mortar composed of one part Portland cement and two parts clean sand. The mixing liquid shall be straight bonding agent equivalent to "Acryl 60."

3.9 STONE BEDDING

A. Where, in the Engineer's or Geotechnical Consultant's opinion, subgrade of pipe trench is unsuitable material, Contractor shall remove unsuitable material to a depth determined by Engineer or Geotechnical Consultant and furnish and place stone backfill in trench to stabilize subgrade. Presence of water does not necessarily mean stone backfill is required. If well points or other types of dewatering will remove the water, Contractor shall be required to completely dewater trench in lieu of stone backfill. Stone bedding will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Stone shall be placed 4 feet wider than the outside diameter of pipe. The pipe shall be carefully bedded in stone as specified, or in accordance with manufacturer's recommendations.

3.10 SAND BEDDING AND BACKFILL

A. Where, in the Engineer's or Geotechnical Consultant's opinion, character of soil is unsuitable for pipe bedding, even though dewatered, additional depth of excavation as determined by Engineer or Geotechnical Consultant shall be made and replaced with clean sand furnished by Contractor.

3.11 DEFLECTION

A. It is the Contractor's responsibility to assure backfill is sufficient to limit pipe deflection to no more than 5%. When flexible pipe is used, a deflection test shall be made by Contractor on the entire length of installed pipeline, not less than 30–days after completion of all backfill and placement of any fill. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or

elliptical ball, a cylinder, or circular sections fused to a common shaft. Ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 95% the inside pipe diameter. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 p.s.i. or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on opposite end of shaft shall produce compression throughout remote end of ball, cylinder, or circular section. Circular sections shall be spaced so distance from the external faces of front and back sections shall equal or exceed diameter of circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through by hand or by being flushed through with water, shall be cause for rejection of individual run. When a deflection device is used for the test in lieu of a ball, cylinder, or circular sections described, such device shall be acceptable to Engineer prior to use. Device shall be sensitive to 1.0% of diameter of pipe being measured and shall be accurate to 1.0% of indicated dimension. Installed pipe showing deflections greater than 5% of the normal diameter of pipe shall be retested by a run from opposite direction. If retest also fails, the suspect pipe shall be repaired or replaced at no cost to Owner.

3.12 LEAKAGE

A. In no stretch of sewer between any two adjoining manholes shall infiltration/exfiltration exceed 25 gallons/day/inch of pipe diameter per mile of pipe. In case leakage exceeds this amount, the sewer shall not be accepted until such repairs and replacements are made to comply with above requirements. Such corrections will be made at the Contractor's expense. All visible leaks shall be repaired, regardless of the amount of leakage.

B. Lines shall be tested for leakage by low pressure air testing, infiltration tests, or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in ASTM F 1417. Prior to infiltration or exfiltration tests, trench shall be backfilled up to at least the lower half of pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When water table is 2 feet or more above top of pipe at the upper end of pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to Engineer. When Engineer determines infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so a head of at least 2 feet is provided above both water table and top of pipe at upper end of pipeline to be tested. The filled line shall be allowed to stand until pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re–established. The amount of water required to maintain this water level during a 2–hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gallons per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Owner.

C. The Contractor shall furnish equipment and plugs and subject force mains to hydrostatic tests at 100 p.s.i. for a period of two hours. Any leaks shall be located and repaired. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. No pipe installation will be accepted until leakage during pressure test is less than the number of gallons listed for each 1000–feet of pipe tested:

6 inches & less – 0.9 gallons	12 inches – 1.80 gallons
8 inches – 1.20 gallons	14 inches – 2.10 gallons
10 inches – 1.50 gallons	16 inches – 2.40 gallons

3.13 CLEANING AND ACCEPTANCE

A. Before acceptance of sewer system, it shall be tested and cleaned to the satisfaction of Engineer. Where any obstruction is met, Contractor will be required to clean sewers by means of rod and swabs or other instruments. The pipe line shall be straight and show a uniform grade between manholes. The Engineer shall check lines by lamping or other methods to determine final acceptance.

3.14 CLOSING PIPE

A. When work or pipe installation is suspended, either for the night or at other times, end of sewer must be closed with a tight cover. Contractor will be held responsible for keeping the sewer free from obstruction.

3.15 PARTIAL ACCEPTANCE OF THE WORK

A. Owner reserves right to accept and use any part of the work. Engineer shall have power to direct on what line the Contractor shall work and order thereof.

3.16 GRASSING

A. Grassing of areas disturbed during construction shall be in accordance with Section 02902 – "Grassing."

3.17 RECORD DATA

A. It will be required of the Contractor to keep accurate, legible records, locating all sewers, force mains, tees, and laterals. These records will be made available to Engineer before final review for incorporation into the Engineer's Record Drawings. Final payment to the Contractor will be withheld until all such information is received and accepted.

3.18 REMOVE AND REPLACE PAVEMENT

A. Pavement shall only be removed after prior written authorization by the Owner. Pavement removed and replaced shall be constructed in accordance with latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled per State Department of Transportation regulations.

Edges of the pavement shall be cut to a neat straight line with a masonry saw. Backfill shall be compacted and tested and a concrete base course of 5,000 p.s.i. placed on the fill as shown on details. The concrete base shall be placed within 24 hours after pipeline is installed. A temporary wearing surface may be used provided it presents a smooth surface. The final wearing surface shall be 2 inches of 9.5 mm, asphaltic concrete.

3.19 METALLIC DETECTOR TAPE

A. Contractor shall place metallic detector tape, suitably coded, directly over all installed pipes at a depth of 18 inches below the finished surface.

Note: Wire on all pipes shall be required in Georgia after January 1, 2001.

3.20 TRACER WIRE

A. Tracer wire will be installed on all force mains, directly on top of the pipe. Wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36–inches apart. Where service laterals connect to main lines, the wire connection shall be made with a direct bury moisture resistant connector. Installation of connector shall be per manufacturer's instructions. The insulated wire must maintain electrical continuity. This tracer wire system shall be checked and tested by the Contractor, in presence of Engineer or Owner prior to acceptance of force main . All equipment, meters, detectors, etc., needed for testing shall be furnished by the Contractor.

3.21 CONNECT SEWERS TO EXISTING STRUCTURES

A. Contractor shall connect the system to existing structures where indicated. For brick structures, a hole not more than 4 inches larger than the outside diameter of new pipe shall be cut neatly in structure, new pipe laid so it is flush with inside face of structure, and annular space around pipe filled with a damp, expanding mortar or grout to make a watertight seal. For precast structures, core proper size hole in structure for pipe being connected, attach flexible sleeve into cored hole and connect new pipe into flexible sleeve with a stainless steel band.

3.22 FIELD QUALITY CONTROL

A. Soil and density tests shall be made by a testing laboratory acceptable to the Engineer. Laboratory tests of the soil shall be made in accordance with ASTM D 1557. In–place density tests shall be made in accordance with ASTM D 6938. Results of the tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Backfill over sewer in traffic areas…….	1 per 100 linear feet or less for each 4 feet of depth or portion thereof.
Backfill over sewer in non–traffic areas…	1 per 500 linear feet or less for each 6 feet of depth or portion thereof.

3.23 AIR RELEASE VALVE

A. The manhole and installation of valve shall be in accordance with detail on drawings. Prior to deciding on the location of any air release valve, Contractor shall provide Engineer with an accurate profile of installed force main so high points in system can be determined.

3.24 FORCE MAIN

A. Ductile Iron Force Mains shall be installed in accordance with AWWA C 600.

B. PVC Force Main shall be installed in accordance with ASTM D 2774.

C. The Contractor shall perform excavation of whatever substances are encountered to a depth that will provide a minimum cover over the top of the pipe of 48 inches from the existing or proposed finished grade.

D. Alignment and Grade – The force mains shall be laid and maintained on lines and grades established by the plans and specifications for the project. Fittings, valves, and tapped or bossed outlets must be installed at the required locations unless field conditions warrant otherwise, and these changes are approved in accordance with the specifications. Valve-operating stems shall be oriented to allow proper operation.

E. Prior Investigation – Prior to excavation, an investigation shall be conducted to determine the location of existing underground structures and conflicts. During excavation, damage to existing structures should be avoided. Special precautions shall be taken when the force main being installed crosses or is adjacent to a facility that is cathodically protected.

F. Unforeseen Obstructions – When obstructions not indicated on the plans interfere with the progress of work, an alteration of the plans is required. These alterations or deviation in line and grade, or the removal, relocation, or reconstruction of the obstructions shall be performed in accordance with the specifications.

G. Trench Construction – The trench shall be excavated to the required alignment, depth, and width specified or shown on the plans and shall conform with all federal, state or provincial, and local regulations for the protection of the workers.

1. Trench Preparation – Trench preparation shall proceed in advance of pipe installation as stated in the specifications.

2. Discharges from trench dewatering pumps shall be directed away from the trench to prevent trench instability and shall be in accordance with federal, state or provincial, and local point-discharge requirements.

3. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways, or other structures. Excavated material shall be placed in compliance with federal, state or provincial, and local regulations.

4. Width – The width of the trench at the top of the pipe shall equal the single-pass capabilities of normally available excavating equipment. The width shall permit the pipe to be laid and joined properly and to allow the backfill to be placed in accordance with the specifications. Trench widths shown below may be used as a guide. When required, trenches shall be wider to permit the placement of timber supports, sheeting, bracing, and appurtenances as required by the safety requirements of the agency having jurisdiction.

Nominal Pipe Size		Trench Width	
In.	(mm)	In.	(mm)
3 and 4	(76 and 102)	28	(0.71)
6	(152)	30	(0.76)
8	(203)	32	(0.81)
10	(254)	34	(0.86)
12	(305)	36	(0.91)
14	(356)	38	(0.97)
16	(406)	40	(1.02)
18	(457)	42	(1.07)
20	(508)	44	(1.12)
24	(610)	48	(1.22)
30	(762)	54	(1.37)
36	(914)	60	(1.52)
42	(1,067)	66	(1.68)
48	(1,219)	72	(1.83)
54	(1,400)	78	(1.98)
60	(1,500)	84	(2.13)
64	(1,600)	88	(2.24)

5. Bell Holes – Holes for the bells shall be provided at each joint, and they shall be no larger than necessary to allow joint assembly and to ensure the pipe barrel will lie flat on the trench bottom. The dimensions of bell-hole depressions for push-on type joints should be large enough to ensure the pipe is not resting on the bells and is supported by the full length of the pipe barrel.

6. Other than noted previously, the trench bottom shall be true and even to provide support for the full length of the pipe barrel. A slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle without damaging coating or polyethylene encasement.

7. Rock Conditions – When excavation of rock is necessary, all rock shall be removed to provide a clearance below and on each side of all pipe and fittings of at least 6 in. (150 mm) for nominal pipe sizes 24 in. (610 mm) or smaller and 9 in. (230 mm) for nominal pipe sizes 30 in. (762 mm) and larger. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the appropriate depths, then leveled and tamped.

8. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stone of sufficient size and placement that could cause a fulcrum point or pointload.

9. Previous Excavations–If the trench passes over a previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soils or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

H. Protecting Property–Trees, shrubs, fences, and all other property and surface structures shall be protected during construction, unless their removal is shown in the plans and specifications.

1. All properties that have been disturbed shall be restored as completely as practical to their original condition.

I. Any cutting of tree roots or branches shall be performed in accordance with the specifications.

J. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered during the work shall be provided in accordance with specifications or applicable regulations.

K. Installing Pipe – The proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and other appurtenances shall be lowered carefully into the trench using a backhoe, a crane, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to force main materials and protective coatings and linings. Under no circumstances shall force main materials be dropped or dumped into the trench. Where practical, the trench should be dewatered prior to installation of the pipe.

K. Examining Material – 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 final disposition as required by the specifications.

L. Pipe Ends – 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 be free from dirt, sand, grit, or any foreign materials before the pipe is laid.

M. Pipe Cleanliness – 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 placed in the pipe at any time.

N. Pipe Placement – 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.

O. Direction of Bells – It is common practice to lay pipe with the bells facing the direction in which work is progressing; however, it is not mandatory. For example, when the main is being laid on a slope, the pipe is frequently laid with the bells facing uphill for ease of installation.

P. Pipe Plugs – At times when pipe-laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means as specified. The plug shall be fitted with a means for venting. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation, if the trench fills with water.

Q. Prior to removal of the plug for extending the line or for any other reason, air and/or water pressure in the line shall be released.

R. Joint Assembly – Shall be performed in accordance to AWWA C 600.

S. Hydrostatic Testing – Shall be performed in accordance with AWWA C 600.

3.25 BYPASSING

A. Bypassing of raw wastewater onto the ground or into a receiving stream is prohibited.

B. Bypassing shall be accomplished with pumping equipment sufficient to maintain the flow of wastewater. Contractor shall provide pump, hoses, materials, and labor to operate and maintain the bypassing operation. A backup pump shall also be made available by the Contractor. Bypassing operations shall be reviewed and acceptable to the sewer system operator before being implemented.

END OF SECTION