

# STANDARD CONSTRUCTION PRACTICES FOR WATER AND SEWER IMPROVEMENTS

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# ARTICLE I

## DESIGN AND CONSTRUCTION SPECIFICATIONS FOR WATER DISTRIBUTION

**SECTION 1.01 PURPOSE:** This section of these Specifications describes products to be incorporated into the installation of potable water supply systems and requirements for these products. The Contractor/Developer shall furnish all products, equipment and do all labor necessary to fulfill the requirements of these Standard Design and Construction Specifications.

### **SECTION 1.02 GENERAL:**

- (A) **Applicable Standards:** The Contractor shall supply all products and do all work in according to applicable American Society for Testing and Material (**ASTM**), American Water Works Association (**AWWA**), American National Standards Institute (**ANSI**), American Welding Society (**AWS**) or other recognized standards. The latest revisions of all standards are applicable. If requested by the County, the Contractor shall submit evidence that the manufacturers have consistently produced water system products of satisfactory quality and performance for a period of at least two years.
- (B) **Substitutions:** Whenever a product is identified in the Specifications by reference to manufacturers' or Vendor's names, trade names, catalog numbers, etc., the Contractor/Developer may freely choose from those referenced products which ones he wishes to provide. Any product other than those so designated will be considered a substitution. Thirty days before starting the construction, the Contractor/Developer shall obtain approval from the County for any substitutes.
- (C) **System Warranty:** Potable water distribution systems installed by a Contractor or Developer that are to be accepted by the County for ownership, operation and maintenance shall be warranted and guaranteed in writing. The warranty period will be for one year from the date of the Letter of Completion. The letter will state that "The completed system is free from all defects due to faulty products or construction, and that the Contractor/Developer shall make such corrections as may be necessary because of such defects upon receiving written notice from the County."
- (D) **Water System Easements:** Water distribution systems installed by a Contractor or Developer accepted by the County for ownership, operation and maintenance will be installed in either dedicated streets or easements on lands owned by the Developer. Easements will be properly executed and recorded and will be a minimum of fifteen feet in width with the water lines in the middle of the easements.

**SECTION 1.03 SUBMITTALS FOR CONSTRUCTION:** Submittals will be construction drawings, shop drawings, prints, descriptive literature, test reports, samples, calculations, pump curves, schedules, material lists and information and items of similar meaning. Construction drawings will be submitted on separate 24 x 36 inch sheets.



Submittals Required: The Contractor/Developer shall furnish seven sets of proposed construction drawings to the County for review according to the procedures outlined in the Glynn County Subdivision Regulations. Additional information such as special drawings, schedules, calculation curves, and wiring diagrams will be provided as specifically requested by the County.

- (A) Contractor/Developer's Review: The Contractor/Developer shall review and check construction drawings and other submittals before submitting them for review. All construction submittals will show approval by the Contractor/Developers initials and date before submitting them to the County for review.

The Contractor/Developer shall submit a minimum of five sets of special construction drawings and submittals initially. A transmittal form or letter will accompany each submittal or group of construction drawings. Construction drawings and submittals will be stamped and returned to the Contractor/Developer in a timely manner.

- (B) County's Review: Construction drawings, material submittals and all other information will be reviewed, stamped, and dated by the County. After review the submittals will be returned as either acceptable or rejected for the noted revisions required.

Approved construction drawings will be forwarded to the Environmental Protection Division (EPD) for review. Upon receiving written approval from the EPD, two sets of submittals bearing the County's notation, will be returned to the Contractor/Developer. The remaining copies will be retained by the County.

Submittals rejected by the County for use will be so noted and returned to the Contractor/Developer in a timely manner. The Contractor/Developer shall resubmit revised construction drawings and material submittals as requested by the County. The County will review and approve construction submittals before the installation or use any questionable products.

- (C) Construction Drawings and Submittals: Construction drawings and submittals not bearing the County's approval notation will not be issued to contractors or subcontractors or will be used for construction purposes. The Contractor/Developer shall maintain at the job site a complete set of construction drawings and material submittals bearing the County's approval notation at all times or the work may be stopped.

**SECTION 1.04 RECORD DATA:** The Contractor shall keep accurate legible records of the location of all water mains, tapping saddles, valves, fittings and laterals. The records will be made available to the County for incorporation into the County's RECORD DRAWINGS. The final system approval will be withheld until such information is received and accepted.

**SECTION 1.05 RECORD DRAWINGS:** Upon completion of the potable water system, the Contractor/Developer shall furnish the Engineering Services Department with a detailed set of "Record Drawings" on 24 X 36 inch Mylar sheets and four legible copies of each sheet. Record drawings will be prepared by a registered Professional Engineer or licensed Surveyor and will show all piping, accessories and field changes installed during the course of construction.

- (A) For open ditch or inverted crown street systems, footage measurements will be shown on the drawings as follows:

Buried gate valves shall have a V- reference number commencing at the tap or tie-in valve on the existing water main with the designation V-1. Upstream valves will be designated V-2, V-3, etc. Fire hydrant valves will be numbered using FHV-1, FHV-2, etc. for the reference numbers. Curb ball valves will be labeled CBV-1, CBV-2, etc.

Footage measurements for water distribution system and/or project improvements will be shown on all record drawings. "Record Drawing" measurements will start at the valve on the existing water line to which the newly installed construction connects. The valve on the existing water line will be labeled as STA. 0+00. From this point measurements will go upstream.

The valve on the existing water line will serve as STA. 0+00 for the branch lines. The first branch line will be labeled line A, second branch line B, third branch C and so on. Thus if the first branch line valve is 300 LF from the valve on the existing water line, the branch valve is labeled STA. 3+00A. Footage measurements on line A will begin over at each branch line or in line valve. In the case where there are no branch lines footage measurements will begin over at each fire hydrant or in line valve.

Footage measurements for water service laterals will be shown on the record drawings. These measurements will include distances from:

1. the nearest main valve or fire hydrant valve down stream of the service tapping saddle.
  2. the tap on the main to the curb stop at or near the property corner.
  3. the end of the service line to the nearest property line.
- (B) For curb and gutter street systems the curb shall be stamped with a "W" at the closest point to the end of the service line (+/- 90° from the street edge for tangent sections and +/- radially on curves). The distance from the back of the curb adjacent to the stamped "W" to the end of the service shall be shown on the "Record Drawings"
- (C) The Professional Engineer or licensed Surveyor preparing the "Record Drawings" shall certify to the County on each RECORD DRAWINGS Mylar that "All Information Is Accurate and Correct" and will show its approval by initials and date.

**SECTION 1.06 CONSTRUCTION MATERIALS:** The Contractor shall furnish and install all valves, pipes, fittings, tapping sleeves, and fire hydrants and all other materials required for the completion of the work as specified. Construction materials furnished shall be according to the following:

- (A) Ductile Iron Pipe (DIP): Will conform to **ANSI/AWWA C150/A21.50** and **ANSI/AWWA A21.51/C-151** for a minimum 150 psi rated working pressure. Pipe will have a cement-mortar lining on the interior according to **ANSI/AWWA C-104/A21.4** latest revision and will be furnished with a bituminous outside coating. The class or nominal thickness, net weight without lining and casting period will be clearly marked on each length of pipe. Joints will be Push-on Type Joints, such as Tyton or Fastite and will conform to **ANSI/AWWA C111/A21.11**.

Restrained joint ductile iron pipe for buried service will be AMERICAN "Flex-Ring Joint" or "Fastite Joint" for pipe 4-inches-36-inches in diameter and "Lok-Ring Joint" for pipe 42-inches-64-inches in diameter, or approved equals. Restrained joint ductile iron pipe for above ground service will be U.S. Pipe "TR FLEX" or Clow "SUPER-LOK" or approved equals.

AMERICAN "Flex-Lok" ball joint pipe will be installed for river crossings, busy waterways, river intakes, swamps and flood lands or where tidal water conditions exist.

The acceptance of ductile iron pipe and fittings shall be on the basis of the County's inspection and the manufacturer's written certification. The certification will state that the pipe was manufactured and tested according to all the required applicable standards.

- (B) Polyvinyl Chloride Pipe (PVC): Will be blue in color with belled ends for push on type jointing. The pipe will bear the seal of the National Sanitation Foundation and conform to all requirements of **AWWA C-900** latest revision. The pipe will also meet the following criteria:

1. 4-inches to 12-inches Pipe: Will be Class 150 with a Dimension Ratio (DR) of 18. PVC pipe will be supplied in lengths of at least 20 feet.
2. 14-inches to 16-inches Pipe: Will conform to **AWWA C 905**. The pipe will have a Dimension Ratio (DR) of 18 and a pressure rating of 235 psi.
3. 2-inches and Smaller: Will have belled ends for push-on type jointing conforming to **ASTM D-3139** and **2241**. The pipe will be Class 200 with a Dimension Ratio (DR) of 21.

- (C) 1-Inch Polyethylene (PE) Tubing: Will be manufactured from virgin polyethylene extrusions compound materials having standard PE code designations PE 3408 according to **ASTM D-3350 condition C**. PE tubing will be of pressure class 200 with an SDR of 9 according to the requirements of **AWWA C-901**. Water service tubing will be Vanguard "Proguard," Orangeburg "SP," J & M Blue Brute. Couplings for tubing will be manufactured and tested according to the requirements of **ANSI/AWWA C-800**. The couplings will be made of bronze conforming to **ASTM B-61** or **B-62**, and will have compression fittings on both ends suitable for connection to PE tubing with inserts. Tubing couplings will be products manufactured by MUELLER, Ford or approved equal.

Special adapters required will be provided as recommended by the manufacturer to adapt the tubing to mechanical jointing with ductile iron pipe, fittings, valves, etc.

- (D) Fittings for Ductile Iron or Plastic Pipe: Will be compact ductile iron. Fittings will conform to **ANSI/AWWA A21.54/C-153** for fittings 4-inches - 16-inches and **ANSI/AWWA A21.10/ C-110** for fittings larger than 16-inches, latest revision. Fittings shall be cement lined in according to **ANSI/AWWA A21.4/ C-104**. An asphaltic coating with a thickness of 1 mil will be applied to all fittings. Fittings will be designed to fit the type of pipe used.
- (E) Fittings for 2-inch Diameter Plastic Pipe: Will conform to **ASTM D-2241** latest revision. The fittings will be CLASS 200 PVC with ring tite rubber joints.
- (F) Fittings for Flanged Pipe: Will be manufactured in according to **ANSI A21.10** and **AWWA C-110**, latest revision and pressure rated at 150 psi.
- (G) Detection Tape: Detectable Mylar encased aluminum foil marking tape will be installed over all plastic water lines. The tape will be "safety blue" in color, at least 2 1/2-inches wide, and will bear the printed identification " Caution: Buried Water Line Below " (reverse printed), so as to be readable through the Mylar. Surface printing on the tape will be equal to Lineguard Type III Detectable. The tape will be installed according to the manufacturer's written recommendation.
- (H) Tracer Wire: The Contractor will install a continuous or properly spliced minimum No. 12 AWG solid plastic coated copper wire on all PVC pipe and polyethylene tubing installed. It will be placed on the entire PVC pipe from iron fitting to iron fitting in a manner shown on Appendix A-12 herein. The wire will also be placed in a like manner on all service laterals. The wire will be installed from a valve or corporation stop to the curb stop as shown on Appendix A-13 and A-14. Care will be taken during backfilling to prevent damaging, misplacing or cutting of the tracer wire. Install a loop wire inside each valve box as shown in Appendix A-9.
- (I) Gate Valves: Will be **AWWA C-509** resilient wedge type. **AWWA C-500** Double disc valves will NOT be used.
  - 1. Four Inches in Diameter and Larger: Buried gate valves will be resilient wedge type, epoxy coated, ductile iron body, bronze mounted, conforming to the requirements of **ANSI/AWWA C-509**. Buried gate valves 16-inches and larger will be gear operated.
  - 2. Buried gate valve ends will be mechanical joint type. Tapping valves will be equipped with a flanged end to mate with the tapping sleeve.
  - 3. Buried gate valves will be equipped with a ductile iron wrench nut, open counter clockwise and will have upper and lower o-ring stem packing seals.

4. Buried gate valves, including gear operated gate valves, will be non-rising stem type gate valves.
  5. Buried gate valves will be products manufactured by M&H Valve, American Flow Control, MUELLER or Clow or approved equal.
  6. Buried gate valves will be installed with heavy roadway screw type valve boxes. The lid will have the words "WATER VALVE" stamped on it.
  7. Two-Inches and Smaller in Diameter: Gate valves used for temporary Flush Valve & Riser or for Blow-Off and Sampling Tap installations will be a bronze, heavy duty, rising stem and rated for 200 pound wsp and will conform to Federal Specification **WW-V-54, Class A, Type II**. Valves will be a Stockham B-100, NIBCO-T-111, Milwaukee 148 or approved equals.
- (J) Valve Boxes: The Contractor shall install a valve box on each buried gate valve and ball valve curb stop. Valve boxes will be cast iron bodied, screw type, heavy duty roadway type. Valve boxes shall be RUSSCO 562-S or approved equal. The valve box will have cast-iron drop covers with the word "WATER" stamped on it. Valve boxes will be adjustable to six inches up and down from the nominal required cover over the pipe. Valve boxes will be equipped with knock outs when installed over a 2-inch ball valve curb stop. Typical buried gate valve box installation details are included in Appendix A-10. In lieu of pouring a concrete collar, the contractor may use a round precast concrete collar.
- (K) Service Line Markers: The Contractor shall furnish and install a minimum No. 4 rebar steel stakes at the end of each service line installed. Steel stakes will be a minimum of 36-inches long. The markers will extend at least 12-inches above the finished grade and will be painted blue. See Appendix A-13 for typical service marker installation detail.
- (L) Corporation Stops: Corporation stops will be ground key, with AWWA Iron Pipe (I.P.) inlet and compression outlet for Copper Tube Size (CTS) O.D. outlet. They will be made of brass conforming to ASTM B-61 or B-62, and will be suitable for the working pressure of the system. Corporation stops will be a MUELLER H-15028 or Ford F1100-G4.
- (M) Curb Stops: Curb stops will have compression connections on both ends suitable for connection to CTS O.D. tubing. They will be ball valve type, made of brass conforming to **ASTM B-61 or B-62**, and will be suitable for the working pressure of the system. Curb stops will be a MUELLER B-25146-3 or Ford F-B44-444G.
- (N) Ball Valve Curb Stops: Ball valve curb stops will be constructed of brass conforming to **ASTM B-61 or B-62**, will be equipped with an operating nut, a pack joint adapter and will be suitable for the working pressure of the system. The valve ends will be male iron pipe thread by female iron pipe thread conforming to **AWWA C- 800**. Buried curb stops will be installed with valve boxes equipped with knock outs.

Ball valve curb stops will be Ford B 81777 WR or approved equals. The operating nut will be a Ford QT-67 or approved equal. The pack joint adapter will be a Ford C 87-77, male iron pipe thread by pack joint, suitable for connection to PVC pipe or approved equals.

- (O) Backflow Preventer: Backflow preventers will be certified by a nationally recognized testing laboratory as conforming to current requirements of **ASSE 3304, AWWA C-506** or **USC-FCCC 8th Edition**. The installation will meet all applicable state and local codes. Backflow preventers 3/4 through 2-inches in diameter will be bronze bodied with threaded connections and a bronze union on either side of the device.

Backflow assemblies 2-inches and larger may be bronze or iron bodied. All internal parts will be of corrosion resistant material. The inlet and the outlet connections will be full faced flanged. The device will be equipped with three leak-proof test cocks.

Reduce pressure zone devices will have a fixed air gap, or funnel installed at the relief port. A drain line will be piped from the discharge side of the air gap as shown on the detail drawings, Appendix A-21 through A-26. Large devices will be supported with two support blocks to prevent flange damage. Backflow preventers will be manufactured by Watts, Hersey or approved equal. The following devices will be installed at the point of contact with the County's system. Backflow preventers will be installed according to the latest version of the Glynn County Water and Sewer Ordinance Cross-Connection Control Plan:

1. Reduced pressure principle: for main supply lines to fire protection systems, hospitals and equipment, car wash facilities, wastewater digesters, sewage plants or other high hazard user.
2. Double-check valve assembly: for food cookers, commercial lawn sprinkler systems, commercial pools, at some types of fire sprinkler system installations or other medium hazard user.
3. Dual check valve assembly: for residential supply lines, large toilet facilities, and individual lawn sprinkler systems at homes or other low hazard user.

- (P) Tapping Sleeves and Crosses: Will be a compact ductile iron, split sleeve, mechanical joint type and will be sized to fit the intercepted pipe. Tapping sleeves will be a MUELLER H-615, MUELLER H-304 stainless steel, FORD FAST style, or approved equal. Tapping crosses will be a MUELLER H-715 or approved equal. Tapping saddles and crosses will be pressure tested at 150 psi, with the County present, before tapping the main.

- (Q) Tapping Valves: Tapping valves will be furnished according to the gate valve specifications shown in Section 1.06 (I). Tapping valves will be equipped with an inlet flanged connection to the tapping sleeve and a mechanical joint outlet connection to the branch pipe. Necessary bolts, glands and gaskets will be furnished by the Contractor. Tapping valves will be a MUELLER H-687 or approved equals. See Appendix A-9 for detailed tapping valve installation.

- (R) Double Strapped Tapping Saddles: Double strapped tapping saddles will be ductile iron body type with National Pipe Threaded outlet. The saddles will have a self energizing O-ring rubber gasket, two alloy steel straps and a female iron pipe tap conforming to **AWWA C-800**. Tapping saddles will be a JCM 402, Dresser Style 194, Smith Blair 313, FORD F-202 or approved equals.
- (S) Flush Hydrants: The Contractor shall install flush hydrants at permanent dead end installations. Flush hydrants will have one 2 1/2-inch Brass NSFT discharge with cap and chain, will be freeze proof, have a traffic break away union; a bronze bodied ball valve with automatic weeps; and will be installed according manufacturers' recommendations. Flush hydrants will be blocked and placed in approximately one cu ft of gravel around the valve assembly. Flush hydrants will be a MUELLER 2-1/8-inch Post Type Hydrant or approved equals. See Appendix A-8 for post type hydrant installation details. See Appendix A-16 for a temporary dead end line flush valve and riser installation detail.
- (T) Fire Hydrants: Fire hydrants will conform to the latest revisions of AWWA C-502, latest revision. Hydrants will be of the compression type, closing with line pressure. The fire hydrant's valve opening will be a minimum of 5-1/4-inches; will be open left; will have two 2-1/2-inch hose nozzles and one 4-1/2-inch pumper nozzle.

In the event of a traffic accident, the hydrant's barrel will break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem. The break design will preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water supply.

The method for attaching the barrel to the standpipe will permit for installing the fire hydrant a minimum of eight different directions.

Fire hydrants will be fully bronze mounted with all working parts of bronze. The valve seat ring will be made of bronze and will screw into a bronze retainer.

All fire hydrants working parts, including the valve seat ring, will be removable through the top of the hydrant without disturbing the barrel of the fire hydrant.

The operating nut will be pentagon in shape and measure 1-1/2-inches from point to flat at the base of the nut and will measure 1-7/16-inches at the top; the faces of the nut will be tapered uniformly and the height of the nut will not be less than one inch. The operating threads will be totally enclosed in an operating chamber separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or oil reservoir. A stop nut will be positioned in the top operating mechanism so that the valve cannot contact the bottom of the shoe when fully open.

The fire hydrants will be of a non-freezing type design and will be provided with a simple and positive automatic drain which will be fully closed whenever the main valve is opened. See Appendix A-6 and A-7 for a typical fire hydrant installation detail.

Minimum depths of bury will be 3.5 feet. The Contractor will provide an offset section equal to products manufactured by GRADELOK to connect the fire hydrant to the hydrant valve and for proper final vertical and horizontal adjustment. Install the offset section according to the manufacturer's recommendations whenever excessive bury is necessary.

The entire outside surfaces of the fire hydrant barrel above grade will be factory painted with Koppers GLAMORTEX 501 red enamel paint or with an equal color that will be approved by the County. Fire hydrants will be a Clow Medallion, M&H 129-01 (traffic model) or a 423-A MUELLER Centurion II or approved equal.

- (U) Couplings: Couplings requiring thrust restraint will be equipped with four steel tie-bolts extending from the steel lugs welded on the pipe to lugs welded on the middle ring of the coupling. The lugs will be shop welded and delivered to the job site ready for installation. Couplings will be Smith & Blair 441, Dresser style 38.
- (V) Polyethylene Encasement: Polyethylene encasement will be used where noted on the approved construction drawings on all ductile iron piping, fittings, valves and appurtenances and installed according to the requirements of **ANSI A21.5** and **AWWA C-105, Sec. 5.4, Method A**.

#### **SECTION 1.07 HANDLING MATERIALS:**

- (A) Pipe and Fittings: The Contractor shall furnish the equipment for unloading, handling, distributing and facilities for storing pipe, fittings, valves and accessories. Materials dropped or dumped during the pipe construction will be subject to rejection by the County without any additional justification.
- (B) Handling: The Contractor shall load and unload pipe, fittings, valves and accessories carefully to prevent shock or damage. Load and unload pipe by rolling it on skids, forklift or front end loader.
- (C) Distributing: The Contractor shall store the pipe and materials so as not to interfere with traffic. No more than 1,000 feet of pipe will be distributed beyond the area where pipe is being laid. The pipe will not obstruct drainage ditches.
- (D) Storage: The Contractor shall store all pipe that cannot be distributed along the route. The Contractor shall properly store pipe in suitable storage areas.

#### **SECTION 1.08 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS:**

The Contractor shall install pipe lines and accessories alongside public highways, or County streets and roadways according to the latest applicable regulations of the State Department of Transportation and Glynn County. The work site will be maintained throughout construction operations with regard to worker safety, traffic control, road maintenance and repair.



- (A) Protection of Traffic: The Contractor shall provide and maintain suitable warning signs, barricades and lights for the protection of traffic. All highway signs removed for construction will be promptly replaced.

The Contractor shall not close or block any highway, city or county street or roadway without first obtaining written permission from the proper authorities.

Project traffic control will conform to the latest edition of the Georgia Manual on Uniform Traffic Control Devices for Streets and Highways.

- (B) Construction Operations: The Contractor shall perform all work along highways, streets and roadways in a manner that causes the least interference with traffic.

1. Stripping: Whenever pipe is installed alongside a road shoulder, the Contractor shall strip and stockpile all of the sod, topsoil, and all other materials that are suitable for the shoulder restoration.
2. Trenching, Laying and Backfilling: The Contractor shall not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove all excess material immediately behind laying operations. The Contractor shall complete the excavation and backfilling for any portion of the trench opened in the same day.
3. Shaping: The Contractor shall immediately after completing backfilling operations reshape damaged slopes, side ditches, and ditch lines. The Contractor shall replace topsoil, sod, and any other suitable materials removed from the road shoulder.

- (C) Excavated Materials: The Contractor shall excavate all materials encountered and dispose of the excess excavated material not required for backfilling in according to applicable local, state and federal regulations. The Contractor shall not place any of the excavated material along highways, streets and roadways in a manner that will obstruct the flow of traffic. Sweep clean all scattered excavated materials off the pavement daily.

- (D) Drainage Structures: The Contractor shall keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material and free to drain at all times during the construction.

- (E) Maintaining Highways, Streets, Roadways and Driveway: The Contractor shall maintain streets, highways and roadways in suitable condition for movement of traffic until the completion and final acceptance of the work. Use steel running plates to maintain traffic flow over all road crossings until the pavement replacement is completed.

The Contractor shall repair all driveways, sidewalks and roadways that are cut or damaged immediately according to ARTICLE III of these specifications.

**SECTION 1.09 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS:** The construction drawings will indicate underground utilities or obstructions that are known to exist according to locates provided by various utility companies. Where these or other unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of the County, to avoid interference. All work performed on the County right of way will be done in compliance with the most current Glynn County Right-of-Way Encroachment Ordinance.

**SECTION 1.10 LOWERING WATER MAINS:** The Contractor shall lower existing water mains to the control elevations shown on the approved construction drawings or as specified by the County. The water lines that are to be lowered will be completely uncovered to the bottom of the main. At all changes in grade or line, the pipe will be firmly wedged against the vertical face of the trench to prevent a joint from blowing off. The main will be lowered to its new elevations by removing the earth from under the main and along-side the pipe uniformly. Deflections in the joints of the main, while lowering or when in final position, will not exceed three degrees for an 18-foot length of pipe. All joints will be reworked so that they do not leak. The joint work will be done in such a manner as to secure tight joints without over straining the bell. The lowered pipe will be true to line and grade.

**SECTION 1.11 OFFSET EXISTING WATER MAINS:** Where water mains must be offset to avoid interference with the new work, The Contractor shall offset existing water mains as shown on the approved construction drawings or as specified by the County. Prior to any work on existing mains, the Contractor shall notify the County Engineering Services Department a minimum of four days in advance of required shut-off.

**SECTION 1.12 TRENCH EXCAVATION:** The Contractor shall excavate trenches to the alignment, depth and width specified or shown on the approved construction drawings. Trench excavation will be in accordance with all federal, state, and local regulations for the protection of the workers. The Contractor shall excavate all materials encountered and dispose of the excess excavated material according to all local, state and federal regulations.

- (A) Depth of Trenches: 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 36-inches from the existing or proposed finished grade, for pipe 12-inches and smaller. Pipe larger than 12-inches in diameter will have 48-inches of cover from plan finished grade.
- (B) Width of Trenches: The Contractor shall excavate the trenches wide enough to allow proper installation of the pipe, fittings, and other materials, and not less than six inches clear of the outside barrel of the pipe on any side at any point. See Appendix C-6 for AWWA suggested top of trench widths.
- (C) Bell Holes: At each pipe joint the Contractor shall excavate a bell hole of ample depth and width to permit a proper joint and to relieve the pipe bell of any load.
- (D) Earth Excavation: The Contractor shall excavate and prepare the trench bottom to support each joint of pipe uniformly throughout its length.

The Contractor shall provide clean fill or gravel to achieve Standard Laying Condition Type 2 in according to **AWWA C-151** if the trench is excavated to excessive width or depth. See Appendix B-22 for standard ductile iron pipe laying condition details.

**SECTION 1.13 TRENCH SHORING:** The sides of trenches will be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by the soil conditions encountered, to protect adjacent property and for safety. Where shown on the approved construction drawings or where directed by the County, the Contractor must install solid sheeting to protect adjacent properties and utilities. The sheeting will be steel or timber. Trench shielding will be installed according to **OSHA 29 CFR, Part 1926 6.50 - 6.52, Subpart P**.

**SECTION 1.14 TRENCH SHORING DESIGNS:** The Contractor shall submit design data, including the section modulus of the members and the arrangement for bracing at various depths, to the County for review before installing the shielding devices. It will penetrate at least three feet below the pumping station or sewer main invert. Sheeting will be removed in units when backfilling has reach the elevation necessary to protect the pumping station, force main, adjoining property and utilities.

When sheeting or shoring cannot be safely removed, it will be left in place. Timber left in place will be cut off at least two feet below the surface.

**SECTION 1.15 DEWATERING TRENCHES:** The Contractor shall dewater excavation continuously and maintain a water level below the bottom of the trench. Dewater running sand by well pointing or under drainage methods. Where the soil conditions do not permit use of well pointing or under drainage systems, construct french drains of crushed stone or gravel to conduct the water to sumps.

**SECTION 1.16 TRENCH STABILIZATION:** The Contractor shall remove and replace the unsuitable material whenever the existing material in the bottom of the trench is unsuitable for the proper installation of the pipe.

When so directed by the County, the Contractor shall undercut and backfill the trench with clean fill or crushed No. 57 granite stone bedding material. Place and compact this material to bring the trench to the required grade. See Appendix B-21 and B-22 for typical bedding requirements for buried pipe lines.

**SECTION 1.17 SEPARATION BETWEEN WATER AND SEWER LINES:** Water mains will not be laid closer than ten feet horizontally to a sanitary sewer without written instruction from the County. Some deviation may be allowed for installation of the water main closer to a sewer, provided that the water main is laid in a separate trench, such that the bottom of the water main is at least 18-inches above the top of the sewer. Water mains crossing sewers should be laid to provide a minimum vertical distance of 18-inches between the invert of the water main and the top of the sewer line. The water and sewer lines in violation of the separation requirements will be encased in concrete. See Appendix B-23 and B-24 for concrete encasement details.

Any pipe, fitting or other material that is discovered to be defective or damaged after being installed, will be removed and replaced immediately. Clean pipe and fittings thoroughly before laying. The Contractor shall keep the pipe lines clean until written final acceptance is received from the County.

**SECTION 1.18 LAYING AND JOINTING PIPE:** The Contractor shall install water lines to conform to the lines and grades as shown on the approved construction drawings.

- (A) Handling: The Contractor shall use suitable tools and equipment to handle and lay pipe and prevent damage to pipe and linings. The Contractor shall examine all pipe carefully for cracks and other defects before the material is installed. The Contractor shall clean pipe thoroughly before laying. Lower all pipe, fittings, valves and accessories into the trench by suitable means. Do not drop or dump pipe, into the ditch. Any pipe, that is discovered to be defective or damaged after being installed, will be removed and replaced immediately.
- (B) Pipe Alignment and Gradient: The Contractor shall lay pipe lines straight in alignment and gradient or follow the true curves as nearly as practicable. Do not deflect any joint of pipe more than  $\frac{2}{3}$  the maximum deflection recommended by the manufacturer. If additional fill is required after the backfilling is completed, install the pipe to a depth that will not cause excessive bury depth once the additional fill is installed.

The Contractor shall maintain a transit and accessories on the job to lay out angles and ensure that deflection allowances and bury depths are not exceeded. Where pipe deflections exceed the manufacturer's recommendation, install fittings as directed by the County and as noted on the approved construction drawings.

- (C) Expediting of Work: The Contractor shall excavate, lay the pipe, install tracer wire, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. When it is necessary to backfill over the end of an uncompleted pipe, close the end with a mechanical type plug.
- (D) Laying Pipe in Trenches: Ductile iron pipe will be laid in according to **ANSI/AWWA C-600**, latest revision. PVC pipe will be laid in according to **AWWA M-23, ASTM D-2774**. The trenches will meet the requirements of Standard Laying Condition Type 2 according to **AWWA C-151**. See Appendix B-21 and B-22 for typical bedding details.

The Contractor shall lay the pipe with solid bearing throughout its length. Attach the tracer wire to the pipe according to the typical detail drawing on Appendix A-12.

1. Earth Trenches: The Contractor shall grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rocks, organics, and other unsuitable materials.

- (E) Push-On Type Joints: When the Contractor installs pipe with push-on type joints, it will be installed according to the product manufacturer's recommendations.
- (F) Mechanical Joints: When the Contractor installs pipes and fittings with mechanical joints; it will be installed in strict accordance with the products manufacturer's recommendations.
- (G) Flanged Joints: The Contractor shall provide a gasket for all flanged type joints. The gasket material will be made of 1/8-inch thick cloth reinforced rubber. The gaskets may be ring or full face type.

The Contractor shall provide the bolts for flanged connections according to the following specifications;

1. Bolts will be steel with American Regular unfinished square or hexagon heads. The nuts will also be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI **B-17.2**. Bolts and nuts will be threaded in accordance with ANSI **B-1.1**, Coarse Thread Series, class 2A and 2B fit.

- (H) Cutting Pipe: The Contractor shall cut ductile iron pipe using an abrasive wheel saw. After cutting the pipe smooth the end before jointing.

The Contractor shall cut PVC pipe using a suitable saw. After cutting the pipe remove all burrs then bevel and or smooth the end before jointing.

**SECTION 1.19 VALVE AND FITTING INSTALLATION:** The Contractor shall check valves for direction of opening, number of turns to open, freedom of operation, tightness of bonnet bolts and test plugs, cleanliness of valve ports and especially seating surfaces. Check valves and fittings for handling damage, and cracks prior to their installation.

- (A) Placement: Valves, fittings, plugs, and caps will be set and joined to the pipe in the manner specified in **SECTION 1.18**. Gate valves will be provided with supports as shown in Appendix A-9. Valves will be installed in the closed position.

In no case will valves be used to bring a misaligned pipe into alignment during installation. Pipe will be supported in such a manner as to prevent stress on the valve.

- (B) Valve Location: Valves in water mains will, where practical, be located within or immediately adjacent to the street property lines unless otherwise shown on the approved construction drawings.
- (C) Drainage Branches and Blow-Offs: Water mains will be drained through drainage branches or blow-offs. Drainage branches, blow-offs, air vents, and appurtenances will be provided with control valves and will be located and installed as shown on the approved construction drawings. Drainage branches or blow-offs will not be directly connected to any storm or sanitary sewer, submerge in any body of water, or be installed in any other manner that will permit back siphonage into the distribution system.

- (D) **Plugs and Caps:** The Contractor shall close dead ends on new mains with plugs or caps that are suitably restrained to prevent blowing off under test pressure. If a blow-off valve precedes the plug or cap, it also will be restrained against blowing off. All dead end lines will be equipped with suitable blow-off facilities.

**SECTION 1.20 THRUST RESTRAINTS:** The Contractor shall install suitable thrust restraints at all points where hydraulic thrusts may develop.

- (A) **Retainer Glands:** The Contractor shall install mechanical type retainer glands on all fire hydrants leads and all other associated fittings, valves, and related piping or as directed by the County. All retainer glands installed will be EBAA IRON, INC., MEG A LUG or approved equal.
- (B) **Harnessing:** The Contractor may install 3/4-inch diameter harness rods with 3/4-inch diameter eye bolts only when and where specifically directed by the County. The harness rods will be manufactured according to **ASTM A-36** or **A-307**, and will have an allowable tensile stress not less than 22,000 psi. The harness rods will be hot dip galvanized and will be field coated with a bitumastic coating before backfilling. When directed by the County, eye bolts, rods, washers and nuts will be 316 stainless steel.
- (C) **Concrete Blocking:** The Contractor shall form and pour concrete thrust blocking at all bends, tees, or other points where thrust may develop.

Concrete will have compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5 inches. For job mixed concrete, submit the concrete mix design for approval by the County. Ready-mixed concrete will be mixed and transported in accordance with **ASTM C-94**.

The Contractor shall form and pour concrete blocking at fittings and valves as directed by the County. Protect bolts, nuts and follow glands from concrete with plastic. Pour the concrete blocking against undisturbed earth. Increase dimensions when required by over excavation. See Appendix A-27 for typical blocking details.

**SECTION 1.21 BACKFILLING:** The Contractor shall backfill and compact the trenches to prevent settlement and displacement of the pipeline installation.

- (A) **Material:** The Contractor shall backfill the trenches with clean earth only. Do not use any rock or organic material excavated from the trenches in the backfill. If necessary, the Contractor shall furnish suitable earth material to backfill the trench.
- (B) **Compaction:** The Contractor shall place clean backfill material in the bottom of the trench and up to two feet above the crown of the pipe in six inch layers. The backfill material will be compacted with two hand operated air hammers with tamping feet, one on each side of the pipe, operated simultaneously.

Once the backfill material is compacted up to the crown of the pipe, the remaining backfill material will be compacted as follows:

1. Install clean backfill material in uniform six inch layers. Tamp the backfill material with light "jumping jack" type tamping equipment.
  2. Install clean backfill material in uniform 12-inch layers. Tamp the backfill material with a heavy air hammer with tamping feet.
  3. Install backfill material in uniform two foot layers. Tamp backfill material with a hydra-hammer type tamping device.
- (C) Compaction Testing: Laboratory tests of the soil will be made according to **ASTM D-698**. In-place density tests will be made according to **ASTM D-1556** or **D-2922**. Results of the test will be furnished to the County by the testing lab before final written approval of the work is requested by the Contractor.
- (D) Backfill Under Roads: Backfill underlying pavement and backfill under dirt and gravel roads will be compacted to at least 95% of the maximum dry density as determined by the Standard Proctor Compaction Test (**ASTM D-698**).

**SECTION 1.22 CROSSING EXISTING ROADWAYS:** The Contractor shall furnish and install steel pipe casings and install the carrier pipe line therein according to the approved detail drawings and the following specifications:

- (A) General: The Contractor shall furnish and operate well points or a under drainage system in the vicinity of the steel pipe casing construction to prevent the accumulation of flood water in the pipe casing and to maintain the ground water table below the pipe casings invert.
- (B) Pipe Casing: The Contractor shall furnish all materials and equipment and will perform all labor required to install the steel pipe casing as shown on the approved construction drawings or as directed by the County.

The steel pipe casing will be Schedule 30 steel pipe manufactured from steel conforming to **ASTM A-139, Grade B**. The outside of the casing pipe will be primed and coated with a hot coal tar enamel a minimum of 0.375 inches thick. Only new primed and coated pipe casing will be used. All rusted steel pipe casing will be rejected. Typical Pipe casing size and thickness will be as shown on Appendix C-1 and C-2.

- (C) Jack and Boring: The Contractor shall install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe. Lengths of casing pipe will be fully welded by a certified welder according to the most current **AMERICAN WELDING SOCIETY (AWS)** recommended procedures.

After the jack and boring installation of the pipe casing has been completed, the Contractor shall install a cleaning plug on the rig and thoroughly clean the inside of the pipe casing of sand and other debris.

- (D) Installation of Pipe: After installation of the pipe casing has been completed, the Contractor shall install the carrier pipe in the casing utilizing factory made spacers. The ends of the casing will be sealed with factory made end seals as recommended by the pipe manufacturer. See Appendix A-19 for typical casing installation details.

Casing Spacers: The Contractor shall install casing spacers on the carrier pipe in a manner that will center the pipe line inside the casing pipe. Casing spacers will be manufactured by Advance Products and Systems, Cascade or approved equal.

Casing End Seals: The Contractor shall close the ends of the pipe casing with factory made 1/8-inch thick rubber seamless end seals. Secure end seal with stainless steel banding straps with 100% non-magnetic worm gear mechanism. Pipe casing end seals will be manufactured by Advance Products and Systems, Cascade or approved equal.

- (E) Traffic Safety: The Contractor shall provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic at all times during the work. The work will be performed in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. If in the opinion of the County the installation is being conducted in an unsafe manner, the Contractor shall be required to stop work and bulkhead the heading until suitable agreements are reached between the Contractor and the County. The County will not be held responsible and will be saved harmless in the event of delays to the Contractor's work resulting from any cause whatsoever.

**SECTION 1.23 STREAM AND DITCH CROSSING:** At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, the Contractor shall carefully compact backfill and place rip rap or grout filled mats to prevent subsequent settlement and erosion. Place rip rap a distance of not less than ten feet up stream and ten feet down stream from any disturbed area. Extend rip rap from 12-inches below stream bed to top of bank. Place rip rap to conform to the natural slope of the stream bank.

Use either (A) or (B) installation method throughout the entire job.

- (A) Stone Rip Rap: The Contractor shall use only sound, tough, durable stones resistant to the action of air and water. Slabby or shaley stones will not be acceptable for use. The specific gravity will be 2.4 or higher. Minimum weight of individual stones will be 50 pounds.

The maximum allowable dimension for an individual stone is 24-inches. The minimum allowable dimension for an individual stone is six inches. At least 50 percent of the stones will have a minimum dimension of 12-inches. Place rip rap in such a way that the smaller stones are segregated but evenly distributed. Place chinking stones in the embed stone rip rap by hand so that a dense, well graded mass is produced.



- (B) Sand-Cement Bag Rip Rap: The Contractor shall use cement sacks or burlap bags having a capacity of from 1 to 2 cubic feet. Do not use bags previously used for sugar or chemicals. Fill bags with a mixture of one part Portland Cement to five parts sand. Embed bags by hand to form a compact layer at least 12-inches thick. Place with overlapping joints. The finished surface will not deviate from that specified by more than three inches at any point.

**SECTION 1.24 TESTING WATER MAINS:** Whenever a potable water supply project previously approved by the County is ready for testing, the Contractor shall fill the line with water, bleed out air and make a hydrostatic leakage test according to **AWWA C600** latest revision.

- (A) Preparation: The Contractor shall provide a hydrostatic test pump, an accurate water meter, an oil filled pressure gauge, and all the other accessories and labor required to perform the test. One inch diameter sampling taps will be installed for every 1,000 LF of pipe installed. Services, if appropriately spaced, can be used for sampling. A blow off and sampling tap will be installed at each dead end to bleed off air and for taking samples for the disinfection test as shown in Appendix A-17 and A-18. Provide and or remove all temporary bulkheads plugs and flanges required to perform the test.
- (B) Test Pressure and Leakage: The Contractor shall test the pipe line at 150 psi for a minimum two hour test period. The test pressure shall be measured at the lowest point. If leaks are detected, the Contractor shall locate, repair and retest the installation until the results are satisfactory to the County. If results are not totally satisfactory, the County may require testing for a longer period of time. The allowable testing leakage will not exceed 11.65 gpd/mile/inch of nominal diameter at a pressure of 150 psi.
- (C) If the initial results are satisfactory, the Contractor shall contact the County Engineering Services Department at (912) 554-7583 and arrange for the pipe line to be tested with the County present.
- (D) Existing Valves: The County will operate existing gate valves and curb ball stops on existing County water systems. The Contractor shall not operate gate valves or curb ball stops on the existing water system without the specific authorization and under direct supervision of the County.

**SECTION 1.25 DISINFECTING WATER MAINS:** The Contractor shall disinfect all newly installed potable water systems, tapping valve and sleeve installations, and all other pipe related installations which may have been contaminated by the work according to **AWWA C651-86** prior to requesting the final connection to an existing County water system.

The Contractor/Developer shall be responsible for the collection and testing of water samples from new water lines or systems. Service laterals to existing residences and other existing buildings will not be connected to new water mains until the water tests have indicated that these mains are safe from contamination. New water mains must be chlorinated prior to any laterals being connected thereto. Application of chemicals into the line as it is laid is prohibited.

A minimum of 48 hours prior to chlorination, the Contractor shall contact the County Engineering Services Department at (912) 554-7583 so that they may schedule the collection of the required sample(s).

- (A) Disinfection Procedure: The Contractor shall prepare a one percent chlorine solution using high-test calcium hypochlorite (HTH) and place an adequate quantity of this solution into the water mains to obtain a minimum chlorine concentrate of 50 ppm. Application of the chlorine may be at the time of filling for pressure testing. At the end of 24 hours check the chlorine residual and if found to be less than 25 ppm add chlorine solution and check again after 24 hours. See Appendix C-3 for the minimum quantities of chlorine solution required per 100 feet of pipe line to obtain the desired chlorine concentration.
- (B) Sampling: The Contractor shall install a sufficient number of faucets to give representative sampling on the newly installed lines. The faucets should be at least 18-inches higher than the ground and must discharge toward the ground. One faucet should be near the point where the public supply enters the new system and another near the end of the main. Faucets will be water-tight and will be removed after testing. Faucets will be tagged with a minimum 6 x 6-inch sign with the warning "DANGER - DO NOT DRINK."
- (C) Final Flushing: After completing the chlorination test, the Contractor shall flush the new installation with potable water and test for chlorine residual at the point of discharge until the chlorine residual is equal to the chlorine residual of the water used for flushing. Allow the pipe line to remain full for 24 hours before taking samples for bacteriological examination. The County will analyze these samples. Results will be acceptable to State and County regulations prior to the Contractor requesting to make a permanent connection to the existing County potable water system. If the samples taken are not satisfactory, the Contractor shall perform additional disinfecting until acceptable samples are obtained.

**SECTION 1.26 PROCEDURES FOR CONNECTIONS OF WATER MAINS:**

- (A) Purpose: To insure that there is a physical disconnection of any new untested water main from existing water mains owned and operated by the County.
- (B) Procedure: Any physical connection of untested water mains with existing County water mains is prohibited except when acceptable cross-connection devices have been installed by the Contractor and checked by County personnel. The Contractor shall contact the Engineering Services Department at (912) 554-7583. The Contractor shall arrange for an inspection of the cross-connection control device before the connection to the existing system is done.
  - 1. Any new water main to be tested must be capped and restrained with retaining glands or thrust blocks to prevent blow out or leakage during the pressure testing.

Water for filling and flushing the new water main will be obtained from any accessible fire hydrant or special wet tap of the existing County main. This physical connection for obtaining water for the new untested main will be protected by a minimum double check valve assembly of appropriate size. Appropriate taps of sufficient size must be made at the end of the new system to allow air to escape during the filling sequence.

2. The physical tie-in with the existing County water system will be physically disconnected after sufficient water for hydrostatic testing and disinfection has been obtained.
3. Once the new water system has demonstrated adequate hydrostatic testing and has been chlorinated in accordance with SECTION 1.25, the new system must be flushed using the filling method in STEP "C". The system will then be subject to bacteriological testing.
4. A minimum of 48 hours prior to making the permanent connection to the existing system, the Contractor shall contact Engineering Services Department at (912) 554-7583 and schedule the inspection of the connection(s). The permanent connection to the new system must be made with clean materials that have been swabbed with heavily chlorinated water. Once the connection is made, the new system must be flushed using water from the existing system to insure adequate flow and velocity into the new system.

# ARTICLE II

## DESIGN AND CONSTRUCTION SPECIFICATIONS FOR WASTEWATER COLLECTION SYSTEMS

**SECTION 2.01 PURPOSE:** This section of the Specifications describes products to be incorporated into the installation of gravity and mechanical sewer systems and requirements for their use. The Contractor/Developer shall furnish and install all products and do all necessary labor to fulfill the requirements of these Specifications.

### **SECTION 2.02 GENERAL:**

- (A) **Applicable Standards:** The Contractor/Developer shall supply all products and do all work according to the American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), American Welding Society (AWS), Occupational Safety and Health Administration (OSHA) or all other recognized standards. Latest revisions of all standards are applicable. If requested by the County, the Contractor shall submit evidence that the manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.
- (B) **Substitutions:** Whenever a product is identified in the County's specifications by reference to manufacturers' or vendor's names, trade names, catalog numbers, etc., the Contractor/Developer may freely choose from those referenced products referenced.

Any item or product, other than those so designated, will be considered a substitution. The Contractor/Developer shall obtain prior approval, in writing, from the County for all substitutions.

- (C) **Warranty:** Wastewater collection systems installed by a Contractor/Developer and accepted by the County for ownership, operation and maintenance will be warranted in writing by the Contractor/Developer. The improvements shall be guaranteed for one year from the date of the final acceptance letter issued by the Glynn County Department of Engineering Services.

Warranty/guarantee letters shall state "**The completed system is free from all defects due to faulty products or construction. In case of failure, I, the Contractor/Developer, will make such corrections as may be necessary due to such defects upon receiving written notice from the Glynn County Department of Engineering Services.**"

- (D) **Sewer Easements and Deeds:** Wastewater collection systems installed by a Contractor/Developer accepted by the County for ownership, operation and maintenance will be installed in either dedicated streets or easements across lands owned by the Developer.

1. Sewer easements for gravity sewers and force mains will be properly executed and recorded. The cleared easement will be a minimum of twenty feet in width with the sewer lines in the middle of the easements.
2. A fee simple deed for wastewater pumping stations will be properly executed and recorded. A minimum 30 x 30 feet fenced in area will be provided for wastewater pumping stations.

**SECTION 2.03 DESIGN CRITERIA:**

- (A) Gravity Sewers: Gravity sewers shall be designed and constructed to give mean velocities, when flowing full of not less than 2.0 feet per second based on Mannings equation using "n" value of 0.009. See Appendix C-7 for minimum pipe slopes which will be provided for plan approval by the County. Pipe slopes greater or lesser than those noted shall be approved in writing by the County before the start of the proposed wastewater system improvements.
- (B) Gravity sewers shall have the last 200 feet section prior to the end of the line at a minimum design slope of 0.6% for 8-inch and 10-inch pipe. Cul-de-sacs with less than eight services shall have gravity sewer serving said services designed at a minimum design slope of 0.6%.
- (C) Sanitary Manholes: The maximum distance between manholes for sewer mains shall be four hundred feet. The Contractor shall install a manhole at the end of each line, where changes in grade, pipe size or alignment occur, and at all road intersections. Manhole sizes in relation to pipe sizes and changes in alignment are shown in Appendix B-7.

**SECTION 2.04 CONSTRUCTION SUBMITTALS:** The term submittals will mean construction drawings submitted on 24 inch by 36 inch sheets, shop drawings, prints, descriptive literature, test reports, samples, calculations, schedules, material lists, pump curves and design information. Submittals will include any additional items of similar meaning.

- (A) Submittals Required: The Contractor/Developer shall furnish the County with five sets of construction drawings and descriptive literature for all manufactured or fabricated products. These submittal documents will be reviewed according to the procedure outlined below. Additional information such as special detailed drawings, scheduled calculations and pump curves, will be provided for review and approval as specifically requested by the County. The Contractor/Developer shall attach a transmittal letter or form with each submittal package.

Construction drawings shall be designed and submitted as outlined in the Glynn County Subdivision regulations section 705.

- (B) Contractor/Developer's Review: The Contractor/Developer shall review and check construction drawings and submittals before submitting documents to the County. The Contractor/Developer shall show approval by initials and date before submitting the documents for review by the County staff. Initially the Contractor/Developer shall furnish the County with a minimum of five copies of all submittals.

- (C) County's Review: Construction drawings and submittal documents will be reviewed, stamped, and dated by the County before they are returned for noted corrections to the Contractor/Developer.

If the construction drawings are found acceptable, the construction drawings will be forwarded to the ENVIRONMENTAL PROTECTION DIVISION (EPD) for review. Until written approval is granted by the EPD, the Contractor shall not begin construction.

The County will approve acceptable construction submittals in writing. Three sets of construction drawings, with the County's approval notation attached will be returned to the Contractor/Developer. Remaining drawings will be retained by the County.

Construction submittals requiring minor corrections before being acceptable will be so noted. The Contractor/Developer shall resubmit rejected construction drawings and submittals to the County for review and approval before installation or use of products.

- (D) Construction Submittals and Drawings: Drawings or other submittals not bearing the County's approval notation shall not be issued to subcontractors or utilized for construction purposes. The Contractor/Developer shall maintain a complete set of construction drawings and material submittals bearing the County's approval notation at the job site always. Otherwise, the work may be halted.

**SECTION 2.05 RECORD DATA:** It shall be required of the Contractor to keep accurate legible records of the location of all sewers, sanitary tees and laterals. These records shall be incorporated into the County's RECORD DRAWINGS. The final system approval will be withheld until such information is received and accepted.

**SECTION 2.06 "RECORD" DRAWINGS:** The Contractor/Developer shall furnish the County with a detailed set of "Record" drawings on 24 X 36 inch Mylar sheets and four legible copies of each sheet. A digital (electronic) copy shall be provided as well. "Record" drawings shall be prepared by a registered professional Engineer or licensed Surveyor. "Record" drawings shall show accurate pipe footage measurements, sanitary manhole top and invert channel elevations, and the location of all sewers, sanitary tees and laterals. All field changes shall be recorded on the "Record" drawings as they occurred.

The Design Engineer or Surveyor shall review and certify to the County on all Mylar drawings that "The Information Shown Is Accurate and Correct." They shall show approval by initials and date.

- (A) Sanitary Sewers: For open ditch or inverted crown street systems, footage measurements for sewage system and/or project improvements shall be shown accurately on "Record" "Drawings". Measurements shall start at the sanitary sewer manhole in the existing sewer system to which the newly install construction connects. The manhole in the existing system shall be labeled STA. 0+00 and measurements shall go upstream. Where a sewer line branches off from the main trunk, the junction manhole shall serve as STA. 0+00 for the branch line. The first branch line shall be labeled with an A, the second branch line with a B, the third line a C and so on.

Thus if the first manhole on the branch line were 225 feet from the junction manhole on the main trunk line, it would have the label 2+25. "Record" footage measurements shall be shown on Record drawings which;

1. Tie sanitary tees to the center of the manhole frame and cover downstream of the service.
  2. Show the distance from the sanitary tee or wye to the end of the service lateral at or near the right-of-way line.
  3. Show the distance from the corner of the corner of the nearest property line to the end of the service.
- (B) Sanitary Sewers: For curb and gutter street systems the curb shall be stamped with a "S" at the closest point to the end of the service (+/- 90° from the street edge for tangent sections and +/- radially on curves). The distance from the back of the curb adjacent to the stamped "S" to the end of the service shall be shown on the "Record Drawings"
- (C) Sewage Force Mains: Force mains shall be shown in plan and profile view. "Record" drawing footage measurement's requirements shall start from the valve vault on the discharge side of the pump station (which shall be labeled STA. 0+00) and continue to the manhole to which the force main discharges. The distance locations of all fittings, air release valves and plug valves shall be given.
- (D) Wastewater Lift Stations: Lift station "Record" drawings shall show the finish wet well base invert, top of wet well slab, finished ground, level controls, influent and effluent pipe elevations. Drawings shall show the fenced in area of the wastewater pumping station and the access road if applicable.

**SECTION 2.07 SEWER PIPE AND ACCESSORIES:** Pipes and accessories will be subject to the inspection by the County at the job site or other points of delivery. This inspection is to help assure that pipes and other products conform to these Specifications.

- (A) HDP/High Density Polyethylene: HDP gravity sewer pipe 18-inches in diameter and larger shall be as manufactured by Gulf Spirallite Engineered Systems. The pipes shall be supplied in lengths not longer than 13 feet.
1. Pipe and Fittings: HDP gravity sewer pipe fitting shall be high density, high molecular weight polyethylene pipe as defined in ASTM D-1248 for Type III, Class C, Category 5, Grade P34 materials. HDP fittings shall be factory fabricated. No field fabrication of fittings shall be allowed. HDP pipe shall be Class 100.
  2. Joints: HDP pipe and fitting joints shall be of the bell and spigot type with a confined rubber gasket. The gasket shall fully comply with the physical on-pressure requirements of ASTM C-443.

3. Manhole Connections: The Contractor shall provide a manhole entry piece consisting of a minimum three foot section of pipe with a smooth surface at one end and a standard bell or spigot at the other end.
  4. Manufacturers Services: The Contractor shall furnish the services of a competent factory representative of the HDP pipe manufacturer for the purposes of supervising and/or inspecting the installation of the pipe. The Contractor shall furnish these services for a minimum of five days during the initial pipe installation.
  5. Acceptance: HDP pipe and fittings will be accepted based on the County's on site inspection and the manufacturer's written certification that the pipe and fittings were manufactured and tested according to the applicable standards.
- (B) POLYVINYL CHLORIDE GRAVITY: PVC pipe shall be suitable for use as a gravity sewer conduit and shall be green in color.

Provisions must be made for contraction and expansion at each joint with a rubber ring. Standard lengths shall be 12.5 feet (+/- 1-inch). Carrier pipes shall be supported by factory made casing spacers when installed in a steel pipe casing. The casing spacers will preclude contact between the pipe bell and coupling and the casing wall. Fittings shall meet the same specification requirements as the pipe. The pipe installation shall conform to the requirements of **ASTM D-2321**.

1. Pipe and Fittings: PVC gravity sewer pipe and fittings shall be **SDR 26** pipe, manufactured according to **ASTM D-3034**. The PVC piping material shall have a minimum cell classification of **12454-B**, or **12364-C** as defined in **ASTM D-1784**.
2. Joints: PVC pipe and fitting joints shall be of the integral bell and spigot type with a confined elastomeric gasket being able to absorb expansion and contraction without any leakage. Joint systems will be subject to the approval of the County and shall be identical for all pipes and fittings.
3. Acceptance: The acceptance of PVC pipes and fittings shall be based on the County's on site inspections and on the manufacturer's written certification that the pipe was tested and manufactured according to the applicable standards.
4. Sanitary Tees: Sanitary tees shall be minimum four inches and the same diameter as the run of the pipe. Sanitary tees shall be the same material as the sewer main.
5. Service Laterals: Sewer service laterals shall be either ductile iron with push-on joints or Polyvinyl Chloride with bells and natural rubber rings for jointing.
6. Metal Detector Tape: A minimum two inch wide metal detector tape shall be installed over all nonmetallic gravity sewers. The tape shall be equal to products manufactured by Lineguard and shall bear the printed identification "Caution Buried Sewer Line Below" (reverse printed) so as to be readable through the Mylar. The tape shall be installed in accordance with manufacturers' written recommendation.



7. Service Line Markers: The Contractor shall furnish and install No.4 steel stakes or a treated 4 x 4 posts at the end of each sewer lateral installed. Markers shall be at least 36 inches long and shall be painted green where they extend above the finished grade. All markers shall extend 12-inches above finished grades. See Appendix B-1 for marker detail.
  8. Tracer Wire: The Contractor shall install a continuous or properly spliced No.12 AWG solid plastic coated copper wire on all nonmetallic sewers. During backfilling the Contractor shall take care to prevent damaging or cutting of the tracer wire. See Appendix B-1 for typical PVC pipe tracer wire installations.
- (C) PVC/Polyvinyl Chloride Pressure Pipes: PVC pressure pipe for force main installations shall be supplied in 20 foot laying lengths.
1. Pipe Conformance: PVC Pipe shall meet the requirements of **ASTM D 2241** Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series), and shall be furnished with an integral bell gasketed joint. PVC Pressure Pipe for 1-1/2 to 15-inch shall be SDR 21 Class 200.
  2. Joints: PVC pipe shall be joined by means of a rubber ring bell joint that shall be an integral part of the barrel or solvent welded at the factory. The joints shall have a space to provide expansion and contraction of the pipe without leaking. Push-on joints shall conform to **ASTM 3139**. Elastomeric seals (Gaskets) shall conform to **ASTM F 477**. Joint systems will be subject to the approval of the County and shall be identical for all pipe installed.
  3. Fittings: Pipe fittings two inches and smaller shall be PVC with Ring Tite rubber joints. Fittings for pipe four inch and larger fittings shall be ductile iron with adapters to PVC pipe. Joints shall be according to **ASTM D-3036**. Pipe fitting joint systems will be subject to the approval of the County and shall be identical for all fittings installed.
  4. Acceptance: Product acceptance will be based on the County's on site inspection and the manufacturer's written certification that the pipe was manufactured and tested according to the applicable standards.
  5. Detection Tape: The Contractor shall install a detectable Mylar encased metal marking tape over all plastic sewer force mains. This tape shall be "safety brown" in color, at least two inches wide, and shall bear the printed identification "Caution: Buried Force Main Below," in reverse print, to be readable through the Mylar. Surface printing on the tape shall be equal to Lineguard Tape II Detectable. The tape shall be buried eight to 12-inches below plan-finished grades after grading is completed and according to the manufacturer's written recommendations.
  6. Tracer Wire: The Contractor shall install a continuous or properly spliced No. 12 AWG solid plastic coated copper wire along with all PVC force mains from iron fitting to iron fitting. The Contractor shall take care during backfilling to prevent damaging or cutting of the tracer wire.

(D) Air Release Valves: The manhole and installation of air release valves shall be according to the details in the approved construction drawings. Before deciding the location of any air release valve, the Contractor shall give the County an accurate profile of the installed force main so that high points in the system can be decided. Air release valves shall be supplied as follows:

1. Type 1: Type 1 air release valves shall be automatic air release type valves and shall be designed to allow escape of air under pressure and close watertight when liquid enters the valve. The valve shall have a maximum orifice diameter of 5/16 inch. Valve bodies shall be cast iron, designed to simplify disassembly for cleaning and maintenance. The floats shall be stainless steel; the valve seat and all working parts shall be of corrosion resistant materials. Type 1 Valves shall be equipped with stainless gate valves and nipples and quick disconnect couplings. Adequate hose shall be supplied to allow back flushing after installation without dismantling the air release valve. Type 1 air release valves shall be recommended by the manufacturer for wastewater service. Type 1 air release valves shall be products manufactured by Apco Valve Corp., Val-Matic or G.A. Industries.
2. Type 2: Type 2 combination air release valves shall consist of an air release valve tapped into the body of an automatic air and vacuum valve. The Type 2 air release valves shall conform to the following:
  - a. Automatic Air and Vacuum Valves: Automatic air release and vacuum valves shall be designed to allow the escape of air, and close watertight when liquid enters the valve, and allow air to enter case of a vacuum.

The valve body shall be cast iron, designed to simplify disassembly for cleaning and maintenance. Floats shall be stainless steel; the valve seat and all working parts shall be constructed of corrosion-resistant materials. This valve shall be equipped with the necessary attachments, including stainless steel valves, nipples, and quick disconnect coupling. Adequate hose shall be supplied to allow back flushing after installation without having to dismantle the valve. Automatic air and vacuum valves shall be recommended by the product manufacturer for wastewater service and shall be products manufactured by Apco Valve Corporation, Val-Matic, G.A. Industries, Crispen, or approved equal.

- b. Air Release Valves: Automatic air release valves shall have a 2-inches diameter N.P.T. inlet, a maximum orifice diameter of 5/16 inch, cast-iron valve body, and shall be designed to simplify disassembly for cleaning and maintenance. The float shall be stainless steel. The valve seat and all internal working parts shall be of corrosion resistant materials. Valves shall be equipped with stainless steel gate valves, nipples, and quick disconnect couplings. Adequate hose shall be installed to allow back flushing after installation without dismantling the valve. Air release valves shall be recommended by the manufacturer for waste water service and shall be products manufactured by Apco Valve Corporation, Val-Matic, G.A. Industries, Crispen, or approved equal.

- c. Single Body Valve: Instead of valves Type 1 or Type 2 described above, a single body, double orifice, sewage combination valve may be installed. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of valves Type 1 and Type 2 noted above. Single body, double orifice valves shall be products by APCO Valve Corporation, Val-Matic, G.A. Industries, Crispin, or approved equal.
- (E) Ductile Iron Pipe (DIP): Ductile Iron Pipe construction shall conform to **ANSI A21.51-9, AWWA C-151** and **ASTM A-746** latest revisions. DIP pipe shall be Class 350 Griffin H<sub>2</sub> Sewer Safe pipe or County approved equals.
- 1. Ductile Iron Joints:
    - a. Flanges Joints: DIP flanges joints shall conform to **ANSI 21.2**. Flanges shall be Class 125. Gaskets for flanges pipe and fittings shall be a 1/16-inch ring gaskets of red sheet rubber. Bolts and bolt studs shall conform to **ANSI B-16.1**.
    - b. Mechanical Joints: Mechanical joints in ductile Iron pipe shall conform to **ANSI A-21.11**.
    - c. Push-on Joints: Push-on DIP pipe joints shall have a rubber gasket that fits into a retainer recess in the bell that produces a watertight joint when the spigot is pushed home.
    - d. Restrained Joints: Restrained joints for pipe, valves, and fittings shall be mechanical joints with ductile iron retainer glands or push-on types equal to American "Lok-Ring," U.S. Pipe "TR Flex," or Clow "Super-Lock". Pipe joints shall have a minimum rated working pressure of 250 psi. The joints shall be according to the applicable portions of **AWWA C-111**. The manufacturer of the joints shall furnish certification, witnessed by an independent laboratory, which the joints furnished have been tested at 500 psi without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.
    - e. Cathodic Protection: The Contractor shall provide approved cathodic protection measures where required by soil conditions, adjacent cathodically protected lines or structures, and other considerations.
  - 2. Ductile Iron Fittings: Ductile iron fittings shall consist of bends, tees, crosses, caps and plugs, reducers, tapped tees, sleeves, etc.
    - a. Fittings for Push-On and Mechanical Joint Pipe: Fittings for push-on and mechanical joint pipe shall be ductile iron, manufactured according to **ANSI A-21.10 (AWWA C-110)** or **ANSI A-21.53 (AWWA C-153)** standards. Ductile iron fittings shall be so designed to adapt to the type of pipe used.

- b. Fittings for Flanged Pipe: Fittings for flanged pipe shall be manufactured according to **ANSI -16.1**, Class 125 flanges.
- 3. Coatings, Linings and Encasement: Ductile iron pipe and fittings shall be bituminous coated on the outside. The inside coating shall be H<sub>2</sub> Sewer Safe SewperCoat as manufactured by Lafarge Calcium Aluminates.
  - a. Bituminous Coating: DIP pipe and fitting bituminous coating on the outside shall be an asphaltic coating approximately 1 mil thick. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be adherent to the iron. All coatings shall meet the requirements of **ANSI/AWWA C151/A21.51 Section 51-8.1**.
  - b. Pipe Linings: The lining shall be SewperCoat as manufactured by Lafarge Calcium Aluminates or approved equal. The coating shall consist of calcium aluminate mortar made of fused calcium aluminate cement and fused calcium aluminate aggregates. Lining thickness shall be 0.125 inches for 6 inches through 12 inches pipe, 0.1875 for 14 inches through 24 inches pipe.
  - c. Polyethylene Encasement: Where shown on the approved construction drawings or as directed by the County, the Contractor shall encase ductile iron pipe in a minimum 8-mil thick tube form polyethylene encasement. The polyethylene encasement shall be installed according to the requirements of **ANSI A-21.5** and **AWWA C-105**, Method A.

**SECTION 2.08 MATERIALS FOR MANHOLES:** The Contractor shall provide the materials for construction of manholes according to the following:

- (A) Precast Concrete: Sanitary manholes shall be of reinforced concrete. They shall be constructed according to the details shown on the approved construction drawings and ASTM C-478 (latest revision). The joints shall be tongue and groove. The joints shall be factory primed and field sealed with a mastic sealant or approved equal.
- (B) Polyethylene Manholes: High density polyethylene (HDPE) manholes will be allowed on a case by case basis as approved by the County. Engineering and technical data must be provided to document that the HPDE manhole is suitable for the proposed location and that it will meet the technical requirements of this specification.
- (C) Mastic Sealants: Mastic sealants shall meet the requirements of **AASHTO M -198**. The sealant shall be preformed type. Minimum nominal diameters shall be two inches. Mastic sealants used shall be products manufactured by "RAM-NEK", butyl rubber, or approved equal.
- (D) Saddle Manholes: Saddle manholes shall be in accordance with details B-8, B-9, or B-10 and be used only with prior written approval.

- (E) Manhole Liners: In areas where a new sewer system saddles an existing sewer line, at lift station receiving manholes, force main receiving manholes or as directed by the County, precast manholes shall include a 5mm thick factory installed HDPE liner. The materials used in the liner shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. The limits of the corrosion protection system shall be all exposed concrete surfaces including walls, taps, sections, risers, etc, unless otherwise directed by the County. Liners shall be Agru "Sure Grip" or approved equals.
- (F) Manhole Frames and Covers: cast-iron manhole frames and covers shall be gray iron, conforming to **AASHTO M 306** for Class 35B gray iron and all other applicable local standards. Acceptance shall be based on Proof Load Tests or Cast Test Bar results. The castings shall be tough, close grained, smooth, and free of blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections.

All frames and covers shall have machined horizontal bearing surfaces with non penetrating pick holes. The cover shall bear the words "SANITARY SEWER." See Appendix C-4 for manhole frame and cover design weight criteria.

1. Bolt-down Manhole Covers: Bolt-down manhole covers shall be equipped with four ½ inch stainless steel bolts and a 1/8 inch red rubber O-ring gasket. All manhole covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into manholes.

- (G) Pipe Connections: Sanitary manholes shall have a factory installed and flexible watertight joints and fasteners for installation of the "manhole entry piece" into manholes. The joint shall be wedge rubber shape equal to "Press Wedge II," or rubber sleeve equal to KOR-N-SEAL. Pipe clamps on joints shall be nonmagnetic series 304 stainless steel.
- (H) Non-Shrink Grout: Non-shrinking grout shall be used to seal lift eye holes, repair leaks and fill the void inside the manhole pipe connector. Non-shrinking grout shall be nonmetallic type.

The grout shall be mixed and placed in accordance with the latest recommendations of the American Concrete Institute, and with the grout manufacturer's published recommendations. See Appendix C-5 for non-shrinking grout requirements. Grout shall be products equal to Hydrostop manufactured by Hydrostop Corporation. Upon request by the County, the Contractor shall furnish independent laboratory test results as evidence of full compliance with these requirements.

**SECTION 2.09 LOCATION AND GRADE:** The approved construction drawings shall show the alignment and grade of sewer mains and the position of manholes and other appurtenances. The grade line shown on the profiles is the grade of the invert of the pipe. The sewer pipe invert and top elevations at each manhole shall be noted. The design slopes shall be according to the grades shown on Appendix C-7.

- (A) The Contractor shall locate and mark the center line of the sewer and clear the easement prior to the start of the project. The clearing for sewer projects installed along County easements will be coordinated with the Glynn County Engineering Department. The clearing for sewer projects installed along State easements will be coordinated with the Department of Transportation.
- (B) The Contractor shall provide a temporary bench mark in the vicinity of each manhole or wet well. A hub shall be located at the center line of each manhole and at all other locations where the alignment of the sewer main changes.
- (C) The Contractor shall begin the gravity waste water system construction at the low end of the sewer and proceed upstream without interruption. Multiple construction sites are not permitted without prior written authorization from the County for each site.
- (D) During construction the Contractor shall protect bench marks and verify their location and elevation if the surrounding area is disturbed, preserve the location of the reference points, and provide all other control points required to properly construct the gravity sewer lines.

**SECTION 2.10 EXISTING UTILITIES AND OBSTRUCTIONS:** The approved construction drawings shall indicate underground utilities or obstructions that are known to exist according to locations provided by various utility companies. Where unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of the County, to avoid interference or job stoppage. All underground utility work will be done in compliance with the most current Glynn County Right of Way Encroachment Ordinance.

- (A) Electronic Pipe and Cable Finder: The Contractor shall furnish and have available at all times an electronic pipe detector, in good working order, to locate existing buried pipe lines or obstructions.
- (B) Relocation of Services: Before the pipe line is laid, the Contractor shall uncover and identify all marked utilities services to avoid interference with such services and to determine whether these services should be relocated. The Contractor shall not attempt to repair any damage done to power, gas, TV cable, or phone services lines resulting from efforts to locate buried services. The Contractor shall notify the utility company involved immediately.

The County will determine the water and or sewer lines to remain in place and the lines requiring relocations. Where the County determines that other utility services require relocating, the Utility will make the necessary changes without cost to the County.

**SECTION 2.11 CONSTRUCTION ALONG ROADWAYS:** The Contractor shall install all sewer lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of the State Department of Transportation and Glynn County with reference to construction operations, safety, road maintenance and repair.

- (A) Traffic Control Devices: The Contractor shall provide traffic control devices that conform to the latest edition of the Georgia Manual on Uniform Traffic Control Devices for Streets and Highways. In locations where traffic flow may be endangered by the construction operations, the Contractor shall at all times maintain and provide suitable signs, barricades and lights for protection of traffic. The Contractor shall replace all roadway signs removed for the construction as soon as possible.

The Contractor shall not close any highway, street or roadway without first obtaining permission from the proper County or Georgia Highway Department authorities.

The Contractor shall provide sufficient barricades, road signs and warning lights and shall maintain at all times at least one traffic lane open during construction. Certified flagmen shall be provided to direct traffic as required by law.

The Contractor shall backfill and back dress all portions of the trench excavated during the same workday. No trench shall remain open over night.

**SECTION 2.12 SEWER EXCAVATION:** The Contractor shall excavate trenches by open cut and true to the lines and grades shown on the approved construction drawings, unless boring is necessary or required. All pavement removal and replacement required by the excavation of trenches shall be done in accordance with the requirements of ARTICLE III. The Contractor shall perform all sewer excavation in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596).

- (A) Trench Dimensions: The Contractor shall excavate trenches to the necessary depths for each class of bedding installed for pipe lines, manholes and other structures. Banks of the trenches shall be cut in vertical, parallel planes equi-distant from the center line. The horizontal distance between such planes, or the overall width of trenches, shall vary with the size of the pipe to be installed.

When vertical banks of trench banks are not practical to construct or create dangerous conditions for workmen, the banks may be sloped provided that such excavation does not damage adjacent structures. Excavate the lower portion of the trench to a width no greater than the outside diameter of the pipe plus 24-inches. Maintain this width up to two feet above the crown of the pipe.

If trenches are excavated to excessive dimensions or collapse because of inadequate or improperly spaced bracing and sheeting, lay the pipe with next better class of bedding. If the excavation for manholes and other structures is made to excessive depth, backfill the area with an approved compacted bedding material to the required grade. See Appendix C-6 for suggested trench widths at the top of the pipe.

**SECTION 2.13 TRENCH SHORING:** The sides of all trenches and excavations shall be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by the soil conditions encountered, to protect adjacent property and for safety. Where shown on the approved construction drawings or where directed by the County, the Contractor must install

solid sheeting to protect adjacent properties and utilities. The sheeting shall be steel or timber. The type of trench shielding installed shall be in accordance with **OSHA 29 CFR, Part 1926 .650 - .652, Subpart P.**

Trench Shoring Design: The Contractor shall submit design data, including the section modulus of the members and the arrangement for bracing at various depths, to the County for review before installing the shielding devices. It shall penetrate at least three feet below the pumping station or sewer main invert. Sheeting shall be removed in units when backfilling has reach the elevation necessary to protect the pumping station, force main, adjoining property and utilities. When sheeting or shoring cannot be safely removed, it will be left in place. Timbers left in place shall be cut off at least two feet below the surface.

**SECTION 2.14 DEWATERING TRENCHES:** The Contractor shall dewater excavation continuously to maintain a water level below the bottom of the trench. Dewater running sand by well pointing or under drainage methods. Where soil conditions do not permit the use of well points or under drainage systems, the Contractor shall construct french drains of No. 57 crushed stone or gravel and conduct water to sumps.

**SECTION 2.15 TRENCH STABILIZATION:** Whenever the material at the bottom of the trench is unsuitable for proper installation of the pipe, the Contractor shall remove and replace the unsuitable material.

When so directed, the Contractor shall undercut the trench, backfill with No. 57 crushed stone bedding material and compact this material to bring the trench to the required grade.

**SECTION 2.16 BEDDING OF PVC AND DUCTILE IRON PIPE:** The Contractor shall install pipe on foundations prepared in accordance with the following specifications.

(A) PVC Pipe: PVC pipe shall be laid as specified using the following classes of bedding required for the various types of soils and conditions encountered. Bedding for PVC pipe shall be in accordance with **ASTM D-2321**, as amended to date, the manufacturer's recommendations and these Specifications.

1. Bedding Materials: Class I materials shall be used for bedding and haunching in wet and dry conditions. Class II, III materials shall only be permitted for bedding and haunching under dry conditions.
2. Depth of Bedding: Materials for bedding will be used to provide uniform longitudinal support for the pipe. Trench shall be undercut to allow for a minimum of six inches of bedding material. After joint assembly, bedding material shall be placed underground around the entire length of the pipe and compacted.

Compaction to the spring line of the pipe shall be of the same material used in the bedding. Backfill with Class I, II, and III material shall be carried to a point six inches above the top of pipe, using hand tools for tamping. If the remaining backfill material contains large particles which could damage the pipe from impact during placement, the initial backfill shall be increased to twelve inches above the top of pipe. Puddling



shall not be allowed as a method of compaction. The remaining backfill shall be specified in **SECTION 2.19** of these specifications. Pipe shall have at least thirty inches (30 inches) of cover before wheel loading and at least forty-eight inches of cover before using heavy-duty tamping equipment such as a hydrohammer.

3. Definition of Bedding Material: Class I, II, and III materials are defined as follows:

Class I - Angular 1/4 to 3/4 inches graded stone. Latest revision of ASTM C-33 Gradation #67 (ASTM #67) or #57 (ASTM #57) are acceptable.

Class II - Coarse sands and gravel with maximum particles size of 3/4 inches including variously graded sands and gravel containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

Class III - Fine sand and clayey (clay filled) gravel, including fine sands, sand-clay mixtures and gravel-clay mixtures.

- (B) Bedding for Manholes and Wet Wells: The Contractor shall excavate a minimum of 12 inches below the planned elevation of the base section and a minimum 12 inches around the outside of the base section. Place and compact No. 57 crushed stone bedding material to the required grade before installing the manhole base section. See Appendix B-3 for a typical manhole base section bedding detail.
- (C) Compaction: Bedding under pipe and manholes shall be compacted to a minimum of 90% of the maximum Standard Proctor density.
- (D) Ductile Iron Pipe: Ductile iron pipe for gravity sewers and force mains shall be laid according to **ANSI A-21.50** using the following type of bedding required for the depth of cover for the various sizes of pipe to be installed. Type 4 and 5 Bedding as shown and described in Ductile/Cast Iron handbook, Fourth Addition, Page 182 - 208 may be used for additional depths if approved by the County.
1. Type 1 - Flat Bottom Trench. Flat bottom trench on undisturbed earth with excavation for bells. Loose backfill shall be as specified in **SECTION 2.19**. See Appendix B-22
  2. Type 2 - Flat Bottom Trench. Flat bottom trench on undisturbed earth with excavation for bells. Lightly consolidated backfill to centerline of pipe, additional backfill shall be as specified in **SECTION 2.19**. See Appendix B-22.
  3. Type 3 - Loose soil Bedding. Pipe bedded in 4-inch minimum Loose Soil. Backfill lightly consolidated to top of pipe. Additional Backfill shall be as specified in the **SECTION 2.19**. See Appendix B-22.
  4. Cover: Maximum depth of cover for ductile iron pipe of the various classes and sizes to be installed are as follows:

**L.A.Y.I.N.G C.O.N.D.I.T.I.O.N  
M.A.X.I.M.U.M D.E.P.T.H O.F C.O.V.E.R (Ft)**

<b>PIPE SIZE</b>	<b>PRESSURE CLASS</b>	<b>NOM. THICK.</b>	<b>TYPE</b>	<b>TYPE</b>	<b>TYPE</b>
<b>In.</b>	<b>Psi.</b>	<b>In.</b>	<b>1</b>	<b>2</b>	<b>3</b>
4	350	0.25	53	69	41
6	350	0.25	26	31	37
8	350	0.25	16	20	25
10	350	0.26	11	15	19
12	350	0.28	10	19	19
16	350	0.30	USE	11	15
18	300	0.32	TYPE	13	17
20	350	0.34	2	15	20

**SECTION 2.17 PIPE INSTALLATION:** The Contractor shall install sewer pipe with the spigots pointing upgrade. The pipe shall be laid in a trench prepared in accordance with **SECTION 2.12**, so that after the sewer is complete, the interior shall conform on the bottom accurately to the grades and alignment fixed or given by the County. Special care should be taken to provide a firm bedding in good material, select borrow, stone backfill or Class "C" concrete, as authorized, for the length of each joint and half of the circumference.

Prior to installation all pipe shall be cleaned out and left clean. Every third joint shall be filled around immediately after being properly placed. The recommendations of the manufacturer of the particular pipe joint used shall be adhered to. The installation of PVC gravity sewer shall conform to the requirements of **ASTM 2321**, as amended to date, as follows:

- (A) Class I Material - USE UNDER WET CONDITIONS - In areas where the pipe will be installed below existing or future ground water levels or where the trench could be subject to inundation Class I material shall be placed to a point six inches above the top of the pipe using hand tools for tamping. Class IV material shall not be allowed in a wet trench.

In the initial stage of placing this type material, take care to ensure that sufficient Class I material has been worked under the haunch of the pipe to provide adequate side support. Precautions will be taken to prevent movement of the pipe during placement of the material under the haunch. Except for the protection of the pipe from large particles of backfill material, little care need be taken and no compaction is necessary in placing backfill material in the balance of the initial backfill area above the pipe. Where unstable trench walls exist because of migratory materials such as water-bearing silts or fine sand, take care to prevent the loss of side support through the migratory action.

USE UNDER DRY CONDITIONS - In any area where ground water will not be experienced at any time above the level of the foundation material or where the trench will not be subject to inundation place Class I material to a point six inches above the top of pipe using hand tools for tamping. If Class II or III material is used above the springline, achieve compaction consistent with Section (B) and (C) depending on the material used.

- (B) Class II Material: Place Class II material to the spring line of the pipe and compact by hand or mechanical tamping. However, in the initial stage of placing this material, take care to ensure that sufficient Class II material has been worked under the haunch of the pipe to provide adequate side support. Take precautions to prevent movement of the pipe during placement of the material under the pipe haunch. Place initial backfill material in two stages; one to the top of the pipe and the other to a point at least 6 inches over the top of the pipe.

Compact each stage of the haunching and initial backfill by hand or mechanical tamping to a minimum of 85 % STANDARD PROCTOR DENSITY. If the remaining backfill material contain large particle which could damage the pipe from impact during placement, increase the second stage of initial backfill to a point at least 12 inches over the top the pipe. If the trench width is less than twice the diameter of the pipe where the moisture content at the pipeline grade is negligible and not subject to seasonal or local variations, Class II material can be installed for pipe haunching in a dry state by hand placement with no compaction. With similar trench moisture conditions, puddle or flood backfill materials to achieve consolidation except during freezing weather.

Place the haunching to the spring line of the pipe, then puddle or flood. Place the initial backfill to provide 9 inches of cover over the top of the pipe, then puddle or flood. Allow time for the puddled or flooded mass in each layer to solidify until it will support the weight of a man. Apply only enough water to give complete saturation of the haunching and backfill material. Drain off excess water or it will retard the drying and consolidation of the haunching and backfill material.

- (C) Class III Material: Place Class III material with care under the lower haunch area of the pipe, compact, and then place additional material to a point six inches above the top of pipe, using hand tools for tamping. If care has been taken to shape the bedding material to the curvature of the pipe, only one stage of placement shall be required to bring the haunching material to the spring line of the pipe.

In either event, thoroughly compact the haunching material to a minimum of 90 % STANDARD PROCTOR DENSITY. Take precautions to prevent movement of the pipe during placing of the material under the pipe haunch.

Perform initial backfilling in the same manner used under dry conditions, using hand or mechanical tamping, but achieve a minimum of 90 % STANDARD PROCTOR DENSITY.

**SECTION 2.18 Handling Pipe And Fittings:** The Contractor shall utilize suitable tools and equipment to handle and install ductile iron pipe and fittings to prevent damage to cement or poly lining. The Contractor shall examine all piping materials for cracks and other defects before and as it is installed.

If any pipe or material is discovered to be defective or damaged after being installed, the Contractor shall immediately remove and replace it.

- (A) Sequence: The Contractor shall excavate, lay the pipe, and backfill as stated above. Do not leave any unjointed pipe in the trench over night. Backfill and compact the trench as soon as possible after laying and jointing is completed. Plug and cover the exposed end of the installed pipeline each day at the close of work and at all other times that work is not in progress. If it becomes necessary to backfill over the end of an uncompleted pipe, the Contractor shall close the end of the pipe with a suitable plug.
- (B) Placing and Jointing: The Contractor shall clean all pipes and fittings thoroughly before laying. Before making the joint, clean the sealing surfaces of dirt, dust, gravel and other foreign substances. Apply the joint lubricant and complete the jointing no later than five (5) minutes after the application of the lubricant or repeat the process. Center the spigot end of the bell of the preceding pipe and shove home. Apply moderate force to ensure proper seating. Protect the pipe bell from damage when the tractor bucket is used to push home large diameter pipes. Field cut pipe for installation of wyes and tees for sewer service connections. Prepare "field cut ends" so that a standard sealing ring can be installed as needed for a water tight joint in accordance with the product manufacturer's instructions.

Immediately after jointing bring the pipe to its final alignment and grade and install the tracer wire on PVC pipe and backfill as required. See Appendix B-1 for typical tracer wire installation.

- (C) Pressure Piping: The Contractor shall comply fully with sections (A) and (B) when laying pressure piping. In addition, the following requirements shall apply:
1. Mechanical and flanges joints shall be installed according to the manufacturer's recommendations.
  2. Special precautions shall be taken to prevent damage to the cement or Polythane lining of ductile iron pipe and fittings during installation of the piping materials.
  3. Force mains shall be laid on a flat and positive grade. The Contractor shall remove and relay any pipeline laid incorrectly on a negative grade
  4. Minimum depth of cover of force mains shall be three feet measured from the crown of the pipe to finished plan grade. Within DOT right-of-way, install force mains at a depth of four feet below the nearest pavement edge.

**SECTION 2.19 BACKFILLING:** The Contractor shall backfill trench work carefully and restore the ground surface to its original condition. Dispose of all surplus or rejected excavated materials.

- (A) Initial Backfill: The Contractor shall place the initial backfill material carefully around the above pipe bedding in uniform 6-inch layers to a depth of at least 18-inches above the pipe bell. Compact each layer thoroughly with suitable hand tools that will not disturb or damage the pipe. Install backfill on both sides of the pipe simultaneously to prevent side pressures.

The initial backfill material shall be earth materials excavated from the trench which is clean and free of rock, organic and other unsuitable materials. If materials excavated from the trenches are not suitable for use as initial backfill material, the Contractor shall obtain suitable materials elsewhere.

After the initial backfill material has been placed and compacted, the Contractor shall backfill with general excavated material. Place backfill material in uniform 12-inch layers in such a manner that injurious side pressure does not occur. The material used will be selected from excavated materials anywhere on the work if this material is suitable.

- (B) **Backfill Under Roads:** Under traffic areas the Contractor shall compact the backfill to a density of not less than 98% of Standard Proctor Compaction Test (**ASTM D-698**). In-place density tests shall be performed in accordance with **ASTM D-1556** or **ASTM D-2922**. One in-place density test shall be performed for each 100 linear feet of pipe or fraction thereof for each four feet of depth or fraction thereof.
- (C) **Backfill In Non-Traffic Areas:** In areas other than traffic areas, the backfill material shall be compacted to a density of not less than 95% of Standard Proctor Compaction Test (**ASTM D-698**). In-place density tests shall be performed in accordance with **ASTM D-1556** or **ASTM D-2922**. One in-place density test shall be performed for each 200 linear feet of pipe or fraction thereof for final six feet of depth or fraction thereof.
- (D) All testing shall be performed by an independent testing laboratory hired and paid by the Contractor. Test results shall be submitted directly to the County.
- (E) **Trench Settlement:** Whenever the trenches have not been properly filled, or if settlement occurs, the Contractor shall refill, smooth off, and finally made to conform to the surface elevation of the ground. Backfilling shall be carefully performed and the original surface restored to the full satisfaction of the County immediately after installation.
- (F) **Additional Backfill Material:** Where final grades above the pre-existing grades are required to maintain minimum cover, additional fill material shall be shown on the approved construction drawing profiles. The Contractor may utilize excess material excavated from the trenches only if the excavated material is suitable for reuse. If the quantity of excess excavated material available is not sufficient, the Contractor shall provide suitable additional fill material.
- (G) **Detection Tape:** The Contractor shall install detection tape approximately two feet below finished grade.

**SECTION 2.20 SEPARATION BETWEEN WATER AND SEWER MAINS:** Parallel separation shall be 10-foot horizontal between gravity sewer, force mains and any existing or proposed water mains. Deviation may be authorized for closer installation provided the sewer line is laid in a separate trench such that the bottom of the water main is at least 18-inches above the top of the force main. Gravity sewers and force mains crossing water mains shall be laid to provide a minimum vertical distance of 18-inches between the invert of the water main and the

top of the force main or gravity sewer line. Where there is less than 18-inches vertical clearance, water mains, gravity sewers and force mains shall: 1) be encased in concrete for a distance which includes the joint on either side of the crossing or 2) the gravity sewer must be designed and constructed equal to water pipe and pressure tested at 150 psi for a minimum 2-hour period to assure watertightness. See Appendix B-23 and B-24 for typical encasement and minimum separation details.

**SECTION 2.21 SANITARY MANHOLES:** Sanitary manholes shall be located and installed according to the approved construction drawings. Typical manhole details are shown on the approved construction drawings. Precast Manhole section shall be construction in accordance with **ASTM C-478**. Manhole sections with either honeycomb defects; exposed reinforcing; broken or fractured tongue or groove; or cracked walls will be subject to rejection by the County for use on the project.

- (A) Handling Precast Concrete Sections: The Contractor shall handle precast sections carefully to prevent cracking or chipping. Any factory coating abraded during the transit or installation process shall be field coated with two coats of BLP Epoxy Coating or equal prior to covering the precast section.
- (B) Provide uniform bedding under the bottom section to prevent uneven loading or settling and to maintain the structure in a plumb and level position. If a preformed opening must be enlarged or altered or if new openings must be made in the field, the Contractor shall minimize the amount of material removed to provide closely matched surfaces for grouting.

**SECTION 2.22 FRAME AND COVER ELEVATIONS:** The Contractor shall install manhole frame and covers outside of paved areas one to three inches above the approved plan finished grade adjacent to the manhole. Whole brick or precast grade rings and mortar shall be used to adjust the frame and cover in landscape areas.

Manhole frame and covers in paved areas shall match the finish pavement grade. Whole brick, precast grade rings and mortar or cast iron grade rings may be used to adjust the frame and cover in paved areas.

**SECTION 2.23 MASONRY:** The Contractor shall use whole hard burned brick of good quality laid in masonry mortar or cement made of one part Type I Portland cement and two parts clean sharp sand. Cement shall conform to **ASTM C-150**. The sand used shall confirm to **ASTM C-53**. After the mortar has dried, apply two coats of bitumastic coating on the mortar.

**SECTION 2.24 DROP CONNECTIONS:** Manholes requiring a drop connection shall be shown on the approved construction drawings. The Contractor shall construct drop connections of the same materials as the upstream sewer line and in accordance with the detail drawings on the approved construction drawings. Base section for drop manholes shall include a factory installed concrete encased PVC elbow.

**SECTION 2.25 INVERT CHANNEL AND APRON:** Factory installed or field constructed manhole invert channels shall be a minimum 5-inches from the bottom of the base section. The

channel in the bottom of the manholes shall be smooth and properly rounded and shall have the same cross section as the invert of the sewers which they connect. Special care must be exercised in laying the channel and adjacent pipes to grade. The apron shall be installed on a 1 to 12 slope and shall be broomed finished to prevent slipping in times of maintenance by the County.

**SECTION 2.26 CONNECTIONS AT SANITARY MANHOLES:** The Contractor shall connect to sanitary manholes by installing manhole entry pieces as follows:

- (A) Do not install the pipe then cut the manhole entry piece. Instead, cut a standard half quarter, or full length pipe so that the manhole entry piece is properly positioned in the manhole wall.
  - (B) The Contractor shall prepare the field cut end so that a standard manhole connector can be installed in the precast section for a water tight joint in accordance with the products manufacturer's recommendations.
  - (C) Connect the connector to the manhole entry piece and to the manhole wall using the type of stainless steel fasteners recommended by the manhole connector manufacturer.
  - (D) Install damp non-shrinking grout in the cavity between the manhole entry piece and the connector from inside the manhole. Coat the grouted areas, once dried, with two coats of BLP Epoxy Coating. See Appendix C-5 for non-shrinking grout requirements.
1. Type A Manhole Connections: The Contractor shall complete Type A manhole connections in accordance with the detail drawings on Appendix B-8. The Contractor shall provide the necessary pipe, sleeves, and couplings required to maintain service in the existing sewer until the new sewer has been completed.

When the new sewer has been completed the County will authorize the Contractor to complete the connection of the existing sewer. At that time the Contractor shall cut or break open the existing sewer at the manhole and plug the effluent pipe with brick and non-shrinking grout, or a pipe plug specifically designed for that purpose. Complete the connection by grouting all connections to the manhole with non-shrinking grout.

2. Type B Manhole Connections: The Contractor shall complete Type B manhole connections in accordance with the detail drawings on Appendix B-9. When the new sewer has been completed, the County will authorize the Contractor to complete the connections of the existing sewer. At that time, the Contractor shall complete the connection of the adjacent manholes, form the new invert channels and then plug the appropriate connecting sewers to be abandoned.
3. Type C Manhole Connections: The Contractor shall complete Type C manhole connections in accordance with the detail drawings on Appendix B-10. When the sewer has been completed, the County will authorize the Contractor to tie in the new sewer lateral to the existing lateral. The Contractor shall install a pre-cast manhole base over the existing sewer, form a new invert, break out existing pipe and plug the abandoned service.

**SECTION 2.27 FUTURE SEWERS:** Where shown on the approved construction drawings or as directed by the County, the Contractor shall provide stub out pipe as shown on the approved construction drawings for future development or extension of the sewer. Future sewers shall be properly laid to alignment and grade as shown on the approved construction drawings and suitably plugged.

**SECTION 2.28 SEWER LATERALS IN MANHOLES:** Sewer service laterals discharging into sanitary manholes shall be installed according to the approved construction drawings. Provide a manhole connector and stainless steel fastener for installation between the service lateral and the manhole wall. See Appendix B-29 for typical manhole base with factory installed service lateral invert construction detail.

**SECTION 2.29 BURIED VALVES:** The Contractor shall equip all buried plug valves with accessories in accordance with the following requirements specified below. Valve installation accessories shall be furnished by the manufacturer of the related valve.

- (A) Valve Boxes: The Contractor shall provide a two piece screw type heavy duty roadway type valve box for each plug valve installed. The valve box shall have cast iron drop covers with the word "SEWER " stamped on it. Valve boxes shall be adjustable to six inches up and down from nominal required cover over the pipe. Typical valve box details are included in Appendix A-10.

If the cover over the main exceeds normal cover, the Contractor shall install a factory made valve box extension section. The valve box extension section shall allow up and down adjustments as stated above.

- (B) Extension Stems: Whenever the cover over the main exceeds normal cover, the Contractor shall install a factory made valve stem extension on the plug valve stem. The valve stem extensions shall raise the operating nut to within 18-inches of the surface. The Contractor shall submit shop drawings to the County for review and approval before installing extension stems.
- (C) Valve Box Collars: The Contractor shall form and pour an 18x18x8 inch concrete collar on each valve box. Concrete collars are optional in paved areas. The concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. In lieu of pouring a concrete collar, the Contractor may use a round precast concrete collar.

**SECTION 2.30 HOUSE CONNECTIONS:** The Contractor shall install sanitary tees designated for connection of service lines in locations according to the approved construction drawings. Service lines shall be installed to the grade and alignment shown on the drawings. Service laterals will end at the right-of-way line unless otherwise directed by the County. See typical service lateral details in Appendix B-1.

- (A) Sewer service lines shall be suitably plugged and marked until put into service. Marking shall be with an 18 inch by ½ inch rebar, painted or flagged with green, and buried 12 to



24 inches below grade. On curb and gutter streets, the curb shall be stamped with an **S**, in the wet concrete, directly over the location of the sewer service. Service lines shall include provisions for cleaning out the line in case of obstructions. Typical detailed drawings of clean out plug installations are included in Appendix B-18.

- (B) The cleanout shall not be installed until the line is put into service.

**SECTION 2.31 THRUST RESTRAINTS:** The Contractor shall install thrust restraints on force mains at points where hydraulic thrust may develop as shown on the approved construction drawings.

- (A) Retainer Glands: The Contractor shall install mechanical type retainer glands on all fittings, plug valves, and related force main piping as shown on the approved construction drawings or as directed by the County. Retainer glands shall be products manufactured by EBAA Iron Inc., MEG-A-LUG or approved equal.
- (B) Blocking: The Contractor may install concrete blocking at bends, tees, caps, crosses, plugs, plug valves and other points on force mains where hydraulic thrust may develop as directed by the County. Form and pour blocking against undisturbed earth as shown on the approved construction drawings, or as directed by the County. Protect nuts, bolts and retainer glands with plastic covering before installing the cement. Increase thrust block dimensions as required by over excavation. See Appendix B-25.
  1. Concrete: Concrete for blocking shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. Mix and transport ready-mix concrete in accordance with **ASTM C-94**. Reinforcement rods shall conform to **ASTM A-615**, Grade 6.
- (C) Harnessing: The Contractor may install 3/4-inch diameter hot dip galvanized rods with eye bolts of equal size where specifically directed by the County. The rod and eye bolts shall be manufactured in accordance with **ASTM A-36** and **A-307** and shall have a tensile stress of not less than 22,000 psi. Coat harness rod with a bitumastic coating before backfilling. 316 Stainless Steel eye bolts, rods, nuts and washers shall be installed as directed by the County.

**SECTION 2.32 CONCRETE COLLARS:** The Contractor shall form and pour an 18x18x8 inch concrete collar at all clean-out plug locations or install a round precast concrete collar as shown on the approved construction drawings. Install the collar at finished grade in landscaped areas and in pavement areas. See Appendix A-10 and B-18 for typical concrete collar placement.

**SECTION 2.33 STEEL PIPE CASING AND ACCESSORIES:** The Contractor shall furnish and install steel pipe casings for road crossings and shall install the carrier pipe line therein according to the following specifications and as shown on the approved construction drawings.

- (A) Steel Pipe Casing: Steel pipe shall be steel conforming to **ASTM A-139**, yield point of

35,000 psi, of diameter and thickness shown on the approved construction drawings for each crossing.

The steel pipe casing shall be Schedule 30 steel pipe manufactured from steel conforming to **ASTM A-139**, Grade B, yield point of 35,000 psi, of diameter and thickness shown on the approved construction drawings for each crossing. The outside of the pipe casing shall be primed and coated with a hot coal tar enamel to a minimum of 3/32-inches thick. Only new primed and coated steel pipe shall be used. Rusted pipe will be rejected. Casing sizes and thickness shall be as shown in Appendix C-1 and C-2.

**Carrier Pipe Casing Spacers:** The Contractor shall install the carrier pipe in the casing using factory manufactured casing spacers to support the carrier pipe. Casing Spacers shall be bolt on style with a shell made in two sections of Heavy T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. See Appendix A-19.

The shell shall be lined with a PVC liner. All nuts and bolts shall be 18-8 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of Heavy T-304 Stainless Steel. The combined height of the supports and runners shall position the carrier pipe in the center of the casing at all times. Casing Spacers shall be manufactured by Cascade Waterworks Manufacturing Company, or approved equal.

- (B) **Pipe Casing End Seals:** The Contractor shall seal the ends of the pipe casing with factory manufactured end seals. See Appendix A-19.

The end seal shall be made of 1/8-inch thick synthetic rubber. The banding straps shall be T-304 stainless steel with 100% non-magnetic worm gear mechanism. Casing ends seals shall be manufactured by Cascade Waterworks Manufacturing Company, or approved equal.

**SECTION 2.34 JACK AND BORING:** The Contractor shall install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by cutting ahead on a continuous auger mounted inside the casing pipe. Fully weld lengths of casing pipe to the proceeding section in accordance with the American Welding Society's recommended procedures. After the boring and installation of the pipe casing is completed, the Contractor shall install a cleaning plug on the rig and thoroughly clean the steel pipe casing throughout.

- (A) **General:** The Contractor shall operate well points or a continuous under drainage system in the vicinity of the pipe casing construction to prevent the accumulation of flood waters inside the pipe casing and to maintain the ground water table below the pipe casing invert. Steel casing of the diameter shown on the approved drawing shall be jacked and bored in the locations indicated. Joints between sections of the steel casing shall be welded by a certified welder. Boring and jacking shall be in accordance with the provisions of SECTION 65 of the Georgia Department of Transportation Standard Specifications.

**SECTION 2.35 TRAFFIC SAFETY:** The Contractor shall provide all necessary bracing, bulkheads and shields that shall ensure complete safety to all traffic at all times during the jack and boring work. The Contractor shall perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. If in the opinion of the County, the installation is being conducted in an unsafe manner, the Contractor shall be required to stop work and bulkhead the heading until suitable agreements are reached between the Contractor and the County. The County will not be responsible and will be held harmless in the event of delays to the Contractor's work resulting from any cause whatsoever.

**SECTION 2.36 CARRIER PIPE INSTALLATION:** After the installation of the pipe casing is completed, the Contractor shall install the carrier pipe line in the pipe casing by use of factory manufactured casing spacers. The casing pipe shall be sealed with factory manufactured synthetic rubber end seals, as stated in **SECTION 2.33 (B)**, after observation by the County. See Appendix A-19 for typical pipe casing detail.

**SECTION 2.37 STREAM AND DITCH CROSSING:** At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, the Contractor shall carefully compact backfill and place rip rap to prevent subsequent settlement and erosion.

This requirement applies equally to construction along the side of a stream or drainage ditch as well as crossing a stream or drainage ditch. Place rip rap a distance of not less than ten feet upstream and ten feet downstream from any disturbed area. Extend the rip rap from one foot below the stream to the top of the bank. Place to conform to the natural slope of the stream bank.

The Contractor shall use installation method (A) or (B) throughout the job.

- (A) Stone Rip Rap: Use only sound, tough, durable stones resistant to the action and effects of air and water. Slabby or shaley pieces will not be acceptable to the County. Specific gravity shall be 2.0 or higher.

Minimum weight of individual stones shall be 50 pounds. The maximum allowable dimension for an individual stone is 24-inches. The minimum allowable dimension for an individual stone is six inches. At least 50 percent of the stones shall have a minimum dimension of 12-inches. Place rip rap in such a way that smaller stones are not segregated but evenly distributed. Place chinking stones in the crevices between the larger stones so that a dense, well graded mass is produced.

- (B) Sand-Cement Bag Rip Rap: Use cement sacks or burlap bags having a capacity of from 1 to 2 cubic feet. The Contractor shall not use bags previously used for sugar or chemicals. Fill bags with a mixture of one part Portland Cement to five parts sand and seal the top to prevent spilling.

Embed the bags by hand to form a compact layer of at least 12-inches thick. Place bags with overlapping joints. The finished surface shall not deviate from that specified by more than three inches at any point.

**SECTION 2.38 INSPECTION AND TESTING SEWERS:** The County reserves the right to periodically inspect the construction. Unless other provisions have been specifically approved by the County, no sewer lines will be placed in service until the County has made a final inspection and acceptance of the facility. The Contractor shall clean and test sewer lines before requesting final acceptance. Where any obstruction is met, clean the sewer by means of rod, swabs, or other instruments. When requested by the County, the Contractor shall flush out lines and manholes before the final inspection is performed.

When the construction is complete in accordance with the approved plans and specifications and the lines cleaned and prepared for inspection, the Contractor shall submit a written request for inspection. The request shall certify that the work is complete and in accordance with the approved plans and specifications.

(A) Gravity Sewers Lines: Gravity sewer lines shall be tested as follows:

1. Alignment and Grade: Gravity PVC or HDP plastic sewer pipe lines shall be straight and show a uniform grade between manholes. All PVC or HDP plastic sewers shall be visually inspected for straightness and uniform grade with the time and date set by the County. The Contractor shall correct any discrepancies discovered during the County's inspections.
2. Leakage Testing: In no stretch of gravity sewer between any two adjoining manholes shall infiltration/exfiltration exceed 100 gpd/per inch diameter/mile. In case leakage exceeds this amount, the sewer shall not be accepted until such repairs and replacements are made to comply with the above requirements.

The Contractor shall furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage tests. If leakage is visible, the Contractor shall furnish and install suitable weirs in manholes approved by the County to determine the amount of leaking ground water into the sewer.

Measure leakage only when all visible leaks have been repaired and the ground water is above the top of the pipe. Repair methods will be approved by the County before backfill material is installed. After the necessary repairs are completed, re-test for leakage.

Where a continuous monitoring of a flow level is required, the Contractor shall provide and the County will operate the required monitoring equipment.

3. Deflection Testing: PVC and HDP gravity sewer pipes shall be tested for excess deflection with the time and date set by the County.

The Contractor shall assure that backfill is sufficient to limit deflection to no more than 5%. PVC or HDP gravity sewer shall be tested for excessive deflection by passing a mandrel through the pipe line with a diameter equal to 95% of the inside diameter of the pipe. The mandrel used shall be supplied by the County. All pipes not passing the 5% deflection limitation test shall be repaired or removed and replaced.

After the completion of successful mandrel testing and cleaning, the County will subject all newly constructed sewer lines to television inspection. All sewer lines, 8 inches in diameter and larger, will be inspected if the lines are to be accepted by the County or will be connected to the County sewer system. Clean shall be defined as free from significant debris, dirt, sand, and other foreign material not normal to a sanitary sewer that would obstruct visual examination of the pipe or would obstruct water flow. Any sags or bellies in the pipe sections shall not hold water more than one-eighth of the pipe's nominal diameter as determined by television inspection. Pipe sections not meeting these criteria shall be subject to removal and replacement, before acceptance by the County and at no cost to the County. If corrective measures are required, the repaired sewer line shall again be subjected to mandrel testing, cleaning, and television inspection. Acceptance testing shall not be performed sooner than 15 days after installation. A representative of the County will witness all acceptance testing. Final approval of the line will be based on successful completion of mandrel testing, cleaning, and television inspection.

It is the responsibility of the Contractor to assure that bedding and backfilling is sufficient to limit deflection and sagging of all PVC pipe to meet the criteria stated above. The County's acceptance will be based on the performance of the sewer line as judged by the stated test criteria.

(B) Service Lateral: It is the responsibility of the Contractor to assure that installation and backfill is sufficient to limit obstructions and deflections in laterals.

1. Deflection: Service laterals will be tested by television inspection. The service lateral shall be flushed with water prior to inspection. The television inspection must show that the service lateral is uniform, with smooth transitions and that all joints are well seated. If not, the lateral shall be repaired or removed and replaced.

(C) Force Mains: The Contractor shall furnish, install and remove all temporary bulkheads, flanges or plugs and subject the force mains to hydrostatic tests at 150 psi for a minimum test period of two hours. Any leaks discovered shall be located and repaired and the line tested until satisfactory results are achieved. Each section tested will be slowly filled with water, care being taken to expel all air from the pipes.

No pipe installation will be accepted until the leakage during the pressure test is less than 11.65 gpd/mile/inch of nominal diameter at a pressure of 150 psi.

**SECTION 2.39 FORCE MAIN CONNECTIONS TO EXISTING STRUCTURES:** The Contractor shall connect the new force main system to the existing structure where indicated on the approved construction drawings. A hole not more than four inches larger than the outside diameter of the new pipe shall be cut neatly in the structure. The new pipe shall be installed with a 90-degree bend inside the structure as shown on the details on the drawing. Fill the annular space around the pipe with damp expanding mortar or non-shrinking grout to make a watertight seal. See Appendix B-14.

**SECTION 2.40 WASTEWATER PUMPING STATIONS:** Sewage pumping stations installed by the Contractor/Developer to be accepted by the County shall be submersible type or grinder

type if the design meets the requirements of **Section 2.40 (F)**, unless otherwise approved or directed by the County. Pumping stations shall be constructed only in locations approved by the County. Pumping station installations shall meet the following minimum requirements:

- (A) Fencing: Security fencing shall be of the complete protection type. The fence shall be seven feet high overall, consisting of 2 inch mesh by 9 gauge by 72 inch aluminum coated steel fabric with black PVC coating, conforming to the latest revision of **ASTM A-491**. The fence shall have a 7 gauge aluminum coated steel coil spring tension wire along the bottom of fence fabric. Three strands of 12 ½ gauge aluminum coated steel of barbed wire with 4 point aluminum barb spaced 5-inches apart mounted on barbed wire support arms shall be installed along the top of the fence fabric. See Appendix B-26 and B-27.

Post: The Contractor shall install galvanized line post, 2-1/2 inch O.D. (3.65 lbs per ft); galvanized corner posts, 3 inch O.D. (5.79 lbs. per ft); galvanized gate posts, four inch O.D. (9.11 lbs per ft); galvanized top rails, 1-5/8 inch O.D. (2.27 lbs per ft) with extra long pressed steel sleeves. Corner and gate post shall have necessary struts and tie bracing.

Gates: A minimum twelve feet wide double leaf gate shall be installed for access to the station. Gates shall be equipped with heavy duty latches and keepers. The fenced in area shall facilitate maintenance equipment access to and from the site.

- (B) Site Cover Preparation: When the backfill is completed to elevation shown on the drawings, the entire site area to be covered with crushed stone shall be treated with a weed killer similar to "Round-up". The site shall then be covered with a black plastic liner prior to installing a minimum six inch thick layer of crusher run, crushed No. 57 stone, gravel or other material approved by the County.

The pumping station site shall be graded to drain to conform to the approved construction drawings. The fence, access road and grassing shall be constructed after the site has been graded.

- (C) Wetwell: Wastewater pumping station wetwells shall be precast reinforced concrete sections conforming to ASTM A-478. The base footing shall be concrete placed on a dry compacted subgrade consisting of a minimum 12-inch thick layer of No. 57 stone. The wetwell shall be constructed to the dimensions shown on the approved construction drawings. The minimum wet well diameter shall be six feet.

1. Access Hatch: The access hatch in the wet well top slab shall have a minimum 48 x 30 inch clear opening, with a load capacity of 150 lbs per square foot. The hatch material shall be Aluminum Alloy 6063-T5 & T6, 1/4 inch plate, with flush type lock and inside spoon handle. The frame shall be equipped with a stainless steel hinged and hasp-equipped cover, two upper guide bar holders and stainless steel chain holders. The hatch frame shall be securely mounted above the pumps. The door shall be torsion bar loaded for ease of lifting and shall have a safety locking handle in open position. Fastening hardware used inside the wetwell shall be stainless steel. It is the contractor's responsibility to confirm that the access hatch is of sufficient size to allow installation and operation of pumps, with mix/flush valve.

2. **Pump Hardware:** The Contractor shall furnish and install guide bars for each pump, to permit raising and lowering the pumps. Guide bars shall be of two inch diameter stainless steel pipe of adequate length to extend from the lower guide holders on the pump discharge connection to the upper guide holder mounted on the access frame. All hardware shall be installed to accommodate two pumps unless otherwise directed by the County. Anchor bolts, nuts, and inserts shall be 316 stainless steel. Pump lifting chains shall be stainless steel. Cables will not be acceptable.
  3. **Wetwell Access:** The wetwell shall be provided with a sleeve, 24 inches below finished grade, for access of the power and control conduits. The sleeve shall be of proper size to accommodate all necessary power and control conduits.
  4. **Wetwell Liner:** All new wetwells shall be coated with products equal to Spectrashield by Spectrum or lined with a factory installed 5mm HDPE liner. The materials utilized in the lining of the wetwell shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. The limits of the corrosion protection system will be all exposed concrete surfaces including walls, tap sections, risers, etc, unless otherwise directed by the County. All penetrations shall be sealed with a welded HDPE boot.
  5. All discharge piping in the wetwell shall be 316 stainless steel.
- (D) **Pump Station Valve Pit:** The valve pit shall be a concrete box of the dimensions shown on the approved construction drawings. Each valve pit shall have a aluminum valve pit hatch cover made of Aluminum Alloy 6063-T5 & T6 with a neoprene gasket to make the hatch water tight. The valve pit cover shall have a minimum clear opening of 3 feet-0 inches x 4 feet-0 inches, with a load capacity of 150 lbs per square foot. The valve pit shall have a minimum two inch diameter drain piped to the wetwell. A swing type check valve shall be installed on the vault drain line as shown on the approved construction drawings. See Appendix B-17 for a typical detail.
- (E) **Pump Design:** The Contractor shall install two submersible type pumps in each wetwell unless otherwise directed by the County. The pumps shall meet the conditions shown on the approved construction drawings and in the specifications. Pumps shall be products manufactured by FLYGT.

Each wastewater pumping station shall have a minimum of 100% standby capacity at the peak design flow. The pumps shall be open, non-clog type designed specifically for the pumping of raw unscreened wastewater and shall have a minimum solids capability of three inches. The design shall be such that the pump unit will be automatically and firmly connect to the discharge connection, permanently installed in the wetwell. The pump shall be easily removable for inspection or service requiring no bolts, nuts or other fastenings to be disconnected.

Major pump components shall be of gray cast iron, Class 30, with smooth surfaces void of blow holes and other structural irregularities. All exposed nuts and bolts shall be of

AISI type 304 or better stainless steel construction. All surfaces coming into contact with sewage, other than stainless steel, shall be protected by a approved sewage resistant coating. Pump exterior shall be sprayed with PVC epoxy primer, and chloric rubber paint finish, or alkyd enamel. The thickness of coating shall be per manufacturer's recommendation for sewage application.

1. Pump Impellers: The impeller shall be made of gray cast iron, (ASTM A-48 Class 30), and shall be enclosed, semi-open, non-clogging, dynamically-balanced, single vane design, capable of passing a minimum of three inch diameter spherical solid. The impeller shall slip-fit onto motor shaft and key and fasten with a stainless steel bolt.
2. Pump Volute: The pump volute shall be made of gray cast iron, (ASTM A-48 Class 30), with smooth internal surfaces free from rough spots and shall have a centerline discharge for guide rail installation. It shall also have a replaceable wear ring or adjustable wear plate.
3. Discharge Connection: The sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices. The pump must adapt to FLYGT guide rail system (including pump base).
4. Pump Bail and Chain: The bail shall be attached to the pump and the chain shackled to the pump bail. This is to permit raising and lifting of pumps for inspection and removal. The chain shall be 304 or 316 steel, stainless steel, sized to support pump weight plus 100%. The shackles and the bail shall be stainless steel of AISI Type 304 or 316 composition.

(F) Grinder Pumps: Grinder type pump stations will be permitted if they meet the following criteria.

1. Design peak flow of less than 80 gallons per minute
2. Area cannot be served by gravity sewer main extension with a depth of less than 14 feet, at any point.

(G) Pump Motor: Pump motors shall be three phase (208 or 240/480). Coordinate three phase power requirements with the local utility. Single phase power shall be considered on a case by case basis. Motors shall be non-overloading at any point in the operating stage. The pump motor shall be a NEMA design B squirrel cage, induction, shell type design, housed in an air-filled, watertight chamber. The stator winding and stator leads shall be insulated with moisture resistant NEMA Class F or greater and shall be heat shrunk. The stator shall be dipped and baked three times in Class F varnish and shall be



heat-shrunk fitted into the stator housing. The motor shall be designed for continuous duty and sustain a minimum of ten starts per hour. The rotor bars and short circuit rings shall be of aluminum. At the design point, the temperature in the winding shall not exceed 155 degree Fahrenheit.

Each phase of the motor shall contain a bimetallic electro mechanical temperature monitor embedded in the motor windings. The monitor shall be connected in series and coupled to the control circuit of the pump control panel so as to shut the pump down should any one of the monitor detect high temperature. The temperature setting of the monitor shall be 140 degree plus or minus 5 degree and shall automatically reset once the stator temperature returns to normal.

1. Pump Efficiency: The efficiency shall be an overall efficiency. The motor at 100% full load shall have a 80% efficiency. The pump at 100% load with a three inch capacity impeller shall have no less than a 41% efficiency.
2. Motor Shaft: The shaft shall be AISI Type 420 stainless steel; one-piece designed to meet the maximum torque requirement at any start-up condition or operating point.

The pump shaft shall rotate on two permanently lubricated bearings. The upper bearings shall be single row grooved balls or roller bearings and the lower shall be heavy double row angular contact bearings. B-10 bearing life shall be a minimum of 40,000 hours.

- (H) Mechanical Seals: Pumps shall be equipped with a tandem double mechanical seal. The oil chamber shall provide lubrication for the seals. Both the lower stationary seal face and rotating seal face shall be made of silicon or tungsten carbide and the other made carbon or tool steel.

The seal faces shall be held in place by individual springs. The springs should withstand weight of pump with proper weight retention. The seals shall require neither routine maintenance nor adjustment and shall not be damaged when the pump is run dry. Seal oil inspection shall be achieved without disassemble of the pump. The seal shall stationary when impeller volutes are removed. It shall require neither maintenance or adjustment.

1. Electronic Probe: The Contractor shall provide an electronic probe in the oil chamber for detecting the presence of water, which would indicate a problem with the seal. If water enters the oil chamber/stator housing, the probe shall close an electric circuit from a solid state device and energize a warning light on the face of the control panel.

- (I) Motor Cable: Motor cable shall enter a junction chamber. The junction chamber shall contain either a terminal board or cable ends and motor leads. All motors shall be dual voltage (240/480). A watertight seal shall be located between the junction chamber and motor chamber.

1. Power Cables: Power cables shall be Submersible Pump Cable type construction. Strain reliefs and elastomer seal shall be provided at each cable entry into the pump. No secondary devices or compounds shall be used. No seals shall be located in the wetwell that will prevent motor power cable removal during service operations.

- (J) Swing Check Valves: Check valves shall be swing type and shall meet the material requirements of AWWA Specification C-508. The valve shall be epoxy coated, iron body, bronze mounted, single gate for non-shock working pressure of 175 psi. The valve shall be so constructed that by simply unbolting and lifting off the cover, the internal working parts may easily be removed and replaced without removing the valve from the line. Check valves shall be supplied with an external swing arm for manual operation during backwash procedures.

Check valves shall have a outside weight and be cushioned type. The cushioned chamber shall be attached to the side of the valve body externally and constructed with a piston operating in a chamber that shall effectively prevent hammering action at the pump discharge heads specified. The cushioning shall be by air, and the cushion chamber shall be so arranged that the closing speed shall be adjustable to meet the service requirements. Check valves shall be suitable for mounting in horizontal lines or vertical lines when water flow is up. Check valves shall have a stainless steel hinge pin that operates in a bronze support bearing. Check valves shall be manufactured by G.A. Industries, CLOW or equal.

- (K) Plug Valves: Plug valves shall be non-lubricated, eccentric type with resilient faced plugs, semi-steel bodies and 125 lb ANSI flanges. Port areas shall have be 100% of full pipe area. Valve seats shall have a welded-in area overlay of high nickel content on all surfaces contacting the plug face. Valves shall have permanently lubricated, stainless steel bearings in the upper and lower plug stem journals. Plugs valves shall have bolted bonnets designed so that they can be repacked without removing the bonnet. All exposed nuts, bolts, springs, and washers shall be zinc plated.

Design of the plug valve shall provide that contact between the seat and the plug shall only occur in the final degrees of the plug movement. Plug valves shall be suitable for throttling service and services where valve operation is infrequent. Plug valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by the hydrostatic tests conducted in accordance with ANSI B-16.1. Plug valves shall be rated at a minimum of 150 psi. Plug valves shall be manufactured by Homestead, MUELLER, or Clow.

- (L) Frost Proof Hydrants: Yard hydrants shall be frost proof type with 36-inch bury. The hydrant shall have a one inch male outlet and a two inch male inlet. The outlet shall be a minimum of 36-inches above plan finish grade. The water line from the main to the hydrant shall be two inch diameter.

The Contractor shall connect to the water main with a tapping saddle or tee and lay two inch pipe to the hydrant. The hydrant shall be set in a gravel pocket. Install an 18x18x8 inch concrete collar around the hydrant after finale grading is completed.

- (M) Backflow Preventer: The backflow preventer for the yard hydrant shall be a two inch bronze bodied, reduce pressure zone (RPZ) assembly. Backflow preventers shall be mounted on the inlet side of the frost proof hydrant and shall be installed a minimum 18-inches above ground.

The Contractor shall have backflow preventers tested by persons possessing a valid Backflow Device Technician certification prior to using water from the hydrant and before final acceptance of the station. Test results shall be submitted to the County for review and approval.

- (N) Bypass Piping: All lift stations shall be piped with a bypass setup for emergency operation capability. The layout of the bypass piping shall be as specified in Appendix B-16. The emergency bypass hose fitting shall be stainless steel male 6 inch cam-lock fitting. Bypass hose fitting shall be rotated to face the entrance gate to facilitate emergency hook-up.
- (O) Force Mains: The minimum diameter of the force main shall be equal to the pump discharge diameter or four inches, whichever is greater. Force mains shall be designed to maintain a minimum flow velocity of two feet per second at the design pumping rate.
- (P) Sewage Pumping Station Control Panel (Multi Trode - MTPC): A pump station control panel shall be provided for each pumping station. Control panels shall respond to a multi sensed probe to automatically start and stop the pump station as well as sound an alarm upon high wetwell levels.
  - 1. The pump control panel shall be the standard system of the manufacturer as modified for this application. Wetwell levels to be used in operation are as shown on the approved construction drawings.
  - 2. Control panels shall be manufactured by Quality Controls or approved equals.
  - 3. Operation Requirements: Control panels shall consist of a main and emergency circuit breaker, a motor circuit protector, and magnetic starter for each pump motor, and 15 amp, 120-volt breaker as required. All pump control operations shall be accomplished by a multi sensed probe type level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle.
  - 4. Level Control System: Level control systems shall be multi Trode type or equivalent, comprising a multi-sensed probe in conjunction with a multi Trode Controller. The system shall operate using low voltage AC as a method of determining liquid level. The level is sensed when the electrical conductivity of the liquid allows a small current to flow, which activates the controller.
  - 5. Multi-Sensed Level Probe: The exposed surfaces of the multi-sensed probe shall be constructed from premium quality PVC extruded tube and Avesta 254 Smo high-grade stainless alloy. Ten sensor points of Avesta 254 Smo are to be spaced equally along the length of the probe assembly with the corresponding, individually

numbered control cables accessible in the attached flexible multi-cored support cable. Flexible probe cables shall be capable of carrying the weight of the probe without the need for additional support and shall be sealed and secured to the tip of the probe by a synthetic rubber compression fitting. Probes shall be pressure injected with a epoxy resin encapsulate to form a rigid homogenous unit.

Probe lengths shall be as shown on the construction drawings or as determined by the engineer as appropriate, at in any case not to exceed 2.5m overall lengths.

Probes shall be suspended, using the stainless steel hook from the stainless stall mounting bracket and cleaning squeegee, positioned at an appropriate place at the top of the wetwell. This shall be done in accordance with the manufacturer's installation instructions.

Probes shall be routed from the wetwell to the control panel via a separate dedicated conduit.

6. For ease of selection of the pump duty (on and off) levels and high or low level alarm set point, each of the 10-probe input wires shall be terminated at a terminal strip inside the control panel.
7. Multi Trode MTPC 2.1 Duplex Pump Controller: Panel mounted pump controllers shall operate in conjunction with the multi-sensored probe by providing extra low voltage AC (12 VAC, 0.8mA. max) via the numbered probe cables. It shall be capable of controlling and monitoring 2 pumps minimum and 1 alarm (selectable - either high level or low level) by activating the pump starters and alarm devices. MTPC controllers shall incorporate 20 front panel LED indicator lamps to give readouts of cycle and setting the Duty Mode. Additionally, a 4-way dipswitch on the rear panel shall be configured to provide the setting of basic operations to match the installation.
8. There shall be a H-O-A switch for each pump installed on the inner panel door.
9. LED Indicator: The MTPC Controller face shall include LED indicators to display the following:
  - Manual/Off/Automatic selection
  - Pump Run
  - Pump Alternation (Duty Mode)
  - Next Pump
  - High or Low Level Alarm
  - Alarm Status (Latch or automatic reset)
10. Key Pad: The key pad shall include membrane-type keys to operate or control the following functions:

Manual/Off/Automatic selection  
Time -delay (15 second) actuation of pump control  
Level alarm reset and alarm latch-off-auto selection  
Alternation (duty mode selector)

11. Dipswitches shall be provided to select the following program functions:

Charge or discharge mode  
High/low level alarm choice

12. Sensitivity settings: 1K-, 4K-, 20K-, or 80K-ohm

13. The Pump Controller shall accept inputs from the Multi Trode probe. Connection shall be simplified by the marrying of numbered probe cables (1-10, as terminated at a distinct terminal strip inside the control panel) to the appropriate terminals on the rear of the MTPC controller.

14. Pump Controllers shall provide volt-free (dry contract) relay outputs for the following:

Pump 1 - change over contacts (SPDT)  
Pump 2 - change over contacts (SPDT)  
High or Low level alarm (flash and constant) (SPDT)

15. Additional terminals on the rear of the MTPC Controller shall be provided to facilitate backup power (12VDC) input and output in the event of power failure.

16. Pump controllers shall be mounted on the internal hinged door of the electrical control panel for the pump station panel and wired in accordance with the manufacturer's installation and operating instructions.

17. Construction: Electrical control equipment shall be mounted within a NEMA Type R dead front enclosure, constructed of not less than 14 gauge type 304 stainless steel. Enclosures shall be equipped with a door and shall incorporate a removable back panel on which control components shall be mounted. The back panel shall be secured to the enclosure with collar studs. Enclosures shall be equipped with a stainless steel drip lip.

18. Components: All motor branch circuit breakers and motor starters shall be of highest industrial quality, and securely fastened to the removable back panels with screws and washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

19. An open frame, across-the-line, NEMA rated, thermal-magnetic motor starter, as manufactured by Square D, shall be furnished for each pump motor. All motor starters shall be equipped to provide overload protection on all phases. Motor starter contacts shall be easily replaceable without removing the motor from the enclosure.

20. A duplex, 12 amp, GFI utility receptacle providing 120 volts, 60 hertz, single phase power shall be mounted inside of the enclosure.
  21. Operating Controls and Instruments: All operating controls and instruments shall be securely mounted on the control compartment door. All controls and instruments shall be clearly labeled to indicate function.
  22. A six digit, nonresetting elapse time meter shall be connected to each motor starter to indicate the total running time of each pump in hours and in tenths of hours.
  23. Control terminal blocks shall be screw clamp type, rated at 600 volts.
  24. Phase Monitors: 230 volt, 3 phase stations shall be equipped with an 11 pin model with two form "C" contacts, 10 amp rated, as manufactured by Diversified Electronics. 480 volt, 3 phase stations shall be equipped with a surface mount unit by Diversified Electronics.
  25. Control wire shall be a minimum 18 AWG, U.L. #1015. All control wire shall be routed through plastic wireway with snap on covers and be neatly bundled and tie wrapped to form a neat assembly.
  26. Engraved nameplates shall be supplied for marking all components. The labels shall be attached with a 5 mil thick, 3M-type adhesive. No foam tape shall be acceptable. The labels shall be uniform in size with ¼ inch minimum letter size.
  27. Control panels shall be equipped with a high-level alarm system consisting of a weatherproof red lexan light and alarm bell. Upon high-level activation, the light shall flash and the bell shall sound. Alarm bells shall remain on until the high level condition clears or until the alarm silence button is pushed. The light shall remain on until the high level condition clears.
  28. A generator receptacle of adequate size shall be provided. A mechanical interlock between main and emergency breakers, which prevents simultaneous actuation of both power sources, shall be provided. Generator receptacles shall be a Crouse-Hinds model AR2041.
  29. The enclosure shall be equipped with a single handle actuated, three point latch-closing mechanism.
  30. Wire Markers: All control wiring shall be numbered on both ends for ease of future trouble shooting.
- (Q) Power System Components:
1. Wiring Diagrams: Prior to installation, the Contractor shall submit three complete sets of electrical wiring diagrams, dimensional drawings, and functional descriptions to the County for approval. Number all conductors to correspond with the wiring diagram provided.

2. Wiring: Wiring shall be as shown on the approved construction drawings. All wire shall be THW and rated for 600 volts, unless otherwise noted.
3. Circuit Breaker: Circuit breakers shall be bolt-on, quick-made, quick-break, thermal magnetic type of the ampacity and interrupting ratings as shown on the drawings. Multiple breakers shall be common internal trip.

Tie handles are not acceptable. Breakers shall be ambient compensated type at 50 degrees C. Circuit breakers shall be NEMA rated.

Motor Breakers shall be a Square D FAL, Class 650 or approved equal. They shall have a minimum symmetrical interrupting capacity of 10,000 Amps at 240 volts and 14,000 at 480 volts.

4. Motor Starter: NEMA rated starter shall be provided for across-the-line starting. Starter shall include auxiliary contacts as indicated by control system functions. Conductors shall be of the highest quality cycles as full load. They shall be a Square D Class 8536 or approved equal.
  5. Grounding/Neutral: Ground and neutral busses shall be provided for all power wiring in panels. Neutral bar lugs shall have same size cable capacity as main breaker.
- (R) Conductors: All conductors shall be copper, type THW and THWN, minimum size No. 12. All conductors shall be color-coded as follows: 230/115 volt, 3 phase, 4 wire system-Phase A: Black, Phase B (high leg): Orange, Phase C: Red, Neutral: White. 480/277 volt, 3 phase, 4 wire system - Phase A - Color Brown, Phase B - Color Orange, Phase C - Color Yellow, Neutral - Color Grey, Ground - Color Green.

The Installer shall number all conductors to show circuit identification and identify each control wiring conductor at each termination and in each accessible enclosure. All conductors in enclosures shall be grouped and laced with nylon tie straps.

There shall be no conductor splices. Connector selection shall be determined by the Installer to comply with the requirements of NEC, the National Electrical Contractors Association's "Standard of Installation", and according to recognized industry practices to ensure products serve the intended functions. Install only one conductor under terminal of individual circuit breakers.

- (S) Electrical Service: The Contractor shall install the electrical service for the pumps in according to the standards of NEMA, The National Electrical Manufacturer Code, and applicable local codes. Three phase power for the pumps shall be provided unless otherwise directed by the County. The electrical service shall be metered separately from any and all other installations.
- (T) Pumping Station Emergency Power: The Contractor shall install the pumping station power supply equipped with provisions for the connection of a portable trailer mounted engine generator set. The arrangement and wiring connections shall be like those shown

on the approved detailed construction drawing. Components shall be rated for expected loads but in no case shall be less than 60 amps. Components that are rated at 200 amps are described below. Construction documents shall show separate mounted main breaker and transfer switch for the auxiliary generator. Permanent emergency power generator shall be provided where design flows exceed 1,000 GPM.

Where higher rated components are required, these components shall be as shown below in items 1 and 2 or equal quality and as similar as possible.

1. Manual Transfer Switch: The Contractor shall install a 3 pole, double throw manual transfer switch in the NEMA 4 enclosure. The switch shall be a G.E. Cat. No. TC35362 or approved equals.
  2. Generator Disconnect: The Contractor shall install a 3 pole, double throw safety switch in NEMA 4 enclosure with mechanical interlock between the pump of position and the receptacle engage function. It shall be a GE Cat. No. THN 3362 JCH or approved equals.
- (U) Protective Coating: The Contractor shall coat all buried piping or submerged metal piping for pumping equipment with a corrosion resistant material. The coating material shall be approved by the County prior to its use.
- (V) Conduit and Connectors: Power cable shall be routed to control panel in appropriately sized PVC coated conduit. The conduit from the wetwell shall terminate 12 inches from the bottom of the control panel. Below the control panel conduit and motor power cable shall be sealed with appropriately sized adhesive coated Raychem heat shrink tubing. Additionally, motor power cables shall be sealed with a watertight DB connector in the control panel.

**SECTION 2.41 SUBMITTALS:** The submittals for submersible pump, motor, guide rail system shall include, but not be limited to the following information relative to submersible pump, motor and guide rail system features.

(A) Submersible and Grinder Pumps:

1. Head capacity efficiency curves.
2. Duty point
3. Input power (kW), voltage, phase, frequency, power factor.
4. Pump efficiency and brake power.
5. Pump construction details: body, vane, impeller, minimum clearance between impeller and volute; vanes, pump dimensions, pump base, discharge nozzle, adapter, seals, bearings, bearing life, bolts, hooks, etc.
6. Pump weight



7. Centerline distance between two pumps
8. Clearance from walls, floor.
9. External coating details of materials, applications, etc.
10. Guide bar rail system: dimensions, material of guide bars, guide supports, hooks, clearance from wall, centerline distances, etc.
11. Motor outline dimensions, weight, construction details, terminal board, seals, shaft dimensions, torque data and structural design data for motor shaft, so cable, bearings, bearing life, etc.
12. Where a winding over temperature device is required, provide a response curve for the temperature device.
13. Three sets of pump operating and maintenance information.
14. Pump overhaul instructions, for each motor rated 5 h.p. and over.

**SECTION 2.42 REMOTE TERMINAL UNIT (RTU):** The work under this section consists of furnishing, installing, testing, FCC licensing, and commissioning Remote Terminal Units (RTU) in accordance with Glynn County Supervisory Control and Data Acquisition (SCADA) system specifications for monitoring and/or controlling the listed requirements. All equipment supplied under this specification shall be totally compatible and integrated successfully with the existing system. Operation protocols, hardware including logic controllers and radio transceivers, control logic programming special features, and spare parts compatibility shall conform to the existing system. Additionally, as part of this specification the supplier shall provide all modifications, additions, deletions, and/or software developmental requirements to successfully integrate the additional RTU's to the existing Man-Machine Interface (MMI) software system and Workstation hardware.

- (A) RTU Hardware: RTU hardware shall be CAT# ESC-4141-GLY Remote Terminal Unit. The unit shall include the enclosure, controller, radio transceiver, antenna, antenna mast, power supply, and miscellaneous cables. The RTU unit shall be supplied by Engineer Services Corporation, P.O. Box 23511, Jacksonville, Florida 32241. Engineering Services Corporation can be contacted at (904) 268-0482; FAX (904) 268-3490.
- (B) Remote Terminal Unit (RTU) shall include the following monitoring points:
  1. Pump 1 status (on-off)
  2. Pump 2 status (on-off)
  3. Pump 1 run time (hours and tenths)
  4. Pump 2 run time (hours and tenths)
  5. Lag pump status (on-off)
  6. Normal wetwell level state, no alarm
  7. High wetwell alarm
  8. Low wetwell alarm
  9. Power failure

10. Phase loss alarm
11. Tamper/intrusion alarm (on panels)
12. Operator emergency alarm
13. SCADA communication failure alarm
14. Potable water distribution pressure
15. Monitor current draw on all three phases

**SECTION 2.43 PORTABLE HOIST:** If required, the Contractor shall furnish a winch type portable hoist for raising and lowering the submersible pumps. The hoist shall be capable of lifting the pumps provided from the wetwell the distance required with a height of hook above access cover of four feet and rotating radius of 22-3/4 inches. A wall socket shall be furnished and installed where shown on the approved construction drawings for anchoring of the hoist. The hoist shall be turned over to the County for offsite storage prior to finale acceptance of the system.

**SECTION 2.44 PUMP TEST:** The Contractor shall furnish the services of a competent factory representative of the pump manufacturer for the purpose of inspecting the installation and initial operation of the pumping station. The equipment shall be inspected for defects or weakness, or both and if found, the equipment shall at once be removed and be replaced with new parts or be made good in a satisfactory manner.

The pump manufacturer's representative shall perform the following operational tests with the County present:

1. Impeller, motor rating and electrical connections shall be checked for compliance to the purchase order.
2. A motor and cable insulation test for moisture or insulation deflects.
3. Prior to submergence, the pumps shall be run dry to establish a correct rotation and mechanical integrity.
4. The pumps shall be run separately for a minimum 30 minutes submerged, a minimum of six feet under water.
5. After operational test No. 4 is satisfactory, the cable insulation test No. 2 shall be performed again.
6. The pump shall be run to develop a pumping head (feet) versus a discharge capacity (gpm) curve. The manufacturer shall certify this "at capacity" pumping curve. A written report stating that the foregoing steps have been done shall be supplied to the County with each pump at the time of shipment.

**SECTION 2.45 WARRANTY:** The pump manufacturer shall make written certification to the County that the equipment and controls have been properly installed and tested in accordance with the approved construction drawings and specifications.

- (A) Warrant at 100% all parts and labor for 1 year (12 MONTHS) that covers normal wear and tear for typical sewage pump applications.
- (B) The manufacturer shall provide a 100% full coverage warranty statement for a period of one year (12 months) from the date of finale acceptance of the pump station by the County for operation and maintenance.
- (C) The pump manufacturer shall furnish the County with a minimum of three service and operation manuals for the pumps installed. Spare parts shall be supplied as previously required by the County.
- (D) The pump manufacturer shall provide the County with the identification of manufacturer's contact person cell phone and beeper number and an alternate name and number for 24-hour availability.

# ARTICLE III

## DESIGN AND CONSTRUCTION SPECIFICATIONS FOR PAVEMENT REPLACEMENT

**SECTION 3.01 PURPOSE:** This section of the Specifications describes products to be incorporated into the removal and replacement of pavements. The Contractor/Developer shall furnish all products, equipment and do all labor necessarily to fulfill the requirements of these Standard Design and Construction Specifications.

**SECTION 3.02 GENERAL:**

- (A) **Applicable Standards:** The Contractor shall supply all products and do all work in according to applicable STATE OF GEORGIA DEPARTMENT OF TRANSPORTATION (DOT), AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO), GEORGIA STATE HIGHWAY DEPARTMENT (GSHD), AMERICAN CONCRETE INSTITUTE (ACI), AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM), CONCRETE REINFORCING STEEL INSTITUTE (CRSI) or other recognized standards. The latest revisions of all standards are applicable.

**SECTION 3.03 REMOVING PAVEMENT:** The Contractor shall remove existing pavement according to the latest specifications of the State Department of Transportation as necessary for installing pipelines and appurtenances as follows;

- (A) **Marking:** Before removing any pavement, the Contractor shall mark the pavement neatly paralleling pipelines and existing street lines. Space the marks to the width of the trench to be excavated before cutting the pavement.
- (B) **Breaking:** The Contractor shall break the asphalt pavement or concrete pavement along the marks by use of jack hammers or by scoring it with a rotary saw and breaking below the score by using jack hammers or other suitable tools.
- (C) **Machine Pulling:** The Contractor shall not remove the pavement with pulling machines until it is completely broken and separated from the pavement that shall remain.
- (D) **Damage to Adjacent Pavement:** The Contractor shall avoid damaging adjacent pavements. They shall replace any accidental damage to the pavement immediately.

**SECTION 3.04 REPLACING ASPHALT PAVEMENT:** The Contractor shall replace existing pavement according to the latest specifications of the State Department of Transportation as necessary for installing pipe lines and appurtenances as follows;

- (A) **Replacing Asphalt Pavement:** Upon the completion of backfilling and consolidation of the backfill, the Contractor shall arrange to have the compaction tested by an independent testing laboratory previously approved by the County. After the compaction testing has been satisfactorily completed, replace all pavements, sidewalks, and bike paths removed during construction. The Contractor shall replace all asphalt pavements, driveways, sidewalks, and bike paths with the same material removed and to the same dimensions that existed or as shown on the approved construction drawings.
- (B) **Site Preparation:** before replacing the pavement, the Contractor shall remove the pavement 12-inches back from the edge of damaged pavement using jackhammers or other suitable tools. Make a final cut in a concrete pavement, using a rotary saw, a 12-inches minimum back from the edge of the damaged pavement.

Granular base material shall be placed to a minimum depth of eight (8) inches and compacted to 95% maximum dry density following trench backfilling and compaction.

- (C) **Concrete Patch:** An eight (8) inch thick concrete slab with black dye in the top two (2) inches may be installed instead of asphalt. The concrete patch shall extend 12-inches on either side of the trench and on undisturbed soil and shall be level with the surface of the existing pavement.

If so directed by the County the base shall be a six (6) inch thick concrete slab extending 12-inches on either side of the trench and on undisturbed soils, then a two (2) inch asphalt surface course shall be placed after a prime coat is applied to the concrete slab at the rate of .25 gallons per square foot to bring the paving to grade.

**SECTION 3.05 CONSTRUCTION MATERIALS:** The Contractor shall place materials for asphalt pavement replacement to dimensions shown on the approved construction drawings. Typical pavement replacement details are included in Appendix P.

- (A) **Base:** The Contractor shall furnish graded aggregate base consisting of processed and blended materials according to SECTION 800, Course Aggregate, of the State Highway Department of Georgia Standard Specifications. Granular material shall meet the following gradation:

Sieve Size %	Passing by Weight
2"	100
1-1/2"	95- 100
1"	70 - 100
1/2"	50 - 80
No. 4	30 - 55
No. 30	12 - 31
No. 200	6 - 15

**SECTION 3.06 PRIME AND TACK COATS:**

- (A) Prime Coat: The prime coat shall consist of spraying the base course with low viscosity liquid asphalt such as RC-30 or RC-70 on the prepared surface of the base and allowing the asphalt to penetrate as far as possible.
- (B) Tack Coat: The tack coat shall consist of spraying the base course with AC-20 or AC-30, Asphalt Cement. When the temperature in the shade is 70 degrees or above, an emulsion such as CRS-2h or CRS-3 may be used.

**SECTION 3.07 SURFACE COURSE:** The surface course for asphalt pavements shall include a paint or tack coat when required by the County, according to the requirements set forth in the Georgia State Highway Department Specifications for Asphaltic Concrete, Type " E " (MODIFIED TOP).

- (A) The surface course shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphalt cement in a central mixing plant. An antistripping agent shall be added to the asphalt-cement in the preparation of the hot mix asphalt concrete when "hydrophilic" aggregates are used. The gradations, asphalt content and stabilities shall be the following:

<b>Sieve Size %</b>	<b>Passing by Weight</b>
3/4"	100
1/2"	85 - 100
3/8"	70 - 85
No. 4	44 - 48
No. 50	10 - 25
No. 200	4 - 7
Asphalt Cement	5 - 7%

Minimum Marshall Stability @ 50 blows - 1,500 lbs.

Apply and compact the surface course in a manner approved by the County. The Contractor shall immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

**SECTION 3.08 TESTS:** The following test shall be made according to the Department of Transportation Specifications or other specified methods.

- (A) Subgrade Compaction: Six (6) inches below the surface. One (1) test per 250 square yards.
- (B) Base: One (1) tests each per 250 square yards.
  - (1) Moisture and Cement Content of Soil-Cement Mixtures.
  - (2) Field Determination of Compaction.

- (C) Asphaltic Concrete: One (1) tests for 250 tons of asphaltic concrete.
  - (1) Asphalt extraction and aggregate tests; one (1) set for each 250 tons of asphaltic concrete.
  - (2) Marshall Stability Tests, stability not less that 1,500 for surface courses. One test for each 250 tons of asphaltic concrete.

**SECTION 3.09 SUPERVISION AND APPROVAL:** The pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement.

The Contractor shall obtain a written agency approval of the pavement restorations before requesting the payment final for the pavement repairs.

The Contractor shall obtain the County's approval for the restoration of pavements that is not the responsibility of a regulatory agency. This shall include private roads, sidewalks, bike paths and driveways.

Complete the pavement restorations when possible after the last of the backfilling is completed.

- (A) Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, the Contractor shall promptly restore or repair defects upon receiving written notification from the County.

**SECTION 3.10 REPLACING CONCRETE PAVEMENT:** The Contractor shall replace existing concrete structures and pavement as necessary for installing pipelines and appurtenances as follows:

- (A) General: Concrete for all parts of the work shall be specified quality and capable of being placed without excessive segregation. When harden, concrete shall develop all characteristics required by these specifications.

**SECTION 3.11 CONCRETE STRENGTH:** The specified compressive strength of the concrete (f'c) for each portion of the structure shall be a minimum of 3,000 psi unless a greater strength is shown on the approved construction drawings. Driveway and road paving shall have a compressive strength of not less than 4,000 psi. Strength requirements shall be based on 28-day compressive strength unless a different test age is specified. The compressive strength of the concrete shall be determined by ASTM C-39.

**SECTION 3.12 FORM WORK:** Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall have sufficient rigidity to maintain specified tolerances. The design and engineering of the formwork, and its construction, shall be the responsibility of the Contractor.

**SECTION 3.13 REINFORCEMENT:** Reinforcing bars shall be deformed except spirals, which may be plain bars. Reinforcing bars shall be Grade 60 conforming to one of the following specifications: ASTM A-615, ASTM A-616, ASTM A-617, ASTM A-706. If called for on the

A-775.

- (A) Sidewalks and Bike paths: Sidewalks and bike paths shall be reinforced by one of the following methods:
  - (1) Welded wire mesh placed 2" from the top surface of the concrete. Minimum size of the mesh shall be 6" x 6" - W2.9 x W2.9.
  - (2) Concrete shall be fiber reinforced.
  - (3) Deformed reinforcement bars providing no less than 0.25 square inches per foot (each way).

**SECTION 3.14 JOINTS:** Construction joints shall be located and detailed on the approved construction drawings. Unless otherwise indicated on the drawings, all reinforcement shall be continued across the joints.

- (A) Tooled Control Joints: Tooled control joints in sidewalks and bike paths shall be provided at a spacing not greater than ten (10) feet on center or twice the width along its length.
- (B) Expansion Joints: Expansion joints shall be located as shown on the approved construction drawings but shall be no further apart than eighty (80') feet along a sidewalk or curb and gutter.
- (C) Joint Sealant: All expansion joints shall be sealed per detail on the approved construction drawings. Joint sealants shall meet the requirements of ASTM C-920, Type S or M, Grade P, Class 25.
- (D) Curb and Gutter: Curb and gutter sections shall be constructed in sections of uniform length not to exceed ten (10) feet in length or be less than six (6) feet in length.

**SECTION 3.15 SURFACE FINISHES:** Formed surfaces shall be given the finishes specified below:

- (A) Rough form finish for concrete surfaces not exposed to the public.
- (B) Smooth form finish for all concrete surfaces exposed to the public view.

**SECTION 3.16 SLAB FINISHES:** Unless otherwise specified on the approved construction drawings, the following finishes shall be used as applicable;

- (A) Broom or Belt Finish: For sidewalks, bike paths, curb and gutter and ramps.
- (B) Troweled Finish: For floors intended as walking surfaces.

- (C) Nonslip Finish: For exterior platforms, steps, and landings, and for exterior and interior pedestrian ramps.



**SECTION 3.17 CONCRETE ROADWAY PAVEMENT REPLACEMENT:** Before replacing the pavement, the Contractor shall make a final cut in on concrete pavements, using a rotary saw, a 12-inches minimum back from the edge of the damaged pavement.

- (A) The existing pavement shall be removed to a minimum of 12-inches on either side of the trench.
- (B) Depth of concrete pavement replacement shall match the existing pavement or shall be a minimum of eight (8) inches thick, whichever is greater.
- (C) Joints and finish of the slab shall match existing pavements. Joints shall have expansion material between old and new paving.
- (D) A minimum eight (8) inch thick concrete slab containing black dye in the top two (2) inches minimum shall be installed. The slab shall extend 12-inches on either side of the trench and on undisturbed earth.

**SECTION 3.18 CONCRETE DRIVEWAY PAVEMENT REPLACEMENT**

- (A) The existing pavement shall be removed to a minimum of 12-inches on either side of the trench.
- (B) Following trench backfilling and compaction, the depth of concrete pavements replaced shall match the existing pavement or shall be a minimum of six (6) inches thick, whichever is greater.
- (C) Joints and finish of the slab shall match existing pavements. Joints shall have expansion material between old and new paving.
- (D) Pavement replacement for each driveway shall be accomplished with one pour. Deviation must be approved by the County.
- (E) All joints shall have waterproof sealer to avoid water intrusion and deterioration of the patch.

**SECTION 3.19 CURB AND GUTTER REPLACEMENTS:** The Contractor shall remove and replace curbs and gutters to their full depth and width.

- (A) Joints and finish of curbs and gutters shall match existing curbs and gutters.
- (B) Joints shall have expansion material between old and new pavements.
- (C) All joints shall have waterproof sealer to avoid water intrusion and deterioration of the work. Deviations must be approved by the County.

**SECTION 3.20 SIDEWALK AND BIKEPATHS REPLACEMENT:** The Contractor shall remove and replace sidewalks and bike paths to their full depth and width.

- (A) Joints and finish of sidewalks and bike paths shall match existing sidewalks and bike paths.
- (B) Joints will have expansion material between old and new pavements as specified.
- (C) Expansion joints shall have waterproof sealer to avoid water intrusion and deterioration of the work. Deviations must be approved by the County.

**SECTION 3.21 EXISTING VALVE BOXES AND MANHOLE FRAME ADJUSTMENTS:**

The Contractor shall furnish all materials and labor and do all excavation and backfilling and other work necessary to complete the item.

- (A) The Contractor shall adjust existing valve boxes and manhole frames to the new grade lines and elevations shown on the approved drawings. All adjustments to structures in areas proposed for pavement shall be accomplished before construction of the base course.

The existing castings shall be removed and, if suitable, reinstalled after adjustments to the structures have been completed. Other materials necessary for this work, such as mortar, grout, concrete, brick, cast-iron grade rings, and other approved materials, shall meet the requirements of these specifications for materials in new structures of the same name.

- (1) Adjust Existing Manhole Frames: Adjustment to grade of existing frames shall include raising or lowering the upper portion of the structure including any necessary sleeve extensions, adjustable manhole rings, gaskets, mortar, masonry or other approved material to bring the frame to the required grade.
- (2) Adjust Existing Valve Boxes: Adjustment to grade of existing valve boxes shall include raising or lowering the upper portion of the box including any necessary sleeve extensions and valve stem extension or other approved material to bring the valve box to the required grade. See Article I of these specifications for valve box and valve stem extension requirements.

# ARTICLE IV

## DESIGN AND CONSTRUCTION SPECIFICATION FOR SITE PROTECTION AND RESTORATION

**SECTION 4.01 PURPOSE:** This section of these Specifications describes products and construction methods to be incorporated into the protection of existing landscape, structures and utilities and the restoration of the project site. The Contractor/Developer shall furnish all products, equipment and do all labor necessary to fulfill the requirements of these Standard Design and Construction Specifications.

**SECTION 4.02 GENERAL:**

- (A) **Applicable Standards:** The Contractor shall supply all products and do all work according to applicable GEORGIA DEPARTMENT OF AGRICULTURE (GDA), AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM) or other recognized standards. The latest revisions of all standards are applicable.

**SECTION 4.03 PROTECTION AND RESTORATION OF WORK AREA:**

- (A) **General:** The Contractor shall return all removed items and restore all areas disturbed, directly or indirectly by work done under these specifications, to their original condition or better, as quickly as possible after the work has started.
- (B) **Man-made Improvements:** The Contractor shall protect, remove and/or replace with the County's approval all fences, piers, docks, walkways, bike paths, disability ramps, curbs, gutters, mail boxes, water and sewer lines, drainage pipes and culverts encountered during the work. The Contractor shall contact and arrange for gas, power, telephone and TV cable lines to be removed or moved by the appropriate utility company.
- (C) **Cultivated Growth:** The Contractor shall not disturb any cultivated trees or shrubbery unless specifically approved by the County. Any such trees or shrubbery that must be removed shall be heeled in by the Contractor and then replanted under the direction of a profession nurseryman.
- (D) **Cutting of Trees:** The Contractor shall not cut or trim trees for the performance of the work unless specifically approved by the County. Protect trees that remain near the work from damage from the equipment. Repair damage trees that are three (3) inch in diameter and larger with the prior directions of a professional nurseryman.

The Contractor shall not store spoil from excavation against tree trunks. Promptly remove all excavated materials stored over the root system of trees to allow proper natural watering of the tree root system.

The Contractor shall remove trees and brush promptly and completely from the work

area. Tree stumps, wood or piles of trash shall not be permitted on the work site at any time.

- (E) Regarding Existing Ditches: The Contractor shall promptly regrade and shape existing drainage ditches disturbed by the work. Ditches shall be regraded and shaped to give a bottom uniform slope, without depression that hold water, and that conforms to plan grades. The side slopes shall be smooth and uniform, dressed by hand, if necessary, conforming to the indicated slopes on the approved drawings.

**SECTION 4.04: SILTATION AND SOIL EROSION CONTROL:** The Contractor shall control siltation and soil erosion by using silt fences, hay bays, mulch, grasses, slope drains, and other erosion control devices or machines as necessary.

Siltation and erosion control shall meet the Georgia Erosion and Sedimentation Act of 1975 as amended to date and with these specifications.

Siltation and soil control may include temporary construction work outside the rights-of-way where necessary because of construction operations, such as haul roads and equipment storage sites.

- (A) Temporary Erosion Control: Temporary erosion shall consist of planting temporary of a quick growing species such as millet, rye grass, or cereal grasses suitable to the area. Seed, fertilizer, mulch periodic watering shall be applied in adequate quantities to assure a full, healthy ground over the entire disturbed area of construction operations. All materials shall be grassed when possible after backfilling operation has been completed.
- (B) Silt Fence: Where shown on the approved construction drawings the Contractor shall build self-supporting silt fences. The silt fence fabric shall be Type "A" (36" height). The manufacturer shall either have an approved color mark yarn in the fabric or label the fabricated silt fence with both the manufacturer and fabric name every 100 feet. The fabric shall meet the following requirements:

**WOVEN FABRICS**

Grab Strength	90 lbs.
Mullen Burst Strength	250 lbs.
UV Resistance	90%
Permittivity	15 gal/min/sf.

Silt fencing shall be an EXXON GTF-180 Fabric, AMOCO Woven Construction Fabric No. 1380 or approved equal.

- (C) Post: Post shall be four (4) feet long 2x4 wood or 0.75-lb./ft steel. Post installation shall start at the center of the low point (if applicable) with remaining post spaced at six (6) feet apart. Posts shall be driven into the ground a minimum of 18-inches. Silt fence fabric shall be secured to the post with nails, staples, wire or string. The toe of fabric shall be buried six (6) inches in the soil with two (2) inch turn backs. If the fence is built in sections, a minimum of 18-inches overlap will be required. The Contractor shall maintain the silt fence until the project is vegetating or accepted. Filter fabric shall be replaced whenever it has deteriorated too such an extended that it reduces the effectiveness of the fabric.

Instead of the silt fence describe above, the Contractor may use hay bales. Hay bales shall be placed as shown on the approved soil erosion detail drawings and secured with 2x2 wood post or No. 4 steel rebar.

**SECTION 4.05 GABIONS:**

- (A) Gabions shall be constructed of heavy galvanized steel wire mesh with a zinc coating of triple hexagon weaves. The mesh wire diameter for the galvanized gabions shall be 2.2 mm (.0866") +/- 2-1/2%; the mesh edge wire shall not be less than 2.7 mm - 2-1/2%. Lacing wire for binding the netting units together shall be 2.2 mm (.0866") + 2-1/2%.

**SECTION 4.06 PLASTIC FILTER FABRIC:**

- (A) Plastic filter fabric shall be a previous sheet of plastic yarn, of a long chain synthetic polymer composed of at least 85% by weight propylene, ethylene, amide, ester, or vinylidene chloride. The fabric shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and/or heat exposure. The cloth should be finished so that the filaments will retain their relative position with respect to each other. The cloth shall be free of defects, rips, holes, or flaws. During shipment and storage, the filter fabric shall be wrapped in a protective material. The fabric shall meet the following requirements.

**WOVEN FABRICS:**

Tensile Strength (any direction)	200 lbs.
Bursting Strength	400 psi
Elongation Before Breaking	15%
Permittivity	4 gal/min/sf.

The product shall be EXXON GTF-400E, AMOCO Woven Construction Fabric No. 2002 or approved equal.

**SECTION 4.07 SITE SAFETY:** The Contractor shall incorporate and utilize all necessary fencing and other safety barriers as necessary, or directed by the County, to prevent trespassing into potentially dangerous areas of the erosion control area.

Every effort shall reasonably be employed by the Contractor to control erosion with the use of, but not limited to, terraces, grassing, and silt fencing during the project. All erosion and sedimentation control measures or facilities, weather temporary or permanent, shall be continuously maintained by the Contractor so as to be effective, or as ordered by the County.

**SECTION 4.08 BUFFER ZONE:**

- (A) A buffer zone is an undisturbed zone or "green belt" surrounding the site, bordering streams or environmentally sensitive areas. Contractors shall not trespass on or in these areas unless he has prior acceptance by the County. Trespass in these areas will not be permitted unless there is no alternative method to accomplish the task. Cost shall not come into consideration in the evaluation of

this type of request.

**SECTION 4.09 CONSTRUCTION EXIT:**

- (A) Construction exits shall be located at the exit of the project to remove mud from the tires of all vehicles leaving the site. The construction exit shall consist of a minimum of six (6) inch thick pad of washed stone meeting ASTM d-448 No. 1 (1-1/2" to 3-1/2" diameter) and of the necessary length to accomplish the task for which it is intended. The pad may require periodic top dressing with two (2) inch of similar stone.

**SECTION 4.10 DUST CONTROL ON DISTURBED AREAS:**

- (A) Dust raised from vehicular traffic will be controlled by wetting down the access road with water or by the use of a deliquescent chemical, such as Calcium Chloride, Anionic Asphalt Emulsion, Latex Emulsion or Resin-in- Water if the relative humidity is over 30%. Chemicals shall be applied according to the manufacturer's recommendations.

**SECTION 4.11 SEDIMENT BARRIER:**

- (A) Sediment barrier shall be constructed of hay bales (pine bales) anchored and embedded into the soil to prevent washout or water washing under the barrier. A minimum of two (2) re-bars, steel pickets or 2" x 2" stakes shall be used per bale and shall be long enough to extend through the bale and be driven into the ground a minimum of 1-1/2 feet. Where two (2) rows are called for, the bales shall be staggered.

**SECTION 4.12 INLET SEDIMENT TRAP:**

- (A) The Contractor shall erect silt fence or hay bales at and around inlets under construction. Existing inlets in paved areas shall be protected by the use of concrete blocks wrapped with filter fabric. Sufficient quantities of selected devices shall be utilized to completely protect the entire length of the inlet. The Contractor may alternately construct a temporary baffle in the inlet on the effluent pipe that accumulated sediment be removed after each erosion event.

**SECTION 4.13 GRASSING:** Materials for regrassing of disturbed areas shall conform to the following:

- (A) Fertilizer: The Contractor shall use 10-10-10 commercial grade fertilizer of accepted type, conforming to state fertilizer laws.
- (B) Lime: The Contractor shall use agricultural grade ground lime that conforms to the requirements of the Georgia Department of Agriculture. Lime shall be added based on soil test.
- (C) Seed: The Contractor shall use seed in restoration work according to all State Laws and to all requirements and regulations of the Georgia Department of Agriculture.

**SECTION 4.14 MULCHING MATERIALS:** The Contractor shall use mulching materials as follows:

- (A) **Straw Mulch:** Straw mulch material shall consist of hay or straw. Straw mulch shall be stalks of wheat, rye, barley, oats, or other accepted straw. These materials shall be reasonably dry and shall be reasonably free from mature seed bearing stalks, roots or bulblets. The Contractor shall comply with all State and Federal domestic plant quarantine regulations.
- (B) **Excelsior Mulch:** Excelsior mulch shall consist of wood fibers cut from sound green timber. The average length of the fibers shall be 4 to 6 inches. The cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to the natural grain of the wood so as to cause splintering of the fibers when weathering in order to provide adherence to each other and to the soil.
- (C) **Wood Cellulose Mulch:** Wood cellulose fiber mulch shall be made of wood chips particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogenous slurry. The mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate the underlying soil. The mulch shall be heat processed so as to contain no germination or growth-inhibiting factors. It shall be dyed (non-toxic) an appropriate color to facilitate metering of material.

**SECTION 4.15 SODDING:** The Contractor shall install sod according to the following:

- (A) **Sod:** The Contractor shall use densely rooted, good quality centipede grass, free of noxious weeds. The sod shall be obtained from areas where the soil is reasonably fertile. The sod shall be raked free of all debris and the grass mowed to two (2) inches before planting. The sod shall contain practically all of the dense root system and not be less than one (1) inch thick. Sod shall be cut in uniform strips not less than 12-inches in width and not less than 24-inches in length.
  - (1) Sod shall be placed between March 1st and December 1st.
  - (2) Sod shall be placed within 24 hours of being cut.
  - (3) Sod shall be moist when laid and placed on moist ground. The sod shall be carefully placed by hand, beginning at the toe of slopes and working upwards. All joints shall be tightly butted and end joints staggered at least 12-inches. The sod shall be immediately pressed firmly into the ground by tamping or rolling. Fill all joint between strips with fine-screened soil. Sod on slopes shall be pegged with sod pegs to prevent movement. The sod shall be watered, mowed, weeded, repaired or otherwise maintained, by the Contractor to insure the establishment of a uniform healthy stand of grass until acceptance is granted by the County.

**SECTION 4.16 STAND OF GRASS:** The Contractor shall establish a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the weather and be capable of re-establishment in the spring.

Before acceptance of the seeding performed for the establishment of temporary vegetation, the Contractor shall be required to produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or the establishment of permanent vegetation is to commence.

- (A) **Seeding Dates And Rates Of Application:** The Contractor shall perform seeding during periods and at the rates specified in the Georgia Department of Agriculture seeding schedules. Seeding work may, at the discretion of the Contractor, be performed throughout the year using the schedule prescribed for the given period. Seeding work shall not be conducted when the ground is frozen or excessively wet. The Contractor will be required to produce a satisfactory stand of grass regardless of the period of the year the work is performed.

**SECTION 4.17 GROUND PREPARATION:** The Contractor shall prepare areas disturbed by the work as follows:

- (A) The areas to be seeded by the Contractor shall be smooth and uniform and shall conform to the finish grade and cross section shown on the drawings or as otherwise designated. Minor shaping and smoothing of uneven and rough areas outside the graded section shall be performed as directed by the County in order to provide for more effective erosion control and for ease of subsequent mowing operations.
- (B) The areas to be grassed, if not loose, shall be loosened to a minimum depth of three (3) inches before agricultural lime, fertilizer, seed or sod is applied. The areas to be seeded shall be cleared of stones, roots and debris.

**SECTION 4.18 LIME AND FERTILIZER:** Following advance preparation, the Contractor shall uniformly spread lime if called for based on soil test and fertilizer over the designated areas and shall be thoroughly mixed with the soil to a depth of approximately two (2) inches. Fertilizer shall be applied at a rate of 500 pounds per acre of the initial application unless otherwise directed by the County. Lime shall be applied at the rate determined by the soil test. Unless otherwise provided, lime shall not be applied for temporary seeding. In all cases where practicable, acceptable mechanical spreaders shall be used for spreading fertilizer.

When fertilizer is applied in combination seed fertilizer drills, no further incorporation will be necessary. The fertilizer and seed shall be applied together when the method of seeding (Wood Cellulose Fiber Mulch) is used. Any stones larger than 2 -1/2 inches in any dimension, larger clods, roots or other debris brought to the surface shall be removed.

**SECTION 4.19 SEEDING:** The Contractor shall apply seeds to areas disturbed by the work as follows:



- (A) Sowing: The Contractor shall sow seed shall within 24 hours following the application of fertilizer and lime and preparation of the seedbed as specified in SECTION 4.13. Seed shall be uniformly sown at the rate specified by the use of acceptable mechanical seed drills. Rotary hand seeders, power sprayers or other satisfactory equipment may be used on areas that are inaccessible to seed drills.
- (B) Seed Cover: The Contractor shall cover seeds and lightly compact the soil by means of a cultipacker or light roller if the drill does not perform this operation. On areas inaccessible to compaction equipment, the seed shall be covered by dragging spiked chains, by light harrowing or by other satisfactory methods.
- (C) Watering: The Contractor shall apply water with a fine spray immediately after each area has been sown.
- (D) Soil Conditions: The Contractor shall not sow seed when the ground is dry, during windy periods or immediately following a rain.
- (E) Mulch Application: All seed areas with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using two (2) tons of mulching material per acre.

**SECTION 4.20 SEEDING (EXCELSIOR MULCH):**

- (A) Seed shall be sown as specified in SECTION 4.19. Within 24 hours after the covering of seed, excelsior mulch shall be uniformly applied at the rate of two (2) tons per acre. The mulch may be applied hydraulically or by other acceptable methods. Should the mulch be placed in a dry condition, it shall be thoroughly wetted immediately after placing. The County may require light rolling of the mulch to form a tight mat.

**SECTION 4.21 SEEDING (WOOD CELLULOSE FIBER MULCH):**

- (A) After the lime has been applied and the ground prepared as specified in SECTION 4.14 and 4.18, wood cellulose fiber mulch shall be applied at the rate of 1,500 pounds per acre in a seed and fertilizer mixture. Hydraulic equipment shall be used for the preparation of fertilizer, seed and slurry of the prepared wood pulp. This equipment shall have a built-in agitation system with an operation capacity sufficient to agitate, suspend, and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles, which will provide an even distribution of the slurry on the various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.

The seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by the hydraulic seeding method specified herein. The materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be so regulated that

the amounts and rates of application shall result in a uniform application of all materials at rates not less than the amount specified. Using color of the wood pulp as a guide, the equipment operator shall spray the prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream so as to fall like rain, allowing the wood fibers to build upon each other until an even coat is achieved.

**SECTION 4.22 MAINTENANCE:** The Contractor shall maintain seeded and a sodded area until final acceptance by the County is granted. Maintenance shall consist of providing protection against traffic, watering to ensure uniform seed germination and to keep surface of soil damp. The Contractor shall be responsible for repairing any areas damaged as a result of construction operations or erosion.

# ARTICLE V

## REMOVAL AND ABANDONMENT PROCEDURES

**SECTION 5.01 PURPOSE:** This section of these Specifications describes methods of removal, salvaging, backfilling and disposal of miscellaneous structures and roadway items. The Contractor shall furnish all labor, materials and equipment necessary to fulfill the requirements of these Standard Specifications.

### SECTION 5.02 CONSTRUCTION METHODS

- (A) Protection of Structures to Remain: If any of the work necessary for the removal of any structure may endanger any new construction, that part of the work shall be finished before new construction is begun. The use of explosives, equipment or devices, which may endanger structures, facilities or other property, to remain in place will not be permitted. If any parts of structures are to remain in place, the Contractor shall protect them from danger during the construction. It is the duty of the Contractor to protect and salvage the value of all materials to be salvaged.
- (B) Extent of Removal: All existing structures together with their parts and connections, shown on the drawings or designated to be removed shall be separated or entirely removed. Where a part of any existing structure is to remain in place, the part to be removed shall extend to a construction joint or cut off to the lines shown on the drawings, leaving reasonably smooth faces. The removal of walls and other masonry construction shall extend to the bottoms of the foundations unless otherwise specified, and in all cases, walls and their foundations within the construction area shall be removed to an elevation at least five (5) feet below the top of the finished grade. For roadways, the removal shall extend to at least three (3) feet below the top of the subgrade.
- (C) Wet Well and Sanitary Manholes: Metal casings shall be removed without damage and shall be reused on new structures or salvages, whichever the Engineer may direct. Unless otherwise shown on the drawings, existing brick or precast manholes and wet wells will be plugged at each outlet and inlet with appropriate mechanical plugs then removed down to four (4) feet below the ground level and filled with good clean fill. The Contractor will compact the fill material as specified in Article II of these specifications.

Wet Well top slabs shall be removed and disposed. The bottom base or slab of sanitary manholes and wet wells shall be removed, or if the Engineer permits the to remain in place, they shall be broken up in such a manner that water readily passes through them.

- (D) Flowable Fill: Sanitary manholes and wet wells will be plugged at each outlet and inlet inside the manhole or wet well with appropriate mechanical plugs then filled with a factory produced flowable fill.

In roadways, the manhole or wet well walls shall be removed down to the top of

the subgrade where the aggregate base course starts. The base section slab shall remain intact if flowable fill is used to backfill existing sanitary manholes and wet wells.

- (F) Backfilling: All trenches and other excavations dug for removing miscellaneous structures shall be backfilled with approved materials. The backfill materials shall be compacted as specified in Article II of these specifications. On embankments, the degree of compaction shall be equal in compaction to the soil surrounding it.
- (G) Structures To Remain: Miscellaneous structures including fences, buildings, pipe lines, poles lines, water and sewer lines, and other improvements which are to be retained by their owners or which are to be removed by others shall be unharmed by the Contractor.

Structures, portions of structures, or materials which are to be salvaged, retained, or used in the reconstruction work and which have been damaged or destroyed as a result of the Contractors operation shall be repaired or replaced by the Contractor at their expense.

- (H) The attention of the Contractor is directed to the possible existence of underground utilities, which may be buried and may not be shown on the Drawings. The Contractor shall take all reasonable precautions to protect these facilities from damage during construction. Facilities to be abandoned, not shown on the Drawings, shall be disposed of as directed the Engineer.

- (I) Fences: Removal of fences shall be done so as to prevent the escape of pets and livestock.

- (1) Fences to be reset

- a. The Contractor shall exercise special care to protect the coating of fence fabric, steel and wooded posts, horizontal members and braces.
- b. The Engineer may require the removing of concrete from and the cleaning of reusable post removed; however, the Engineer will permit the Contractor to substitute new post in lieu of cleaning the old ones. No separate payment will be made for new posts substituted for old ones.

**SECTION 5.03 DISPOSAL OF MATERIALS:** All materials having salvage value shall be carefully removed and neatly stacked or stockpiled on the site near the point of removal and above the high water levels as directed by the Engineer. The Engineer may direct that concrete shall be broken into sizes suitable for riprap and stockpiled at a designated location by the Contractor.

Waste materials shall be spread on the site or other designated point as directed by the Engineer. If the waste materials are not suitable for this purpose, the Contractor shall dispose of the materials off the site at their expense as part of this pay item.

**SECTION 5.04 PIPE ABANDONMENT:** The Contractor will plug sewer mains and services in sanitary manholes with appropriate mechanical plugs. The manhole will be filled with flowable fill to a minimum distance of 12-inches over the crown of the hole in which the plug is installed.

Sewers with excessive infiltration located underneath an existing or proposed structure will be plugged at the downstream manhole and filled to the upstream manhole with flowable fill. The Contractor will abandon the downstream manhole as outlined in Section 5.02 (D) of this specification before the line is filled with flowable fill material.

Sewer laterals will be cut off at four (4) feet below ground level and plugged with an appropriate mechanical plug unless otherwise shown on the drawings. The Contractor will compact the backfill fill material as specified in Article II of these specifications.

# ARTICLE VI

## DESIGN AND CONSTRUCTION SPECIFICATIONS FOR PIPE BURSTING

**SECTION 6.01 PURPOSE:** This section of these Specifications describes products to be incorporated into the installation of sanitary sewer pipe burst materials and requirements for these products. The Contractor/Developer will furnish all products, equipment and do all labor necessarily to fulfill the requirements of these Standard Design and Construction Specifications

### SECTION 6.02 GENERAL

- (A) Description: This includes requirements to rehabilitate sanitary sewers by the pipe bursting method. This method involves splitting the existing pipe and immediately installs a new polyethylene pipe, reconnections of existing sewer house connections, television inspection of the polyethylene pipe and complete installation according to the contract documents.

Only pneumatically operated equipment with either front or rear expanders for the proper connection to the polyethylene will be allowed for use. The pneumatic tool must be used with a constant tension hydraulic twin capstain winch of either 5, 10, or 20 tons; the size of the winch depends on the diameter of the pipe to be replaced. In no case, the constant tension on the winch will exceed 20 tons.

- (B) Applicable Standards: The Contractor/Developer will supply all products and do all work according to the American Society for Testing and Materials (**ASTM**), American Water Works Association (**AWWA**), American National Standards Institute (**ANSI**), Occupational Safety and Health Administration (**OSHA**) or other recognized standards. Latest revisions of all standards are applicable. If requested by the County, the Contractor will submit evidence that the manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two (2) years.
- (C) Quality Assurance: The Contractor will be certified, in writing, by the Pipe Bursting System Manufacturer that such firm is a fully trained licensed installer of their pipe bursting system. The Contractor must be licensed by British Gas and must have a minimum of one hundred thousand feet of pipe installed by the pipe bursting method and five years field experience. The certification and license will be submitted as part of the bid documents.
- (D) Personnel Certifications: Polyethylene pipe joining will be done by personnel trained and certified in the use of thermal butt-fusion and recommended methods for new pipe connections.

The Contractor will provide a certification of training for each person directly involved with the handling, inserting, trimming, and finishing of the pipe. Any new member to the site not previously certified will verify certification with the County before any work is done by the new member.

(3) The Contractor will hold the County completely harmless in any legal action resulting from patent infringements. The Contractor must provide to the County verification that all licensing agreements with British Gas are current and that there are no legal actions pending against the licensee.

(E) **Warranty:** Wastewater collection systems installed by the Contractor/Developer will be warranted in writing by the Contractor/developer. The improvements will be guaranteed for one (1) year from the date of the final acceptance letter issued by the County to the Contractor.

**Warranty/guarantee** letters will state that the completed system is free from all defects due to faulty products or construction. In the event of failure, I, the Contractor/Developer, will make such corrections as may be necessary due to such defects upon receiving notice from the County.

**SECTION 6.03 CONSTRUCTION SUBMITTALS:** The term submittals will mean shop drawings, prints, descriptive literature, test reports, samples, calculations, schedules, materials list, design information, catalog data and manufacture's technical data showing complete information on material composition, physical properties and dimension of new pipe and fittings. Include manufacturers' recommendation for handling, storage and repair of pipe and fittings damaged. The Contractor will furnish the County with five (5) sets of construction drawings and descriptive literature for all manufactured or fabricated products.

(A) Construction Methods Submittals: The method of construction, grouting process and restoration of existing sewer house connections will include but not be limited to the following submittals:

(1) Detail drawings for information only showing excavation locations, dimensions, sheeting and shoring, method of dewatering and other utilities that may be affected; width and length of working area, access pit, and portion of existing sewers to be removed to conduct the work; sewage flow by pass; and maintenance of traffic.

(B) Shoring and Sheeting: Design of the sheeting and shoring for excavations, and dewatering will be the Contractors responsibility. The type of trench shielding installed will be in accordance with OSHA 29 CFR, Part 1926, Subpart P.

(C) Employee Certifications: Written certification of employees training for pipe bursting installations. Flagmen will be certified and card bearing.

(D) Television Inspection Reports: The Contractor will furnish television inspection reports and videotapes made before and after pipe insertion.

- (E) Joint Test: The Contractor will furnish certificate test reports for the polyethylene pipe fusion joint test or certificate of compliance.

**SECTION 6.04 DELIVERY, STORAGE AND HANDLING:** The Contractor will use suitable tools and equipment to handle and install pipe and fittings to prevent damage to the pipe and fittings. The Contractor will transport, handle and store pipe and fittings as recommended by manufacturer.

- (A) Damaged Pipe and Fittings: If pipe and fittings become damaged before or during installation, it will be the Contractor responsibility to make the required repairs as recommended by the manufacturer. If so ordered by the County, the damaged pipe or fittings will be replaced as required at the Contractors expense, before going any further.
- (B) Materials on Site: The Contractor will deliver, store and handle other materials to the site as required to prevent damage.
- (C) Storage Sites: Before the work begins, the Contractor will identify storage sites for materials with the County at the construction location. Security at the storage site will be the responsibility of the Contractor.

**6.05 MATERIALS:** Polyethylene Plastic Pipe and fittings will be High Density Polyethylene pipe and will meet the applicable requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) based on Outside Diameter, ASTM D2348, and ASTM D 3550.

- (A) Insertion Size: Sizes of the insertions to be used will be such to renew the sewer to its original or greater than flow capacity.
- (B) Pipe Materials: All pipe and fittings will be made of virgin material. No rework by the Contractor is permissible except that obtained from the manufacture’s own production of the same formulation will be used.
- (C) Pipe Appearance: The pipe and fittings will be homogenous throughout and will be free of visible cracks, holes foreign material, blisters or other deleterious faults.
- (D) Acceptance: Pipe and fittings shall be accepted based on the County’s on site inspection and the manufacturer’s written certification that the pipe and fittings were manufactured and tested according to the applicable standards.

**SECTION 6.06 DIMENSION RATIOS:** The minimum wall thickness of the polyethylene pipe and fittings will meet the following:

<b>Depth of Cover (Feet)</b>	<b>Minimum SDR of Pipe</b>
0 - 16.0	19
>16.1	17

- (A) Pipe Identification: The pipe material and color will be white, black or as specified.



**SECTION 6.07 TESTS:** The Contractor will perform test for compliance with this specification. Test will be made as specific herein and according to the applicable ASTM Specification. A certificate with this specification will be furnished, upon request by the County, by the manufacturer for all material furnished under this specification. Polyethylene plastic pipe and fittings may be rejected to meet any requirements of this specification.

**SECTION 6.08 EQUIPMENT:** The Contractor will use pipe bursting equipment designed and manufactured to force its way through existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. The pipe-bursting unit will be pneumatic and will generate sufficient force to burst and compact the existing line. The Contractor will strictly adhere to the manufacturers= specifications for what size tool should be used in what diameter of pipe, and the parameters of what size tool percentage of up size is allowed.

- (A) Pipe Bursting Tools: The pipe-bursting tool will be pulled through the sewer by a winch at the upstream manhole. The bursting unit will pull the polyethylene pipe with it as it moves forward. The bursting head will incorporate an expander to prevent collapse of the hole ahead of the PE pipe insertion. The pipe-bursting unit will be remotely controlled.

The pipe-bursting tool will be pneumatic. The bursting action of the tool will increase the external dimensions sufficiently, causing breakage of the pipe while expanding the surrounding ground. This action will not only break the pipe, but also create the void into which the burster can be winched and enables forward progress to be made. At the same time, the polyethylene pipe directly attached to the sleeve on the rear of the burster, will also move forward.

A hydraulic winch will give the burster friction by which it can be moved forward. To form a complete operating system, the burster must be matched to a constant tension twin capstain engine hydraulic winching system.

**SECTION 6.09 WINCH UNIT:** A hydraulic winch will be attached to the front of the bursting unit. The winch will provide a constant tension to the burster so it may operate in an efficient manner that will ensure directional stability in keeping the unit on line.

The winch will be hydraulically operated, providing a constant tension throughout the operation. The winch will be of the constant tension type, but will be fitted with a direct reading load gauge to measure the winching load. The winch must automatically maintain a constant tension at a set tonnage reading.

The constant tension winch will supply sufficient cable in one continuous length so that the pull may be continuous between approved winching points. The winch, cable and cable drum must be provided with a safety cage and supports so that it may be operated safely without injury to persons or property.

The Contractor will provide a system of guide pulleys and bracing at each manhole that will reduce cable contact with the existing sewer between manholes.

The supports to trench shoring in the insertion pit will completely separate from the winch boom support system, and will be so designed that neither the pipe nor the winch cable will be in contact with them.

**SECTION 6.10 EXISTING SEWER SERVICE CONNECTION:** All sewer service connections will be identified and found before the pipe insertion to expedite reconnections. Upon commencement, pipe insertion will be continuous and without interruption from one manhole to another, except as approved by the County and their representative. Upon completion of insertion of the new pipe, the Contractor will expedite the reconnections of services to reduce any inconvenience to the customers.

- (A) Sewer Service Pipe Saddles: Existing sewer services will be connected to the new pipe by methods previously approved by the County. The pipe saddles should be made of a material compatible with that of the pipe. Fusion of pipe saddle connections to the main is the only means of assuring that complete leak-free joint is obtained.
  - (1) Electro fusion pipe saddles as manufactured by Central Plastics, will be installed according to the manufacturer=s recommended procedures.
  - (2) Conventional Fusion pipe saddles as manufactured by Central Plastics, Philips Driscopipe, or Plexco will be installed according to the manufacturers recommended procedures.

**SECTION 6.11 NEW SEWER SERVICE CONNECTIONS:** The Contractor will make connections of the new service lateral\* to the mainline by means of a compression-fit service connection. The service connection will be specifically designed for connection to the sewer main being installed and will be INSERTA TEE as manufactured by Fowler Manufacturing Company, Hillsboro, Oregon, (503) 357-2110; or a previously approved equal. The Contractor will strictly follow the installation procedures and use equipment as referenced in manufacturers= written installation instructions.

**\* TYPES AVAILABLE FOR ALL MAINLINES**

TYPES	GASKETED BELL SDR35	GASKETED BELL IPS/SCH 40
PVC Hub	ASTM D3034 SDR 35	ASTM D3034 SDR 26
Rubber Boot	ASTM C443	ASTM C443
Band	301 SS	301 SS
Screw	305 SS	305 SS
Housing	301 SS	301 SS
Gasket	ASTM F477	ASTM F477

**SECTION 6.12 BYPASSING SEWAGE:** The Contractor, when and where required, will provide a diversion for the pipe bursting/replacement process. The pumps and by-pass pumping equipment required during installation of the pipe will be subsidiary to the pipe reconstruction item.

- (A) Continuity of Sanitary Sewer Service: The Contractor will be responsible for to each facility connected to the section of sewer during the execution of the work.
- (B) Sewage Backups: The Contractor will be responsible for the cost for clean up, repair, and all property damage claims if sewage backup occurs and enters buildings or spills into parking lots or other areas where clean up by profession personnel are required.

**SECTION 6.13 TELEVISION INSPECTION:** The Contractor will perform pre and post television inspection of the work. The television inspections will be done by experienced personnel trained in finding breaks, obstacles and service connections by closed-circuit color television.

- (A) Television inspection will include the following:
  - (1) Video tapes (post) to be submitted to and approved in writing by the County before the final invoice is submitted.
  - (2) Video tapes will remain the property of the County; the Contractor may retain a second copy for his use.
  - (3) All flows tributary to the reach of sewer being inspected will be completely by-passed around the reach during inspection if necessary and if required by the County.
  - (4) Post construction videotape upon completion of reconstruction of each reach of sewers with the voice description, as appropriate with stationing of services showed. Data and stationing of services will be shown on video.
- (B) Acceptance: Should any portion of the inspection tape be of inadequate quality or coverage, as determined by the County, the Contractor will be informed in writing by the County. That portion will be reinserted and video taped at no additional expense to the County.

**SECTION 6.14 CONSTRUCTION METHOD:** Equipment used by the Contractor to perform the work will be located away from buildings so as not to create noise impact. The Contractor will provide a silent engine compartment with the winch to reduce machine noise as required to local requirements.

- (A) Damage Controls: The Contractor will install all pulleys, rollers, bumpers, alignment control devices, and other equipment required to protect the existing manholes, and to protect the pipe from damage during installation.  
  
Lubrication may be used as recommended by the manufacturer. Under no circumstances will the pipes be stressed beyond its elastic limit. Winch line is to be centered in pipe to be burst with an adjustable boom.

- (B) Pipe Installation: The installed pipe will be allowed the manufacturer's recommended time for cooling and relaxation due to tensile stressing. The Contractor will wait at least four (4) hours prior to any reconnections of service lines, sealing of the annulus, or backfilling of the entry/retrieval pits. Sufficient excess length of new pipe, but not less than four (4) inches, shall be allowed to protrude into the manhole to provide for occurrence. Restraint of pipe ends shall be achieved by means of Central Plastics Electro fusion couplings (800) 654-387. The Electro fusion couplings shall be slipped over pipe ends against manhole wall and fused in place. Installation of Electro fusion couplings shall be done in accordance with the manufacturer's recommended procedures.
- (C) Sealing: Following the relaxation period, the annular space may be sealed. Sealing shall be made with material approved by the County and/or their representative and shall extend a maximum of eight (8) inches into the manhole wall in such a manner as to form a smooth, uniform, water-tight joint. The terminating pipe ends in manholes shall be connected by Central Plastics Electro fusion couplings to eliminate ground water infiltration. Installations of Electro fusion couplings shall be done in accordance with the manufacturers recommended procedures.

#### **SECTION 6.15 FIELD TESTING:**

- (A) ***Internal Inspection:*** After the existing sewer is completely replaced, the Contractor shall ***internally inspect with television camera*** and videotape as required. The finished videotape shall be continuous over the entire length of the sewer between two manholes to be free from visual defects.
- (B) ***Defects:*** Defects, which may affect the integrity or strength of the pipe in the opinion of the County and/or their representative, ***shall be replaced at the Contractors expense.***

**SECTION 6.16 PIPE JOINING:** The Contractor will assemble and join the polyethylene pipe at the site using the butt-fusion method to provide a leak-proof joint. Threaded, gasket or solvent-cement joints and connections will not be permitted.

- (A) Fusing: All equipment and installation procedures done by the Contractor shall be in strict compliance with the manufacturers recommendations. Fusing methods shall be accompanied by personnel certified in writing as fusion technicians by a manufacturer of polyethylene pipe and/or fusion equipment.
- (B) Fused Joints: Butt-fused joints shall be true in alignment and shall have uniform rollback roll back beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to or greater than that of the pipe. All joints shall be subject to acceptance by the County and/or their representative prior to insertion. The Contractor shall cut out all defective joints out and replaced at no cost to the County.

Any section of the pipe with a gash, blister, abrasion, nick, scar or other deleterious fault greater in depth than 10% of the wall thickness, shall not be used, and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above with the prior approval of the County. In addition, any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling, as determined by the County and/or their representative, shall be discarded and not used.

- (C) Terminal sections of pipe that are joined within the insertion pit shall be connected with Central Plastics Electro fusion Couplings or connectors with tensile strength equivalent to or greater than that of the pipe being joined.

#### **SECTION 6.17 MEASUREMENT AND PAYMENT:**

- (A) The inserted pipe shall be paid for per linear foot of the size pipe specified and shall include all pipe bedding, backfill material, annulus sealing material, and launching pits. Locating and reconstruction of services and all reconnections of services shall be paid for each connection made, including fittings and pipe.
- (B) The work performed as prescribed by this item will be paid at the unit price per linear foot of sanitary sewer by pipe bursting/replacement for the specified pipe diameter and location, per each for A Locate, reconstruct and reconnect@ for the specified pipe diameter, which price shall be full compensation for the installation of the new pipe, furnishing and placing of all materials, labor, tools, equipment, cleaning and preparation of the existing pipe to receive the new liner and any other necessary to complete the project.
- (C) *Video inspection of final installed pipe shall be paid based on the cost per linear feet to televise the entire length of new pipe.*
- (D) The cost of any necessary by-pass pumping shall be considered subsidiary to the cost of pipe installation and shall not be a separate pay item.