PART 1 - GENERAL

The following specification is intended for use for the design, selection of materials, and construction of force main projects. The force mains, if applicable, shall meet the requirements of the Florida Department of Environmental Protection (FDEP) permit.

1.1 SCOPE

1.1.1 General

This specification provides the requirements for force mains construction for the project.

1.1.2 Work Included

The Contractor shall, unless specified otherwise, furnish all labor, materials, equipment, tools and all other associated appurtenances, necessary to do the work required under the contract to include but not limited to unloading, hauling, and distributing all pipe, fittings, valves and appurtenances. The Contractor shall also remove any surfacing as required; excavate the trenches and pits to the required dimensions; construct and maintain all required for traffic control; sheet, brace, and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, guards, and warning lights; lay and test the pipe, valves, fittings and appurtenances; backfill and consolidate the trenches and pits; maintain all surfaces over the trench until surface restoration is completed; restore the surfaces unless otherwise stipulated; remove surplus excavated material; and clean the site of the work.

The Contractor shall also furnish all labor, materials, equipment, tools and all other associated appurtenances required to rearrange sewers, conduits, ducts, pipes, or other structures encountered in the installation of the work.

1.1.3 Location of the Work

The location of this work is as shown on the Contract Documents.

1.1.4 Coordination of the Work

The Contractor shall be responsible for the satisfactory coordination of the construction of the force mains with other construction and activities in the area. Delays in work resulting from lack of such harmony shall not in any way be a cause for extra compensation by any of the parties.

1.1.5 Working Hours

The work shall be carried out in accordance with local ordinance and not to cause any unreasonable nuisance to affected residents. Under emergency conditions, this limitation may be waived by the consent of Charlotte County Utilities (CCU).

1.2 METHOD OF MEASUREMENT & PAYMENT

The work shall be measured and the compensation determined in the following manner:

1.2.1 Force Mains

Direct bury and directional bore force main pipe shall be paid for at the contract bid price per lineal foot for each size and type of material specified which shall include the cost of furnishing all pipe, pipe bend sections, jointing material, restraints, stainless steel stiffeners, bedding material and all other appurtenances and of delivering, handling, laying, dewatering, trenching, sheeting and backfilling, furnishing and installing flowable fill used for tunneling/defecting pipe under and adjacent to existing storm piping/structures (unless separate bid item is provided), testing, restoring the surface (unless separate bid item is provided), necessary permits, and all material or work necessary to install the pipe complete in place at the depth specified on the plans and/or as directed by CCU.

The length of pipe for direct bury installation for which payment is made shall be the actual overall length measured along the axis of the pipe without regard to tee sections or bend sections. All lengths shall be measured in a horizontal plane unless the grade of the pipe is more than fifteen percent (15%). No payment consideration will be given to depth zones for the installation of the force mains.

The length of pipe for directional bore force mains pipe shall be measured by measuring the length pipe before installation and subtracting the lengths of the pipe cut from the ends of pipe when the bore pipe is connected to the pipe on either end. The difference is the length of the pipe in the ground.

1.2.2 Ductile Iron Fittings

Ductile iron fittings shall be paid for by the contract bid price by weight (latest revision of AWWA C153) and shall include all labor, equipment, materials and all associated appurtenances to install the ductile iron fittings. Restraints shall be considered incidental to the ductile iron fittings contract bid price and no direct compensation will be made therefore. Any other items necessary for the installation of the ductile iron fittings that are not included in the manufacturer's specified weight, including but not limited to bolts, gaskets, jointing materials, labor, and testing shall be considered incidental to the project.

1.2.3 Tie Back Assembly (for Existing Facilities Only)

The tie back assembly, if required, for connection to existing facilities which are not properly restrained, shall be paid for at the contract bid price per each which shall include the cost of furnishing tie back assembly device, stainless steel threaded rods, fittings, concrete blocking, restraints and any other appurtenances and of delivering, handling, excavation, sheeting,

backfilling, dewatering, restoring of the surface and all material or work necessary to install the unit complete in place at the depth specified on the plans.

1.2.4 Locate Balls and Marker Tape

a. Locate balls shall be paid for at the contract bid price per each which shall include all labor, equipment, materials and associated appurtenances to install and program the marker balls and submit the marker ball data to Charlotte County Utilities (CCU).

b. Marker tape shall be considered incidental to the force mains.

1.2.5 Testing

All required testing shall be considered incidental to the project and no direct compensation will be made therefore.

1.2.6 Miscellaneous

All other items required for the completion of the project and not included as a specific bid item shall be considered incidental to the project and no direct compensation will be made therefore.

1.3 REFERENCED STANDARDS (LATEST REVISION)

AWWA: C-153, C-900, C-905, C-909, C-906-90, C-151, C-153, C-111, C-600, C-651, and C-652

ASTM: A-139, D-1785, D-1869, D-1120, D-2241, D-3350, D-1248-68, D-1598, D-1599

FDEP: Wastewater Collection/Transmission System Requirements

AASHTO Code

Florida Administrative Code

Ten States Recommended Standards for Wastewater

1.4 PARTIAL LISTING OF RELATED SECTIONS

001570 - Erosion and Sediment Control
001760 - Surveying and Record Drawing
002240 - Dewatering
002330 - Low Pressure Force Mains
002340 - Valves
002530 - Submersible Sewage Pump Lift Station-Package Design
002540 - Submersible Sewage Pump Lift Station- Standard Design
002930 - Grassing
009900 - Surface Preparation, Painting and Coating

Note: This is only a partial listing of related sections. The Contractor shall be responsible to review the entire contract documents.

1.5 SUBMITTALS

For only those materials that the Contractor is requesting deviations from these specifications, the Contractor shall submit in writing documentation to justify approval of these materials by Charlotte County Utilities (CCU) prior to the start of the project. The Contractor shall submit four (4) signed copies of the material submittals.

The contractor submittals shall include the statement that the submittals have been reviewed and the materials meet the contract specifications and/or standard details.

The Contractor shall provide proof of supplier certification/training for buttfusing pipe for any employee fusing pipe.

Final approval is at the discretion of CCU.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 General

The materials used in this work shall be all new and conform to the requirements for class, kind, size and material as specified below.

All pipe furnished for force main installations shall be of the type, kind, size, and class indicated for each particular line segment as shown on the engineering drawings and/or designated in the Contract Items.

2.1.2 Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

a. PVC Pipe: PVC pipe for force mains shall conform to the requirements of AWWA C-900 (4" through 12"), AWWA C-905 (14" through 36"), and AWWA C-909 (4” through 24”) and shall be Class 150 DR 18 for all open cut and direct bury installations with a minimum of forty eight (48) inches of cover. For shallower depth, the type of pipe and installation shall require prior CCU approval. The manufacturer shall insure all quality control test and AWWA requirements are complied with during the production of PVC pipe.

b. C-900, C-905, and C-909 pipes shall have an integral bell formed with a race designed to accept the gasket in accordance with their respective AWWA requirements. The spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth. Provisions shall be made for expansion and contraction at each joint. All surfaces of the joint where the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.

c. Pipe Color: All C-900, C-905, and C-909 force main pipes shall be green in color with a PVC ASTM D-1120 and ASTM D-2241 reference, the class pressure rating, and the DR number permanently and plainly marked on the pipe.

d. Rubber Gasket Joints: C-900, C-905, and C-909 polyvinylchloride pipe joints shall be the bell and spigot type using rubber gasket push-on type joints. Rubber gaskets shall be molded to a circular form to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to ASTM D-1869 and AWWA C-900 elastomeric seals for joining plastic pipe.

e. Fittings: All ductile iron fittings shall be in accordance with AWWA Specification C-153 and as a minimum have the same pressure rating of the connecting pipe. All ductile iron fittings shall be either:

- fusion bonded epoxy coated as per AWWA Specification C-116

or

- ceramic epoxy coated as per ASTM Specifications F-4176-95A, G-95, B-117, D-1308 and E-96

All exposed fasteners such as bolts, nuts, washers, and threaded rod shall be Type 316 stainless steel and all buried fasteners such as bolts, nuts, fasteners, washers, and threaded rod shall be “Cor-Ten” steel or Cor-blue coated. Mechanical joint bolts shall not protrude more than ½ inch through the nut after joints are assembled.

f. Fastener Threads: All stainless steel fastener threads shall be coated with an anti-seize compound as approved by CCU.

2.1.3 <u>High Density Polyethylene (HDPE) Pipe and Fittings</u>

a. High Density Polyethylene (HDPE) pipe shall meet the requirements of AWWA C-906 for polyethylene pressure pipe and fittings and for PE-3408 SDR 11. HDPE pipe shall meet ASTM D-3350 cell classification of PE 345434C. Permanent identification of the pipe shall be provided by co-extruding green longitudinal stripes into the pipes outside surface for force mains. All polyethylene piping shall have ductile iron pipe nominal outside diameters.

Individual sections of HDPE piping shall be joined together by thermal butt-fusion to make a continuous section of pipe as recommended by the pipe manufacturer. Bends in HDPE pipe shall not be within ten (10) pipe diameters from any fitting or valve. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. HDPE piping shall not be joined by solvent cements, adhesive or threaded type connections.

The color marking stripes shall be aligned during the fusing process and the pipe shall be pulled through the bore to allow identification of the type of system utilizing the HDPE pipe.

b. All fittings and sleeves used with high density polyethylene (HDPE) pipe shall be fusion bonded epoxy coated ductile iron with mechanical joints rated to 350 psi and conforming to AWWA C-153 and C-111. All MJ fitting connections to polyethylene pipe shall be restrained with Mega-Lug restrainers. The HDPE pipe shall be reinforced on the ends using stainless steel wedge internal stiffeners.

The mechanical connection to MJ fittings and sleeves shall use mechanical restraints that meet specification requirements. Size-on-size mechanical connection to PVC or DI pipe shall be by compact ductile iron solid sleeves with Mega-Lug restrainers.

No electro fusion fittings shall be used with HDPE unless specific written approval is provided by CCU.

HDPE molded butt fittings and couplings for non-standard fittings and couplings shall require special approval from CCU for installation.

2.1.4 Ductile Iron Pipe and Fittings

a. The ductile iron pipe covered by this specification shall be the push-on joint type or mechanical joint type, centrifugally cast to conform to all requirements of AWWA Specifications C-151 and C-153, latest revisions.

The maximum allowable deflection of the pipe shall not exceed two percent (2%) of the pipe diameter. Ductile iron pipe will be fully encased in an 8 mil polyethylene sleeve, in accordance with AWWA C-105, Method A. The pipe and the polyethylene sleeve shall be color coded green by a means acceptable to CCU.

b. All piping and fittings shall be either:

- fusion bonded epoxy coated as per AWWA Specification latest revision

or

- ceramic epoxy coated as per ASTM Specifications F-4176-95A, G-95, B-117, D-1308 and E-96

c. Polyethylene material shall conform to ASTM Standard Specification D1248-68, latest revision. All ductile iron piping shall be marked "DUCTILE IRON" in large letters. The nominal wall thickness shall be plainly marked on each piece of pipe and the pipe installed so that the markings can be read from the top of the trench.

Minimum thickness of ductile iron pipe shall be as follows:

3” Ductile Iron Pipe	0.25”	Class 51
4” Ductile Iron Pipe	0.26”	Class 51
6” Ductile Iron Pipe	0.25”	Class 50
8” Ductile Iron Pipe	0.27”	Class 50
10” Ductile Iron Pipe	0.29”	Class 50
12” Ductile Iron Pipe	0.31”	Class 50
14” Ductile Iron Pipe	0.33”	Class 50
16” Ductile Iron Pipe	0.34”	Class 50
18” Ductile Iron Pipe	0.35”	Class 50
20” Ductile Iron Pipe	0.36”	Class 50
24” Ductile Iron Pipe	0.38”	Class 50
30” Ductile Iron Pipe	0.39”	Class 50

36” Ductile Iron Pipe	0.43”	Class 50
42” Ductile Iron Pipe	0.47”	Class 50
48” Ductile Iron Pipe	0.51”	Class 50
54” Ductile Iron Pipe	0.57”	Class 50

d. Rubber gasket joints shall be in accordance with AWWA Specification C-111 latest revision.

e. All fittings shall be in accordance with AWWA Specification C-153 latest revision and have the same pressure rating of the connecting pipe. All exposed fasteners such as bolts, nuts, washers, and threaded rod shall be Type 316 stainless steel. All buried fasteners such as bolts, nuts, washers, and threaded rod shall be “Cor-Ten” steel or Cor-blue coated steel. Mechanical joint bolts shall not protrude more than ½ inch through the nut after joints are assembled.

f. All stainless steel fasteners threads shall be coated with an anti-seize compound as approved by CCU.

2.1.5 Pipe and Fittings Unloading at Site

The contractor shall inspect each shipment of pipe and fittings and make provisions for a timely replacement of any damaged material. The contractor shall unload by hand or use canvas slings to avoid scratching the pipe. The contractor shall not sling or drag pipe over an abrasive surface. Pipe or fittings damaged during handling shall be removed from the site and replaced with new pipe and/or fittings. The contractor shall follow the manufacturer’s storage specification and store pipe and fittings in such a manner that prevents damage due to crushing, piercing, excessive heat, harmful chemicals, and exposure to sunlight.

2.1.6 Marker Balls and Marker Tape

a. Force main marker balls shall be 3M 4 inch marker ball model 1424XR/ID and green in color.

b. Force main marker tape stripes shall be green in color.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

Direct Bury, Directional Bore, and Jack and Bore: All direct bury, directional bore, and jack and bore force main pipe shall be installed at a minimum depth of forty-eight (48) inches or as approved by CCU. If additional fittings are required where not shown on the engineering drawings to maintain alignment around curves, the Contractor shall provide the required number fittings and be compensated at the unit price as proposed on the bid form.

NOTE: If the new construction is tying into existing utilities, the Contractor shall verify the existing utilities, such as fittings and valves, are restrained prior to the start of installation of the valve or piping. If not properly restrained, the contractor shall notify CCU in writing and shall restrain the existing utility as approved by CCU.

3.1.1 Direct Bury of Material

a. Open cut PVC force main piping shall be Class 150 DR 18 for all areas with a minimum of forty eight (48) inches of cover. For shallower depth, the type of pipe and installation shall require prior CCU approval.

b. Proper implements, tools, and facilities satisfactory to CCU shall be provided and used by the Contractor for the safe and convenient execution of the work and the testing. All pipe, fittings, and valves shall be carefully lowered into the trench in such a manner as to prevent damage to force main materials and protective coatings and linings. The force main materials shall not be dropped or dumped into the trench. The pipe shall be laid with the manufacturers lettering designating the type and size of pipe visible from the top of the open trench. Wherever it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane to avoid obstructions or where long-radius curves are permitted, the amount of pipe or joint deflection shall not exceed fifty (50) percent of the manufacturer's recommended limit. Pipelines intended to be straight shall not deviate from the straight line at any point in excess of one (1) inch.

c. Open cuts of roads for trenching and direct bury of force mains shall not exceed 8’ in width. All effort shall be made to minimize the width of the trench and the amount of restoration.

d. All existing materials removed to facilitate the tunneling or deflecting of direct bury piping under or adjacent to existing storm piping and/or structures shall be replaced by flowable fill. Prior to placing flowable fill, the area between the direct bury piping and existing piping or structure shall be hollowed out to a defined cavity along the length of the direct bury piping. The Contractor is responsible for filling the entire cavity with flowable fill and replacing the flowable fill as necessary throughout the contract and warranty period should erosion occur.

e. PVC pipe may be laid in the trench in single sections or preassembled multiple sections including no more than 1 full stick of pipe, 1 partial stick of pipe, and intervening required fittings and/or valves. Preassembled sections of pipe shall be carefully fed by hand or with the use of approved equipment on the pipe bed. The contractor shall provide pockets in the pipe bed material to eliminate any concentration of loads on the bell ends or joints. The ends of mechanical joint pipe and fittings and rubber gasket joint pipe and fittings shall be clean of all dirt, grease, and foreign matter prior to installing fittings or joining of pipe sections. A joint lubricant shall be applied to all gaskets prior to joining two pipe sections together. To preclude the possibility of cross usage between force main and potable water piping, the joint lubricant shall have been tested and approved for potable water service. No lubricant shall be used that harbor bacteria or damage the gaskets.

f. Cutting pipe for inserting valves, fittings, or closure pieces shall be in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axes of the cut pipe. The cut end of mechanical joint pipe shall be dressed to remove sharp edges or projections which may damage the rubber gasket. For push-on joints, the contractor shall dress the pipe cut ends by beveling as recommended by the manufacturer.

3.1.2 Directional Bore of Material

a. Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient execution of the work. The Contractor shall meet the jointing and cutting pipe direct bury force main piping requirements as they apply to the directional bore. A log of the bore depths shall be based on one foot intervals staking from the entry and exit locations and intermediate centerline. The vertical and horizontal location readings shall be plotted on a one inch (1") equals twenty feet (20') natural scale drawing which shall be provided to CCU within 48 hours of completion of the bore.

   No electro fusion fittings shall be used with HDPE unless specific written approval is provided by CCU.

b. For force mains eight (8”) inches in size or smaller, the HDPE pipe shall have the same outside diameter as the connecting mains. For larger sizes, the HDPE pipe shall have the same size or larger inside diameter as the connecting mains unless otherwise noted on the plans; provided for in the Special Provisions; or approved by CCU.

c. The depth of all directional bores for FDOT roads shall be in accordance with the FDOT permit requirements.

d. The slurry may be recycled for reuse in additional hole opening operations if approved by CCU or it shall be removed and disposed of at an approved dump site. No fluids shall be allowed to enter any unapproved areas or natural waterways.

e. For directional bores under any surface water (subaqueous) the drilling contractor must submit a ‘frac-out’ response plan for review and approval prior to starting the directional bore. During execution of all subaqueous directional bores, the drilling contractor must have at the site the necessary material, equipment, and manpower to properly respond to a ‘frac-out’ in accordance with the ‘frac-out’ response plan.

3.1.3 Marker Balls and Metallic Marker Tape

a. Contractor shall provide and install metallic marker tape and provide, program, and install marker balls for all installed trenched pipe. For trenchless pipe installations the Contractor shall provide, program, and install marker balls. Metallic marker tape is not required on trenchless pipe installations. The metallic marker tape shall be marked green for wastewater. The metallic tape shall be laid 12 to 18 inches above the pipe and the ball markers placed directly on top of the pipe or fitting. For trenchless pipe installations the marker balls shall be placed with a minimum of 18 inches of cover with the exception that no marker balls are required for that portion of pipe that lies beneath the water surface at a subaqueous crossing.

b. Installation: The balls shall be installed at all changes of direction and fittings absent of any valve. For cul-de-sacs having continuous fused or roll piping with no in-line fittings, the balls shall be placed starting at the point of curvature of the cul-de-sac and every 50 linear foot to the end of the line. On straight runs of pipe, the balls shall be installed at every power pole. If power poles do not exist, the balls shall be placed every 150 feet from the nearest change of direction or fitting. At road and driveway crossings the marker balls shall be placed on each side of the road or driveway, two feet from the pavement or driveway edge, or as otherwise

approved by CCU. On vertical deflections the marker ball shall be placed on the top fitting only.

c. Programming: The contractor shall program all balls and provide a copy of the programmed data in each marker ball in either Microsoft EXCEL or Access electronic format to CCU. The contractor as-built drawings shall show the location of all marker balls.

3.1.4 Fittings

When tightening bolts, the contractor shall bring the gland up toward the flange evenly while maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively a little at a time. DO NOT over stress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble again after cleaning. Fittings shall be installed in accordance with the manufacturer's printed instructions.

3.1.5 Restraints

Piping shall be restrained in accordance with the CCU standard details restraint table. The table is based on a safety factor of 2.0 and takes into account variables such as type of soil, type and depth of the trench, and depth and type of pipe. In addition, the restraints may be supplemented with thrust blocks. CCU may require the engineer to provide the dimensions of the thrust block for approval prior to construction.

3.1.6 Storm Sewer Conflicts

Force mains that must be installed with less than 12 inches of clearance under storm sewer pipes or structures due to existing physical limitations that prohibit deflection or directional drilling, require construction of a bridging structure that is acceptable to CCU to support the storm sewer prior to installation of the force main. The force main pipe section under the storm sewer pipe or structure shall be replaced with a single 20 LF stick of ductile iron pipe centered under the storm sewer pipe or structure. The ductile iron pipe shall be fully encased in an 8 mil polyethylene sleeve in accordance with AWWA C-105, Method A. Polyethylene material shall conform to ASTM Standard Specification D 1248-68. The contractor shall submit details of the proposed bridging structure and force main pipe installation to CCU for review and approval prior to the start of construction at the conflict location.

3.1.7 Water Main Crossing

All force mains shall cross water mains at ninety (90) degrees and with a minimum angle of forty-five (45) degrees.

3.2 TESTING MAINS AND TAPPING SLEEVES

All pressure tests shall be in accordance with AWWA C-600, latest revision. A pressure test shall be required for all installations of force mains and all appurtenances. Pressure testing shall not exceed 1500 linear feet unless otherwise approved by CCU.

3.2.1 Pressure Test

a. Pipe:

The contractor shall hydrostatically pressure test all PVC, HDPE, and DI force mains in accordance with the latest revision of AWWA C-600 series as applicable. Oil filled gauges shall only be used for all pressure tests. The tests shall be at 150 psi for a period of two (2) hours. The allowable loss for one (1) hour shall be determined by the following formula:

$$\text{Allowable Leakage} = \frac{(D)\,(L)\,(PY)}{133{,}200}$$

Where: D = nominal diameter of the pipe in inches
L = length of pipe in feet
PY= square root of test pressure during the leakage test in pounds per square inch

Calibrated test equipment shall be on site to verify the loss of water during the testing period.

b. Tapping Sleeves:

All force main tapping sleeves shall be hydrostatically pressure tested in accordance with the latest revision of AWWA C-600. The test shall be conducted at 150 psi for a period of two (2) hours. No loss of pressure is allowed.

c. Procedures:

Each section of pipe between valves, between the tapping sleeve and the pipe, and/or the valve and the tapping sleeve shall be slowly filled with water from a safe source, and the specified test pressure shall be applied by means of a water pump in a manner satisfactory to CCU. In the case of testing a pipe where valves do not exist, the contractor shall plug the end of the line as approved by CCU. The pump, pipe, and/or tapping sleeve connections, gauge, and all necessary apparatus shall be furnished by the contractor and shall be approved by CCU prior to conducting any test. All necessary pipe taps for testing shall be made by the contractor as approved by CCU. CCU may request testing of isolated portions between valves within the test section if a portion of that main has critical components such as multiple fittings at an extreme deflection. The contractor shall be responsible to remove any pipe taps installed for this purpose upon completion of the test as approved by CCU.

Pressure testing shall be measured from sample points and/or blow-off assemblies for force main pressure tests. CCU shall witness all tapping sleeves and force main pressure tests.

END OF SECTION