

CITY OF HOSCHTON
WATER & SEWER DEPARTMENTS
September 2018



STANDARD SPECIFICATIONS
FOR CONSTRUCTION OF
WATER & SEWER MAINS

79 CITY SQUARE
HOSCHTON, GEORGIA

30548

PH: 706-654-3034

**STANDARD SPECIFICATIONS
FOR CONSTRUCTION OF WATER AND SEWER MAINS**

**September 2018
WATER AND SEWER DEPARTMENTS**

**FOR THE
CITY OF HOSCHTON, GEORGIA**

Section Title	Page No.
---------------	----------

TABLE OF CONTENTS

Field Engineering	01050
Abbreviations/Definitions.....	01070
Traffic Control.....	01570
Site Preparation.....	02100
Earthwork for Utilities	02225
Rock Removal	02227
Temporary Erosion Control	02270
Rip Rap.....	02272
Boring and Jacking	02300
Horizontal Directional Drilling.....	02341
Restoring Sidewalks, Curbs, Gutters and Storm Drainage Structures.....	02523
Manholes	02601
Coatings for Existing Manholes and Wastewater Structures	02602
Coatings for New Manholes and Wastewater Structures	02603
Fire Hydrants	02645
Water Distribution Systems	02660
Water Service Connections.....	02665
Sewage Lift Station.....	02731
Sanitary Sewer Force Mains	02732
Sanitary Sewer	02736
Protection, Relocation and Restoration of Existing Utilities.....	02750
Inspection and Testing.....	02799
Chain Link Fence and Gates.....	02830
Site Restoration.....	02905
Grassing.....	02931
Concrete Reinforcement	03200
Concrete.....	03300
Grout.....	03600
Lift Station Electrical Work.....	16000
Standby Generator	16621
Interior Pipe Coating.....	18000
Exterior Pipe Coating	18001

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. WORK covered in this Section includes the surveying and field engineering required to complete the project and meet the provisions of this document.

1.02 QUALITY CONTROL

- A. DEVELOPER/CONTRACTOR will employ a Land Surveyor registered in the State of Georgia and acceptable to the City of Hoschton.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 SURVEY REQUIREMENTS

A. Construction Staking

- 1. The DEVELOPER/CONTRACTOR shall provide all construction staking using recognized surveying and engineering practices. The surveyor shall locate lines, grades and locations called for in the approved development drawings.

B. Record Drawings ("As-Built Drawings")

- 1. The Public Works Department of the City of Hoschton requires that all record or as-built drawings be submitted in the following file format: PDF (portable document format), DXF (drawing exchange format), or DWG (AutoCad drawing) unless waived by the City.
- 2. The City of Hoschton requires that all record drawings be completed utilizing and based on Georgia State Plane coordinates.
- 3. The horizontal datum = NAD 1983 with 1995 adjustment.
- 4. The vertical datum = NAVD 1988 and were computed from the original height based on the "National Geodetic Vertical Datum of 1929" (NGVD 1929) utilizing the Vertcon conversion program.
- 5. The drawing's layer names shall be as specified in the following list of layer names and descriptions.

Layer Name	Layer Description
BENCHMARK	Location of benchmarks, including surveyed monuments, right-of-way markers, property pins, etc
BUFFER	Location and information of buffers for water bodies, detention ponds, wetlands, and property set-backs
CONTOUR_LABELS	Labels of the contour lines showing proper elevations
CONTOURS	Topography of the site at the conclusion of the project at 2-ft. intervals
ESMT_PERM	Location and size of permanent easement
NORTH	The north arrow with proper orientation
SCALE	Graphic scale reflecting correct paper scale
TEXT	Informative or descriptive text
EXBLDG	The footprint location of any existing structure located on the site (regardless of whether they are to be demolished or will remain)
EXBRIDGE	Location and type of any existing bridges
EXCL	The centerlines of any existing roads within the site with road names
EXCOMM	Location of any existing overhead or underground telephone lines, cable lines, fiber optics, cable boxes, pedestals or utility poles
EXCONTOURS	Topography of the site prior to any grading, all contour lines showing proper elevations at 2-ft. intervals
EXCREEK	Location of any existing creek, stream, pond, lake, or any other water body
EXCURB	Location of curb lines of any existing road within the site
EXDITCH	Location of the centerline of any existing ditch
EXEOG	Location of existing edge of gravel, including roads, parking, and driveways
EXEOP	Location of existing edge of pavement, including roads, alleys, parking, loading docks or driveways
EXFENCE	Location and type of any existing fences
EXFLOOD-LIMITS	Location and information of any existing flood limits
EXGAS	Location, type and size of any existing natural gas lines, valves or meters
EXGUARD	Location of any existing guard rails
EXPL	Location of existing property lines
EXPOWER	Location of any existing power lines, electricity transmission lines, transformers, or utility poles
EXRAIL	Location and information of any existing railways
EXRW	Location and information for existing right-of-ways
EXSAN	Location and information for existing sanitary sewer on the downstream manhole, upstream manhole and sewer line type and size
EXSTORM	Location and information for existing storm sewer of the downstream manhole, upstream manhole, pipe types and sizes, culverts, inlets, headwalls, and inverts
EXTREES	Location of any existing tree lines, trees bushes, shrubs or miscellaneous landscaping (regardless of whether they are to be demolished or will remain)
EXWALKS	Location of any existing sidewalks
EXWATER	Location, size and type of existing waterlines, water valves, water meters and fire hydrants

ABBLDG	Footprint of the building(s) located at the site with the finished floor elevation- to include awnings, out-buildings, etc.
ABCL	Road centerlines of any new or adjusted roads added to the development
ABCURB	Road curb lines of any new or adjusted road added to the development
ABDITCH	Centerline of any new ditches added to the development
ABEOP	Location of any new or adjusted edge of pavement, including roads, alleys, parking, loading docks or driveways
ABFENCE	Location and type of any new fences

ABFLOOD-LIMITS	Location and information of any new flood limits
ABGAS	Location, type and size of natural gas lines, valves or meters
ABGUARD	Location of guard rails
ABPOWER	Location of all power lines, electricity transmission lines, transformers, or utility poles
ABRAIL	Location and information of railways
ABSAN	Location and information on the sanitary sewer piping and manhole tops and inverts
ABSTORM	Location and information on the storm sewer pipe types and sizes, manhole tops, inverts, culverts, inlets and headwalls
ABTREES	Location of tree lines, trees bushes, shrubs or miscellaneous landscaping
ABWALKS	Location of all sidewalks within the site
ABWATER	Location, size and type of waterlines, water valves, water meters and fire hydrants on the site

6. Prior to final acceptance of a development, or before issuance of a Certificate of Occupancy, DEVELOPER/CONTRACTOR is required to provide the City of Hoschton three (3) hard copy sets of draft record drawings, scaled and a digital (PDF and DWG or DXF) set of drawings, showing horizontal location of all structures and major appurtenances installed. These included, but are not limited to, manholes, sewer laterals, water mains, water valves, water meters, force mains, pump stations, air/vacuum release valves, structures, earth embankments, ponds, and any other component of the sewer or water system. The elevations of all gravity sewers, storm sewers, structure inverts, and structure tops shall be shown.
7. The following items shall be called out with specific coordinates: all valves (water and/or sewer), fire hydrants, and sanitary sewer manholes.
8. Final submittal shall include two (2) sets of stamped and signed plans and a digital (PDF and DWG or DXF) copy of all plans.

END OF SECTION

SECTION 01070

ABBREVIATIONS/DEFINITIONS

PART 1 GENERAL

1.01 GENERAL

- A. Wherever in these Specifications the abbreviations or pronouns in place of them are used, the intent and meaning shall be interpreted as specified herein. Wherever used in these Specifications, the following terms shall have the meanings indicated and shall be applicable to both the singular and plural thereof:

1.02 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APHA	American Public Health Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CFR	Code of Federal Regulations
CRSI	Concrete Reinforcing Steel Institute
DXF	Drawing Exchange Format or Drawing Interchange Format
DWG	Drawing
EPA	Environmental Protection Agency
EPD	Environmental Protection Division (State)
FS	Federal Specifications
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
MUTCD	Manual on Uniform Traffic Control Devices
NAD	North American Datum
NAVD	North American Vertical Datum
NBS	National Bureau of Standards
NCPI	National Clay Pipe Institute
NCSA	National Crushed Stone Association
NEMA	National Electrical Manufacturers Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PCI	Prestressed Concrete Institute
SSPC	Steel Structures Painting Council
COH	City of Hoschton
WEF	Water Environment Federation

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01570

TRAFFIC CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. DEVELOPER/CONTRACTOR shall furnish all materials and labor for the installation and continuous maintenance of traffic control devices throughout the project.
- B. This item of work shall include furnishing, installing, maintaining, relocating and removing all traffic control devices used for the purpose of regulating, warning or directing traffic during the construction or maintenance of the project.
- C. Upon completion of work, warning devices are to be removed by the DEVELOPER/CONTRACTOR.

1.02 SAFETY

- A. The governing factor in the execution and staging of work for the project is to provide the public with the safest possible travel conditions along the roadway through the construction zone. The DEVELOPER/CONTRACTOR shall arrange his operation to keep the closing of any lane of a roadway to an absolute minimum.
- B. No work shall be started on any phase of the project until all appropriate traffic control devices are in place and in operation.
- C. DEVELOPER/CONTRACTOR shall take all practical precautions to maintain traffic flow, and provide safety of workers and the general public.
- D. At the end of each workday, contractor shall clear the roadway of all dirt and debris and add additional safety devices to maintain safe travel lanes for night traffic.
- E. When not in use, all traffic control devices shall be removed, placed or covered so as not to be visible to traffic.

1.03 REFERENCES

- A. Manual for Uniform Traffic Control Devices (MUTCD) (latest edition).
- B. Georgia Department of Transportation (Ga. DOT) Standard Specifications for Construction of Roads and Bridges (latest edition), Section 150.
- C. Georgia Department of Transportation (Ga. DOT) Standard Construction Details (latest edition).

PART 2 PRODUCTS

2.01 TRAFFIC CONTROL DEVICES

- A. Traffic Control Devices include: signs and their supports, signals, pavement markings, barricades with sand bags, channelizing devices, warning lights, arrowboards, flaggers, or any other device used for the purpose of regulating, warning or guiding traffic through the construction zone.
- B. All Traffic Control Devices used on the project shall conform to the plans, Ga. DOT Construction Details and Specifications, and MUTCD.
- C. Traffic Control Devices shall be in proper, acceptable condition when in use. Devices which are unclear, damaged, or not correctly positioned shall be promptly restored to fully operational condition.

PART 3 EXECUTION

3.01 PLANS AND PERMITS

- A. DEVELOPER/CONTRACTOR is to prepare and provide a traffic control plan and obtain all applicable and necessary permits from all appropriate authorities.

3.02 TRAFFIC CONTROL DEVICES

- A. The DEVELOPER/CONTRACTOR shall be responsible for the proper location, installation, and arrangement of all traffic control devices. Special attention shall be given to advance warning signs during construction operations in order to keep lane assignment consistent with barricade placement at all times. The DEVELOPER/CONTRACTOR shall cover all Traffic Control Devices which are inconsistent with detour or lane assignment patterns during the transition from one construction stage to another.
- B. Construction signs referring to daytime lane closures during working hours shall be removed or covered during non-working hours.
- C. The DEVELOPER/CONTRACTOR shall ensure all Traffic Control Devices installed by him are operational 24 hours a day, including weekends and holidays. The DEVELOPER/CONTRACTOR shall provide inspections of all Traffic Control Devices (installed by him) throughout each day.

3.03 PUBLIC ACCESS

- A. Private driveways and parking areas shall be accessible at all times unless temporary closings are necessary for construction work and the DEVELOPER/ CONTRACTOR has notified the affected individuals and has approval from them.

3.04 SAFETY

- A. If trenches are to remain open overnight, or for an extended period of time, DEVELOPER/CONTRACTOR is to provide heavy duty cover plates to allow vehicles access. Cover plates shall be properly secured and in safe working order as not to endanger the public.
- B. Where flaggers are required, they are to be adequately trained and certified for the job.
- C. When traveling in lanes open to public traffic, the DEVELOPER/CONTRACTOR's vehicles shall always move with and not against or across the flow of traffic. These vehicles shall enter and leave work areas in a manner which will not be hazardous to, or interfere with, traffic, and shall not park on or stop except within designated work areas. Personal vehicles shall not park within the right of way except in specific areas designated by the COH.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. WORK to be performed under this section shall consist of clearing and grubbing the site within the limits of the approved Development Drawings and disposal of all waste materials.
- B. WORK also included under this section shall include the removal and replacement of existing fences and the erection of temporary fences.
- C. Definitions
 - 1. Clearing: The removal and disposal of all exposed objectionable matter such as: trees, brush, logs, buildings, fences, poles, rubbish, loose boulders and other debris resting on or protruding through the ground surface.
 - 2. Grubbing: The removal and disposal of all objectionable matter such as: logs, poles, stumps, structures, boulders, rubbish, and other debris which is embedded in the soil.

1.02 REGULATORY REQUIREMENTS

- A. No clearing and grubbing shall begin until the erosion and sedimentation control plan has been approved.
- B. Conform to applicable code for disposal of debris.
- C. Conform to local Fire Department Codes for burning debris on site. DEVELOPER/ CONTRACTOR shall obtain all necessary permits prior to burning on site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials used for protection of trees and vegetation to remain during clearing operations shall be at DEVELOPER/CONTRACTOR'S option. Materials chosen are subject to review by the COH upon installation shall be approved by the COH to ensure maximum protection to vegetation.
- B. Materials used for the repair of trees and vegetation damaged shall be at DEVELOPER/CONTRACTOR'S option but may be subject to approval by the COH prior to use.

- C. Herbicides shall not be used unless written approval is given by the COH.
- D. Explosives shall not be used unless necessary permits are obtained from all Authorities having jurisdiction.
- E. Materials used for the replacement or relocation of existing fences shall be of equal or superior quality to those fence materials existing prior to construction unless specified otherwise on the plans.

PART 3 EXECUTION

3.01 GENERAL

Where new construction on existing roads is required, the DEVELOPER/CONTRACTOR shall video tape and photograph the route prior to beginning construction in such a manner as to provide sound, visual evidence as to the pre-existing conditions along the route of construction. The CONTRACTOR shall keep these records on file; the COH may request copies as needed.

3.02 CLEARING

- A. No tree, shrub, or other landscaping plants shall be removed unless absolutely necessary for the construction of the proposed improvements. All shrubs or landscaping plants removed or damaged during construction shall be replaced by the DEVELOPER/CONTRACTOR at his expense, with landscaping approved by the COH.
- B. Limits of clearing shall be contained within the areas within Right-of-way, Easement and Construction limits as shown on the approved Drawings.
- C. Existing fences that can be reused (if approved by the COH) shall be carefully removed and stored at such a distance they shall not be damaged by construction activity.
- D. Fences that cannot be reused shall be removed to such a distance to allow construction activity and shall be replaced with new materials similar to existing fences upon completion of construction.

3.03 GRUBBING

- A. The limits of grubbing shall be contained within Right-of-way, Easement and Construction limits as shown on the approved Drawings.
- B. Stumps and roots shall be grubbed and removed to a depth not less than 2 feet below existing grade or bottom of foundation structure.

- C. All holes or cavities, which extend below the subgrade elevation of proposed WORK shall be filled with crushed rock or other suitable material and compacted to the same density as the surrounding material.

3.04 PROTECTION

- A. Streets, roads, adjacent property, and other works to remain shall be protected throughout the work in accordance with local laws and ordinances.
- B. DEVELOPER/CONTRACTOR shall make every effort to protect existing benchmarks, R/W markers, monuments, iron pins, property corner markers, etc. If any are disturbed or destroyed, CONTRACTOR shall provide services of a registered land surveyor to replace the markers.
- C. No trees shall be cut outside of areas designated without specific approval of the COH, and any trees designated shall be protected from damage by DEVELOPER/CONTRACTOR'S construction operations.
- D. Existing trees and other vegetation to remain shall be protected as directed by the COH:
 - 1. Trees shall be protected by fencing, barricades, or wrapping.
 - 2. Shrubs and bushes shall be protected by fencing, barricades, or wrapping. Wrapping of bushes and shrubs with plastic film will not be permitted.
 - 3. Shallow-rooted plants shall be protected at ground surface under and in some cases outside the spread of branches by fencing, barricades, or ground cover protection.
- E. In the event archaeological resources are uncovered, the DEVELOPER/CONTRACTOR shall notify the COH prior to proceeding with WORK.
- F. DEVELOPER/CONTRACTOR shall erect temporary fences as necessary to preserve the privacy of all affected property owners whose existing fences are being removed or relocated. Temporary fences shall be of sufficient strength and quality to prevent escape of animals and livestock and to prevent the intrusion of animals and people.
- G. It is DEVELOPER/CONTRACTOR'S responsibility to coordinate, with each affected property owner, the removal and erection of fences and to maintain any temporary and/or relocated fences throughout the contract period.
- H. DEVELOPER/CONTRACTOR shall assume all costs incurred by any property owner in the loss of animals or livestock due to an insufficiency of replaced or temporary fences during the contract period and maintenance period thereafter.
- I. It is the DEVELOPER/CONTRACTOR'S responsibility to secure any insurance necessary to protect himself in the event of loss or damage to any animals, livestock and property for the duration of the project and maintenance period.

3.05 DISPOSAL

- A. DEVELOPER/CONTRACTOR shall remove and dispose of all excess material resulting from clearing or site preparation operations. DEVELOPER/CONTRACTOR shall dispose of such materials in a manner acceptable to the COH at an approved location where such materials can be lawfully disposed.
- B. DEVELOPER/CONTRACTOR may, at no cost, retain any materials of value from clearing operations for his own use or disposal by sale unless otherwise stated in these Specifications. Such material shall be removed from construction area before completion of WORK. The COH assumes no responsibility for protection or safekeeping of any materials so retained by DEVELOPER/ CONTRACTOR.
- C. Materials shall be disposed of by burying.
- D. Burning will be permitted if the required permits have been acquired from the local Fire Department. Burning of debris on site must conform to local fire department codes and must be in compliance with the applicable EPD Rules and Regulations. Burning will be permitted only at times when conditions are considered favorable for burning and at locations approved by proper State or local authorities. Materials to be burned shall be piled neatly and, when in a suitable condition, shall be burned completely. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. All burning shall be so thorough that the materials are reduced to ashes. No logs, branches, or charred pieces shall be permitted to remain. DEVELOPER/CONTRACTOR shall at all times take special precautions to prevent fire from spreading to areas beyond the limits of cleared areas and shall have available at all times, suitable equipment and supplies for use in preventing and suppressing fires. Unguarded fires will not be permitted.
- E. Material to be removed from site shall be removed as it accumulates to prevent any unsightly spoil areas.
- F. All unsuitable excavated materials must be properly disposed of in a manner acceptable to the COH and will not adversely affect the environment. Disposal of construction debris and solid waste must be in compliance with the EPD Land Protection Solid Waste Act and Rules and Regulations.

3.06 DUST CONTROL

- A. The DEVELOPER/CONTRACTOR shall use all means necessary to control dust on and near work areas and on and near all off-site borrow areas when dust is caused by construction operations during performance of work. The DEVELOPER/CONTRACTOR shall thoroughly moisten all surfaces as required to prevent dust

being a nuisance to the public, neighbors and traffic hazards.

END OF SECTION

SECTION 02225

EARTHWORK FOR UTILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

Work under this section shall include all operations necessary for excavating, backfilling and compaction of material necessary for the construction of pipelines and all appurtenant facilities including sewage pump station, concrete saddles, pipe protection, etc., and for the disposal of waste and unsuitable materials.

1.02 RELATED WORK

- A. Section 02270 – Temporary Erosion Control
- B. Section 02931 - Grassing

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM), Annual Book of Standards
 - 1. ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400) ft-lb/ft³).
 - 2. ASTM D2167, Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 - 3. ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 4. ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 5. AWWA C600, Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 6. AWWA C605, Standard for Underground Installation of PVC Pressure Pipe and Fittings for Water
 - 7. AWWA C150, American National Standard for the Thickness Design of Ductile-Iron Pipe
 - 8. ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes
- B. Occupational Safety and Health Administration (OSHA), Code of Federal Regulations 29

CFR Part 1926, Subpart P – Excavation, latest revision.

1.04 GEOTECHNICAL ENGINEERING SERVICES

- A. The CONTRACTOR-DEVELOPER shall obtain the service of a Georgia registered geotechnical engineer to perform all compaction tests specified herein. Evidence and documentation of testing shall be required at the COH's discretion.

PART 2 PRODUCTS

2.01 BEDDING STONE

Class IA or IB aggregate materials in accordance with ASTM D 2321.

2.02 BACKFILL

Reused or imported earth free of stone, clods, broken rock, or concrete larger than 3 inches in largest dimension, or organic matter, rubbish, or other unsuitable material.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify bedding and backfill material to be used are acceptable. Do not use frozen material.
- B. Verify areas to be backfilled are free of debris, snow, ice, or water and surfaces are not frozen.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. When necessary, compact subgrade surfaces to density requirements for backfill material.

3.03 SHEETING, SHORING AND BRACING

- A. CONTRACTOR shall be responsible for supporting and maintaining all excavations required even to the extent of sheeting and shoring the sides and ends of excavations with timber or other supports. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and to conform with OSHA 29 CFR 1926, Subpart P – Excavations, latest revision.
- B. Excavations adjacent to existing or proposed utilities, buildings and structures, or in paved streets or alleys shall be sheeted, shored and braced adequately to prevent undermining beneath or subsequent settlement of such structures or pavements. Underpinning of adjacent utilities and structures shall be done when necessary to maintain utilities and structures in safe

condition. The CONTRACTOR-DEVELOPER shall be held liable for any damage resulting to such utilities, structures or pavements as a result of his operations.

- C. The need and adequacy of sheeting, shoring, bracing, or other provisions to protect men and equipment in a trench or other excavation shall be the sole and exclusive responsibility of CONTRACTOR-DEVELOPER.

3.04 EXCAVATION

A. Trench Excavation

1. Trench excavation shall consist of the removal of materials necessary for the construction of pipelines and all appurtenant facilities including collars, concrete saddles, and pipe protection called for on Drawings.
2. Excavation for pipelines shall be made in open cut unless otherwise shown on Drawings. Trenches shall be cut true to lines and grades shown on Drawings. Minimum pipe cover shall be 48" measured from the top of pipe to the ground surface.
3. Use of motor-powered trenching machine will be permitted but full responsibility for the preservation, replacement, and/or repair of damage to any existing utility services and private property shall rest with CONTRACTOR.
4. Bell holes for bell and spigot pipe and/or mechanical joint pipe shall be excavated at proper intervals so the barrel of the pipe will rest for its entire length upon the bottom of the trench or bedding material.
5. Pipe trenches shall not be excavated more than 400 feet in advance of pipe laying and all work shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
6. Unless otherwise specified herein or shown on Drawings, wherever pipe trenches are excavated below elevation shown on Drawings, CONTRACTOR-DEVELOPER, at his own expense, shall fill the void thus made to proper grade with Class D concrete or with compacted layers of crushed rock or other material conforming to requirements specified herein for backfill.
7. In all cases where materials are deposited along open trenches they shall be placed so that no damage will result to the WORK and/or adjacent property in case of rain or other surface wash.
8. Remove soft, spongy, or otherwise unstable materials encountered at elevation of pipe which will not provide a firm foundation for the pipe. Extend bedding depth as necessary to reach firm materials.

- B. Any unauthorized excavation shall be corrected at the CONTRACTOR-DEVELOPER's expense.
- C. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- D. Grade top perimeter of excavation to prevent surface water run-off into excavation.
- E. Notify COH and ENGINEER of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

3.05 DEWATERING

- A. CONTRACTOR shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the WORK. Dewatering shall be accomplished by methods which will ensure a dry excavation and preservation of final lines and grades of bottoms of excavations. Methods of dewatering may include sump pumps, well points, deep wells, or other suitable methods which do not damage or weaken structures, foundations, or subgrades. Shallow excavations may be dewatered using open ditches provided such ditches are kept open and free-draining at all times. Dewatering methods used shall be acceptable to ENGINEER. Footing pits or trenches shall be protected by small earth dikes and plastic covers when they are left open in rainy weather.
- B. Unless specifically authorized by COH, groundwater encountered within the limits of excavation shall be depressed to an elevation not less than twelve (12) inches below the bottom of such excavation before pipe laying or concreting is started and shall be so maintained. No concrete structures shall be exposed to unequal hydrostatic forces until the concrete has reached its specified 28-day strength. Water shall not be allowed to rise above bedding during pipe laying operations. CONTRACTOR shall exercise care to prevent damage to pipelines or structures resulting from flotation, undermining, or scour. Dewatering operations shall commence when ground or surface water is first encountered and shall be continued until such times as water can safely be allowed to rise in accordance with provisions of this section.
- C. Standby pumping equipment shall be kept on the job site. A minimum of one standby unit (one for each ten in the event well points are used) shall be available for immediate installation should any pumping unit fail. Installation of well points or deep wells shall be adequately sized to accomplish the WORK.
- D. CONTRACTOR-DEVELOPER shall not operate dewatering devices (i.e., pumps, etc.) before the hour of 8:00 AM and after the hours of 8:00 PM in a residential area unless otherwise approved by COH.
- E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with foundation backfill. Foundation backfill shall be placed in bottom of trench to within 6" of the bottom of pipe. Six (6) inches of bedding stone shall be placed over the top of the foundation backfill.

- F. CONTRACTOR shall dispose of water from the WORK in a suitable manner without damage to adjacent property. Conveyance of water shall be such as to not interfere with construction operations or surrounding property owners. No water shall be drained into WORK built or under construction. CONTRACTOR-DEVELOPER will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.
- G. Storm water runoff shall be controlled by means of temporary erosion control methods specified, as shown on Drawings, or as directed by ENGINEER.
- H. Water shall be disposed of in such a manner as not to be a menace to public health and in accordance with applicable Environmental Protection Agency, Corps of Engineers, and State Environmental Protection Division standards and permits.

3.06 BEDDING/BACKFILLING

- A. The backfilling of trenches shall be started immediately after construction. Bedding and backfill material shall be earth or aggregate in accordance with Part 2 and the Drawings. Material shall be deposited in the initial horizontal layer (before compaction) on each side of the pipe. The initial layer shall be thoroughly tamped or rammed around the pipe until the initial layer's density is equal to the density of the adjacent undisturbed soils, as per the COH Standard Details. The second bedding material layer shall be deposited horizontally to a depth to provide a cover of not less than 12 inches over top of pipe. The remainder of the backfill shall be placed in horizontal layers 18 inches (maximum) in depth. The second and subsequent bedding/backfill layers shall be compacted by compaction tools to a density equal to the density of the adjacent undisturbed soils.
- B. Compact aggregate and soil backfill under roads, structures, and driveways to a minimum of 95% of maximum dry density at not less than 2% below nor more than 2% above the optimum moisture content as determined by ASTM D 698.
- C. All backfilling shall be done in such a manner that the pipe or structure over or against which it is being placed will not be disturbed or injured. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be removed and repaired to the satisfaction of COH and then re-backfilled.
- D. Backfilling shall not be done in freezing weather, and shall not be done with frozen material or upon frozen materials.
- E. All backfilling shall be left with smooth, even surfaces, properly graded and shall be maintained in this condition until final completion and acceptance of the work.
- F. Leave stockpile areas completely free of excess fill materials. After construction and cleanup, stockpile areas shall be seeded in accordance with provisions specified in Section 02931.
- G. Use "Class B" bedding in all wet trenches and under driveways, regardless of pipe material. See Detail S-9 in the City of Hoschtou Water & Sewer Departments Standard Construction Details.

Use "Class B" bedding for all PVC gravity sewer laterals. See Detail S-9 in the City of Hoschton Water & Sewer Departments Standard Construction Details.

- H. Use "Class C" bedding for DIP gravity sewer, laterals, and sewer force mains. See Detail S-10 in the City of Hoschton Water & Sewer Departments Standard Construction Details.
- I. Use "Class D" bedding for DIP water mains. See Detail S-11 in the City of Hoschton Water & Sewer Departments Standard Construction Details.

3.07 SUBSURFACE OBSTRUCTIONS

- A. In excavating, backfilling, and laying pipe, care must be taken not to remove, disturb, or injure any existing water, telephone, gas pipes, storm drainage pipe, headwalls or catch basins, or other conduits or structures. If necessary, the CONTRACTOR-DEVELOPER at his own expense, shall sling, shore up, and maintain such structures in operation, and shall repair any damage to them. Before final acceptance of the work, he shall return all such structures to as good condition as before the work started.
- B. The CONTRACTOR-DEVELOPER shall give sufficient notice to the interested utility of his intention to remove or disturb any pipe, conduit, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the execution of the work, the CONTRACTOR-DEVELOPER shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the CONTRACTOR-DEVELOPER to promptly notify the affected authorities shall make him liable for any needless loss so far as interference with the normal operation of the utility.
- C. When pipes or conduits providing service to adjoining buildings are broken during progress of the work, the CONTRACTOR shall repair them at once.
- D. Delays such as would result in buildings or residences being without services overnight or for a needlessly long period during the day will not be tolerated. Should it become necessary to move the position of a pipe, conduit or structure, it shall be done by the CONTRACTOR-DEVELOPER in strict accordance with the instructions given by the utility owner involved.
- E. The COH will not be liable for any claim made by the CONTRACTOR-DEVELOPER based on underground obstructions being different from that indicated in the plans.

3.08 BORROW EXCAVATION

Wherever the backfill of excavated areas or the placement of embankments or other fills require material not available at the site, suitable material shall be obtained from other sources. This may require the opening of borrow pits at points not immediately accessible to the WORK. Before a borrow pit is opened, the quality and suitability of the material to be obtained shall be approved by the COH. Any soil tests required for approval of the borrowed material proposed shall be at the DEVELOPER'S expense.

3.09 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

- A. Materials removed by excavation, which are suitable for the purpose, shall be used to extent possible for backfilling pipe trenches and for making embankment fills, subgrades or for such other purposes as may be shown on Drawings. Materials not used for such purposes shall be considered waste material and shall be disposed of at the CONTRACTOR-DEVELOPER's expense.
- B. Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.
- C. Unsuitable materials, consisting of rock, wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the COH, shall be removed from the work site and disposed of by CONTRACTOR-DEVELOPER at his expense.
- D. No waste material shall be dumped on private property unless written permission is furnished by owner of property and unless a dumping permit is issued from local jurisdiction.

3.10 TESTING

- A. Compaction of fill and backfill to the specified moisture-density relationship of soils shall be verified by in-place density tests using ASTM D 2167, 1556 or other ASTM in-place density tests approved by the COH. Maximum density determination and in-place density tests shall be performed by a soils technician employed by the CONTRACTOR-DEVELOPER. Frequency and location of tests shall be adequate to ensure proper compaction has been achieved.
- B. Areas not meeting the required compaction shall be re-compacted until the desired degree of compaction is achieved. All costs associated with re-testing failed areas of compaction shall be paid for by the CONTRACTOR-DEVELOPER.

3.11 PROTECTION

Protect excavation by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in of loose soil into excavation. Protection shall be in accordance with OSHA 29 CFR 1926, Subpart P-Excavations, latest revision.

3.12 FINAL GRADING

- A. After other earthwork operations have been completed, sites of all structures and embankments shall be graded to finished grade as shown on the Drawings. Grading operations shall be so conducted that materials shall not be removed or loosened beyond required limits. Finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from use of hand tools. If CONTRACTOR is able to obtain required degree of evenness by means of mechanical equipment, he will not be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished.

- B. Unless otherwise specified or shown on the Drawings, all finished ground surfaces shall be graded and dressed to present a surface varying not more than plus or minus 0.10 foot. Any finished surfaces resulting in inadequate drainage or washouts shall be corrected by the CONTRACTOR-DEVELOPER at his expense.

3.13 SETTLEMENT

- A. CONTRACTOR-DEVELOPER shall be responsible for all settlement of backfill, fills, and embankments which may occur during warranty period.
- B. CONTRACTOR-DEVELOPER shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from COH.

END OF SECTION

SECTION 02227

ROCK REMOVAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Removal of all rock materials discovered during excavation for the purpose of construction. Removal shall include drilling and/or blasting incidental thereto and disposal of excavated materials.
- B. When necessary for prosecution of the WORK, the use of explosives to assist rock removal may be exercised by DEVELOPER provided this use is in compliance with all local, State, Federal and other Governmental regulations applying to transportation, storage, use and control of explosives.

1.02 RELATED WORK

- A. Section 02225 - Earthwork for Utilities

1.03 REFERENCES

- A. NFPA 495 - Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.
- B. OSHA 2207 - Construction Industry Standards, Subpart T - Demolition.
- C. Rules and Regulations of Safety Fire Commissioner, Chapter 120-3-10.

1.04 QUALITY ASSURANCE

- A. Explosives Firm: Company specializing in explosives for disintegration of subsurface rock with documented experience.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code, including Rules and Regulations of Safety Fire Commissioner, Chapter 120-3-10, for explosive disintegration of rock.
- B. Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.
- C. All explosives shall be stored securely in compliance with all laws and ordinances, and all such storage places shall be clearly marked DANGEROUS EXPLOSIVES. Blasting caps, electric blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives or blasting agents. Locked storage shall be provided satisfactory to the CITY OF HOSCHTON, never closer than allowed by the Safety Fire Commissioner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Rock (Definition): Solid mineral material with a volume in excess of 1/2 cu yd that cannot be broken down and removed by use of heavy construction equipment, such as a Caterpillar 225 or equivalent, having a bucket curling force rated at not less than 25,700 pounds, bulldozer such as a Caterpillar D8K equipped with single tooth hydraulic ripper, 3/4 cu yd capacity power shovel, rooters, etc., and without drilling or blasting. Materials which can be loosened with a pick, hard pan, boulders less than 1/2 cu yd in volume, chert, clay, soft shale, soft and disintegrated rock and any similar material shall not be considered as rock. (All materials to be considered unclassified or common excavation)
- B. Explosives: Shall be suitable for intended purposes at the DEVELOPER's option subject to review by the COH.
- C. Delay Devices: Type recommended by explosives firm to be used as accessory to explosives. Subject to review by the COH.
- D. Blasting Mat: When the use of explosives is necessitated during prosecution of the WORK, DEVELOPER shall incorporate the use of blasting mats of type recommended by explosives firm to lessen the danger of projectiles occasionally resultant from blasting of rock.

PART 3 EXECUTION

3.01 INSPECTION

- A. Rock in utility trenches shall be excavated over the horizontal limits of excavation and to depths as follows:

Size of Pipeline (Inches)	Depth of Excavation Below Bottom of Pipe (Inches)
Less than 4	6
4 to 6	8
8 and over	12

Space below grade for pipe shall then be backfilled with 3/4-inch crushed rock or gravel or other approved materials and tamped to proper grade.

3.02 ROCK REMOVAL - MECHANICAL METHOD

- A. Excavate for and remove rock by the mechanical method.
- B. Where pipes are constructed on concrete cradles, rock shall be excavated to bottom of cradle as shown on plans.
- C. Where rock foundation is obtained at grade for over 50 percent of area of any one structure, the portion of foundation that is not rock shall be excavated below grade to reach a satisfactory foundation of rock. The portion below grade shall be backfilled with Class C concrete.
- D. Where rock foundation is obtained at grade for less than fifty (50%) of any one structure and satisfactory rock cannot be found over the remaining area by reasonable additional excavation, the rock shall be removed for a depth of twelve (12) inches below grade and the space below grade shall be backfilled with crushed stone as specified for pipelines.
- E. Rock excavation near existing pipelines or other structures shall be conducted with utmost care to avoid damage. Injury or damage to other structures and properties shall be promptly repaired to the satisfaction of the COH and by DEVELOPER at his own expense.
- F. Remove excavated material from site.
- G. DEVELOPER shall correct excess rock removal by backfill to grade with Class C (3000 psi) concrete in accordance with backfilling and compaction requirements of Section 02225 (Earthwork for Utilities), at his own expense.

3.03 ROCK REMOVAL - EXPLOSIVE METHOD

- A. The DEVELOPER shall notify any owners of adjacent buildings or structures, and any public utility owners having structures or other installations above or below ground, in writing prior to use of explosives. Such notice shall be given sufficiently in advance so that they may take such steps as they may deem necessary to protect their property from injury and/or damage.
- B. Rock excavation by use of explosives shall be conducted with due regard for safety of persons and property in the vicinity and in strict conformance with requirements of local, State and Federal ordinance, laws and regulations of the Safety Fire Commissioner.
- C. Blasting shall be conducted so as not to endanger persons or property, and whenever required, the blast shall be covered with mats or otherwise satisfactorily confined. The DEVELOPER shall be held responsible for and shall make good any damage caused by blasting or accidental explosions.
- D. The DEVELOPER shall permit only authorized and qualified persons to handle and use explosives.

- E. Smoking, firearms, matches, open flame lamps, and other fires, flame or heat producing devices and sparks shall be prohibited in or near explosive magazines or while explosives are being handled, transported or used.
- F. No person shall be allowed to handle or use explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs.
- G. All explosives shall be accounted for at all times. Explosives not being used shall be kept in a locked magazine, unavailable to persons not authorized to handle them. The DEVELOPER shall be held responsible for maintaining an inventory and use record of all explosives. Appropriate authorities shall be notified of any loss, theft, or unauthorized entry into a magazine.
- H. No explosives or blasting agents shall be abandoned.
- I. DEVELOPER's employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including, but not limited to, visual and audible warning signals, flags, or barricades, to ensure safety.
- J. A seismograph shall be used at the nearest structure during blasting events that are within 750 feet of the nearest house, public building, school, church, commercial or institutional building and roadway. The velocity/shock wave shall not exceed the established limits of U.S. Bureau of Mines RI 8507; appendix (b).

Exception: Where all pedestrian and vehicular traffic on a roadway can be restricted to a distance of 750 feet or greater from the blast site at the time of the firing of the blast or where a variance is issued by the State Fire Marshal's Office.
- K. Disintegrate rock and remove from excavation.
- L. Cut away rock at excavation bottom to form level bearing.
- M. Remove shaled layers to provide sound and unshattered base for pipe foundations.
- N. Remove excavated material from site.
- O. Correct unauthorized rock removal or overbreak in accordance with backfilling and compaction requirements at his own expense.

3.04 FIELD QUALITY CONTROL

Provide for visual inspection of bearing surfaces and cavities formed by removed rock for inspection by the CITY OF HOSCHTON.

END OF SECTION

SECTION 02270

TEMPORARY EROSION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Erosion control shall be employed during all phases of the construction period and shall include all measures required to prevent soil erosion from the site until permanent erosion control measures are installed. WORK shall be accomplished through, but not limited to, the use of berms, dikes, sediment barriers, sediment traps, sediment basins, silt fences, temporary grasses, check dams, mulching, construction exits and slope drains.
- B. Erosion control measures described herein shall be installed prior to starting construction activities and continued until such time as permanent planting and restoration of natural areas is effectively in control of erosion from project site.
- C. Failure to install and maintain temporary erosion control measures throughout the construction period may be cause to halt construction by the COH or governing authorities until such measures are correctly installed and operational.
- D. For obtaining a Land Disturbance Activity Permit, The DEVELOPER/CONTRACTOR shall submit the Erosion control Plan and Application to the COH for review and comment.
- E. The Development Permit will not be issued until the COH has approved the plan and issued the Land Disturbance Permit.

1.02 RELATED WORK

Section 02272 - Rip Rap

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. DEVELOPER/CONTRACTOR shall comply with applicable codes, rules, ordinances, regulations, and laws of local, municipal, state or federal authorities having jurisdiction over project.
- C. "Manual for Erosion and Sediment Control in Georgia" published by the State Soil and Water Conservation Committee of Georgia, latest edition.

- D. DEVELOPER/CONTRACTOR shall comply with the State of Georgia Erosion and Sedimentation Control Act of 1975, latest amendment or revision. All erosion and sedimentation control measures shall be designed, installed, and maintained in accordance with the Manual for Erosion and Sedimentation Control in Georgia, latest edition.

- E. DEVELOPER/CONTRACTOR shall comply with Georgia Department of Natural Resources Environmental Protection Division National Pollutant Discharge Elimination System (NPDES) General Permits for Construction Activity GAR 100001, GAR 100002 & GAR 100003 activity permits

PART 2 PRODUCTS

All products shall comply with the Manual for Erosion and Sedimentation Control in Georgia, latest edition.

PART 3 EXECUTION

3.01 RUN-OFF EROSION AND SEDIMENTATION CONTROLS

- A. During construction, route run-off through sedimentation barriers and check dams as practical.

- B. DEVELOPER/CONTRACTOR shall maintain sedimentation devices in functional condition. Sedimentation barrier, silt fences, and check dams shall be cleaned out when these devices are **AT MOST** 60 percent of their capacity. Defective materials in barriers and check dams shall be replaced.

- C. DEVELOPER/CONTRACTOR shall establish sedimentation barriers at the toe of slopes under construction. These barriers may be relocated and reused after permanent slope stabilization becomes established. As they are relocated, any defective materials shall be replaced. In addition, all debris and silt at previous location will be removed.

- D. A 6-inch minimum thickness of crushed stone construction exit pad shall be located and maintained at all access points to site from public streets in accordance with details shown on Drawings. All construction vehicles leaving construction site shall have mud cleaned from their tires at these points to protect public streets from the transportation of sediment from site.

3.02 CLEANUP AND REMOVAL

- A. At the time that permanent erosion control is effective, temporary devices and their accumulated sediments shall be removed.

- B. Silts and deposits removed from control barriers shall be placed in eroded areas if available and shall be replanted, or removed from site.

END OF SECTION

SECTION 02272

RIP RAP

PART 1 GENERAL

1.01 SCOPE OF WORK

This section pertains to the use of riprap for the protection of rivers, creeks and ditches from the effects of erosion and scouring. The work required consists of all materials, accessories, equipment, tools and labor required to install riprap.

1.02 REFERENCES

- A. Manual for Erosion and Sediment Control in Georgia (SCS Manual published by the State Soil and Water Conservation Committee of Georgia (latest edition).
- B. Georgia Department of Transportation Standard Specifications, Construction of Roads and Bridges (latest edition).

PART 2 PRODUCTS

2.01 RIP RAP

All stone for rip rap shall conform to the following tables for the type specified on the drawings as recommended by the Georgia DOT Standard Specifications, Section 603:

**TABLE NO. 1
GRADED RIP RAP STONE**

Type Ga. D.O.T.	Screen Size inches (Sq. opening)			Common Uses	Filter Stone ASTM D-448
	Max.	Avg.	Min.		
3	12	9	5	Creek Banks Pipe Outlets	6 or 57
1	24	12	7	Lakes & Shorelines, Rivers	3, 4 or 5

2.02 FILTER BEDDING STONE

Materials used for filter bed stone shall conform to the following table as recommended by the Georgia DOT Standard Specifications, Section 603:

FILTER BEDDING STONE

ASTM D-448 TABLE 1	Normal Sizes (inches)
3	2" - 1"
4	1 1/2"-3/4"
5	1" - 1/2"
6	3/4"-3/8"
57	1" - No. 4

2.03 GEO-TECHNICAL FILTER FABRIC

- A. As an alternate to filter bedding stone, the DEVELOPER/CONTRACTOR may use geo-technical filter fabric.
- B. Filter fabric shall have strength and engineering properties that meet or exceed those of MIRAFI 700X or PROPEX 1199, or equivalent. Filter fabric shall be as recommended by the Georgia DOT Standard Specifications, Section 171.

2.04 LOCALLY EXCAVATED ROCK

Rock excavated from the site may be used for work described under this section, provided that the quality and size requirements meet the requirements of Articles 2.01 and 2.02.

2.05 MATERIAL AVAILABILITY

The gradations of stone sizes listed in these tables are guidelines. Individual quarries may produce different gradations depending on local conditions. If gradations are different from those listed, DEVELOPER/CONTRACTOR is to notify the COH for approval prior to use on the project.

PART 3 EXECUTION

3.01 STONE OR CONCRETE RIP RAP

- A. Prepare area to receive rip rap. Ensure area is sufficiently stable and compacted to receive the stone.
- B. Install either filter stone to thickness specified on drawings, or geo-technical filter fabric per manufacturer's recommendations.
- C. Upon completion of the filter bed preparation, the rip rap shall be dumped and handled into place to form a compact layer to a thickness as shown on the drawings. Tolerance for rip rap shall be plus 6 inches, with no under-tolerance permitted.

3.03 CLEAN-UP

- A. After installation is complete, the rip rap and the area surrounding the riprap shall be cleared of all debris.
- B. Grassing or mulch stabilization is to be installed on all disturbed areas after clean-up is complete.

END OF SECTION

SECTION 02300

BORING AND JACKING

PART 1 GENERAL

1.01 SCOPE OF WORK

WORK covered in this section includes furnishing all labor, materials, accessories, equipment and service required to properly complete pipeline construction using boring and jacking under railroads and State, County, or City highways and streets, as described herein and/or shown on Drawings.

Any tunneling required shall be designed, specified, and permitted by the DEVELOPER, and reviewed by the COH.

1.02 RELATED WORK

- A. Section 02225 - Earthwork for Utilities
- B. Section 02660 - Water Distribution Systems
- C. Section 02732 - Sanitary Sewer Force Mains
- D. Section 02736 - Sanitary Sewer
- E. Section 03300 - Concrete

PART 2 PRODUCTS

2.01 MATERIALS

- A. Boring and Jacking

Minimum casing size shall be 12-inches in diameter. Steel casing pipe, sizes 12 inches through 24 inches shall be spiral or straight seam welded steel pipe conforming to ASTM A 139, Grade A. Minimum wall thickness of steel pipe for railroad and roadway crossings shall be in accordance with Owner's specifications, or 0.25" Wall minimum, whichever is greater.

- B. Carrier Pipe: For waterlines all carrier pipes shall be DIP and installed with restrained joint gaskets as specified in Section 02660. For sewer forcemains all carrier pipes shall be PVC and installed with restrained joints as specified in Section 02732. For gravity sewer, the carrier pipe shall be DIP, and installed with restrained joint gaskets as specified in Section 02732, and shall have interior coating as specified in Section 18000.
- C. Class "D" (2500 psi) Concrete: As specified under Section 03300 (Concrete).

PART 3 EXECUTION

3.01 GENERAL

- A. Any solidification of embankments, boring heading, or sides shall be the DEVELOPER/ CONTRACTOR'S responsibility and shall be done at his own expense.
- B. Trench excavation; all classes and types of excavation; the removal of rock, muck, debris; the excavation of all working pits; and backfill requirements of Section 02225 are included under this section.
- C. Adequate sheeting, shoring, and/or bracing for embankment operating pits and other appurtenances shall be placed and maintained to ensure that WORK proceeds safely and expeditiously. Upon completion of required WORK, the sheeting, shoring, and bracing shall be left in place, cut off, or removed, as designated by the COH.
- D. DEVELOPER/CONTRACTOR shall maintain and operate pumps, well points, and drainage system equipment to keep work dewatered at all times.
- E. Bored installations shall be a bored-hole diameter essentially the same as the outside diameter of casing pipe to be installed.
- F. Casing pipe shall be jacked into boring as soon as possible after boring is made. Lengths of casing pipe as long as practical shall be used. Joints between sections shall be completely welded as recommended for joining the particular type of pipe.
- G. Once jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of DEVELOPER/CONTRACTOR.
- H. Care shall be taken to ensure that casing pipe installed by boring and jacking or open cut method will be at the proper alignment and grade.
- I. Open cut installations, where permitted, shall be in accordance with details and procedures shown on Drawings.
- J. Ends of casing shall be sealed in accordance with Detail S-16.
- K. After casing pipe is installed, the carrier pipe shall be installed exercising care to protect its coating and lining and maintain its joint integrity. Carrier pipe shall be concentric and be placed in proper horizontal and vertical alignment using prefabricated pipe collars spaced radially around pipe and secured to remain firmly in place. Spacing of collars shall be no greater than ten (10') feet on center longitudinally in casing pipe. See Detail S-16.

3.02 HIGHWAY/ROADWAY/RAILROAD CROSSINGS

- A. DEVELOPER/CONTRACTOR is responsible for the permitting, coordinating and scheduling of all construction work within State, County, or City highways, or railroad rights-of-way prior to, during, and after utility installation.
- B. DEVELOPER/CONTRACTOR shall review and coordinate construction methods, materials, and safety measures with the affected OWNER.
- C. For open cut trench installations, DEVELOPER/CONTRACTOR shall be responsible for scheduling and coordinating all construction work. WORK at one particular crossing shall be completed with the trench backfilled, compacted, and a temporary crushed stone surface provided for traffic before any work is started on another such crossing.
- D. Installations shall be done to leave free flows in drainage ditches, pipes, culverts, or other surface drainage facilities of the highway, street, or its connections.
- E. Where sodding is disturbed by excavation or backfilling operation, such areas shall be replaced by mulch sodding on slopes 5 percent or less. Slopes over 5 percent shall be replaced with block sodding. No separate payment shall be made for sodding which shall be included in the bid prices for installation of pipe.
- F. Trench excavation within the right-of-way, but not under pavement, shall be backfilled as described in Section 02225 (Earthwork for Utilities).
- G. Surplus material shall be removed from the right-of-way and the excavation finished flush with surrounding ground.
- H. Grout backfill shall be used for unused bores or abandoned pipes.
- I. Boring, jacking, or driving of casing pipes shall be accomplished without jetting, sluicing, or wet boring.
- J. Excavated materials and equipment shall not be placed on the pavement or shoulders of roadways.
- K. In no instance will DEVELOPER/CONTRACTOR be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadways or railroads.

END OF SECTION

SECTION 02341

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SCOPE

- A. Materials and equipment required to install potable water main, reclaim main, gravity sewer, and force main pipe using horizontal directional drilling (HDD) method of installation. The pipe size, type and length shall be as specified herein and as shown on the Drawings. Work shall include and not be limited to proper installation, testing, and environmental protection and restoration.
- B. Protect all known underground utilities, structures, and drains using approved softdig techniques.
- C. The directional drill shall be accomplished by first drilling a pilot hole to design standards, and then enlarging the pilot hole no larger than 1.2 times the outside diameter of the pipe or pipe bell, if applicable, to accommodate pull back.
- D. Work shall be constructed using all local, DOT, and OSHA rules and guidelines for traffic control and safety.

1.02 REFERENCE DOCUMENTS

- A. American Water Works Association (AWWA)
 - 1. AWWA C104: Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
 - 2. AWWA C111, Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 - 3. AWWA C151, Standard for Ductile Iron Pipe, Centrifugally Cast for Water or Other Liquids
 - 4. AWWA C600, Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
 - 5. AWWA C651, Standard for Disinfecting Water Mains
 - 6. AWWA C150, Standard for Thickness, Design of Ductile Iron Pressure Pipe
- B. NSF International (NSF)
 - 1. NSF61 Drinking Water System Components

1.03 Not used

1.04 QUALITY ASSURANCE

- A. The CONTRACTOR shall provide the COH with 72 hours notice (Monday – Friday) prior to any underground drilling operations.
- B. At the request of the COH, the CONTRACTOR will provide a hands on overview of the drilling and locating equipment to be used, as well as the methods and practices of monitoring the accuracy of the bore.
- C. The CONTRACTOR shall exercise all due diligence in attempting to maintain accurate line and grade with minimum deviation to the submitted Pilot Bore Profile. The COH shall be notified immediately of any unforeseen site conditions which, the CONTRACTOR feels, will render the bore unusable or beyond the agreed limits of accuracy.

PART 2 PRODUCTS

NOTE: For sewer conveyance applications, PVC or HDPE pipe is required. DIP for sewer will only be considered in special design applications.

2.01 DUCTILE IRON PIPE FOR HORIZONTAL DIRECTIONAL DRILLING

- A. Shall conform to latest requirements of AWWA C151.
- B. Shall be cement mortar lined in accordance with AWWA C104 standard thickness.
 - 1. Unless otherwise specified, pipe shall have restrained joints conforming to AWWA.
 - 2. Unless otherwise specified, pressure class shall be 350 psi.
 - 3. Pipe shall be U.S. Pipe TR Flex DIP or American Flex-Ring DIP.

2.02 HIGH DENSITY POLYETHYLENE PIPE FOR HORIZONTAL DIRECTIONAL DRILLING

Item	Size	Description
General	All	Pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.
Pipe		ASTM D3350, high density polyethylene, maximum allowable hoop stress 800 psi at 73.4 degrees F. Polyethylene resins shall conform to Type PE 3408 or better. Protection shall be provided against ultraviolet light degradation using carbon black, not less than 2 percent well dispersed in the resin.

		<p>Pipe wall thickness shall reflect the required SDR* and diameter, as shown in Table 8, ASTM F714.</p> <p>Design Stress Rating: ASTM F714, 800 psi hydrostatic.</p> <table> <thead> <tr> <th>Pressure Rating</th> <th>SDR*</th> </tr> </thead> <tbody> <tr> <td>200</td> <td>9</td> </tr> <tr> <td>160</td> <td>11</td> </tr> <tr> <td>130</td> <td>13.5</td> </tr> <tr> <td>100</td> <td>17</td> </tr> <tr> <td>80</td> <td>21</td> </tr> <tr> <td>65</td> <td>26</td> </tr> <tr> <td>50</td> <td>32.5</td> </tr> </tbody> </table> <p>*SDR: standard dimension ratio = OD/thickness</p>	Pressure Rating	SDR*	200	9	160	11	130	13.5	100	17	80	21	65	26	50	32.5
Pressure Rating	SDR*																	
200	9																	
160	11																	
130	13.5																	
100	17																	
80	21																	
65	26																	
50	32.5																	
Fittings	6 inch & smaller	<p>Molded fittings, butt fusion joined, conforming to ASTM D3261.</p> <p>All fittings shall have the same pressure rating as pipe, unless otherwise noted.</p>																

- A. Connections between HDPE and C900 PVC/DIP shall be via a Ductile Iron Pipe Size MJ adaptor as manufactured by Isco Industries, or approved equal. **CONTRACTOR to provide shop drawings TO ENGINEER for these connections.**

2.03 FUSIBLE C900 PVC PIPE

- A. Fusible polyvinylchloride pipe shall conform to AWWA C900 or AWWA C905. Testing shall be in accordance with AWWA standards for any of these pipe types.
- B. Fusible polyvinylchloride pipe shall be manufactured under the trade names Fusible C-900 or Fusible C-905 for Underground Solutions, Inc. Poway, CA. (858) 679-9551. Fusion process shall be as patented by Underground Solutions, Inc. Poway, CA. Patent No. 6,982,051.
- C. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

- D. Fusible polyvinylchloride pipe shall be manufactured in standard 40' nominal lengths, or custom lengths as applicable.
- E. Fusible polyvinylchloride pipe shall be blue in color for potable water use.
- F. Pipe shall be min. DR 18, Pressure Class 235, but chosen per design pressure.
- G. Pipe generally shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:
 - 1. Nominal pipe size
 - 2. PVC
 - 3. Dimension Ratio, Standard Dimension Ratio or Schedule
 - 4. AWWA pressure class
 - 5. AWWA Standard designation number
 - 6. Extrusion production-record code.
 - 7. Trademark or trade name
 - 8. Cell Classification 12454 and/or PVC material code 1120 may also be included
 - 9. NSF-61 mark verifying suitability for potable water service
- H. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
- I. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's guidelines for this procedure. All fusion joints shall be completed as described in this specification.
- J. Acceptable fittings for use with fusible polyvinylchloride pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10; AWWA/ANSI C111/A21.11; or AWWA/ANSI C153/A21.53.
 - 1. Connections to fusible polyvinylchloride pipe may be made using a restrained or non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged fittings.
 - 2. Bends, tees and other ductile iron fittings shall be restrained with the use of thrust blocking or other means as indicated in the construction documents.
 - 3. Ductile iron fittings and glands shall be installed per the manufacturer's guidelines.

PART 3 EQUIPMENT AND PERSONNEL REQUIREMENTS

3.01 DRILL RIG

- A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pull back the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused (if required), a magnetic guidance system or walk-over system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good,

safe condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

- B. The directional drilling machine shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.
- C. The drill head shall be steerable by changing its rotation, and shall provide necessary cutting surfaces and drilling fluid jets.
- D. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.

3.02 GUIDANCE SYSTEM

- A. An electronic walkover tracking system or a Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to fifty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to manufacturer's specifications of the vertical depth of the borehole at sensing position at depths up to forty feet and accurate to 1-foot horizontally.
- B. The CONTRACTOR shall supply all components and materials to install, operate, and maintain the guidance system.
- C. The guidance system shall be of a proven type, and shall be set up and operated by personnel trained and experienced with the system. The operator shall be aware of any geo-magnetic anomalies and shall consider such influences in the operation of the guidance system.

3.03 DRILLING FLUID (MUD) SYSTEM

- A. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water, and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be minimum of 1,000 gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.
- B. Drilling fluid shall be composed of clean water and bentonite clay. Water shall be from an authorized source with a pH of 8.5 to 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. No additional

material may be used in drilling fluid without prior approval from ENGINEER. The bentonite mixture used shall have the minimum viscosities as measured by a March funnel:

- Rocky Clay - 60 seconds
- Hard Clay - 40 seconds
- Soft Clay - 45 seconds
- Sandy Clay - 90 seconds
- Stable Sand - 80 seconds
- Loose Sand - 110 seconds
- Wet Sand - 110 seconds

These viscosities may be varied to best fit the soil conditions encountered, or as determined by the operator.

- C. The mud pumping system shall have a minimum capacity of 35-500 GPM and the capability of delivering the drilling fluid at a constant minimum pressure of 1200 psi. The delivery system shall have filters in-line to prevent solids from being pumped into drill pipe. Used drilling fluid and drilling fluid spilled during operations shall be contained and conveyed to the drilling fluid recycling system or shall be removed by vacuum trucks or other methods acceptable to ENGINEER. A berm, minimum of 12 inches high, shall be maintained around drill rigs drilling fluid mixing system, entry and exit pits and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey drilling fluid from containment areas to storage and recycling facilities for disposal.
- D. The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid and render the drilling fluid reusable. Spoil separated from the drilling fluid will be stockpiled for later use or disposal.

3.04 OTHER EQUIPMENT

- A. Pipe Rollers: Pipe rollers shall be of sufficient size to fully support the weight of the pipe while being hydrotested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.
- B. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of ENGINEER.
- C. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the ENGINEER prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system shall maintain line and grade within the tolerances prescribed by the particular conditions of the project.

3.05 PERSONNEL REQUIREMENTS

- A. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. Each person must have at least two years directional drilling experience.
- B. All welders used for splicing and connecting steel and HDPE pipe shall be certified welders. No welds will be allowed by a welder that does not have their certification card on site.

- C. A competent and experienced supervisor representing the CONTRACTOR and Drilling SUBCONTRACTOR shall be present at all times during the actual drilling operations. A responsible representative who is thoroughly familiar with the equipment and type of work to be performed must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the job site during the actual Directional Bore operation. The CONTRACTOR and SUBCONTRACTOR shall have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner.
- D. Personnel who are unqualified, incompetent or otherwise not suitable for the performance of this project shall be removed from the job site and replaced with a suitable person.

PART 4 EXECUTION

4.01 GENERAL REQUIREMENTS

- A. The COH must be notified 72 hours in advance (Monday – Friday) of starting work. It shall be the responsibility of ENGINEER to provide inspection personnel at such time as appropriate without causing undue hardship by reason of delay to the CONTRACTOR.
- B. All work under this specification affecting the Georgia Department of Transportation (GDOT) property, right-of-way or facilities shall be carried out to the full satisfaction of the GDOT authorized representative. The CONTRACTOR shall fully inform himself of all requirements of the GDOT as pertains to specific project and shall conduct all his work accordingly.

4.02 DIRECTIONAL DRILLING OPERATION

- A. The CONTRACTOR shall provide all material, equipment, and facilities required for directional drilling. Proper alignment and elevation of the bore hole shall be consistently maintained throughout the directional drilling operation. The method used to complete the directional drill shall conform to the requirements of all applicable permits.
- B. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If CONTRACTOR is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.
- C. Readings shall be recorded after advancement of each successive drill pipe (no more than 20 lf.) and the readings plotted on a scaled drawing. Access to all recorded readings and plan and profile information shall be made available to the COH at all times. At no time shall the deflection radius of the drill pipe exceed the deflection limits of the carrier pipe as specified herein.
- D. A complete list of all drilling fluid additives and mixtures to be used in the directional operation will be available to the COH.
- F. The pilot hole shall be drilled on bore path with minimal deviation proportionate to the grade being maintained. In the event that pilot does deviate from the bore path,

CONTRACTOR will notify COH and COH may require CONTRACTOR to pull-back and re-drill from the location along bore path before the deviation. In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, CONTRACTOR shall contain the fractured area with necessary erosion control devices to prevent damage to property or the environment.

- G. Upon completion of pilot hole phase of the operation, a complete set of “as-built” records shall be submitted in duplicate to the COH. These records shall include copies of the plan and profile drawing, as well as directional survey reports as recorded during the drilling operation.
- H. Upon approval of the pilot hole location, the hole opening or enlarging phase of the installation shall begin. The bore hole diameter shall be increased to accommodate the pullback operation of the required size and type of pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the CONTRACTOR’s discretion with the final hole opening to be determined by the subsurface conditions, except when installing gravity sewer.
- I. The open bore hole may be stabilized by means of bentonite drilling slurry pumped through the inside diameter of the drill rod and through openings in the reamer. The drilling slurry must be in a homogenous / flowable state serving as an agent to carry the loose cuttings to the surface through the annulus of the borehole. The volume of bentonite mud required for each pullback shall be calculated based on soil conditions, largest diameter of the pipe couplings, capacity of the bentonite mud pump, and the speed of pullback as recommended by the bentonite drilling fluid manufacture. The bentonite slurry is to be contained at the exit or entry side of the directional bore in pits or holding tanks. The slurry may be recycled at this time for reuse in the hole opening operation, or shall be hauled by the CONTRACTOR to an approved dumpsite for proper disposal.
- J. The pipe shall be joined together according to manufacture’s specifications. The gaskets and the ends of pipe must be inspected and cleaned with a wet cloth prior to each joint assembly so they are free of any dirt or sand. The ends of pipe must be free of any chips, scratches, or scrapes before pipe is assembled. A pulling eye will be attached to the pulling head on the lead stick of pipe which in turn will be attached to a swivel on the end of the drill pipe. This will allow for a straight, smooth pull of the product pipe as it enters and passes through the borehole toward the drill rig and original entrance hole of the directional bore. The product pipe will be elevated to the approximate angle of entry and supported by means of a sideboom with roller arm, or similar equipment, to allow for the “free stress” situation as the pipe is pulled into the exit hole toward the drill rig. The product pullback phase of the directional operation shall be carried out in a continuous manner until the pipe reaches the original entry side of the bore. When pulling back pipe, rollers shall be used at all times to prevent damage to the pipe or wrap.

4.03 PIPE HANDLING

- A. Care shall be taken during transportation of the pipe such that it will not be cut, kinked or otherwise damaged.
- B. Ropes, calipers, fabrics, or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings

spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped into rocky or unprepared ground.

- C. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
- D. The handling of the joint pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Slings for handling the pipeline shall not be positioned at pipe joints. Sections of the pipes with deep cuts and gouges shall be removed and the ends of the pipeline rejoined.

4.04 TESTING PIPE

- A. Cleaning and flushing are to be done by the CONTRACTOR in accordance with the requirements of the contract.
- B. Directional drilling pipe shall be tested by CONTRACTOR after pullback in accordance with Section 02660, 02732, or 02736.
- C. The manufacturer's recommendations on bend radius and tensile strength shall be observed.

4.05 SITE RESTORATION

- A. Following drilling operations, CONTRACTOR shall de-mobilize equipment and restore the work site to the original conditions or better. All excavations will be backfilled and compacted according to Section 02225.
- B. Surface restoration shall be completed in accordance with the requirements of the Project plans, to a condition as good as or better than existed prior construction.
- C. No ground, trees, shrubs, signage, or any other existing items are to be disturbed as a result of the proposed horizontal directional drilling. In the event that any ground, trees, shrubs, signage, or any other existing items are disturbed, the CONTRACTOR shall replace and otherwise restore the area to its original condition at the satisfaction of the affected property owner.

4.06 RECORD KEEPING AND AS-BUILTS

- A. CONTRACTOR shall maintain a daily project log of drilling operations and a guidance system log with a copy given to the COH at completion of project.
- B. The MGS data shall be recorded every 25 feet during the actual crossing operation. The CONTRACTOR shall furnish "as-built" plan and profile drawing based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation. The MGS data shall be certified accurate by the CONTRACTOR to the capability of the MGS System.

END OF SECTION

SECTION 02523

RESTORING SIDEWALKS, DRIVEWAYS, CURBS, GUTTERS AND STORM DRAINAGE STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

WORK included in this Section consists of repair or replacement of sidewalks, curbs and gutters, driveways, and storm drainage structures.

1.02 RELATED WORK

A. Section 02225 - Earthwork for Utilities

B. Section 03300 - Concrete

1.03 REFERENCES

Georgia Department of Transportation (GADOT) Standard Specifications, Construction of Roads and Bridges, Latest Edition.

PART 2 PRODUCTS

2.01 CRUSHED STONE BASE

Stone base shall be a Graded Aggregate Base conforming to Section 815 of GADOT Standard Specifications.

2.02 CONCRETE

Shall be ready-mixed concrete conforming to Class "C" (3,000 psi) as specified under Section 03300 of these Specifications.

2.03 HOT MIX ASHALT CONCRETE

Mix Type "F" conforming to Section 400 of GADOT Standard Specifications.

2.04 STORM DRAIN PIPE

In accordance with Section 550 of GADOT Standard Specifications.

2.05 TACK COAT

Cutback asphalt, grade RC-70 or RC-250, or emulsified asphalt, EAP-1, conforming to Section 412 of GADOT Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Restore all sidewalks, driveways, curbs, gutters and storm drains to or better than the original, but not less thickness or quality than specified herein or shown on the Drawings.
- B. Carefully backfill any excavated area on which sidewalks, driveways or curbs and gutters are to be placed as specified in Section 02225 of these Specifications as applicable.
- C. If, prior to the expiration of the warranty period, any sidewalk, driveway or curb and gutter which has been damaged, due to undermining, or for any other cause which may be attributed to the work of the CONTRACTOR/DEVELOPER, the CONTRACTOR/DEVELOPER shall remove such damaged work and all loose earth. He shall then backfill with crushed stone base, properly compact and replace damaged sidewalks, driveways, curbs or gutters.
- D. WORK which the DEVELOPER/CONTRACTOR may do in connection with the replacement and repair of damaged work during the period of maintenance, shall be done at his expense, in accordance with the rules and requirements of the authority within whose jurisdiction such pavement is located, and in accordance with the additional requirements of the specifications, and the DEVELOPER/CONTRACTOR shall furnish evidence to the COH that the work has been completed to the satisfaction of such authority.
- E. Before replacing any sidewalk, driveway, curb or gutter, remove the existing sidewalk, driveway and/or curb and gutter back from the edge of excavation at least 12 inches or to the nearest joint if the nearest joint is within two (2) feet.
- F. All cuts shall be made by channeling machine, pneumatic tools, or such other methods as will furnish a straight clean cut in the concrete without undue shattering.
- G. The DEVELOPER/CONTRACTOR shall provide crushed stone base over trenches after completion of backfill.
- H. Should settlement, cracks or other indications of failure appear in concrete, pavement, driveways, curbs, pipes or other structures, the defective material shall be removed to the extent necessary to secure firm, undisturbed bearing and shall be re-laid in a satisfactory manner.

3.02 CURBS AND GUTTERS

- A. Portland Cement Concrete curbs and gutters shall conform to Georgia D.O.T. Standard Specifications. Match existing curb. Construct 1/2" wide expansion joints with premolded joints filler across curb at all tangent points and at fifty feet intervals and one inch wide expansion joint filler and 3/4" joint sealing between curbs and concrete

paving. Finish curb surface with dense uniform texture equal to burlap drag, and cross-score with 1/4" deep cross-joints at ten-foot intervals.

- B. Concrete curbs and gutters shall be finished in accordance with Section 03300. Face forms shall be removed as soon as possible and the exposed surfaces finished with a wood float. Straight edging, done along the edge of the gutter and top of curb and median shall conform to those requirements for the adjacent pavement, but with no irregularities to exceed 1/4 inch in 10 feet.
- C. Machine methods of placing may be used, providing the end result is satisfactory.

3.03 SIDEWALKS AND DRIVEWAYS

- A. CONTRACTOR/DEVELOPER shall replace/restore all sidewalks and/or driveways disturbed during construction.
- B. Sidewalks shall conform to requirements of Georgia D.O.T. Standard Specifications. Minimum sidewalk thickness shall be 4 inches. Provide transverse contraction joints at 6' interval by cutting a groove in the fresh concrete 1" deep with a jointer having an approved radius and a cutting blade not over 1/8" thick.
- C. Construct 1/2" wide expansion joints with premolded joint filler across walks at a maximum of fifty feet intervals. Finish to a broom and burlap drag gritty surface. Tool all joints and all edges to provide smooth border between sections. Match existing sidewalks.
- D. Concrete sidewalks and driveways shall be given a finish made by stiff-bristle brooming. The surface shall be tested with a 10-foot straightedge laid parallel to the centerline. Any irregularities in excess of 1/4 inch in 10 feet shall be eliminated while the concrete is still plastic. Concrete sidewalks constructed as curb cut (wheelchair) ramps, shall have a rough or textured finish.
- E. Prepare aggregate base and install hot mix Asphaltic Concrete on driveways in conformance with Sections 310 and 400 of GADOT Standard Specifications.

3.04 RESTORING STORM DRAINAGE PIPE

- A. CONTRACTOR/DEVELOPER shall restore and replace storm drainage pipe and appurtenances when they are disturbed during construction.
- B. Storm drainage structures shall be replaced to the same horizontal and vertical locations prior to their removal or disturbance due to construction.
- C. Materials used in the replacement or restoration of storm drainage structures shall be of the same or better quality, size, type and length of that removed or disturbed during construction.

- D. Storm drainage pipe damaged due to the negligence on the part of the DEVELOPER/CONTRACTOR shall be replaced at the DEVELOPER/CONTRACTOR's expense.

3.05 CLEAN UP

- A. Before work shall be considered complete, remove material not used and rubbish from job site.
- B. Any subsequent settlement of pavement, exposed surfaces or backfill shall be repaired and the surface shall be brought to grade.
- C. Any, and all items disturbed by the construction shall, in every case, be restored to their original or better condition, prior to completion of the construction.

END OF SECTION

SECTION 02601

MANHOLES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. WORK required under this section consists of all materials, accessories, equipment, tools, and labor required to install precast concrete standard manholes, where shown on Drawings, and to perform all adjustments to guarantee satisfactory system operation.
- B. Manholes shall be constructed of specified materials to sizes, shapes, and dimensions, and at locations shown on Drawings. Height of manholes shall be such that top of manhole frame will be as shown on Drawings, and invert shall be at designed elevations. Wall thickness of precast concrete manholes shall be in accordance with ASTM 478 or as shown on Drawings.

1.02 RELATED WORK

- A. Section 02225 - Earthwork for Utilities
- B. Section 02602 – Coatings for Existing Manholes and Wastewater Structures
- C. Section 02603 – Coatings for New Manholes and Wastewater Structures
- D. Section 03200 - Concrete Reinforcement
- E. Section 03300 - Concrete

1.03 REFERENCES

- A. ASTM A 48, Standard Specification for Gray Iron Castings.
- B. ASTM C 32, Standard Specification for Sewer and Manhole Brick (made from clay or shale).
- C. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
- D. ASTM C 443, Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- E. ASTM C 478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
- F. ASTM C 1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) test.

- G. ASTM C 923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.04 QUALITY ASSURANCE

After delivery to site, materials which have been damaged in transit or are otherwise unsuitable for use in the WORK, shall be rejected and removed from the site.

1.05 DEPTH OF MANHOLES

Maximum manhole depth shall be 20 vertical feet from ground level.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete

1. Concrete, cement, sand and water used in manhole construction shall conform to the applicable requirements stated in Section 03300 of these Specifications. All concrete shall be of class shown on Drawings.
2. Steel reinforcement shall conform to the applicable requirements of Section 03200 of these Specifications.

B. Precast Concrete Manholes

1. Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section, and a base section conforming to the typical manhole details as shown on Drawings, concrete to be Type II, 4,000 psi wetcast concrete.
2. Precast manhole sections shall be manufactured, tested, and marked in accordance with latest provisions of ASTM C-478.
3. Ends of each reinforced concrete manhole riser section and bottom end of manhole top section shall be so formed that when manhole risers and top are assembled, they will make a continuous and uniform manhole.
4. Joints of manhole sections shall be of tongue and groove, or male and female type. There are two acceptable types of joints allowed as follows:
 - a. The joints shall be manufactured and sealed in accordance with ASTM C990 (latest edition) and sealed with BN-109 Butyl-Nek Sealant by Henry Company or approved equal.
 - b. The joints shall be manufactured and sealed in accordance with ASTM C443 (latest edition) and sealed with a rubber gasket.

- c. All exterior joints regardless of type shall be sealed with RU 116 Rubr-Nek External Joint Wrap, 6-inches wide by Henry Company or approved equal.
5. Holes in manhole bases to receive sewer pipes shall be precast at the factory at required locations and heights. Knocking out of holes in the field will not be permitted.
6. Holes in precast bases to receive sewer pipes shall be provided with flexible manhole connectors of high quality synthetic or natural rubber or with stainless steel wedge connection and conform to ASTM C923. Approved products are ALOK Gasket, Kor-N-Seal II or equal. Coring will only be permitted with approval of COH when unknown field conditions arise.
7. Manhole inverts shall be constructed of Class C (4,000 psi) concrete in accordance with details on Drawings and shall have the same cross section as the invert of the sewer with which they connect. Invert shall be carefully formed to required size and grade by gradual and even changes in sections. Changes in direction of flow through sewer shall be made to a curve with as large a radius as size of manhole will permit.
8. Precast inverts will be allowed.
9. The interior walls of wet wells, first manhole upstream of wet wells, forcemain discharge manholes, and drop manholes shall be coated according to Section 02603 (Coatings for New Manholes and Wastewater Structures.)
10. The interior walls of existing manholes that receive forcemain discharges shall be coated according to Section 02602 (Coatings for Existing Manholes and Wastewater Structures.)

C. Frames, Covers and Steps

1. Manhole frames, stepsets and covers shall be cast iron conforming to minimum requirements of latest ASTM A-48, for Class 35B Gray Iron Castings. Castings shall be made accurately to required dimensions, fully interchangeable, sound, smooth, clean and free from blisters or other defects. Defective castings which have been plugged or otherwise treated shall not be used. Each casting shall have its actual weight in pounds stenciled or painted on it in white paint.
2. Manhole frames and covers shall be of size and location as shown on Drawings. Where manholes are to be located under roads or driveways, whether paved or unpaved, frames and covers shall be equal to Neenah Foundry Co., No. R-1642 with T-Gasket, or approved equal. Where called for on drawings, frames and covers shall be equal to Neenah Foundry Co., No. R-1916-F (bolt down) with T-Gasket, or approved equal.
3. All bolts or screws must be stainless steel.

4. Contact surfaces of all manhole covers and corresponding supporting rings in rims shall be machined to provide full perimeter contact.
 5. Sanitary sewer manhole covers shall have cast on the top in letters 1 inch high, as shown on the COH Details. Cover shall be Neenah Type "A".
 6. Steps: Manhole steps conforming to applicable provision of ASTM C-478 such as "Wedg-Lok" as manufactured by Delta Pipe Products, or plastic steps as manufactured by M. A. Industries, Inc., American Step, or approved equal, shall be used.
- D. Brick used in manhole construction shall be either solid or cored, medium hard or better, Grade SM brick conforming to requirements of ASTM C-32 for sewer and manhole brick.
- E. Mortar for brick manhole construction shall be sand-cement mortar composed of one part Portland cement to two parts clean sand conforming to ASTM C-144. Twenty pounds of hydrated lime per sack of cement may be added. No retempered mortar shall be used.

All drop manholes with outside drop connections shall include all exterior drop pipe additions to standard manholes complete with drop pipe encasement, excavation, and foundation cushion. All outside drop pipe materials are to be ductile iron, including a minimum of one (1) joint of ductile iron pipe entering the manhole. Any drop from the invert in to the invert out equal to or greater than 2.0 feet shall be constructed as an outside-drop manhole. See the Town of Braselton Water & Sewer Departments Standards.

PART 3 EXECUTION

3.01 MANHOLES

- A. Manhole bases shall be placed on 6-inch bed of foundation stone to required elevation.
- B. Joints of precast sections shall be sealed with approved gasket under ASTM C443 or C990. External joint rap, such as Rub R Nek or Butyl Lok Wrap must be used on all precast joints. Interior joints shall be grouted.
- C. After installation of pipe to proper grade and alignment, make required seal of pipe and manhole base and formed inverts in accordance with Specifications and as shown on Drawings.
- D. Manhole shall have a minimum of 0.2' (2/10') fall, measured from inlet to outlet.
- E. Install manhole frames and covers in accordance with Specifications and as shown on Drawings.
- F. Backfilling of manhole in accordance with Section 02225 (Earthwork for Utilities).

- G. Elevation adjustment shall be made by the use of precast reinforced grade rings manufactured in accordance to ASTM C478. Brick are also permitted.
- H. Lift inserts must be integrally cast into the structures. Holes will not be permitted to penetrate the entire wall thickness.
- I. Spare Parts – Manhole hook number to be determined by COH at end of construction.

3.02 COATING REQUIREMENT

See specification sections 02602 and 02603 for coating requirements.

3.03 INSPECTION

Refer to section 02799

END OF SECTION

SECTION 02602

COATINGS FOR EXISTING MANHOLES AND WASTEWATER STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This specification covers the materials and application of an epoxy filler-surfacer, a fast setting cementitious substrate resurfacer, an epoxy primer/sealer, a corrosion-resistant epoxy lining, and an elastomeric fiber reinforced urethane chimney seal for protection of existing municipal wastewater manholes and wet wells subject to water infiltration, corrosion and erosion.
- B. All products required to complete this application may be provided by Corrosion Specialties, Inc. and all manufacturer's recommendations, specifications and installation requirements must be adhered to.
- C. The products detailed in this specification shall be used to protect existing concrete manholes, steel rings and covers, wet wells, lift stations and other wastewater concrete infrastructure involved in municipal wastewater collection and treatment.
- D. The scope of work shall include the following:
 - 1. Surface preparation in accordance with Part 3.0 of this specification.
 - 2. Filling of all voids and bug holes with an epoxy filler-surfacer or a cementitious substrate resurfacer.
 - 3. Grouting of joints and around pipes with a fast setting cementitious substrate resurfacer or an epoxy filler-surfacer.
 - 4. Application of a 4.0 mil epoxy primer/sealer.
 - 5. Application of a 50.0 mil thick epoxy corrosion/erosion resistant barrier.
 - 6. Sealing of chimney area in manholes to stop infiltration at frame and grade ring juncture.
- E. The following wastewater structures shall be coated in accordance with specification 02602:
 - 1. All existing manholes receiving proposed forcemain discharge.
 - 2. All existing manholes immediately upstream of proposed wetwells.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The epoxy filler-surfacer shall be the Carboline Carboguard 510SG epoxy filler for sealing and filling porous and irregular cementitious surfaces.
- B. The epoxy filler-surfacer for the joints shall be the Carboline Carboguard 510SG epoxy filler.
- C. The epoxy primer/sealer shall be the Carboline Carboguard 690 epoxy primer.
- D. The chemical-resistant epoxy lining shall be the Carboline Plasite 4500S Epoxy. The lining shall be a solvent, VOC and HAPS free epoxy system designed specifically for protection of concrete in municipal wastewater collection and treatment systems. All epoxy systems must have proven successful applications in the wastewater industry and must have successfully passed the Redner Test.
- E. In manholes, upon completion of cementitious and/or epoxy lining systems on the interior walls, an elastomeric lining composed of fiber reinforced, asphalt modified urethane shall be applied to the interior of the chimney area from the top of the manhole lid frame and down past the grade ring. The elastomeric lining shall be the Sauereisen F-88 Chimney Seal.

PART 3 EXECUTION

3.01 AREA PREPARATION

- A. Temperature of Working Area - Optimum temperature for handling and applying the materials is 60-80°F. Store material within the 60°F to 80°F range for 48 hours prior to use. At material temperatures below 60°F, the application becomes more difficult and curing is retarded. At temperatures above 95°F material working time is reduced.
- B. Application of epoxy products in direct sunlight and/or with rising surface temperatures may result in blistering of the materials due to expansion of entrapped air or moisture in the concrete.
- C. Concrete surfaces that have been in direct sunlight must be shaded for 24 hours prior to application and remain shaded until the initial set has taken place. When the surface temperatures are rising, it may be necessary to postpone the application or apply during the cooler evening hours.
- D. Steel surfaces must be abrasive blasted in accordance with SSPC-SP6 Commercial Blast Cleaning. Concrete surfaces must be abrasive blasted in accordance with SSPC-SP13 Surface Preparation of Concrete to remove all laitance, loose or damaged concrete, oils greases, chemical contaminants and previously applied coatings or sealers. Suitably prepared concrete should have a uniform surface texture resembling coarse sand paper. The blasting abrasive shall be a low free silica product such as Dupont Starblast.

3.02 APPLICATION

- A. All specified products must be installed in strict accordance with installation instructions detailed on manufacturer's product data sheets and other pertinent data, which shall be included as submittal data.
- B. All specified products must be installed by qualified and trained applicators in accordance with this specification.

3.03 CONTRACTOR PRE-QUALIFICATION

Contractor qualification and training is available from Corrosion Specialties, Inc. All bidders must obtain written confirmation from Corrosion Specialties, Inc. that they are qualified to install the specified products required in this specification and submit this written confirmation to the City Engineer.

3.04 CLEAN-UP

Consult product data sheets for all information pertaining to clean-up of specified products.

3.05 SETTING/CURING

Setting and curing of specified products shall be in strict accordance with instructions detailed on manufacturer's product data sheets.

3.06 SHELF LIFE

Consult manufacturer for specific details on shelf life and provide documentation that all products are within the shelf life limitations specified by the manufacturer.

3.07 CAUTION

Conform to all warnings on product Material Safety Data Sheets and consult container label caution statements for any hazards in handling these products.

END OF SECTION

SECTION 02603

COATINGS FOR NEW MANHOLES AND WASTEWATER STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This specification covers the materials and application of an epoxy filler-surfacer, a fast setting cementitious substrate resurfacer, an epoxy primer/sealer, a corrosion-resistant elastomeric polyurethane lining, and an elastomeric fiber reinforced urethane chimney seal for protection of municipal wastewater manholes and wet wells subject to water infiltration, corrosion and erosion.
- B. All products required to complete this application may be provided by Corrosion Specialties, Inc. and all manufacturer's recommendations, specifications and installation requirements must be adhered to.
- C. The products detailed in this specification shall be used to protect new concrete manholes, steel rings and covers, wet wells, lift stations and other wastewater concrete infrastructure involved in municipal wastewater collection and treatment.
- D. The scope of work shall include the following:
 - 1. Surface preparation in accordance with Part 3.0 of this specification.
 - 2. Filling of all voids and bug holes with an epoxy filler-surfacer or a cementitious substrate resurfacer.
 - 3. Grouting of joints and around pipes with a fast setting cementitious substrate resurfacer.
 - 4. Application of a 4.0 mil epoxy primer/sealer.
 - 5. Application of a 50.0 mil thick elastomeric polyurethane corrosion/erosion resistant barrier.
 - 6. Sealing of chimney area in manholes to stop infiltration at frame and grade ring juncture.
- E. The following new wastewater structures shall be coated in accordance with specification 02603:
 - 1. All wetwells.
 - 2. All manholes receiving forcemain discharge.
 - 3. All manholes immediately upstream of wetwells.
 - 4. All drop manholes.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The epoxy filler-surfacer shall be the Carboguard 510SG Epoxy Filler / Surfacer for sealing and filling porous and irregular cementitious surfaces, or approved equal.
- B. The epoxy filler-surfacer for the joints shall be the Carboguard 510SG Epoxy Filler / Surfacer, or approved equal.
- C. The epoxy primer/sealer shall be the Carboline Carboguard 690 epoxy primer, or approved equal.
- D. The chemical-resistant elastomeric polyurethane lining shall be the Carboline Reactamine 760, or approved equal. The linings shall be a solvent, VOC and HAPS free polyurethane system designed specifically for protection of concrete in municipal wastewater collection and treatment systems. All polyurethane systems must have proven successful applications in the wastewater industry.
- E. In manholes, upon completion of cementitious and/or elastomeric polyurethane lining systems on the interior walls, an elastomeric lining composed of fiber reinforced, asphalt modified urethane shall be applied to the interior of the chimney area from the top of the manhole lid frame and down past the grade ring. The elastomeric lining shall be the Sauereisen F-88 Chimney Seal, or approved equal.

PART 3 EXECUTION

3.01 AREA PREPARATION

- A. Temperature of Working Area - Optimum temperature for handling and applying the materials is 60-80°F. Store material within the 60°F to 80°F range for 48 hours prior to use. At material temperatures below 60°F, the application becomes more difficult and curing is retarded. At temperatures above 85°F material working time is reduced.
- B. Application of epoxy and polyurethane products in direct sunlight and/or with rising surface temperatures may result in blistering of the materials due to expansion of entrapped air or moisture in the concrete.
- C. Concrete surfaces that have been in direct sunlight must be shaded for 24 hours prior to application and remain shaded until the initial set has taken place. When the surface temperatures are rising, it may be necessary to postpone the application or apply during the cooler evening hours.
- D. All structures to receive specified products must be properly designed and capable of withstanding imposed loads. Steel surfaces must be abrasive blasted in accordance with SSPC-SP6 Commercial Blast Cleaning. Concrete surfaces must be abrasive blasted in accordance with SSPC-SP13 Surface Preparation of Concrete to remove all laitance, loose or damaged concrete, oils greases, chemical contaminants and previously applied coatings or sealers. Suitably prepared

concrete should have a uniform surface texture resembling coarse sand paper. The blasting abrasive shall be a low free silica product such as Dupont Starblast.

3.02 APPLICATION

- A. All specified products must be installed in strict accordance with installation instructions detailed on manufacturer's product data sheets and other pertinent data, which shall be included as submittal data.
- B. All specified products must be installed by qualified and trained applicators in accordance with this specification.
- C. All structures shall be coated prior to being installed in ground. The joints shall be coated upon installation.

3.03 CONTRACTOR PRE-QUALIFICATION

Contractor qualification and training is available from Corrosion Specialties, Inc. All bidders must obtain written confirmation from Corrosion Specialties, Inc. that they are qualified to install the specified products required in this specification and submit this written confirmation to the City Engineer.

3.04 CLEAN-UP

Consult product data sheets for all information pertaining to clean-up of specified products.

3.05 SETTING/CURING

Setting and curing of specified products shall be in strict accordance with instructions detailed on manufacturer's product data sheets.

3.06 SHELF LIFE

Consult manufacturer for specific details on shelf life and provide documentation that all products are within the shelf life limitations specified by the manufacturer.

3.07 CAUTION

Conform to all warnings on product Material Safety Data Sheets and consult container label caution statements for any hazards in handling these products.

END OF SECTION

SECTION 02645

FIRE HYDRANTS

PART 1 GENERAL

1.01 RELATED WORK

- A. SECTION 2660 – Water Distribution System

1.02 REFERENCES

- A. AWWA, Section C502 - Dry-Barrel Fire Hydrants (Latest Edition)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Hydrants shall be manufactured in full compliance with American Water Works Association Standard for Dry-Barrel Fire Hydrants, 250 psi working pressure, C502, and as herein amended.
- B. Hydrants shall be Mueller Super Centurion 250; M&H Style 129; U. S. Pipe M-94-250psi; or American Flow Control B84-250psi; see Fire Hydrant Assembly Detail W-7.
- C. Hydrants shall be three-way, post type, dry top traffic model with compression main valve opening against and closing in the direction of normal water flow.
- D. Internal main valve diameter shall be minimum of 5-1/4".
- E. Hydrants shall have name of manufacturer, year manufactured, and nominal valve size in legible, raised letters cast on barrel of bonnet.
- F. Dry Top Bonnet
 - 1. Shall be constructed with moisture-proof lubrication chamber, which provides automatic lubrication of threads and bearing surfaces each time hydrant is operated.
 - 2. Assembly shall be comprised of top "O" ring serving as dirt and moisture barrier and a lower "O" ring, which shall serve as a pressure seal.
- G. Operating Nut
 - 1. Shall be of regular pentagon shape measuring 1-1/2" point to flat; i.e. National Standard, and shall open by turning counter-clockwise (left).
 - 2. Nozzle caps shall have same cross-section as operating nut and shall come with heavy duty, non-kinking chains.

3. Chains shall be securely affixed to hydrant upper barrel and permit free turning of caps.

H. Traffic Design

1. Hydrant barrel sections shall be connected at groundline in a manner that will prevent damage to hydrant when struck by vehicle.
2. Main valve rod sections shall be connected at groundline by frangible coupling.
3. Standpipe and groundline safety construction shall be such that the hydrant nozzles can be rotated to any desired position without disassembling or removing top operating components and top section of hydrant standpipe.

- I. Main valve shall be made of synthetic rubber and formed to fit the valve seat accurately.

J. Main Valve Seat

1. Shall be of bronze and assembly into hydrant shall involve bronze to bronze thread engagement.
2. Two (2) "O" ring seals shall be provided as positive pressure seal between the bronze seat ring and shoe.
3. Valve assembly pressure seals shall be obtained without employment of torque compressed gaskets.
4. Hydrants shall be designed to allow removal of all operating parts through hydrant barrel by means of single, lightweight disassembly wrench without excavation.

K. Drain

1. Mechanism shall be designed to operate automatically with the operation of main valve and shall allow a momentary flushing of drain ports.
2. Minimum of two (2) internal and two (2) external bronze lined drain ports shall be required in main valve assembly to drain hydrant barrel.
3. Inlet connection shall be cast iron inlet elbow and shall have 6" mechanical joint connection.
4. Barrel extension sections shall be available in 6" increments complete with rod, extension coupling and necessary flanges, gaskets and bolts so that extending hydrant can be accomplished without excavating.
5. No lead will be allowed in nozzle installation.
6. Hydrants shall be tested in strict accordance with AWWA C502 at supplier's expense. Certificate of compliance shall be furnished to OWNER upon request.

- L. Fire hydrants shall have two 2-1/2" diameter hose connections and one 4-1/2" pumper connection. Standard hose threads shall be provided.

2.02 SPARE PARTS

- A. DEVELOPER/CONTRACTOR shall provide the COH with one (1) set of maintenance wrenches and three (3) breakaway repair kits for every fifteen (15) of each type of hydrant provided or to be determined by the City at end of construction.

PART 3 EXECUTION

3.01 SETTING HYDRANTS

- A. Hydrants to be installed so the finish grade is at the hydrant bury line.
- B. Extension required to bring hydrant to proper grade shall be furnished and installed by DEVELOPER/CONTRACTOR at his expense.
- C. Fire hydrant assembly shall consist of the ductile iron hydrant tee, gate valve, ductile iron lead pipe, and hydrant. Pipe restrainers must be used to restrain assembly. Pipe restrainers to be anchor coupling type or Grip Ring Pipe Restrainers as manufactured by Romac Industries, Inc. or approved equivalent. **PVC IS NOT ALLOWED FOR HYDRANT ASSEMBLY.**
- D. Hydrants shall be installed with a maximum distance between the hydrants of 500 feet, and at intersections.
- E. Hydrants shall be installed with a minimum supply line of 6" in diameter.

3.02 PAINTING, COATING AND LUBRICATING

- A. Iron parts of hydrant shall be thoroughly cleaned inside and outside.
- B. Unless otherwise stipulated or directed, surface shall be coated or painted with, or dipped in, an asphalt or bituminous base paint or coating, except for the exterior portion above the groundline.
- C. Hydrants shall be covered with two (2) coats of paint, the first being allowed to dry thoroughly before applying second coat.
- D. Exterior of hydrant valve above finished groundline shall be thoroughly cleaned and painted in shop with two (2) coats of Koppers Primer 621, or approved equivalent.
- F. Following installation, hydrants shall be painted with two (2) field coats of enamel paint.
- G. Final hydrant color shall be metallic silver.

END OF SECTION

SECTION 02660

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. WORK covered by this Section consists of furnishing and installing water distribution pipes and appurtenances, including, but not limited to, reaction blocking, testing, and disinfection.

1.02 RELATED WORK

- A. Section 02225 - Earthwork for Utilities
- B. Section 02665 - Water Service Connections

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM), Annual Book Standards.
 - 1. ASTM D 2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
 - 2. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- B. American Water Works Association (AWWA) Standards.
 - 1. AWWA C104, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - 2. AWWA C110, Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.
 - 3. AWWA C111, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 4. AWWA C151, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or other Liquids.
 - 5. AWWA C153, Standard for Ductile-Iron Compact Fittings, 3 in. through 24 in. and 54 in. through 64 in., for Water Service.
 - 6. AWWA C509, Standard for Resilient – Seated Gate Valves for Water Supply Service.

7. AWWA C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
8. AWWA C600, Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
9. AWWA C651, Standard for Disinfecting Water Mains.
10. AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
11. AWWA C909, Standard for Molecular Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. through 24 in., for Water Distribution.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. DEVELOPER/CONTRACTOR shall be responsible for safe unloading, storage and care of material furnished by or to him until it has been incorporated into work.
- B. Unload pipe, fittings, or valves by lifting with hoists or skidding to avoid damage.
 1. Pipe shall not be unloaded by rolling or dropping off trucks.
 2. Pipe handled on skidways shall not be skidded or rolled against pipe already on ground.
- C. Unload material at site of work, near place where it will be placed in trench.
 1. Materials shall be placed for least interference with traffic.
 2. Provide signs, lights, and barricades as necessary to protect public.
- D. Handle material carefully to prevent breakage and to avoid damage to coatings and linings.
 1. Keep interior of pipe, fittings, and valves, free of dirt or foreign matter at all times.
 2. Do not place materials in drainage ways or ditches.

PART 2 PRODUCTS

2.01 GENERAL

All water distribution piping mains shall be new unused ductile iron pipe, C900 PVC or C909 PVCO only. All materials used and come into contact with drinking water during its distribution shall not adversely affect drinking water quality and public health and must be certified for conformance with American National Standards Institute/National Sanitation Foundation Standard 61 (ANSI/NSF Standard 61).

2.02 DUCTILE IRON PIPE

- A. Shall conform to latest requirements of AWWA C151.

- B. Shall be cement mortar lined in accordance with AWWA C104 standard thickness.
 - 1. Unless otherwise specified, pipe shall have push-on compression type joints conforming to AWWA C111 or AWWA C153 (Latest Editions).
 - 2. Minimum pressure class shall be 350 psi.
 - 3. All pipe shall be painted blue over 60% of the pipe.

- C. Ductile iron pipe for minor creek crossings shall be connected with restrained joints.

- D. Ball-Joint Pipe- Major Creek and River Crossings
 - 1. Shall be manufactured for river crossing applications.
 - 2. Joints shall be boltless.
 - 3. Joints shall be restrained.
 - 4. Joint shall provide up to 15° deflection.

2.03 PLASTIC PIPE (PVC)

- A. 4" Diameter to 10" Diameter shall be either of the following:
 - 1. Molecular Oriented Polyvinyl Chloride (PVCO)
 - a. Molecular oriented polyvinyl chloride (PVCO) pipe shall meet requirements of AWWA C909, latest edition.
 - b. Pipe shall be Pressure Class 235 (DR18) or Pressure Class 305 (DR 14) as indicated with outside diameter (OD) dimensions of cast iron pipe.
 - c. Joints
 - 1) Shall be made with elastomeric gaskets.
 - 2) Bell end pipe using elastomeric gaskets shall meet requirements of ASTM D 2122.
 - 3) Elastomeric gasket couplings shall meet requirements of AWWA C909 (latest revision) for the specified pipe class and shall meet the requirements of ASTM F477.
 - d. Provide marking on pipe exterior as specified in AWWA C909.
 - 2. C900 Polyvinyl Chloride (C900 PVC)

- a. C900 polyvinyl chloride (PVC) pipe shall meet requirements of AWWA C900, latest edition.
- b. Pipe shall be Pressure Class 235 (DR18) or Pressure Class 305 (DR 14) as indicated with outside diameter (OD) dimensions of cast iron pipe.
- c. Joints
 - 1) Shall be made with elastomeric gaskets.
 - 2) Bell end pipe using elastomeric gaskets shall meet requirements of ASTM D 2122.
 - 3) Elastomeric gasket couplings shall meet requirements of AWWA C900 (latest revision) for the specified pipe class and shall meet the requirements of ASTM F477.
- d. Provide marking on pipe exterior as specified in AWWA C900.

3. Pipe color shall be blue.

2.04 Cul – de – Sacs

See Standard Detail W-24.

2.05 CAST AND DUCTILE IRON FITTINGS

- A. Fittings for ductile iron pipe and PVC pipe shall be cast or ductile iron and shall conform to requirements of AWWA C110 or AWWA C153 and shall be cement mortar lined in accordance with AWWA C104 standard thickness.
- B. Joints shall conform to AWWA C111.
- C. Fittings shall be mechanical joint unless otherwise specified on Drawings.
- D. Gaskets for PVC pipe shall be duct tip transition type compatible with type of pipe used.

2.06 RESTRAINED JOINTS-DIP

- A. DIP Push-on application – restrained joints shall be “Fast-Grip Gasket” by ACIPCO or “Field-Lok Gasket” by U. S. Pipe.
- B. DIP Mechanical joint restraints shall be “Mega-Lug 1100 Series” by EBBA Iron Sales, MJ-Field-Lok Series DI by U. S. Pipe or approved equal.
- C. PVC Push-on application restrained joints shall be “Mega-Lug 1900 Series” by EBBA Iron Sales, or approved equal.
- D. PVC mechanical joint restraints shall be “Mega-Lug 2000 PV Series” by EBBA Iron Sales, MJ Field Lok Series PV by U.S. Pipe or approved equal.

- E. Joint preparation and installation shall be in accordance with manufacturer's recommendations.

2.06 GATE VALVES

- A. Shall conform to requirements of AWWA C509 or C515 for resilient seated gate valves, iron body, with bonded epoxy coating conforming to AWWA C550.
- B. Shall be designed for 250 psi working pressure and 500 psi hydrostatic test pressure.
- C. Accepted manufacturers are Mueller, M&H, American Flow Control, and U.S. Pipe and Foundry Co.
- D. Shall be of iron body, bonded epoxy, and shall have non-rising bronze stem, and shall be wrench operated.
- E. Valves shall open by turning counter-clockwise, and operating nuts shall be standard two inches square.
- F. Suitable stem guides shall be provided, where required.
- G. Shall be furnished with mechanical joint suitable for connection to pipe into which it will be installed for buried service.
- H. Small Gate Valves: Valves smaller than 3 inches shall conform to level of quality and manufacturing standards established for valves 3 inches and larger by respective AWWA Standards.
- I. Gate valves shall be installed at a maximum spacing of 1000 linear feet, and at a minimum of 3 valves per 3-way tees intersections, and at a minimum of 4 valves per 4-way crosses or intersections. Additional valves may be required at the COH's discretion.

2.07 PRESSURE REDUCING VALVES

- A. Pressure Reducing Valves and vaults shall be designed and sized by the DEVELOPER's engineer, and reviewed by the COH. Pressure Reducing Valves shall be as manufactured by CLA-VAL. Some installation may require high and low flow set-ups.
- B. All Reducing Valves and vaults shall be installed with the COH's most current SCADA and telemetry.
- C. Precast vaults for each pressure reducing valve must be supplied and installed. The vault must be sized for each application so as to allow ample working room in the vault. Contractor is to provide shop drawings of the proposed units for approval by the COH and ENGINEER at the Preconstruction Conference.

2.08 AIR RELEASE VALVES

- A. Shall be cast iron body with stainless steel (ASTM A240) float and synthetic seat equal to Crispin PL 10, Type N. Valves shall be installed in a doghouse manhole as per the COH's standard detail W-12.
- B. Orifice size shall be as follows:

MAXIMUM OPERATING PRESSURE (PSI)						
	50	100	150	200	250	300
ORIFICE	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{1}{4}$ "	$\frac{3}{16}$ "	$\frac{5}{32}$ "	$\frac{1}{8}$ "

For general use a $\frac{3}{16}$ " orifice will be adequate. However, DEVELOPER/ CONTRACTOR is to verify actual size with COH prior to installation.

2.09 AIR/VACUUM VALVES

- A. Shall be cast iron body with stainless steel (ASTM A240) trim and float equal to Crispin UL20 or approved equivalent. Valves shall be installed as per the COH's standard detail W-13.
- B. Orifice size shall be 2" diameter.
- C. Internal parts shall be stainless steel (ASTM A240) or bronze.

2.10 VALVE MARKERS

- A. Shall be furnished with each gate valve and air release/vacuum valve installed as indicated on the drawings, with exception of fire hydrant valves.
- B. Marker shall be Rhino Hybrid (plastic/Fiberglass) Post 1 Rail, color blue, 66", USA Blue Book catalogue no. 70123.
- C. Label Decal shall be white with blue text, 2-7/8" X 14", reading WARNING WATER VALVE. Decal shall also bear the name, CITY OF HOSCHTON-PHONE NUMBER 706-654-3034.
- D. NO concrete valve markers shall be used.

2.11 VALVE BOXES AND COVERS

- A. Shall be provided with valves.
- B. Shall be of adjustable screw type, of length required with a minimum 6" of adjustment allowed, and installed as shown on standard details.
- C. Shall be protected by concrete donut if not in curbing, sidewalk, or road.

- D. Shaft shall be 5 inch diameter with base to be minimum of 8 inch diameter by 9-inch height inside.
- E. Base size and extension piece shall be as required for each individual size of valve and depth.
- F. All valve boxes shall be installed with a "Debris Cap". This device shall be manufactured by SW Services, Inc., Phoenix, Arizona, or approved equal.
- G. In Lieu of the above standard valve box and debris cap, the Valve box shall be American Flow Control "Trench Adaptor". The box shall be an assembled unit composed of valve box, extension stem, and a self-centering alignment ring. Valve box shall be adjustable for variable depths.

2.12 TAPPING VALVES

- A. Tapping sleeve shall be MJ Style, all stainless tapping sleeve, with removable bolts and 360° gasket.
- B. Tapping machines and competent supervision shall be provided for making of taps. All taps shall be made in the presence of the COH representative.
- C. Tapping sleeves shall be properly sized to fit existing pipe and shall be of split sleeve type with ends suitable for connection into pipeline into which it will be installed.
- D. Largest tap allowed shall be "size on size". The new water main may be increased in size beyond the installed tapping sleeve and valve.
- E. Valves furnished with sleeves shall conform to requirements herein above for gate valves, except for modifications required to permit use of full size cutter through valves.
- F. Outlet of valves shall be mechanical joint for joining with water mains.
- G. After tap is completed, the "cut out" section of pipe or "coupon" shall be tagged, labeled as to date and location, and submitted to City Inspector.
- H. Tapping sleeves shall be pressure tested immediately after installation as per the testing requirements of this section.

2.13 DETECTION TAPE AND WIRE

- A. Detector marking tape shall be non-metallic and shall be installed minimum 2 feet above the pipe. Tape shall be highly visible and minimum 2 inches wide. Lettering shall read "Caution: Buried Water Line".
- B. Detection wire shall be size #12 AWG solid copper, installed the entire length of the piping. All splices shall be made with waterproof connectors. For each joint of pipe, wire shall installed a minimum of 12-inches above the pipe and properly connected to fittings and valves and hydrants and valve box tops so line can be relocated with a pipe finder after burial. All splices shall be connected with waterproof connectors.

2.14 SAMPLE STATION

- A. Sampling station shall be Eclipse No. 88 by Kupferle Foundry, St. Louis, MO.
- B. A minimum of one (1) sample station is required per development. Show sample station on plans at the further most point in the proposed water system from the point of connection to the City's water system. Additional sampling stations may be required depending on size and location of the development.

PART 3 EXECUTION

3.01 ALIGNMENT AND GRADES

- A. Depth of Pipes
 - 1. Shall be 48 inches measured from finished grade to top of pipe unless otherwise specified.
 - 2. Depth may be greater than 48 inches, if approved by the City.
- B. Valves
 - 1. Shall be installed with stems vertical.
- C. Pipe Curvatures
 - 1. Maximum horizontal or vertical permissible deflection at joint shall be 5 degrees.

3.02 INSTALLING PIPE

- A. General
 - 1. Curbing must be installed prior to installing any waterlines.
 - 2. Trenches must be dry. Pipe and appurtenances shall be installed only when trench conditions are suitable
 - 3. Proper implements, tools, and facilities shall be provided by DEVELOPER/CONTRACTOR for safe and convenient performance of the work.
 - 4. Where water mains parallel or cross sanitary sewers, a minimum horizontal separation of ten (10') feet and minimum vertical separations of 18" must be provided. At crossings, one full length of water pipe must be located so that both joints are as far from the sewer as possible.
 - 5. Water mains under roadways shall be ductile iron pipe (DIP).
- B. Installation
 - 1. Lower pipe, fittings, valves, and hydrants carefully into trench piece by piece by means of derrick, ropes, or other suitable tools or equipment.

2. Prevent damage to water main materials and protective coatings and linings.
3. Do not drop or dump water line materials into trench.
4. Carefully examine pipe and fittings for cracks and other defects while suspended above trench immediately before installation in final position.
 - a) Defective pipe or fittings shall be clearly marked and shall be removed from site.
5. Clean bell and spigot ends of each piece of pipe thoroughly before pipe is laid.
6. Prevent foreign material from entering pipe while it is being placed in line.
 - a) Provide protective covering for ends of pipe until connection is made to adjacent pipe, if necessary.
 - b) No debris, tools, clothing, or other materials shall be placed in pipe during laying operations.
7. As each length of pipe is placed in trench, spigot end shall be centered in bell and pipe forced home and brought to correct line and grade.
 - a) Pipe shall be secured in place with approved backfill material tamped around it.
 - b) Precautions shall be taken to prevent dirt from entering joint space.
8. Open ends of pipe shall be closed by watertight plug, or other means approved by the COH, at times when pipe laying is not in progress.
 - a) If water is in trench, plug shall remain in place until trench is pumped completely dry. Water shall not be allowed to run into pipe at any time during construction.
9. Lay pipe with bell ends facing in direction of laying against direction of flow.
 - a) Where pipe is laid on grade of 10 percent or greater, laying shall start at bottom and shall proceed upward with bell ends of pipe upgrade.

3.03 CUTTING PIPE

Cut pipe for inserting valves, fittings, or closure pieces in neat manner without damage to pipe or lining and so as to leave smooth end at right angles to axis of pipe.

3.04 DETECTION OF NON-FERROUS PIPE

See part 2.13.

3.05 JOINTING

- A. Jointing of pipe, fittings, and valves shall be made in strict compliance with manufacturer's printed instructions.
- B. Mechanical Joints
 - 1. Thoroughly clean outside of spigot and inside of bell prior to installation.
 - 2. Clean gasket.
 - 3. Tighten nuts with torque limiting wrench.
 - 4. Nuts spaced 180 degrees apart shall be tightened alternately in order to produce equal pressure.
- C. Push-On Joints
 - 1. Furnish and install adapters if required to join bells and spigots of different sizes.
 - 2. Thoroughly clean inside of bell and outside of spigot end prior to installation.
 - 3. Insert and lubricate gasket using lubricant furnished or recommended by pipe manufacturer.
 - 4. Spigot end of pipe shall be entered into socket with care used to keep joint from contacting ground.
 - 5. Complete joint by forcing plain end to bottom of socket with forked tool or jack-type tool.

3.06 SETTING VALVES AND FITTINGS

- A. Valves, fittings, plugs, and caps shall be set and joined to pipe in manner specified above for cleaning, laying and joining pipe.
- B. Valves shall be set plumb and a valve box shall be provided for every valve.
 - 1. Valve box shall not transmit shock or stress to valves and shall be centered and plumb over wrench nut of valve, with box cover flush with surface of finished pavement or such other level as may be directed.
 - 2. **FOR INSTALLATION WHERE THERE ARE ROADSIDE DITCHES, VALVES AND VALVE BOXES SHALL BE PLACED ON THE BACK SIDE OF THE DITCH AT LEAST FIVE (5) FEET FROM THE CENTERLINE OF THE DITCH.**
- C. Backfill around valves shall be carefully tamped in 6 inch layers for full depth of trench with valve box in place.
- D. Provide concrete pad at surface as indicated on STANDARD DETAILS.

3.07 ANCHORAGE

- A. Plugs, caps, tees, bends, and valves, unless otherwise specified, shall be provided with restrained joints in accordance with Part 2 and reaction blocking.
- B. Concrete reaction blocking shall conform to these specifications and the applicable standard details.
- C. Reaction blocking shall be concrete, having a compressive strength of not less than 3,000 psi after 28 days. "Sackcrete" shall not be used.
- D. Blocking shall be placed between solid, unexcavated earth and fitting to be anchored; area of bearing on pipe and on ground in each instance shall be that shown on DRAWINGS.
- E. Blocking shall, unless otherwise shown or directed, be so placed that pipe and fitting joints will be accessible for repair.
- F. Metal harness of tie rods or clamps of adequate strength to prevent movement may be used to compliment concrete blocking and restrained joints if approved by the COH.
- G. Steel rods or clamps shall be galvanized or bituminous coated.

3.08 CONNECTION TO EXISTING MAINS

- A. NO CONNECTIONS TO EXISTING WATERMAINS SHALL BE MADE WITHOUT THE PRESENCE OF CITY OF HOSCHTON PERSONNEL.
- B. DEVELOPER/CONTRACTOR shall coordinate with the CITY OF HOSCHTON regarding connections to existing mains.
- B. Connection to existing mains shall be made at such time as to minimize disruption of water service to public.
- C. Connections to existing mains shall be made using proper fittings and specials to suit actual conditions.
- D. Existing pipes, which are cut or damaged by DEVELOPER/CONTRACTOR, shall be repaired, reconnected, and returned to service in equal or better condition.

3.09 STREAM and UTILITY CROSSINGS

- A. Pipe shall be placed beneath streambeds or ditches, around, over, or under sewers, culverts, gas mains, telephone ducts, water mains, or other structures.
 - 1. Do not pass pipe through any drainage pipe, culvert, sewer, or manhole.
 - 2. Provide minimum of 48 inches under streambeds or ditches, unless approved by Engineer in writing.

3. Provide minimum of 6 inch earth or sand cushion between proposed water line and any other utility or structure or as indicated on drawings.
 - A. Where water lines are installed below free flowing streams, the DEVELOPER is responsible for adequate pipeline design of each crossing on a case by case basis subject to the COH's review. The Developer's Engineer shall consider the soils, creek flow, pressure, topography, thrust restraint, construction techniques allowed, etc. in order to design and specify appropriate layout and pipe joints.
 - B. The DEVELEPER shall be responsible for all and any necessary permitting by the all authorities having jurisdiction for stream crossings or crossing of state waters including but not limited to EPD, County, and the Army Corps of Engineers.

3.10 HYDROSTATIC TESTS

Refer to section 02799

3.11 DISINFECTION

See Specification 02799.

END OF SECTION

SECTION 02665

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

WORK covered by this Section consists of furnishing all materials and installation of all service connections to the water system. Responsibilities for water service connections are as follows.

- A. For meters ¾" to 2" – Contractor installs tap and meter box. City supplies and installs meter and backflow preventer.
- B. For meters 3" and larger – Contractor supplies and installs. COH Representative must be present.

1.02 RELATED WORK

Section 02660 - Water Distribution System

1.03 REFERENCES

- A. Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water (AWWA C901).
- B. Cold Water Meters – Displacement Type (AWWA C700).
- C. Specifications for Gray-Iron Castings (ASTM A-48).

PART 2 PRODUCTS

2.01 SERVICE TUBING

- A. Up to 3" diameter shall be polyethylene (PE) conforming to AWWA C901, SDR9, PC200. Tubing may be in 20-foot straight lengths or 60-100 foot coils.
- B. Tubing O.D. shall be compatible with accessories specified herein below.

2.02 WATER METERS

- A. 5/8 x 3/4 Inch and 1 Inch Meters
 - 1. Where indicated on the drawings, 5/8 x 3/4 inch meters shall be Badger Model M25, and 1" shall be Badger Model M55 disc type, magnetic drive, with sealed registers, totalizer, and straight reading dials in gallons, frost-proof design, meeting AWWA Standard C700. Encoder shall be Model HR-E-LCD reading in US Gallons. Each meter shall be installed with Badger Orion Cellular LTE Endpoint to full working order.

B. 2" and Larger Domestic Meters

1. All domestic meters greater than 1" shall be compound meters and shall be Badger Recordall Compound Meter with HR-E- LCD encoder. Compound meters shall consist of a combination of an AWWA Class II turbine meter for measuring high rates of flow and a piston type positive displacement measuring chamber for measuring low rates of flow enclosed in a single lead-free alloy housing.
2. Meters shall be installed with Badger Orion Cellular LTE Endpoint to full working order.
3. Maincases shall be flanged. 2" meters shall be oval flanged and 3" through 6" sizes shall be round flanged per Table 4, AWWA C702.
4. The registers shall be permanently roll-sealed, straight reading indicating gallons. Register shall include a center-sweep test hand, a low flow indicator, and a glass lens. The register shall be serviceable without interruption of the meter's operation.
5. The meter serial number shall be imprinted on the meter flange.

C. Fire Line Meters

1. All fire line meters shall be as specified on COH standard detail W-21 3" and Larger Meter Connections Fire Line Only.

2.03 METER BOXES

A. 5/8 x 3/4 inch and 1 inch meters:

1. Box shall be Model DFW1200TT-12-BODY by DFW Plastics, Inc.
2. Dimensions shall be 21-13/16" L x 16-9/16" W x 12" deep.
3. Lid shall be Model DFW1200-1T-DEEP-LID by DFW Plastics, Inc. Lid shall allow for a recess mount of the AMR.
3. Box shall be set below grade, with top flush with ground surface.

B. 2 inch meter and 2 inch backflow preventor:

1. Shall be Carson Model 1730 18" Super Jumbo XL Meter Box with solid plastic, drop in, locking cover and AMR undercover hanger.
2. Base dimensions shall be 30" L x 17" W x 18" deep.
3. Box shall be set below grade, with top flush with ground surface.

C. For meters 3-inch and larger, concrete vaults are required. Contractor shall provide shop drawings for approval by COH and ENGINEER at the pre-construction conference.

2.04 ACCESSORIES

A. Shall be compatible with pipe and service tubing furnished.

B. Service saddles shall be Smith-Blair, Inc. Model 313. (No direct taps allowed)

- C. Corporation stop shall be Ford Catalog Number F1000.
- D. Cut-off valve shall be a ¾", 1" or 2" WATTS Series WBV brass ball valve.
- E. For 2" meters, backflow preventer shall be an Apollo 40-100 Series with isolation valves and test cocks.
- F. For ¾" and 1" meters, dual check valve shall be an Apollo 40-300 Series.
- G. Valve box for cut-off valve shall be a Carson Industries Model 910.
- H. ¾" and 1" curb stop shall be lockable FORD straight meter ball valve with pack-joint inlet and meter swivel nut outlet. 2" curb stop shall have a pack-joint inlet and meter flange outlet.

PART 3 EXECUTION

3.01 GENERAL

- A. Service connections shall be installed in the same manner as water distribution mains, and in accordance with Section 02660 of these Specifications, except for depth, which shall be 24 inches at the meter box.
- B. Each lot of a development shall have an individual service connection.
- C. Meter boxes shall be placed as shown on the construction drawings or as directed by COH REPRESENTATIVE.
- D. Service connections shall be made where directed by the COH REPRESENTATIVE.
- E. Jack and bore service tubing under pavement. No pavement cutting will be permitted.
- F. Any pipe, solder, or flux used in the installation or repair of water lines must be lead free. Pipes and fittings must not contain more than 8.0% lead, and solders and flux must not contain more than 0.2% lead.
- D. All plastic water pipes and service lines must bear the National Sanitation Foundation (NSF) seal of approval for potable water.

END OF SECTION

SECTION 02731

SEWAGE LIFT STATION FLYGT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The lift station shall be designed at a minimum in accordance with standards and references set forth by the Georgia Environmental Protection Division, and in accordance with the COH's minimum requirements as well.
- B. For subdivisions, apartment complexes, shopping centers, and similar developments, the COH requires the use of submersible-type lift stations. All wastewater lift stations shall be reviewed by the COH.
- C. For the COH's review, the DEVELOPER-CONTRACTOR shall submit Detail Sheet PS-1 completed with all pertinent data, and documentation showing all necessary calculations for appropriate lift station and wetwell design. The COH may require any additional information at its discretions in order to complete its review.
- D. Each lift station design and site is unique, and shall be reviewed by the COH as such. This includes site layout, access, electrical requirements, appearance, controls, etc. These standards are presented as a minimum requirement and guideline only; changes or additional requirements to each station may be required by the COH at their discretion as a result of review during plan submittals and/or construction.

1.02 PUMPS

- A. The COH accepts only submersible sewage pumps: heavy duty, vertical shaft, non-clog type, submersible centrifugal pumps. The following manufacturer(s) are approved: Flygt.
- B. All Flygt pumps shall be of the N-series.
- C. The pumps furnished under this Section shall be the product of the same supplier to ensure maximum compatibility and interchangeability of parts. The DEVELOPER-CONTRACTOR shall assign unit responsibility to the pump supplier or manufacturer for the equipment specified in this section in order to enhance compatibility, ease of construction, and efficient maintenance of the components of each pumping system. The pump manufacturer shall coordinate pump controls so that a complete and operable system is achieved.
- D. Refer to Section 16000, Electrical Plans for electrical equipment requirements.

1.03 MINIMUM GENERAL REQUIREMENTS

- A. All stations shall be a duplex at minimum.
- B. All stations shall be designed as submersible non-clog lift station complete with maintenance friendly layout and grading, motors, permanent discharge elbows, guide

bars, intermediate, upper and lower guide bar brackets, power cables, lifting chains, pump controls, level sensor, generator, lighting and pole, yard hydrant, anchor bolts, valve vault, wetwell, aluminum access hatches, fence, site work, spare parts and other accessories including all necessary labor, supervision, materials, tools, and appurtenances.

- C. Minimum wetwell diameter shall be 10-feet.
- D. Wetwell shall be coated as per specification section 02602.
- E. Each station shall be furnished and installed with a permanent standby generator in accordance with specification section 16621.
- F. Each lift station shall be furnished and installed with the COH's most current Telemetry by Mission Controls. Contact the COH's sewer department for the latest requirements.
- G. Odor Control System
- H. Check valves shall be cushioned weighted type.
- I. See lift station details for reference.
- J. All phases of construction shall be inspected as per the COH's requirements.
- K. Paved access driveway.
- L. All Ductile Iron Pipe at conveying sewage shall have an interior coating, as specified in Specification 18000.
- M. All Ductile Iron Pipe inside the wetwell conveying sewage shall have an exterior coating, as specified in Specification 18001.

1.04 WORKMANSHIP AND MATERIALS

- A. All equipment and materials furnished under this Contract shall be new, suitable for the conditions of service to which they will be subject and equal to the best of their respective classes. Grade and quality shall meet the applicable cited specifications and standards.
- B. Workmanship shall be of the highest quality and shall be carried out by competent and experienced workmen.

1.05 SUBMITTALS

- A. The CONTRACTOR shall provide as a minimum the submittals listed below. Two (2) bound hard copies and one (1) digital copy in Portable Document Format (PDF) of submittals shall be submitted to the COH and approved prior to fabrication, shipment or work specified under this section begins.
 - 1. Manufacturer's data including materials of construction and equipment weight.

2. Predicted performance curves developed for the specific application. Performance curves shall plot speed, capacity, head, horsepower, efficiency, and NPSH requirements over the manufacturer's recommended range of operation and shall include shut off (zero capacity) to Run Out (maximum capacity).
3. Motor submittal data.
4. Shop drawings including dimensions and cross sectional views of all equipment showing details of construction.
5. Shop drawings including plan and sectional views of the pumps in the sump.
6. A written report on the factory test results as specified in Section 1.05 of this Specification.
7. Extended warranty as specified in Section 3.08 of this Specification.
8. The CONTRACTOR shall also include complete working details, dimension, assembly, and installation drawings, catalog and other data, and manufacturer's specifications and data indicating all parts, accessories and appliances, all piping, valves, motors, conduit, wiring and equipment, methods and material of construction, location, and installation, support, anchorage and connections and wiring diagrams, surface finishes and other information as may be required, complete in every detail, to define the articles to be furnished and indicate whether or not they comply with the Specifications.
9. A tabulated list of all motors and electrical devices shall also be furnished. Include ampere and voltage operating characteristics for all devices. For motors, include full load amperes, power factor, efficiencies, slop and temperature rise. Process the tabulated list, plus all special wiring diagrams as shop drawings and as soon as possible in order to expedite the electrical work on electrical drawings.
10. The CONTRACTOR shall also furnish under this section two (2) bound hard copies and one digital copy in portable document format (PDF) of complete and detailed instructions for the operation, lubrication, and maintenance of all equipment furnished and installed hereunder. The manuals shall be furnished after final approval of all shop and working drawings but prior to shipment of equipment. Manuals shall be complete with wiring diagrams, lubrication schedules and recommended lubricants, drawings, cuts, parts lists, and other necessary data. All parts shall be numbered or otherwise clearly identified to facilitate ordering or replacements. Descriptions of all operations control devices and their specific functions shall also be included.

1.06 EXPERIENCE QUALIFICATIONS

- A. The equipment to be furnished hereunder shall be made by a manufacturer regularly engaged in such work, and who has furnished similar installations and had them in successful and continuous operation for a period of 10 years.

1.07 FACTORY TESTS

- A. Each pump to be delivered under this Section shall be tested for performance at the pump manufacturer's factory to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points that are specified. All tests shall be run in accordance with the latest edition of the American Hydraulic Institute Standards and at the appropriate voltage and frequency. Testing shall also include, but not be limited to, the following:
- B. Testing performed upon each pump shall include the following inspections:
1. Head vs. flow with five (5) equally spaced points including shutoff and maximum flow shall be certified.
 2. The input KW, speed, power factor, no load current, and torque characteristics shall be certified.
 3. Impeller, motor rating and electrical connections shall first be checked for compliance to the specifications.
 4. A motor and cable insulation test for moisture content or insulation defects shall be made.
 5. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
 6. The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water.
 7. After the operational test described in line No. 6, the insulation test described in line No. 4 shall be performed again.
 8. After testing, the pump shall be inspected to insure that the pump maintains full watertight integrity.
- C. A written report stating the tests have successfully been completed and providing the results of the test shall be provided for each pump as part of the shop drawing submittal process.

PART 2 PRODUCTS

2.01 PUMP REQUIREMENTS

- A. The pump(s) shall be heavy duty, electric submersible, centrifugal non-clog units designed for handling raw, unscreened sewage and wastewater and shall be fully guaranteed for this use. The pumps provided shall be capable of operating in an ambient liquid temperature of **104 DEGREES F**. Since the high temperature of **104 DEGREES F** is specified by the National Electrical Manufacturers Association (NEMA) and Factory Mutual (FM), motors with a maximum ambient temperature rating below **104 DEGREES F** shall not be acceptable.

- B. The pump and motor unit shall be suitable for continuous operation at full nameplate load while the motor is completely submerged, partially submerged or totally non-submerged. The use of shower systems, secondary pumps or cooling fans to cool the motor shall not be acceptable.
- C. The pump, mechanical seals and motor units provided under this specification shall be from the same manufacturer in order to achieve standardization of operation, maintenance, spare parts, manufacturer's service and warranty.

2.02 PUMP CONSTRUCTION

- A. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- B. Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
- C. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.03 EQUIPMENT FEATURES

A. COOLING SYSTEM

- 1. Each unit shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

B. CABLE ENTRY SEAL

- 1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single

cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. **The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.**

C. MOTOR

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.
2. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
3. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.
4. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

5. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

D. BEARINGS

1. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

E. MECHANICAL SEALS

1. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
2. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.
3. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.
4. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

5. Seal lubricant shall be non-hazardous.

F. PUMP SHAFT

1. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

G. IMPELLERS

1. The impeller shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

H. VOLUTE/SUCTION COVER

1. The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

I. PROTECTION

1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.
2. A leakage sensor shall be included to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. **USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.**

3. The thermal switches and FLS shall be connected to a Mini CAS (Control And Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

J. EXPLOSION-PROOF PUMPS:

1. The pump system including the pump, motor and power cable shall be approved for use in areas classified as hazardous locations in accordance with the NEC Class I, Div. 1, Group C and D service as determined and approved by a U.S. nationally recognized testing laboratory (U.L., FM, CSA) at the time of the bidding of the project. As required by Factory Mutual (FM) the motor shall be capable of operating in pumped media up to **104 DEGREES F**. Motor thermal switches shall monitor and protect the motor from excessive temperature. An internal Float Switch shall be available, as an option, in the motor chamber. Service of explosion-proof submersible units shall be performed by qualified FM experienced personnel. **The pump manufacturer must provide training schools to qualify personnel in the proper service and repair of explosion proof pumps.**

K. MIX FLUSH SYSTEM:

1. One (1) pump shall be furnished and installed with the Flygt mix flush valve.

L. GUIDE SYSTEM

1. The pumps shall be provided with a guide system to allow easy removal of the pumps without entering the wet well. Two guide bars shall be provided extending from the top slab of the pump station to the discharge connection of each pump and shall assist in raising and lowering the pump unit. The discharge connection shall be bolted to the floor and shall serve as a lower attachment for the guide bars. The working load of the lifting system shall be 50% greater than the pump unit weight.
2. The pump unit shall be guided on the bars by a guide bracket which shall be an integral part of the pump. Each pump shall be fitted with sufficient length of stainless steel chain capable of lifting the pump and motor. The necessary fittings and eye bolts shall be provided.
3. The materials shall be stainless steel, type 316L and/or ASTM A276 Type 304

M. MODIFICATIONS/OPTIONS INCLUDED:

1. Explosion-proof Pumps (X)/FM.

2.04 PUMP CONTROL PANEL

A. GENERAL

1. The power service shall be 3 phase as specified on the electrical plans.

2. The control function shall provide for the operation of the pumps under normal conditions and shall alternate the pumps on each pump down cycle to equalize the run times. In the event the incoming flow exceeds the pumping capacity of the lead pump, subsequent pump shall automatically start to handle the increased flow. As the flow decreases, the pumps shall cut off at the elevations shown on the plans.
3. Motor starters shall be solid state reduced voltage type with isolation and bypass contactors. The solid state reduced voltage starters shall have soft start with current limiting features. The solid state starters shall be by Allen Bradley or Square-D.

B. ENCLOSURE

1. The enclosure shall be a NEMA-4X stainless steel; free standing panel with 24" legs. The enclosure shall adequately house all of the components. The door gasket shall be rubber composition with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. An air conditioner unit shall be provided for the enclosure to remove heat. The air conditioning unit shall be sized adequately for operation in the ambient temperature of 104 degrees F.
2. The pump control panel shall contain the following controls and indicators:
 - a. A "Hand - Off- Auto" switch for each pump.
 - b. The "Hand" position will force the pump to turn on unless operation is precluded due to a fault condition.
 - c. The "Off" position disables the pump. Power cannot be applied to the pump with the switch in this position.
 - d. The "Auto" position causes the pump to operate based on the wet well water level in conjunction with the pump control logic.

C. INNER DEAD FRONT DOOR

1. A polished aluminum dead front shall be mounted on a continuous aircraft type hinge, contain cutouts for mounted equipment, and provide protection of personnel from live internal wiring. Cutouts for breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters, duplex receptacle and other operational devices shall be mounted on the external surface of the dead front. The dead front shall open a minimum of 150 degrees to allow access to equipment for maintenance. A 3/4" break shall be formed around the perimeter of the dead front to provide rigidity.

D. BACK PLATE

1. The back plate shall be manufactured of 12 gauge sheet steel and be finished with a primer coat and two (2) coats of baked on white enamel. All hardware mounted to the subpanel shall be accomplished with machine thread tapped

holes. Sheet metal screws are not acceptable. All devices shall be permanently identified.

E. POWER DISTRIBUTION

1. The panel power distribution shall include all necessary components and be wired with stranded copper conductors rated at a minimum of 90 degrees c. All conductor terminations shall be as recommended by the device manufacturer.

F. CIRCUIT BREAKERS

1. All circuit breakers shall be adequately sized by electrical engineer and be heavy duty thermal magnetic or motor circuit protectors with minimum interrupting rating of 22,000A R.M.S. symmetrical. Motor circuit protectors may be used only for motor starters. Each motor breaker shall be sized to meet the pump motor operating characteristics. The circuit breakers shall be U.L. listed. The control circuit and the duplex receptacle shall individually be controlled by heavy duty breakers.
2. Circuit breakers shall be indicating type, providing "On-Off-Trip" positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating "Trip".
3. Thermal magnetic breakers shall be quick-make and quick-break on both manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip.
4. Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable.

G. TRANSFORMERS

1. Control transformers shall provide the 120 V AC and/or 24 V AC for control circuits. Transformers shall be fused on the primary and secondary circuits. One leg of the secondary shall be grounded.

H. PHASE MONITOR

1. A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reversed phasing and loss of a phase. Control circuits shall de-energize upon sensing any of the faults and shall automatically restore upon return to normal power.

I. ALARM SYSTEM

1. The alarm light shall be a weatherproof, shatterproof, red light fixture with a 40 watt bulb to indicate alarm conditions. The alarm light shall be turned on by the alarm level.

J. PUMP CONTROL SYSTEM

1. The pump controller shall be Flygt Multismart MSM, or approved equal.
2. Provide a pressure transducer type level sensor Flygt cat. #LTU-701 or approved equal with adequate cable length to reach control panel without splicing.
3. Provide one high level alarm float in the wetwell as a back up to the level sensor probe.
4. Provide one low level float in the wetwell as a back up to the level sensor probe that will stop the pumps.
5. Provide 4-20ma signal proportional to level.
6. Provide one spare level sensor for the pump station.

K. ANCILLARY EQUIPMENT

1. The ancillary equipment listed below shall be included in/with the control panel.
 - a. Six digit pumps run time meters.
 - b. Watertight pump motor cables to reach the control panel without splicing.
 - c. 1 GFCI 20 A Duplex Receptacle
 - d. Provide the following alarm/status contacts for connection to the telemetry R.T.U:

Parameter	Relay Contacts	
	Open	Closed
Pump Run Status (for each pump)	Not Running	Running
Pump Failure (for each pump)	Normal	Failure
High-high Level	Normal	High High Level
Low Level	Normal	Low Level
Wet well level high	Normal	High Level
Continuous Level (4-20 mA)		
Phase loss	Normal	Failure
ATS Normal and Emergency Position	Normal	Failure
Generator Fail and running		

1. Note that this table also contains the contact state associated with the associated status information.
2. The relay contacts shall be rated for 120VAC operation with a minimum current capacity of 0.1A (100mA).

L. MISCELLANEOUS

1. Drawings: a final as-built drawing encapsulated in mylar shall be attached to the inside of the front door. A list of all legends shall be included.
2. Panel markings: all component parts in the control panel shall be permanently marked and identified as they are indicated on the drawing. Marking shall be on the back plate adjacent to the component. All control conductors shall be identified with wire markers as close as practical to each end of conductors.
3. Testing: all panels shall be tested to the power requirements as shown on the plans to assure proper operation of all the components. Each control function shall be activated to check for proper operation and indication.
4. Guarantee: all equipment shall be guaranteed for a period of one (1) year from date of acceptance. The guarantee shall be effective against all defects in workmanship or defective components.
5. Manufacturer: the manufacturer shall be a UL listed shop for industrial control systems and shall provide evidence of such on request from the engineer or using authority.

M. The Panel Vendor shall provide training and documentation on the operation, troubleshooting, and maintenance of the control panel. Documentation shall include:

1. Operator's manual(s) which contains the following information:
 - a. The function of each control and indicator.
 - b. A troubleshooting guide geared for the operator.
 - c. Description of fuses and circuit breakers and their locations within the panel.

N. Odor Control

1. Each station shall be provided and installed with Odor Control as follows. The unit shall be guaranteed against defects in material and or workmanship for a period of 1 year.
 - a. Install Wager 2050-i-450 blowerless system.
 - b. System shall include:
 - 1) This specification defines the requirements for a Wager 2050-i-450 Vent Scrubber, manufactured by Wager Company, Rural Hall, NC.
 - 2) The 2050FAPC-i-450 consists of dry scrubbing media contained in a fabricated aluminum plate housing. It is powder coated grass green, with a 4", 6", or 8" outlet.

- 3) The 2050-i-450 shall contain 450 lbs. of dry-scrubbing media that is engineered for the removal of H₂S gas. The media is contained in (9) corrugated plastic containers that are 11" x 18" in size.
- 4) The airflow shall be designed for passive applications. The configuration shall be arranged so that the contaminated air shall flow from the bottom flange and be forced upward through the media bed and discharged through the ventilated openings.
- 5) The 2050FAPC-i-450 contains EIGHT air admittance valves. They intake directly into the lines without any restrictions from the unit's media bed. This assures continued airflow during pumping sequences needed with the air release valves, and also with a vacuum sewer system where outside fresh air is required for system operation.
- 6) All components of the 2050FAPC-i-450 shall include:
 - a) A fabricated aluminum plate body, powder coated grass green.
 - b) 450 lbs. of odor scrubbing media engineered in pellet form.
 - c) 4", 6", or 8: flanged connection – Optional metric flanges available.
 - d) Tamper proof lockable hook and security latches.
 - e) Disposable media corrugated plastic inserts.
- 7) Vent Scrubber Material
 - a) Fabricated Aluminum Plate
 - b) NINE corrugated plastic canisters that measure 11. 6" x 18. Each canister contains 50 LBS of odor scrubbing media.
 - c) Latches in 316SS
 - d) Hooks in 316SS
 - e) 450 lbs. of odor scrubbing media designed for removal of H₂S gas.

- f) 4", 6" or 8" flanged connection with 7.5" (191mm) bolt circle.
 - g) Non-toxic, Landfill disposable media only.
 - 8) Media Specification
 - a) Moisture content : 35% Max
 - b) Crush Strength: 35% - 70% Max
 - c) Abrasion: 4.5% Max
 - d) Pellet Diameter: 1/16" (1.5mm-6.5mm)
 - 9) Wager media only will be accepted due to its high level removal capacity. No equals will be accepted. Carbon will not be accepted.
- c. Coordinate with COH Wastewater Department for exact location

PART 3 EXECUTION

3.01 INSTALLATION

- A. The CONTRACTOR shall furnish and install the pumps at the locations shown on the Contract Drawings and in accordance with the pump manufacturer's specification and recommendations. All discharge elbows shall be mounted on concrete pedestals prepared for them and over anchor bolts set in the concrete. Pump pedestals shall be carefully set at proper elevation, location and alignment, and leveled after which they shall be properly grouted in with grout filling the entire underside of the base. Grouting shall be as recommended by the manufacturer. All piping shall be brought to the pump connection in such manner as to prevent the possibility of applying any loads or stresses to pump connections.

3.02 ANCHOR BOLTS AND FASTENERS

- A. Anchor bolts, nuts, washers, and fasteners shall be furnished with the equipment herein specified and set in conformance with templates or drawings also supplied by the manufacturer. All anchor bolts, studs, fasteners, washers, and nut shall be Type 316 stainless steel. The CONTRACTOR shall install all anchor bolts, studs, washers, nuts and fasteners required to complete the work of this Contract.

3.03 SAFETY GUARDS

- A. All exposed shafts, couplings, belts, etc., shall be provided with removable, rigidly constructed and mounted protective safety guards, meeting in full the requirements of the OSHA standards, State safety standards and all local codes or ordinances that may apply. Guards shall be designed to facilitate access for lubrication, maintenance, and/or belt replacement.

3.04 PAINTING

- A. Unless otherwise specified, all mild steel parts not buried in concrete, cadmium plated, galvanized or plastic covered, shall be shop primed with one coat of paint recommended as compatible with finish coats by the manufacturer whose paint is to be used for field painting. Stainless steel, aluminum, brass, bronze, galvanized or cadmium plated steel, and plastic covered parts will not be painted. Machined and finished surfaces shall be protected with a suitable lubricant to prevent rusting.
- B. The CONTRACTOR shall, under this Section, remedy all damage to shop coatings after installation of equipment, and to the satisfaction of the ENGINEER.
- C. All ductile iron pipe and fittings inside the wetwell and valve vault shall be painted per Section 18001.

3.05 TOOLS AND LUBRICANTS

- A. The CONTRACTOR shall furnish a complete set of any special tools required for the maintenance and operation of this equipment, as designated by the equipment manufacturer.

3.06 FIELD TEST AND START-UP SERVICE

- A. See Specification 02799.

3.08 PUMP WARRANTY

- A. See Specification 02799.

END OF SECTION

SECTION 02732

SANITARY SEWER FORCE MAINS

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 02225 - Earthwork for Utilities
- B. Section 02750 – Protection, Relocation, and Restoration of Existing Utilities
- C. Section 02341 – Horizontal Directional Drilling
- D. Section 03300 – Concrete
- E. Section 18000 – Interior Pipe Coating
- F. Section 18001 – Exterior Pipe Coating

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. American Water Works Association (AWWA).
- C. American National Standards Institute (ANSI).

1.03 QUALITY ASSURANCE

Each pipe shall be clearly marked as required by governing ASTM standard specifications to show its class, date of manufacture, and name or trademark of manufacturer.

1.04 DELIVERY, STORAGE AND HANDLING

- A. DEVELOPER/CONTRACTOR shall be responsible for safe unloading, storage and care of material furnished by or to him until it has been incorporated into the WORK.
- B. Unload pipe, fittings, or valves by lifting with hoists or skidding to avoid damage.
 - 1. Pipe shall not be unloaded by rolling or dropping off trucks.
 - 2. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
- C. Unload material at site of work, near place where it will be placed in trench.
 - 1. Materials shall be placed for least interference with traffic.

2. Provide signs, lights, and barricades as necessary to protect public.
- D. Handle material carefully to prevent breakage and to avoid damage to coatings and linings.
1. Keep interior of pipe, fittings and valves, free of dirt or foreign matter at all times.
 2. Do not place materials in drainage ways or ditches.

PART 2 PRODUCTS

2.01 GENERAL

All force mains shall be HDPE or PVC pipe only unless an area with a trench loading would require ductile iron, the City will consider DIP.

2.02 HIGH DENSITY POLYETHYLENE PIPE

- A. ASTM D3350, high density polyethylene, maximum allowable hoop stress 800 psi at 73.4 degrees F.
- B. Polyethylene resins shall conform to Type PE 3408 or better.
- C. Protection shall be provided against ultraviolet light degradation using carbon black, not less than 2 percent well dispersed in the resin.
- D. Pipe wall thickness shall reflect the required SDR* and diameter, as shown in Table 8, ASTM F714.
- E. Design Stress Rating: ASTM F714, 800 psi hydrostatic. Minimum allowed is SDR 11.

Pressure Rating	SDR*
200	9
160	11

*SDR: standard dimension ratio = OD/thickness

- F. Connections between HDPE and C900 PVC/DIP shall be via a Ductile Iron Pipe Size MJ adaptor as manufactured by Isco Industries, or approved equal. **CONTRACTOR to provide shop drawings TO ENGINEER for these connections.**
- G. Pipe shall have green stripe.

2.03 POLYVINYL CHLORIDE PIPE (PVC)

- A. 4" Diameter and Larger
 1. Polyvinyl chloride (PVC) pipe 4" diameter and larger shall meet requirements of AWWA C900.

2. Pipe shall be Pressure Class per design pressures but a minimum shall be class 235 (DR18) with outside diameter (OD) dimensions of cast iron pipe.
3. Joints
 - a) Shall be made with elastomeric gaskets.
 - b) Bell end pipe using elastomeric gaskets shall meet requirements of ASTM D 2122.
 - c) Elastomeric gasket couplings shall meet requirements of AWWA C900 (latest revision) for the specified pipe class and shall meet the requirements of ASTM F477.
4. Provide marking on pipe exterior as specified in AWWA C900.
5. Pipe color shall be green.

2.04 DUCTILE IRON PIPE (only permitted in special cases if approved by the City)

- A. Shall conform to latest requirements of AWWA C151.
- B. Shall be painted green over 60% of the pipe's surface.
- C. Shall be interior lined in accordance with Specification 18000.
 1. Unless otherwise specified, pipe shall have push-on compression type joints conforming to AWWA C111 or AWWA C153 (Latest Editions).
 2. Minimum pressure class shall be 350 psi.

2.05 CAST AND DUCTILE IRON FITTINGS

- A. Fittings for ductile iron pipe shall be cast or ductile iron and shall conform to requirements of AWWA C110 or AWWA C153 and shall be interior lined in accordance with specification 18000.
- B. Joints shall conform to AWWA C111.
- C. Fittings shall be mechanical joint unless otherwise specified on Drawings.

2.06 HIGH DENSITY POLYETHYLENE FITTINGS

- A. Molded fittings, butt fusion joined, conforming to ASTM D3261.
- B. All fittings shall have the same pressure rating as pipe, unless otherwise noted.

2.07 PLUG VALVES

- A. All plug valves shall be of the tight closing, resilient faced plug type and shall be of the bi-directional eccentric seating so that the opening movement of the plug results in the plug rising off the body seat contact. Valves shall be bubble tight at 175 psi and shall be as manufactured by Pratt, DeZurik, or equivalent.
- B. Valve bodies shall be constructed of cast iron ASTM A-126 Class B, and shall have integrally cast mechanical joint ends or flanged ends. End connections shall meet the following specifications: 125# ANSI B16.1 flange drilling, mechanical joint per AWWA C-111. Mechanical joint connections shall be used unless otherwise specified in the drawings.
- C. Thrust bearing shall be provided at the top and bottom faced surfaces of the plug. Thrust bearings shall be stainless steel.
- D. For above ground installations handwheel actuators shall be provided for valves larger than six (6) inches in diameter.
- E. Gear actuators with 2-inch nut shall be provided for buried valves.
- F. For buried forcemains, plug valves shall be installed at a spacing of every 2,500 LF apart.

2.08 AIR RELEASE VALVES

- A. Air Release valves for sewage applications shall be Golden Anderson Industries, Fig. 925 Standard Sewage Air Release Valve, or equivalent.
- B. The valve shall be supplied with flushing attachments consisting of: bronze shut off and flushing valves, quick-connect couplings, and 5 feet of rubber hose, for backwashing with clean water.
- C. The valve shall be float operated and shall employ a compound lever mechanism to enable the valve to automatically release air and gases from a sewage pipeline while the system is pressurized and operating.
- D. The valve shall close drip-tight, incorporating an adjustable Buna-N orifice button. All internal metal parts shall be stainless steel. The linkage/lever mechanism shall have the capability of being removed from the valve without disassembly of the mechanism. The float shall be stainless steel and capable of withstanding a 1,000 psi test pressure.
- E. Body and cover shall be of cast iron conforming to ASTM A126 Class B. Inlet connection shall be 2" or 3" NPT, or 4" flanged as required. Outlet connection shall be 1/2" NPT.

2.09 AIR/VACUUM VALVES

- A. Air/Vacuum valve shall be Golden Anderson Industries, Fig. 935 Sewage Service Air/Vacuum Valve, or equivalent.

- B. The valve shall be supplied with flushing attachments consisting of: bronze shut off and flushing valves, quick-connect couplings, and 5 feet of rubber hose, for backwashing with clean water.
- C. The valve shall automatically exhaust large quantities of air and gasses while the pipeline or system is being filled and allow air to reenter during draining or when negative pressure exists.
- D. The valve shall be float operated and shall close drip tight against a renewable rubber seat. All internal metal parts shall be made of stainless steel.
- E. Body and cover shall be of cast iron conforming to ASTM A126 Class B. Inlet shall be NPT to 3" size, or 125# flange in 4" and larger as required. Outlet shall be NPT.

2.10 DETECTION TAPE AND WIRE

- A. Detector marking tape shall be non-metallic and shall be installed minimum 2 feet above the pipe. Tape for sewer shall be highly visible green and minimum 2 inches wide. Lettering shall read "Caution: Buried Sewer Line".
- B. Detection wire shall be size #12 AWG solid copper, installed the entire length of the piping. All splices shall be made with waterproof connectors. For each joint of pipe, wire shall installed a minimum of 12-inches above the pipe and properly connected to fittings and valves so line can be relocated with a pipe finder after burial. All splices shall be connected with waterproof connectors.

PART 3 EXECUTION

3.01 PIPE LAYING

- A. Excavation and bedding shall be as specified in Section 02225 (Earthwork for Utilities).
- B. Each piece of pipe and each fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in trench. Pipe laying shall begin at the discharge end and proceed toward the Pump Station with the bell ends pointing upstream.
- C. Bell holes shall be sufficient size to allow ample room for making pipe joints properly. Bell holes shall not be cut out more than ten joints ahead of pipe laying. The bottom of trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length as shown on the Development Drawings. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe to avoid sudden offsets or inequalities in flow line.
- D. Water shall not be allowed to run or stand in trench while pipe laying is in progress, before the joints are completely set, or before trench has been backfilled.
- E. No joints shall be made where pipe or joint materials have been soiled by earth in handling until such soiled surfaces are thoroughly cleaned by wire brushing and wiping until all traces of earth are removed.

- F. Interior of all pipes shall be kept thoroughly clean. After each line of pipe has been laid, it shall be carefully inspected and all dirt, trash, rags and other foreign matter removed from interior.
- G. Backfilling of trenches shall be started immediately after the pipe has been installed. Backfill shall be deposited and compacted as provided under the Section 02225 (Earthwork for Utilities).
- H. Force mains shall be installed so that a minimum grade of 1.0% is always maintained downhill away from a sewage air release valve. If this grade is maintained, entrapped air will always accumulate at the air release valve, and air locking of the force main will be avoided.
- I. Thrust blocking shall be made of Class "D" (2500 psi) concrete as defined in Section 03300 (Concrete).
- J. Full length of each section of pipe shall rest solidly upon the bedding.
 - 1. Any pipe that has its alignment, grade or joints disturbed after laying shall be taken up and relaid.
 - 2. Minimum cover shall be 48 inches. WORK within the Department of Transportation or railroad right-of-ways may have to be deeper than 48 inches according to their minimum requirements.
- K. Lay pipe with bell ends facing in direction of laying against direction of flow.
 - 1. Where pipe is laid on a grade of 10 percent or greater, laying shall start at bottom and shall proceed upward with bell ends of pipe upgrade.
- L. Contractor shall verify that no sewer is being installed in the same trench as a water main or within 10 lateral feet or 18 vertical inches of an existing waterline. Where crossings do occur, the sewer pipe is to be located so that both joints are as far from the water main as possible. If it is impossible to obtain proper horizontal and vertical separation, both the water and sewer shall be constructed complying with requirements for water supply piping and shall be pressure tested to 150 psi to assure water tightness before backfilling. The sewer should also be encased in watertight carrier pipe or concrete, extending 10 feet on both sides of the crossing. See the latest edition of the Recommended Standards for Wastewater Facilities, Great Lakes-Upper Mississippi River Board of State Public Health and Engineering Managers, Section 38.3.

3.02 SETTING VALVES AND FITTINGS

- A. Valves, fittings, plugs, and caps shall be set and joined to pipe in manner specified above for cleaning, laying and joining pipe.
- B. Valves shall be set plumb and a valve box shall be provided for every buried valve. Valve box shall not transmit shock or stress to valves and shall be centered and plumb over wrench nut of valve, with box cover flush with surface of finished pavement or such other level as may be directed.

- C. Backfill around valve shall be carefully tamped in 6-inch layers for full depth of trench with valve box in place.
- D. Provide concrete pad at surface.

3.03 JOINT CONSTRUCTION

All joints for the various types of pipes shall be installed according to pertinent AWWA, ASTM, and manufacturer's specifications. Any defective work will be removed and replaced if it can not be corrected in accordance with the above mentioned specifications.

3.04 ANCHORAGE

- A. Plugs, caps, tees, bends, and valves, unless otherwise specified, shall be provided with "restrained joints in accordance with Part 2 and reaction blocking.
- B. Concrete reaction blocking shall conform to these specifications and the applicable standard details.
- C. Reaction blocking shall be concrete, having a compressive strength of not less than 3,000 psi after 28 days. "Sackcrete" shall not be used.
- D. Blocking shall be placed between solid, unexcavated earth and fitting to be anchored; area of bearing on pipe and on ground in each instance shall be that shown on DRAWINGS.
- E. Blocking shall, unless otherwise shown or directed, be so placed that pipe and fitting joints will be accessible for repair.
- F. Metal harness of tie rods or clamps of adequate strength to prevent movement may be used to compliment concrete blocking if approved by the COH.
- G. Steel rods or clamps shall be galvanized or bituminous coated.

3.05 STREAM and UTILITY CROSSINGS

- A. Pipe shall be placed beneath streambeds or ditches, around, over, or under sewers, culverts, gas mains, telephone ducts, water mains, or other structures.
 - 1. Do not pass pipe through any drainage pipe, culvert, sewer, or manhole.
 - 2. Provide minimum of 48 inches under streambeds or ditches, unless approved by Engineer in writing.
 - 3. Provide minimum of 6 inch earth or sand cushion between proposed water line and any other utility or structure or as indicated on drawings.

- B. Where force mains are installed below free flowing streams, the DEVELOPER is responsible for adequate pipeline design of each crossing on a case by case basis subject to the COH's review. The Developer's Engineer shall consider the soils, creek flow, pressure, topography, thrust restraint, construction techniques allowed, etc. in order to design and specify appropriate layout and pipe joints.
- C. The DEVELOPER shall be responsible for all and any necessary permitting by the all authorities having jurisdiction for stream crossings or crossing of state waters including but not limited to EPD, County, and the Army Corps of Engineers.

3.06 HYDROSTATIC TESTS

Refer to section 02799

END OF SECTION

SECTION 02736
SANITARY SEWER

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 02225 - Earthwork for Utilities
- B. Section 02750 – Protection, Relocation, and Restoration of Existing Utilities
- C. Section 02341 – Horizontal Directional Drilling
- D. Section 03300 – Concrete
- E. Section 18000 – Interior Pipe Coating
- F. Section 18001 – Exterior Pipe Coating

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. American Water Works Association (AWWA).
- C. American National Standards Institute (ANSI).

1.03 QUALITY ASSURANCE

- A. Each pipe shall be clearly marked as required by governing ASTM standard specifications to show its class, date of manufacture, and name or trademark of manufacturer.
- B. Any pipe or specials that have been broken, cracked, or otherwise damaged before or after delivery, or which have failed to meet required tests, shall be removed from site of work and shall not be used.

1.04 DELIVERY, STORAGE AND HANDLING

- A. DEVELOPER/CONTRACTOR shall be responsible for safe unloading, storage and care of material furnished by or to him until it has been incorporated into the WORK.
- B. Unload pipe, fittings, or valves by lifting with hoists or skidding to avoid damage.
 - 1. Pipe shall not be unloaded by rolling or dropping off trucks.
 - 2. Pipe handled on skidways shall not be skidded or rolled against pipe already on ground. Unload material at site of work, near place where it will be placed in trench.

- C. Unload material at site of work, near place where it will be placed in trench.
 - 1. Materials shall be placed for least interference with traffic.
 - 2. Provide signs, lights, and barricades as necessary to protect public.

- D. Handle material carefully to prevent breakage and to avoid damage to coatings and linings.
 - 1. Keep interior of pipe, fittings and valves, free of dirt or foreign matter at all times.
 - 2. Do not place materials in drainage ways or ditches.

PART 2 PRODUCTS

2.01 GENERAL

All gravity sewer shall be PVC pipe only unless an area with a trench loading would require ductile iron, the Town will consider DIP.

- A. Pipe and fittings shall be new materials which have not been previously used.
- B. Minimum depth for sanitary sewer shall be three (3) feet except under pavement; then, the minimum depth shall be five (5) feet.
- C. All sewer lines shall be PVC.
- D. Any sanitary sewer with a depth less than 15 feet shall be SDR 35 PVC. Any sewer with a depth of fifteen (15) feet or greater shall be SDR 26.
- E. Any sanitary sewer less than five (5) feet under pavement shall be SDR 26.
- F. Maximum depth of sewer lines from finished grade shall be 20 vertical feet.

2.02 BEDDING AND BACKFILL

- A. Bedding material shall be as specified in Section 02225 (Earthwork for Utilities).
- B. Backfill material shall be as specified in Section 02225 (Earthwork for Utilities).

2.03 DUCTILE IRON PIPE (DIP) (Do not use for any sewage -Casing only-)

- A. Ductile iron pipe supplied may be push-on, mechanical, or flanged joint.
- B. Ductile iron pipe shall:
 - 1. Conform to AWWA C150 and AWWA C151.

2. Be thickness pressure class 350.
 3. Shall be interior lined in accordance with Specification 18000.
 4. Have rubber jointed gaskets conforming to AWWA C111.
 5. Be painted green.
- C. The weight, casting period, and class or nominal thickness shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be clear and legible. All cast marks shall be on, or near, the bell.

2.04 POLYVINYL CHLORIDE PIPE (PVC)

- A. Pipe shall meet all requirements of ASTM D-3034, SDR-35, SDR 26, unless otherwise specified. Pipe shall be unplasticized polyvinyl chloride with integral wall bell and spigot joints with a rubber ring gasket.
- B. Fittings shall meet all requirements of ASTM D-3034, SDR-35, unless otherwise specified. PVC material shall have a cell classification of 12454-B or C as defined in ASTM D-1784. Fittings in sizes through 8" shall be molded in one piece. Fittings 10" and larger shall be molded or fabricated. Gaskets shall have a minimum cross-sectional area of 0.20 sq. in. and conform to ASTM F-477.
- C. Provisions must be made for contraction and expansion at each joint with an elastomeric gasketed joint.
- D. Joints shall utilize rubber gaskets conforming to ASTM F477.

2.05 CLEANOUTS

- A. Pipe cleanouts shall be the same size as the pipe. A cleanout installation shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. A countersunk PVC screw plug shall be caulked in female adapter.
- B. The Cleanout at the property line in right-of-way shall be installed in plastic Box shall be Model DFW1000.10 polypropylene BODY black 18" x 12-7/16" at the base with a solid top lid model DFW 1000.1-Lid, with no wording on the lid by DFW Plastics, Inc.

2.06 FLEXIBLE COUPLINGS

- A. Flexible Coupling shall be made of polyvinyl chloride with stainless steel sheer ring, manufactured by FERNCO, Davison, Michigan or approved equivalent.
- B. Sizes of flexible couplings shall be selected according to the types of pipe material being used.

2.07 SPARE PARTS

- A. To be determined at end of construction by City.

PART 3 EXECUTION

3.01 PIPE LAYING

- A. Manholes shall be installed at a maximum distance of 400 feet.
- B. PVC sewer laterals; shall have Class 'B' bedding, minimum. DIP shall have Class 'C' bedding, minimum.
- C. Contractor shall verify that no sewer is being installed within 10 lateral feet or 18 vertical inches of an existing waterline. Where crossings do occur, the sewer pipe is to be located so that both joints are as far from the water main as possible, and sliplined or encased in concrete. See the latest edition of the Recommended Standards for Wastewater Facilities, Great Lakes-Upper Mississippi River Board of State Public Health and Engineering Managers, Section 38.3 and Braselton Standard Detail S-33.
- D. Excavation and pipe bedding shall be performed in accordance with Section 02225 (Earthwork for Utilities).
- E. Each piece of pipe and each fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in trench. Pipe laying shall proceed upgrade, starting at lower end of grade and with the bells uphill.
- F. Bell holes shall be sufficient size to allow ample room for making pipe joints properly. Bell holes shall not be cut out more than ten joints ahead of pipe laying. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe in order to avoid sudden offsets or inequalities in flow line.
- G. Water shall not be allowed to run or stand in trench while pipe laying is in progress, before the joints are completely set, or before trench has been backfilled.
- H. No joints shall be made where pipe or joint materials have been soiled by earth in handling until such soiled surfaces are thoroughly cleaned by wire brushing and wiping until all traces of earth are removed.
- I. As work progresses, interior of all pipe shall be kept thoroughly clean. After each line of pipe has been laid, all earth, trash, rags and other foreign matter shall be removed from interior.
- J. Backfilling of trenches shall start immediately after the pipe has been installed. Backfill shall be deposited and compacted as provided under Section 02225 (Earthwork for Utilities).
- K. Full length of each section of pipe shall rest solidly upon the bedding. Any pipe that has its alignment, grade or joints disturbed after laying shall be taken up and relaid.

- L. Lay pipe with bell ends facing in direction of laying against direction of flow.
 - 1. Where pipe is laid on grade of 10 percent or greater, laying shall start at bottom and shall proceed upward with bell ends of pipe upgrade.
- M. Piping shall have a minimum slope as per the Ten States Standards.

<u>Nominal Sewer Size</u>	<u>Minimum Slope in ft/100ft (m/100m)</u>
8 inch (200mm)-----	0.40
10 inch (250mm)-----	0.28
12 inch (300mm)-----	0.22
14 inch (350mm)-----	0.17
15 inch (375mm)-----	0.15
16 inch (400mm)-----	0.14
18 inch (450mm)-----	0.12
21 inch (525mm)-----	0.10
24 inch (600mm)-----	0.08
27 inch (675mm)-----	0.067
30 inch (750mm)-----	0.058
33 inch (825mm)-----	0.052
36 inch (900mm)-----	0.046
39 inch (975mm)-----	0.041
42 inch (1050 mm)-----	0.037

- N. Maximum slopes and velocities shall be in accordance with the Ten States Standards as follows:
 - 1. Where design velocities exceed 15 feet per second, special provisions incorporated to protect against displacement by erosion and impact.
 - 2. Sewers on 20 percent slopes or greater shall be anchored securely with concrete, or equal, anchors spaced as follows:
 - a. Not over 36 feet center to center on grades 20 percent and up to 35 percent
 - b. Not over 24 feet center to center on grades 35 percent and up to 50 percent
 - c. Not over 16 feet center to center on grades 50 percent and higher.

3.02 DETECTION TAPE

- A. Detector marking tape shall be non-metallic and shall be installed minimum 2 feet above the pipe. Tape shall be high visibility green and minimum 2 inches wide. Lettering shall read "Caution: Buried Sewer Line".
- B. Detection wire shall be size #12 AWG solid copper, installed the entire length of the piping. All splices shall be made with waterproof connectors. For each joint of pipe, wire shall installed a minimum of 12-inches above the pipe and properly connected to fittings and

valves so line can be relocated with a pipe finder after burial. All splices shall be connected with waterproof connectors.

3.03 REPAIR CONNECTIONS

- A. When repair connections are to be made, the City has the ultimate discretion to approve or disapprove of the proposed repair method by the CONTRACTOR. Existing pipe wastewater flow is to be stopped. If necessary, temporary measures are to be taken to ensure continuous sewer service.
- B. Saw cut the existing pipe five feet (5') minimum each side of the break.
- C. Prepare pipe bedding in accordance with the Standard Bedding Details.
- D. Replace the pipe with a section of pipe that is the same diameter and length as that removed.
- E. Insert the flexible couplings and tighten in accordance with the manufacturers specifications.
- F. Insert the stainless steel sheer ring in accordance with the manufacturer's specifications.
- G. Prior to backfilling the open trench, allow flow to return to the pipe and check for leaks.
- H. Backfill the trench in accordance with Section 02225 - Earthwork for Utilities.
- I. Videotape and perform pressure tests in accordance with this Section, Part 3.

3.04 SERVICE CONNECTIONS

- A. Service connections to the main sewer shall be provided as per the Standard Details. Each service line is to have a cleanout at the property line and cleanouts located along the service line between the property line and the building. The spacing of the cleanouts shall not exceed 80 feet. Cleanouts will also be provided at all 90 degree and 45 degree horizontal bends. Services lines will be run at a minimum grade of 1%. If there is more than one discharge point from the building to be served, (i.e. bathroom discharge separate from laundry discharge) then they shall be combined to enter the trunk sewer as one.
- B. If the existing structure does not have toilet facilities, then the service piping shall be run to within two feet (2') of the lowest point on the perimeter of the structure and marked as described above.
- D. Saddle taps are not to be used on new sewer mains. Tee-wyes of the appropriate size are to be used.
- E. Where connection to an existing sewer is necessary, it shall be performed with a saddle tap core. "Knock-outs" will NOT be allowed. All cores are to be performed in the presence of a representative of the COH.
- F. Service laterals for residential commercial or industrial applications shall be SDR 35 PVC (ASTM 3034).

3.05 JOINT CONSTRUCTION

All joints for the various types of pipes shall be installed in accordance with pertinent AWWA, ASTM, and manufacturer's specifications. Any defective work will be removed and replaced if it cannot be corrected in accordance with the above mentioned specifications.

3.06 TESTING- Refer to section 02799

3.07 FINAL ACCEPTANCE

- A. Final inspection will include a visual observation of each section of sewer by looking from manhole to manhole with aid of reflected sunlight or an electric torch in the presence of the COH's REPRESENTATIVE.
- B. Such light used for inspection shall be plainly visible from manhole to manhole. Reflected light from manhole to manhole will not be considered as plainly visible light and shall be reason for rejection of section of sewer as not being laid true to line and grade.
- C. Pipe shall be true to line and grade; shall show no leaks; shall be free from cracks and dirt or other materials which will reduce full cross sectional area.
- D. Joints shall be tight.
- E. Finished acceptance of each section or run of sewer tested will not be issued until leakage has been reduced to rates not exceeding maximum specified herein as permissible.
- F. Developer or Contractor shall not connect any housing or commercial to infrastructure until they have received a letter of acceptance.

END OF SECTION

SECTION 02750

PROTECTION, RELOCATION AND RESTORATION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. DEVELOPER/CONTRACTOR is responsible for determining the location of all existing utilities in the work area. **The Utilities Protection Center (UPC) must be contacted at least three regular business days before work begins. The UPC can be reached at the statewide toll-free number: 1-800-282-7411.**
- B. DEVELOPER/CONTRACTOR shall be required, at his own expense, to do everything necessary to protect, support, and sustain all sewers, culverts, water, or gas pipes, electric lights, power, telephone, or telegraph poles or conduits, and other fixtures laid across or along site of WORK, even to the extent of using hand labor in making trench openings under or over these. OWNER, as well as company or corporation owning said pipes, poles, or conduits must be notified in advance of same by DEVELOPER/CONTRACTOR, before any such fixtures are removed or disturbed. In case any sewer, gas, or water pipes, service pipes, electric lights, power, telephone or telegraph poles or conduits, or other fixtures are damaged they shall be repaired by authorities having control of the same, and expense of repairs shall be paid by the DEVELOPER/CONTRACTOR.
- C. No underground or overhead facilities encountered shall be disturbed without proper authority from OWNER, and then only in such manner as OWNER may prescribe and approve.
- D. Should it become necessary to change position, or permanently or temporarily remove any electric conduits, telephone conduits, water pipes, gas pipes, sewerage pipes, or other pipes, conduits, or wires in order to clear structure being built or to permit DEVELOPER/CONTRACTOR to use a particular method of construction DEVELOPER/CONTRACTOR shall cease work if necessary, until satisfactory arrangements shall have been made by owners of said pipes, wires, or conduit, to properly care for or relocate same as necessary to permit WORK to proceed as required for proper completion of Contract.

1.02 GENERAL CONDITIONS

- A. DEVELOPER/CONTRACTOR shall locate all underground obstructions prior to excavation so as to prevent any damage to those services or other utilities.
- B. Any damages must be repaired without delay and cost of such repairs must be borne by DEVELOPER/CONTRACTOR.

PART 2 PRODUCTS

- A. See Section 02660 - Water Distribution Systems
- B. See Section 02732 - Sanitary Sewer Force Mains
- C. See Section 02736 - Sanitary Sewer
- D. See Section 03300 - Concrete

PART 3 EXECUTION

3.01 RELOCATION OF WATER LINES

- A. Only when approved by the COH shall any water mains, service lines, or water meters be relocated during progress of WORK.
- B. Material used for relocation of any water mains or appurtenances shall be of same size and strength as existing material.
- C. When existing water lines and appurtenances are removed for relocation and are not to be replaced by new material, they shall be suitably stored until they are relocated.
- D. When existing water lines and appurtenances are removed for relocation and are to be replaced by new material, remaining materials shall be disposed of by DEVELOPER/CONTRACTOR at his expense.

3.02 RELOCATION OF SANITARY SEWERS

- A. Only when approved by the COH shall any sanitary sewer lines or service laterals be relocated during progress of WORK.
- B. Material used for relocation of any sanitary lines shall be of same size and strength as existing material. As a minimum, materials shall be as specified herein.
- C. Removed material during relocation of sanitary sewers shall be disposed of by DEVELOPER/CONTRACTOR at his expense.
- D. Allowing raw wastewater to flow onto the ground or into a receiving stream is strictly prohibited.

3.03 RELOCATION OF ELECTRIC POWER POLES AND CONDUITS

- A. Power pole relocation and electric service relocation shall be performed by Local Electrical Department.
- B. Temporary electrical service shall be provided when permanent electric service will be interrupted for more than one day.

- C. Cost of relocation of all electric utilities shall be responsibility of DEVELOPER/
CONTRACTOR.

3.04 RELOCATION OF GAS LINES

- A. Gas mains and gas services are to be relocated by the local gas company.
- B. Temporary gas service shall be provided when permanent gas service will be interrupted for more than one day.
- C. Cost of relocation for gas mains shall be responsibility of DEVELOPER/
CONTRACTOR.

3.05 RELOCATION OF TELEPHONE

- A. Telephone cable and conduit are to be relocated by the local telephone company.
- B. Cost of relocation of the telephone cable and conduit shall be the responsibility of
DEVELOPER/CONTRACTOR.

END OF SECTION

SECTION 02799

INSPECTION AND TESTING

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 02601 – Manholes
- B. Section 02660 – Water Distribution Systems
- C. Section 02732 – Sanitary Sewer Forcemain
- D. Section 02736 – Sanitary Sewer

PART 2 PRODUCTS

2.01 Not used.

PART 3 EXECUTION

3.01 SANITARY SEWER - GRAVITY

- A. For all testing that requires reports, said reports shall be submitted to the COH Water and Sewer Departments prior to acceptance.
- B. The DEVELOPER/CONTRACTOR shall NOT make any physical connections between any water and/or sewer taps to any proposed services for residential, commercial or industrial until a written approval letter is provided by the COH acknowledging that all testing and disinfection has been successfully completed.
- C. The pipe inspector shall be notified no later than 48 hours (Monday through Friday) before installed pipe is scheduled to be buried, tested, or inspected.
- D. Prior to scheduling any testing of the sewer infrastructure, all final grading and stabilization including cuts and fills must be complete in the vicinity of the sewer piping. No official testing of manholes and piping (air test, mandrel, video, vacuum test, etc.) shall begin until final grade, sub-base, and curb has been completely installed on site. Once final grade has been established, the DEVELOPER may request and schedule inspection and testing with the COH. Testing shall not commence until the COH is satisfied that the above criteria and the intentions of said criteria have been met.
- E. After completion of any section of pipe, the grades, joints and alignment shall be true to line and grade.
 - 1. Joint surfaces shall be smooth.

2. There shall be no visible leakage and sewer shall be completely free from any cracks, protruding joint materials, deposits of sand, mortar or other materials on inside.

F. Low Pressure Air Leakage Testing

1. Immediately following cleaning, the installed sewer shall be tested using low pressure air. This testing shall be conducted in accordance with ASTM Section F-1417-92, "Time-Pressure Drop Method". General procedures are as follows:
 - a. Isolate the section of sewer line to be tested by inflatable stoppers or other suitable test plugs.
 - b. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. All plugs and caps shall be securely braced to prevent blow-out. One of the plugs or caps should have an inlet tap, or other provision for connecting a hose to a portable air control source.
 - c. Connect the air hose to the inlet tap and portable air control source. The air equipment shall consist of necessary valves and pressure gages to control an oil-free air source and the rate at which air flows into the test section to enable monitoring of the air pressure within the test section.
 - d. Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig.
 - e. After the pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 to 4.0 psig for at least 2 minutes depending on air/ground temperature conditions. The air temperature should stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until equilibrium is obtained; however, a minimum of 3.5 psig is required.
 - f. All test pressures are measured as gage pressure, which is any pressure greater than atmospheric pressure. Since water produces a pressure of 0.43 psi for every foot of depth, air test pressures must be increased to offset the depth of ground water over the sewer line. If the ground water level is 2-feet or more above the top of the pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gage, the air test method should no be used. Before the air test method is used, the ground water level should be lowered by pumping or dewatering.
 - g. *Time-Pressure Drop Method*—Air is slowly introduced into the section of pipe to be tested, until the air pressure is raised to approximately 4.0 psi and the test pipe section is stabilized. Disconnect the air supply and decrease the pressure to 3.5 psi before starting the test. Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi, and compare this interval to the required time to decide if the rate of air loss

is within the allowable. Minimum holding times required by pipe diameter are shown in Table 1.

Table 1

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	230:46

- h. If pipe installation fails to meet these requirements, CONTRACTOR shall determine source or sources of leakage, and shall repair or replace all defective materials or workmanship.
- i. Final acceptance of each section or run of sewer tested will not be issued until leakage has been reduced to rates not exceeding maximum specified herein.

G. Mandrel Testing

A mandrel test of the sewer shall be made at least 30 days after backfilling as follows:

1. Developer is to utilize an approved mandrel kit to test all reaches of the sewer.
2. Mandrel shall be pulled through all gravity sewer pipe while COH's representative is present.
3. Mandrel shall be sized to allow 5% maximum deflection in pipe dimension..

H. Video Record

1. DEVELOPER/CONTRACTOR is to provide the COH with a color DVD or digital file of the inside of every reach of sanitary sewer installed.
2. Video shall record the following information:

- d. Distance and location description of every service line connection installed.
3. Video shall be labeled with date of recording and location.
4. The manhole numbering system shall be the same as shown on the approved Development Drawings.

I. Miscellaneous Items

1. Safety Precautions: Low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is over pressurized or plugs are installed improperly. It is extremely important that various plugs be installed so as to prevent sudden expulsion of a poorly installed or partially inflated plug (i.e., a force of 250 lbs. (112N) is exerted on an 8-inch (200 mm) plug by an internal pressure of 5 psi (34 kPa)). Observe the following precautions:
 - a. No one shall be allowed in manholes during testing because of hazards.
 - b. Install all plugs securely.
 - c. When lines are to be tested, it may be necessary that plugs be braced as an added safety factor.
2. Special Equipment
 - a. Air compressor with capacity of 85 cubic feet to 125 cubic feet.
 - b. Pressure bags (plugs) for each size of pipe installed.
 - c. Bracing material for plugs may be required during testing as an added safety factor.

3.02 MANHOLE

- A. After completion of sanitary sewer systems, all manholes shall be visually inspected to insure all joints are seated, all lift holes are grouted, all inverts are properly constructed, and pipe to manhole connections are installed per manufacturer's recommendations.
- B. Vacuum Testing
 1. Each manhole shall be tested immediately after assembly and prior to backfilling as defined by ASTM C1244 *Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test*.
 2. All lift holes shall be plugged with an approved non-shrink grout.
 3. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.
 4. The test head shall be placed at the inside of the top of the ring and the seal inflated in accordance with the manufacturer's recommendations.

5. Following the procedures as defined ASTM C1244, a vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The TOWN's time requirements shall substitute for the requirements of ASTM C1244 as follows: The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60", and 90 seconds for 72" diameter manholes.
6. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
7. The system will not be accepted by the COH until all manholes pass a vacuum test.

3.03 SANITARY SEWER FORCE MAIN

A. HYDROSTATIC TESTS

1. Pressure and leakage tests will be required on each section of line between valves and shall be conducted in accordance with AWWA C600 and or C605.
2. General Procedure
 - a. Furnish and install corporation stops at high points on line to release air as line is filled with water.
 - b. Furnish suitable pump, connections, and necessary apparatus including means for accurately measuring water introduced into line during testing.
 - c. Test pressure shall not be less than 1.25 times the stated working pressure of the pipeline measured at the highest elevation along the test section. Test pressure shall not be less than 150 psi or 1.5 times the stated working pressure at the lowest elevation (whichever is greater) of the test section. The test pressure shall not exceed the thrust restraint design pressures or 1.5 times the pressure rating of the pipe or joint, whichever is less as specified by the manufacturer.
 - 1) Test pressures shall be as directed by the COH.
 - 2) Test shall be conducted for a minimum of 2 hours.
 - 3) Pressure shall not vary by more than 5 psi during test.
 - d. Testing Allowance.
 - 1) The testing allowance is the maximum amount of water that may be added into the pipeline section during hydrostatic testing in order to maintain ± 5 psi of the test pressure.

- 2) The maximum allowable makeup water shall be based on the following formula:

$$L = \frac{S \times D \times (P^{0.5})}{133,200}$$

Where L is the testing allowance of makeup water in gallons per hour; S is the test length in feet, D is the pipe diameter in inches and P is the average test pressure in pounds per square inch.

- 3) No pipe installation shall be accepted if the amount of make up water required exceeds the amount determined in the formula above.
 - e. Locate, remove, and replace any defective pipe, valves, fittings, or hydrants.
 - f. Repeat tests until results are satisfactory to the COH.

3.04 SEWAGE LIFT STATION

A. FIELD TEST

1. The pumps installed shall be tested at start-up by the Pump Manufacturer or his Authorized Representative. All hydraulic, mechanical and electrical tests shall be run to insure the proper installation, operation, and maintenance of the pumps. As a minimum, the site tests shall include checks for:
 - a. Compliance with operating requirements. The following requirements shall be witnessed prior to acceptance by the COH.
 - 1) Pump turns on at high level
 - 2) Pump turns off at low level
 - 3) Alarm at high-high level
 - 4) Generator turns on with disconnection of power
 - b. Correct rotation before mounting to the discharge connection.
 - c. Balanced voltage and current.
 - d. Insurance that the connection between the pump and discharge connection does not leak. If the connection leaks, the discharge elbow shall be replaced by the DEVELOPER-CONTRACTOR OR pump manufacturer.
 - e. Megger stator and power cables.
 - f. Check seal lubrication.

- g. Check power supply voltage.
- h. Measure motor operating load and no load current.
- i. Check level control operation and sequence.
- j. Insurance that the connection between the pump and discharge connection does not leak. If the connection leaks, the discharge elbow shall be replaced by the pump manufacturer at no cost to the supplying CONTRACTOR or OWNER
- k. Compliance with operating conditions specified for flow rate and TDH: At least 2 draw down tests shall be conducted for each pump, and parallel pumping at each wetwell to determine average discharge pumping rate. CONTRACTOR shall provide necessary personnel and equipment to assist ENGINEER in measuring wetwell depths during testing. CONTRACTOR shall be solely responsible for making all arrangements for scheduling tests, and having adequate personnel and potable water for testing and start up.

B. ADJUSTING, TESTING, TRAINING AND ADDITIONAL SERVICES

1. In addition to the tests listed under this Section, each pump together with actual motors shall be fully tested in water at the pump manufacturers' works to establish that all rating conditions have been met. The DEVELOPER-CONTRACTOR shall make all remedial work necessary on any or all pumps should they fail to meet the conditions specified at no extra compensation. Pumps shall then be retested and failure to meet the specified conditions after remedial work has been performed may be cause for rejection of the pumps. Three (3) certified copies of these tests on all pumps shall be submitted to the COH.
2. On completion of the work, the entire pumping equipment shall be lined up, operated and adjusted by qualified representatives of the several pump and control manufacturers, and under the intended operating conditions, and shall be left in first class, satisfactory, operating conditions, ready for continuous and satisfactory operation. The DEVELOPER-CONTRACTOR shall furnish all power, oil, fuses and other supplies for the field testing of the pumps, equipment, controls, and appurtenances, together with the services of the manufacturer's representatives. The DEVELOPER-CONTRACTOR shall furnish a documented list of all components with a list of manufacturers and contacts.
3. In addition, upon successful start-up of station and COH is satisfied that all components are in working order, the DEVELOPER-CONTRACTOR shall make available experienced factory trained representatives to provide the required operation and maintenance instruction to plant personnel for a period of not less than 8 hours to 16 hours.

C. LIFT STATION WARRANTY

- 1) The DEVELOPER-CONTRACTOR AND lift station supplier/manufacturer shall submit the proper documentation demonstrating that the supplier/manufacturer warrants all components, controls, equipment and the pumps being supplied to the OWNER against defects in materials and workmanship for a period of five (5) years or 10,000 hours under a Municipal Wastewater Permanent Installation Warranty. The DEVELOPER-CONTRACTOR shall furnish a documented list of warranties and warranty start dates for all components.

3.05 WATER DISTRIBUTION SYSTEM

A. HYDROSTATIC TESTS

1. Pressure and leakage tests will be required on each section of line between valves and shall be conducted in accordance with AWWA C600 and or C605.
2. General Procedure
 - a. Furnish and install corporation stops at high points on line to release air as line is filled with water.
 - b. Furnish suitable pump, connections, and necessary apparatus including means for accurately measuring water introduced into line during testing.
 - c. Test pressure shall not be less than 1.25 times the stated working pressure of the pipeline measured at the highest elevation along the test section. Test pressure shall not be less than 200 psi or 1.5 times the stated working pressure at the lowest elevation (whichever is greater) of the test section. The test pressure shall not exceed the thrust restraint design pressures or 1.5 times the pressure rating of the pipe or joint, whichever is less as specified by the manufacturer.
 - 1) Test pressures shall be as directed by the COH.
 - 2) Test shall be conducted for a minimum of 2 hours.
 - 3) Pressure shall not vary by more that 5 psi during test.
 - d. Testing Allowance.
 - 1) The testing allowance is the maximum amount of water that may be added into the pipeline section during hydrostatic testing in order to maintain ± 5 psi of the test pressure.

- 2) The maximum allowable makeup water shall be based on the following formula:

$$L = \frac{S \times D \times (P^{0.5})}{133,200}$$

Where L is the testing allowance of makeup water in gallons per hour; S is the test length in feet, D is the pipe diameter in inches and P is the average test pressure in pounds per square inch.

- 3) No pipe installation shall be accepted if the amount of make up water required exceeds the amount determined in the formula above.
- e. Locate, remove, and replace any defective pipe, valves, fittings, or hydrants.
 - f. Repeat tests until results are satisfactory to the COH.

B. DISINFECTION

1. Pipe, fittings, valves, and appurtenances which have been exposed to contamination by construction shall be thoroughly cleaned, chlorinated, drained, and flushed in accordance with AWWA Specification C651.
2. Procedure
 - a. Flush line prior to disinfection. Flushing shall produce minimum velocity of 2.5 feet per second in pipe.
 - b. Disinfect pipe using liquid chlorine or hypochlorite to produce a dosage of 50 mg/l for a 24 hour contact period.
 - c. Open and close valves several times during disinfection period.
 - d. After 24 hour retention period, flush chlorinated water from line until chlorine concentration of water leaving main is no higher than that generally prevailing in existing system, or less than 1.0 mg/l.
 - e. Disposal of the heavily chlorinated water shall be in accordance with AWWA Standard C651. The environment to which this water will be discharged shall be inspected. If there is any question that the water will damage the environment, a reducing agent shall be used to neutralize the chlorine. The heavily chlorinated water shall not be discharged to a creek, storm sewer, or sanitary sewer without first being dechlorinated.

- f. DEVELOPER/CONTRACTOR shall have sample analyzed by a certified laboratory. Then sample results sent to the COH.
3. Repeat disinfection procedures until bacteriological analysis results are acceptable to the COH.

END OF SECTION

SECTION 02830

CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

The work covered in this section shall include all materials, labor, and equipment necessary for a complete installation of the chain link fencing.

1.02 RELATED WORK

- A. Section 03300 - Concrete
- B. COH Standard Details, PS-6, Chain Link Fence and Gate.

1.03 REFERENCES

- A. ASTM A 392, Zinc-Coated Steel Chain Link Fence Fabric.
- B. ASTM A 824, Metallic-Coated Marcellled Tension Wire for use with Chain Link Fence Fabric.
- C. ASTM A-121, Standard Specification for Zinc Coated (Galvanized) Steel Barbed Wire.
- D. ASTM F 552, Definitions of Terms Relating to Chain Link Fencing.
- E. ASTM F 567, Standard Practices for Installation of Chain-Link Fence.
- F. ASTM F 626, Standard Specifications for Fence Fittings.
- G. ASTM F 669, Standard Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.
- H. ASTM F 1083, Pipe, Steel, Hot-dipped, Zinc-Coated (Galvanized) Welded, for Fence Structures.
- I. ASTM C 94, Ready Mix Concrete.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Allied Tube and Conduit Corporation.
- B. American Security Fence Corporation.
- C. Southeastern Wire, P.O. Box 1968, Tampa, Florida 33601.

- D. Cyclone Fence (United States Steel Corporation).
- E. Manufacturer and distributor of complete fencing systems, or approved equivalent.

2.02 POSTS AND FABRIC

Posts and fabric shall be as specified in the following table:

Materials	Fence Height - 8 Feet
Fabric	2" Mesh 9 Gauge.
Corner Post	4"
Line Post	2"
Gate Post	6"
Top Rail and Brace	1"

Post sizes should conform to Table 1, ASTM F-1083 (schedule 40 steel pipe). All post and rails shall be hot dipped galvanized per ASTM F-1083.

2.03 TOP RAIL

Top Rail shall be continuous with coupling spaced at intervals not to exceed 20 feet.

2.04 POST TOP

- A. All posts shall be provided with post tops which will fit over the outside of posts to exclude moisture and shall be combination tops with barbed wire supporting arms. Post tops shall be provided with a hole suitable for the through passage of the top rail. Posts without barb arms shall be fitted with a cap.
- B. Barbed wire supporting arms shall be at an angle of 45 degrees, and shall be fitted with clips or other means for securing three lines of barbed wire. The top line shall be approximately 12" horizontally from the fence line and 12" above the top of the fabric and the other lines spaced uniformly between the top line and the top of the fabric.

2.05 POST BRACES

A horizontal, galvanized post brace shall extend to each adjacent line post at mid-height of the fabric for each gate, corner, pull and end post. A diagonal 1/2" diameter truss rod shall also be provided from the line post to the gate, corner, pull, or end post, with a turnbuckle or other equivalent device for tension adjustment. Two diagonal tension truss rods shall be provided for each fence panel adjacent to a gate, end, corner or pull post.

2.06 STRETCHER BAR

Stretcher bars 1/4" x 3/4" inch in size, with length 1" less than fabric height, shall be provided for stretching and securing the fabric at each gate, end, corner and pull post, one for each gate and end post and two for each corner and pull post.

2.07 TENSION

Wire shall be provided along the top and bottom edges. It shall be not less than No. 7 gauge coiled spring wire. Galvanized ties or clips shall be provided for attaching tension wires to fabric.

2.08 WIRE TIES

Shall be 9 gauge.

2.09 BARBED WIRE

Shall be two (2) strand 12 gauge with 4 points at 5" o.c. per ASTM A-121.

2.10 GATE

A. Frame

1. Fabricate gate frames from steel pipe to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections. Rigid connections provide security against removal or breakage.
2. Extend end members of gate frames 1'-0" above to member and prepare to receive 3 strands of wire. Provide clips for securing wire to extensions.
3. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
4. Fabricate frames of minimum 1-1/2" (NPS).

B. Fabric - Provide same fabric as for fence. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.

C. Gate Hardware: Provide hardware and accessories for each gate, in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, and offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf.
2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch. Center drop to be provided on double gates.
3. Padlock: Bronze cylinder type lock with three (3) keys is to be provided for each set of gates. Locks are to be keyed per direction of COH representative.

4. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

2.11 FINISHES

- A. Galvanized: ANSI/ASTM A 123; 2.0 oz/sq. ft.
- B. Aluminum coating: ASTM A 428; 0.40 oz/sq. ft.
- C. Thermally fused vinyl coating: Dark green color on either coating.
- D. Vinyl Components: Dark green color.
- E. Accessories: Same finish as fabric.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not begin installation and erection before final grading is completed.
- B. Work shall be performed in a safe and orderly fashion in accordance with Occupational Safety and Health Administration (OSHA) regulations.

3.02 POST INSTALLATION

- A. Excavation: Drill or hand excavate (using posthole digger) holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.
 1. Excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times the largest cross-section of post.
 2. Excavate hole depths 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- B. Fence Post Setting
 1. Line posts shall be placed equidistant at intervals not to exceed 10 ft. o.c. The intervals to be measured parallel to the grade of proposed fence and in the line of the fence.
 2. Line, end, corner and pull posts shall be of sufficient length to allow for installation to a depth as shown on Detail PS-6.
 3. Posts shall be set vertically and plumb and encased in cylindrical concrete footings at least four times the post diameter, with at least a 2" cover on the bottom of the post. Extend the concrete at least 2" above grade and crown to shed water.

3.03 RAIL INSTALLATION

Connect top rail securely to the posts using boulevard clamps or other suitable means, so that a continuous brace is formed.

3.04 CHAIN LINK FABRIC

Chain link fence fabric shall be installed over the outside face of the fence framework. Fabric shall be tied to line posts and middle rails with 9 gauge galvanized or aluminum wire spaced 12" maximum. Fence fabric shall be flush with ground.

3.05 TENSION WIRES

Install tension wires along bottom of fence before stretching fabric and tie to each post. Fasten fabric to tension wire using 9 gauge, wire ties or galvanized wire hog rings spaced 24" o.c.

3.06 BARBED WIRE

Pull wire taut and install to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.

3.07 GATES

Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate.

3.08 STRETCHER BARS

Thread through or clamp to fabric 4" o.c. and secure to posts with metal bands spaced 15" o.c.

3.09 BRACE ASSEMBLIES

Install braces so posts are plumb when diagonal rod is under proper tension.

END OF SECTION

SECTION 02905

SITE RESTORATION

PART 1 GENERAL

1.01 SCOPE OF WORK

Work included in this section consists of, but is not limited to: the restoration of pavement (asphalt, concrete and granular), driveway, concrete curbs and gutters, sidewalks, fences, walls, underground and above ground utilities, repair, replacement and/or relocation. Restoration of the landscaping, i.e., shrubs, trees and grassing, is also part of this work.

1.02 REFERENCES

A. Braselton Standard Details

1.03 QUALITY ASSURANCE

- A. The DEVELOPER/CONTRACTOR shall notify the Utility Protection Center at least 72 hours prior to beginning any construction. Call TOLL FREE 1-800-282-7411, 7:00 A.M. to 4:30 P.M., Monday through Friday.
- B. Any existing site improvements damaged during construction will be repaired at the DEVELOPER/CONTRACTOR's expense, to its existing condition to the satisfaction of OWNER and COH.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Existing materials may be reused when restoring the construction site to original condition unless those materials have been damaged or deteriorated in any way.

If material cannot be reused as determined by the COH, it shall be replaced with new material of like type at DEVELOPER/CONTRACTOR's expense.

PART 3 EXECUTION

3.01 GENERAL

Particular care shall be taken to minimize disturbance to existing site improvements within the limits of construction. The DEVELOPER/CONTRACTOR will take whatever measures are necessary to prevent damage, which may include, but is not limited to, erection of barriers, tree protective fencing, shoring and bracing of excavations and staging of the construction.

3.02 CONSTRUCTION

- A. No excavations shall be allowed to remain open overnight. Excavations shall be properly backfilled or covered with steel plates to allow safe crossing of trenches by vehicles and/or pedestrians.
- B. All work must be approved by the owner and the COH prior to acceptance.

3.03 MAINTENANCE

- A. The DEVELOPER/CONTRACTOR will notify the COH to inspect restored areas as soon as construction is complete and no further disturbances/damages would be likely to occur.
- B. For work performed on Georgia D.O.T., Local County, and the COH property or Rights-of-Way, the DEVELOPER/CONTRACTOR shall warrant the work free from defects of material and workmanship for a period of one year after acceptance.
- C. Clean up work areas by removing any scraps, rubbish or surplus material and dispose of properly off the project site.
- D. Wash and hose down paved surfaces to remove all mud, debris, and other extraneous material prior to final inspection.

END OF SECTION

SECTION 02931

GRASSING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Work under this section includes preparation of subsoil, placement of topsoil and seeding or sodding of all areas disturbed during construction activities as defined on the drawings.
- B. This section also includes maintenance of all grassed areas. Maintenance consists of regular mowing, fertilizing, and regular watering until acceptance by the COH.

1.02 RELATED WORK

Section 02270 – Temporary Erosion Control

1.03 REFERENCES

- A. "Manual for Erosion and Sediment Control in Georgia" - latest edition, prepared by the Georgia Soil and Water Conservation Commission.
- B. ASPA (American Sod Producers Association) - GuideLine Specifications to Sodding.
- C. Standard Specifications, Construction of Roads and Bridges, (latest edition), State of Georgia, Department of Transportation.

1.04 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Deliver sod on pallets. Protect exposed roots from dehydration.
- D. Do not deliver more sod than can be laid within 36 hours.

1.06 MAINTENANCE SERVICE PERIOD

- A. Maintain grassed areas immediately after placement until grass is well established and exhibits a vigorous growing condition for two (2) cuttings.

PART 2 PRODUCTS

- 2.01 Seeding or sodding materials shall be in accordance with approved species requirements in the "Manual for Erosion and Sediment Control in Georgia" - latest edition.

PART 3 EXECUTION

3.01 EXAMINATION

Verify that prepared soil base is ready to receive the work of this Section.

3.02 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of 4 inches over area to be seeded or 2 inches over area to be sodded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.03 SEEDING AND SODDING OPERATIONS

- A. Seeding and Sodding operations shall be in accordance with approved species, schedules, application rates, and planting procedures required in the "Manual for Erosion and Sediment Control in Georgia" – latest edition.

PART 4 ACCEPTANCE

4.01 GENERAL REQUIREMENTS

- A. The CONTRACTOR/DEVELOPER shall provide plant establishment of the specified permanent vegetation prior to final acceptance of the Project. Plant establishment shall consist of preserving, protecting, watering, reseeding, or replanting and other such work and at such time as may be necessary to keep the grassed areas in a satisfactory condition. The CONTRACTOR/DEVELOPER shall water the grassed areas during such period as frequently as necessary to promote maximum practicable growth. Water shall be provided by the Contractor at his expense.
- B. The COH may require replanting at any time if an area or a portion of such area shows unsatisfactory growth.

4.02 GROWTH AND COVERAGE

- A. It shall be the Contractor's responsibility to ensure satisfactory growth and coverage. Grassed areas will be considered acceptable when grass has reached a point of maturity, coverage is at least 98% of the total area with no bare spots exceeding one square foot, and the ground surface is fully stabilized against erosion.

- B. Maintain newly graded, topsoiled, and seeded areas until final acceptance. Restore areas showing settlement or washes to specified grades at CONTRACTOR/DEVELOPER's expense. Newly seeded areas shall be watered as necessary or reseeded at the CONTRACTOR/DEVELOPER's expense until final acceptance.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Reinforcing steel bars, welded steel wire fabric for cast-in-place concrete.
- B. Support chairs, bolsters, bar supports, and spacers for supporting reinforcement.

1.02 RELATED WORK

Section 03300 - Concrete: Concrete placement.

1.03 REFERENCES

- A. ACI 301 – Specification for Structural Concrete
- B. ACI 315 - Details and Detailing of Concrete Reinforcement
- C. ACI 318 – Building Code Requirements for Structural Concrete and Commentary
- D. ACI 350 – Environmental Engineering Concrete Structures
- E. ANSI/ASTM A185 – Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
- F. ASTM A615 – Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- G. CRSI - Manual of Practice
- H. CRSI 63 - Recommended Practice for Placing Reinforcing Bars
- I. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

1.04 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and Documents 63 and 65.
- B. Conform to ACI 318 and 301.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: ASTM A615, 40 ksi yield grade billet-steel bars, uncoated finish.
- B. Welded Steel Wire Fabric: ANSI/ASTM A185 plain type; in coiled rolls; uncoated finish.

2.02 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage, annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.03 FABRICATION

- A. Fabricate in accordance with ACI 301, 315, and 318 providing concrete cover.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.

3.02 STORAGE

Storage of reinforcement shall be in such a manner as to prevent damage to the reinforcing bars. All steel shall be kept clear of the ground, protected from the weather.

END OF SECTION

SECTION 03300

CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

Concrete foundation walls, sanitary structures, pipe encasements, thrust blocking and slabs on grade.

1.02 REFERENCES

- A. ACI 301 – Specification for Structural Concrete
- B. ACI 318 – Building Code Requirements for Structural Concrete and Commentary
- C. ACI 350R – Environmental Engineering Concrete Structure
- D. ASTM C33 – Specification for Concrete Aggregates
- E. ASTM C94 - Specification for Ready-Mixed Concrete
- F. ASTM C150 - Specification for Portland Cement
- G. ASTM C260 - Specification for Air-Entraining Admixtures for Concrete
- H. ASTM C494 - Specification for Chemical Admixtures for Concrete
- I. Georgia Department of Transportation Standard Specifications (Section 500)
- J. ACI 306.1 – Standard Specification for Cold Weather Concreting

1.03 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301 and 318.
- B. Obtain materials from same source throughout the WORK.
- C. Tests: As listed in "Methods of Sampling and Testing", Section 18, ASTM C94. Qualifications of laboratory, responsibilities of all parties involved, and designation of the party to employ, and to pay for, specified services are covered in the Supplementary General Provisions.

1. Concrete:
 - a) Mix and Control: The verifications and control of concrete mixes shall be the work of an independent testing laboratory. Cost of testing shall be paid by DEVELOPER/CONTRACTOR.
 - b) Laboratory Services shall test aggregates for specifications compliance.
2. Contractor shall submit design mixes and testing as required by ACI 301.

1.04 TESTS

- A. Testing and analysis of concrete will be performed in accordance to ACI 301.
- B. Submit proposed mix design of each class of concrete to ENGINEER for review prior to commencement of work.
- C. Four concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed each day.
- D. One slump and entrained air test will be taken for each set of test cylinders taken.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I, II, or III Portland Type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical Admixture: ASTM C494, of any type must be approved prior to use.

2.03 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94.
- B. Provide concrete for all applications of the following characteristics:
 1. Class B - Normal Weight 4,000 psi @ 28 days

2. Class C - Normal Weight 3,000 psi @ 28 days
 3. Class D - Normal Weight 2,500 psi @ 28 days
- C. Use accelerating admixtures in cold weather only when approved. Use of admixtures will not relax cold weather placement requirements.
 - D. Use set-retarding admixtures during hot weather only when approved.
 - E. Concrete mix for concrete work subject to freeze-thaw cycling will have entrained air in accordance with ACI 301.

PART 3 EXECUTION

3.01 INSPECTION

Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

3.02 PREPARATION

Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Bonding agent shall be approved prior to use. Apply bonding agent in accordance with manufacturer's instructions.

3.03 PLACING CONCRETE

- A. Notify the COH a minimum of 24 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301.
- C. Hot Weather Placement: When hot weather placement is required, Contractor shall submit plans for approval by Owner and Engineer.
- D. Cold Weather Placement: ACI 306.1.
- E. Ensure reinforcement, inserts, embedded parts, formed joints and opening are not disturbed during concrete placement.
- F. Maintain concrete cover around reinforcing as per ACI 318.
- G. Place concrete continuously between predetermined construction joints. Construction joints not in construction plans shall be approved.
- H. All construction joints shall be constructed in accordance with construction documents.

I. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify CONTRACTOR/DEVELOPER and COH upon discovery.

J. Placing during non-daylight hours

1. Concrete shall be placed during daylight hours unless otherwise approved by the Engineer. Placing of concrete in a portion of work shall not be started unless that portion of the work can be completed during daylight. Daylight is defined as the period one hour before sunrise to one hour after sunset.

2. If it is desired by the CONTRACTOR to place concrete during non-daylight hours, the CONTRACTOR shall provide an adequate lighting system approved by the ENGINEER. Approval of the placing of concrete during non-daylight hours shall in no way lessen the responsibility of the CONTRACTOR as related to the WORK.

3.04 FINISHING

A. Concrete surfaces shall have rough edges tooled-off; irregularities shall be filled pointed-up and spot finished.

B. Dress all exposed concrete corners with a $\frac{3}{4}$ " x $\frac{3}{4}$ " chamfer.

3.05 FIELD QUALITY CONTROL

A. Concrete Control: The verification and control of all concrete shall be performed by an independent testing laboratory. Cost of testing shall be paid by CONTRACTOR/DEVELOPER. All concrete testing shall be performed by ACI certified technicians in accordance with ASTM C94.

B. Laboratory Services shall be as follows:

1. Make, cure, store and break test cylinders conforming to requirements of ASTM C31 "Standard Method of Making and Curing Concrete Test Specimens in the Field"; ASTM C39 "Standard Method of Test for Compressive Strength of Cylindrical Specimens"; ASTM C143 "Standard Method of Test for Slump of Portland Cement Concrete"; ASTM C172 Test cylinders and slump tests shall be made at job site and under no circumstances shall they be taken at a central mixing plant.

2. Reports on all tests conducted by laboratory shall be rendered promptly and distributed as follows:

a) COH - two (2) copies

b) DEVELOPER/CONTRACTOR - As requested

3. Reports of control cylinders for job placed concrete shall conform to the requirements of ASTM C94.

C. Contractors Function in Concrete Testing

1. Contractor/Developer shall comply with ACI 301. Contractor/Developer shall provide assistance as necessary for cylinder sampling.
2. Keep a daily log, recording quantities of each class of concrete used, the area of location of each quantity of concrete relating to its controlling cylinder and the slump of this concrete, and general weather conditions. The CONTRACTOR/DEVELOPER shall furnish this information to the laboratory for inclusion in the test reports. The CONTRACTOR/DEVELOPER shall obtain delivery tickets showing the class and strength of concrete, the size of coarse aggregate and the slump order. The CONTRACTOR/DEVELOPER shall identify these tickets relative to the area of placement of the concrete and shall retain them on file. He shall produce the tickets, should COH so request.

D. Detailed Requirements

1. Of the test cylinders taken, one shall be broken at 7 days, two shall be broken at 28 days and one held in reserve.
2. Acceptance of concrete shall be in accordance with ACI 301.

3.06 PATCHING

- A. Patch imperfections.

3.07 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.
- B. Repair or replace concrete not properly placed or of the specified type.

3.08 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

WORK required under this section consists of mixing, forming, placing and curing. CONTRACTOR shall furnish all cement, aggregate, water, labor, equipment and other materials necessary or convenient to him for completing the WORK described in these Specifications.

1.02 REFERENCES

- A. ACI 530.1 – Specification for Masonry Structures
- B. ASTM C1019 – Test Method for Sampling and Testing Grout
- C. ASTM C476 - Specification for Grout for Masonry
- D. ASTM C531 – Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- E. ASTM C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- F. DOT Specification Section 600 – State of Georgia Standard Specifications of Construction of Roads and Bridges (latest edition)

1.03 DELIVERY AND STORAGE

- A. Prevent damage to or contamination of grouting materials during delivery, handling and storage.
- B. Store all grouting materials in undamaged condition with seals and labels intact as packaged by manufacturer.

1.04 QUALITY ASSURANCE

- A. Tests
 - 1. Mix and Control
 - a. Verification and testing of grout mixes shall be work of an independent testing laboratory. Cost of testing shall be paid by CONTRACTOR/DEVELOPER.

b. Laboratory services shall test aggregates for specifications compliance.

B. Strength

Grout shall attain a minimum 28 day compressive strength as listed below. Take one sample and cast two specimens for each 30 cubic yards of grout of fraction thereof being placed.

Test Specimens

- | | | |
|----|------------------|------------------|
| 1. | Masonry Grout | Minimum 2000 psi |
| 2. | Non Shrink Grout | 3000 psi |

C. Casting of grout specimens shall be as follows:

1. Grout testing shall be in accordance with ASTM C1019.
2. Cost of the testing and laboratory reports shall be paid for by CONTRACTOR/DEVELOPER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Masonry Grout – ASTM C476.

Masonry grout shall conform with ASTM C476.

B. Non Shrink Grout

1. Premixed/Preproportioned Grout
 - a. Five Star Brand Non Shrink Grout or approved equal.
 - b. Grout shall not contain gypsum, aluminum or iron powders and shall meet the shrinkage requirements of ASTM C-883. Epoxy grout will not be permitted if the substrate is to be exposed to temperatures greater than 140°F.
 - c. Minimum time of workability shall be 30 minutes at ambient temperature.
 - d. Application shall be in conformance to manufacturer's specifications.
2. Site Proportioned/Mixed Grout (Use shall be approved by OWNER/ENGINEER.)

- a. Site mixed grout shall be of "dry pack" or "earthmoist" consistency with 0-1 inch slump. Grout shall consist of three parts sand to one part portland cement with only enough water added to wet all the material.
- b. All surfaces shall be cleaned of all dirt and oil prior to application.
- c. Prior to placement of grout, the substrate shall be wetted with potable water until saturated without ponding.
- d. Grout shall be applied by packing by hand or with the use of a wooden plunger.

PART 3 EXECUTION

3.01 MIXES

- A. Mix design shall be submitted to ENGINEER for approval. It shall be used in reinforced unit masonry and as shown on Drawings for leveling surfaces.
- B. Masonry Grout shall be used for the following: Leveling surfaces; sloping surfaces; and patching anchor holes or small defective areas of concrete.
- C. Masonry Grout shall be proportioned and mixed in accordance with ASTM C-476 for coarse grout, Table 1.

3.02 MIXING

- A. Masonry grout shall be mixed and placed in accordance with ACI 530.1
- B. Mix grout as close to WORK area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials. Do not mix more grout than can be placed within 20 minutes.

3.03 PROCEDURES

- A. Installation methods and procedures shall be as recommended by manufacturer and/or as approved by ENGINEER before WORK is begun.
- B. Type of grout and method of installation for Tunneling, Boring and Jacking shall be furnished to ENGINEER for his review and approval prior to use in construction operation.

3.04 FORMWORK

- A. DEVELOPER/CONTRACTOR shall build leakproof forms that are strong and securely anchored and shored to withstand grout pressures.

- B. Enough clearance shall be provided between the formwork and the area to be grouted to permit proper placement of grout.

3.05 SURFACE PREPARATION FOR GROUT

- A. Remove all defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by bush-hammering, chipping or other similar means, until a sound, clean concrete surface is achieved.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Cover concrete areas with waterproof membrane until ready to grout.
- D. Remove foreign materials from all steel surfaces in contact with grout.
- E. Align, level and maintain final positioning of all components to be grouted.
- F. Take special precautions during extreme weather conditions according to manufacturer's published instructions.
- G. Immediately before grouting, remove waterproof membranes and clean any contaminated surfaces.
- H. Saturate all concrete surfaces with clean water; remove excess water and leave none standing.

3.06 PATCHING CONCRETE

- A. Defects in formed concrete surfaces shall be repaired within 24 hours of placement, to the satisfaction of the O, and defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete, which is honeycombed or otherwise defective, shall be cut out and removed to sound concrete, with edges square cut to avoid feathering.
- B. Except as modified herein, concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. All repair work shall be adequately cured.

3.07 CURING

Cure exposed grout for 3 days after placing by keeping wet or coating with a curing compound.

END OF SECTION

SECTION 16000

LIFT STATION ELECTRICAL WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

WORK described in this section shall consist of furnishing, installing, and connecting all panels, motor control center, lighting fixtures, and all other equipment shown or otherwise indicated in the DEVELOPMENT DRAWINGS. This section shall provide minimum, general guidelines and requirements; all and any electrical plans shall be designed by a qualified, registered electrical engineer in the state of Georgia.

1.02 CODES AND STANDARDS

- A. WORK performed under this section shall conform to the latest edition of the National Electrical Code.
- B. Equipment and material furnished under this section shall be new, unused, and shall be manufactured to the following standards:
 - 1. I.E.E.E. - Institute of Electrical & Electronic Engineers.
 - 2. A.N.S.I. - American National Standards Institute.
 - 3. U.L. - Underwriters Laboratories, Inc.
 - 4. I.C.E.A. - Insulated Conductor Engineers Association.

1.03 POWER SERVICE

- A. Power service will be 480Y/277V, 3-phase, 4-wire delta for the pump stations. The developer is responsible to coordinate with the Power Company and ensure that 3 phase power is available to the site.
- B. DEVELOPER shall furnish and install wooden pole, service entrance conduits, and cables including necessary weatherhead. Coordinate with the power company the location of their transformer pole.
- C. DEVELOPER shall furnish and install metering equipment including conduits and cables as required by the power company.

PART 2 PRODUCTS

2.01 CONDUITS

- A. Rigid conduits shall be hot-dipped galvanized steel.
- B. Electrical metallic tubing shall not be used at any location.
- C. Flexible conduits shall be used for final connection to motors.

- D. Conduits shall be U.L. listed.
- E. Schedule 40 PVC conduits shall be provided for underground installation. When a conduit is to be stubbed up, a PVC to steel adaptor and galvanized steel elbow shall be provided. All exposed conduit extensions shall be rigid galvanized steel.
- F. No conduit runs or junction boxes are to be installed inside or on top of wet well. Splicing of cables inside the wetwell will not be permitted.
- G. All items shall be water-tight.

2.02 CABLES

- A. Underground service entrance and motor feeder conductors shall be U.L. listed as "XHHW".
- B. Conductors shall be copper. Minimum size for power and lighting conductors shall be #12 AWG.
- C. Control cables shall be type XHHW, stranded copper, minimum size #14 AWG.
- D. Signal cables shall be twisted and shielded, #16 AWG minimum.
- E. Cables shall be U.L. listed and shall be manufactured by G.E., General Cable, Rome, Collyer, or approved equivalent.

2.03 PANELBOARDS

- A. The panelboards shall be U.L. listed.
 - 1. Circuit breakers shall be bolt-on type.
 - 2. Busses shall be copper.
 - 3. A ground bus shall be provided in the panel.
- B. Panelboard shall be as manufactured by Square D, Westinghouse, General Electric, or approved equivalent.
- C. The Panel Vendor shall provide a set of electrical schematics (wiring diagrams) which accurately reflect the actual construction of the control panel. All components and wiring in the control panel shall be numerically labeled at each termination with its own number designation and referenced on the schematics by the corresponding labels. The schematic shall contain a legend table which explicitly describes any acronyms, abbreviations, or non-standard symbols used to describe the circuitry or its components. The schematics shall be laminated and attached to the inside doorway of the panel.

2.04 SURGE PROTECTIVE DEVICE (SPD)

- A. The surge protective device shall be suitable for connection to 3-phase, 4-wire power service. Provisions shall be made to mount the lightning arrester to the equipment mounting structure.
- B. The surge protective device shall be Eaton, Catalog No. SPD-250-480Y-3-Q or approved equivalent. The SPD shall have the following options: NEMA 4X stainless steel enclosure, integral disconnect, with the following a nema 4x stainless steel enclosure and internal disconnect, 250kA per phase, surge counter, EMI/RFI filtering, providing up to 50 dB of noise attenuation from 10 kHz to 100MHz, form c relay contact, thermally protected MOV technology, and a 10 year warranty. .

2.05 GROUNDING

CONTRACTOR shall furnish and install grounding system as shown on Drawings. Ground rods shall be 3/4-inch diameter x 10-foot long copperweld. Ground rods shall be driven into ground until top is 24 inches below grade and connected with #2 bare copper wire. Ground conductors shall be cadwelded to rod and routed to main circuit breaker, lightning arrester, and lighting transformer.

2.06 WIRING DEVICES

- A. A minimum of one (1) duplex weather proof receptacle is required. Duplex receptacles shall be 20 ampere, 120 volts, specification grade, NEMA 5-20R configuration. Switches shall be rated 20A. All the device coverplates shall be stainless steel.
- B. Wiring devices shall be U.L. listed and manufactured by G. E., Hubbell, Arrow Hart, or approved equivalent.

2.07 AUTOMATIC TRANSFER SWITCH

The automatic transfer switch shall be designed, built, tested and furnished and warranted by the manufacturer of the generator to ensure one source of responsibility for the complete standby power system. Transfer switch shall be U.L. listed and rated for 100% of the total system load.

2.08 DRY TYPE TRANSFORMERS

- A. Dry type transformer shall be in ventilated outdoor enclosure with core and coil assemblies mounted on rubber isolation pads to reduce the sound level. Two full capacity 5% below normal taps shall be provided.
- B. Transformer shall have 220°C insulation system with 115°C rise allowing 15% overload capability.
- C. Transformer shall be U.L. Listed and manufactured by Square D, Westinghouse, G.E. or approved equivalent.

2.09 MAIN CIRCUIT BREAKER

The main circuit breaker at pump stations shall be NEMA-4X stainless steel enclosure with external operating handle to padlock the breaker in "on" and "off" positions. The main circuit

breakers shall be sized such that the minimum interrupting capacity accommodates the capacity of the service entrance and shall be U.L. listed for service entrance. The circuit breaker must be mounted inside the fenced area of the station.

2.10 LIGHTING

1. Lamp light shall be Lumark Model LDRL-T2-C05-120V-Photo Cell with the following options: 130W, Bronze Finish,
2. Mounting pole shall be a 20 foot square tapered steel hinged pole, KW Industries #THSP with bronze finish
3. Provide mounting adapter/bracket with bronze finish.
4. Provide lowering winch on pole.
5. Timer shall be provided with light switch.
6. A motion sensing feature shall be provided with light.

PART 3 EXECUTION

3.01 GUARANTEES AND TESTS

- A. WORK shall be guaranteed for 12 months after date of acceptance. WORK shall be free from improper grounds and short circuits.
- B. DEVELOPER is required to test new pump stations with generator prior to acceptance of the facility with manufacturer's representatives.

END OF SECTION

SECTION 16621

STANDBY POWER GENERATOR

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. WORK described in this section shall consist of furnishing a permanent standby power generator.
- B. DEVELOPER shall furnish all material and labor to perform the work.

1.02 CODES AND STANDARDS

- A. WORK performed under this section shall conform to the latest edition of the National Electrical Code.
- B. Equipment and material furnished under this section shall be new, unused, and shall be manufactured to the following standards:
 - 1. I.E.E.E. - Institute of Electrical and Electronic Engineers
 - 2. A.N.S.I. - American National Standards Institute
 - 3. U.L. - Underwriters Laboratories, Inc.
 - 4. I.C.E.A. - Insulated Conductor Engineers Association

PART 2 PRODUCTS

2.01 STANDBY GENERATOR

- A. The standby generator shall be rated for continuous standby service for the station's full load demand. This shall include running one pump and other auxiliary equipment (e.g. – lights, etc.).
- B. The generator shall be housed in a weatherproof enclosure. Quiet site soundproofing shall be provided to reduce noise to 70 db at a distance of 7 meters for diesel powered generators and 68 db at a distance of 7 meters for natural gas powered generators.
- C. The entire standby generator set shall be warranted for a period of five years from the date of commissioning.
- D. Outdoor weather-protective housing with residential grade muffler shall be installed. The housing shall have hinged side access doors and a rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. Vibration isolators as recommended by the generator

set manufacturer shall be provided. The generator must be mounted far enough away from obstructions to allow all doors to be opened 90°. All conduits and gas lines shall be installed underground.

- E. The generator shall be supplied with all auxiliary systems necessary for operation (i.e. – batteries, battery charger, block heater, etc.).
- F. The standby generator set shall include an automatic transfer switch rated for 100% of full load. The switch should be provided with indicators for all phases of operation and be equipped with a fully programmable timer for exercising the equipment. The switch must be selectable for load or no load.
- G. The standby generator shall be provided with a manual override feature.
- H. The transfer switch shall be in NEMA-4X stainless steel enclosure. The switch shall be configured to switch back when power is restored to the station.
- I. Generators shall be diesel powered with 100 gallons minimum fuel storage or 24-hour operating time, whichever is greater. Fuel storage shall be accomplished by the use of a corrosion-resistant double wall sub-base fuel tank only. No underground storage will be allowed. A leak detection device shall be provided in the interstitial space for sensing fuel leakage.
- J. A generator ground grid must be provided.
- K. The generator control panel shall be instrumented to provide the following status information by way of relay contacts:

Parameter	Relay Contacts	
	Open	Closed
Generator Status	Not Running	Running
Fuel Level	Normal	Low
Generator	Failure	Normal

1. Note that this table also contains the contact state associated with the associated status information.
2. The relay contacts shall be rated for 120VAC operation with a minimum current capacity of 0.1A (100mA).

- L. Generators shall be manufactured by Cummins, Caterpillar, or Kohler.

PART 3 EXECUTION

3.01 TESTING

- A. Services of manufacturer's authorized representative shall be provided for supervision of the installation, check-out and start-up.

- B. The generator set shall be tested under full load for a period of two hours at the pump station. The diesel fuel and other equipment and materials required for the testing shall be provided by the generator set supplier.
- C. Upon completion of the check-out and testing, the manufacturer's representative shall provide written certification that the system has been properly installed, tested and is functioning properly.
- D. DEVELOPER/CONTRACTOR shall fill fuel tank completely after final acceptance.

3.02 INSTRUCTIONS

Provide after the successful testing one "Instructions and Training Session" with the Owner's designated personnel. Give instructions on operation, function and maintenance.

Provide two (2) hard copy sets and two (2) digital PDF copies of complete Operation and Maintenance Manuals.

3.03 SYSTEM SERVICE CONTRACT

Provide for Owner's consideration a copy of the manufacturer's standard service contract after the successful start-up.

END OF SECTION

SECTION 18000

INTERIOR PIPE COATING

PART 1 GENERAL

- A. All sanitary sewer ductile iron pipe and fittings shall be coated on the interior with Protecto 401™ Ceramic Epoxy.

1.01 RELATED WORK

- A. Section 02732 – Sanitary Sewer Forcemains
- B. Section 02736 – Sanitary Sewer

1.02 CONDITION OF DUCTILE IRON PRIOR TO SURFACE PREPARATION

- A. All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.

PART 2 PRODUCTS

2.01 LINING MATERIAL

- A. The required coating is Protecto 401™ Ceramic Epoxy. The material shall be an amine cured novolac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

1. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.
2. The following test must be run on coupons from factory lined ductile iron pipe:
 - a. ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
 - b. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.
 - c. Immersion testing rated using ASTM D-714-87.
 - 1) —20% Sulfuric acid—No effect after two years.
 - 2) —140°F 25% Sodium Hydroxide—No effect after two years.
 - 3) —160°F Distilled Water—No effect after two years.
 - 4) —120°F Tap Water (scribed panel)—0.0 undercutting after two years with no effect.
 - d. ASTM G-22 90 Standard practice for determining resistance of Synthetic

Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.

- e. An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

PART 3 EXECUTION

3.01 APPLICATION

A. Applicator

- 1. The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. All applicators must be independently inspected at least two times per year to insure compliance with the requirements of this specification. This inspection must be coordinated and reviewed by the manufacturer of the lining material and any deviation from the application and/or quality requirements shall be corrected by the applicator. All inspections shall be in writing and a permanent record maintained.

B. Surface Preparation

- 1. Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas with oil, grease, or any substance that can be removed by solvent, shall be solvent cleaned to remove those substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted.

C. Lining

- 1. After surface preparation and within 12 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness. No lining shall take place when the substrate or ambient temperature is below 40°F. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

D. Coating of Bell Sockets and Spigot Ends

- 1. Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using Protecto 401™ Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot

ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

E. Number of Coats

1. The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

F. Touch-Up and Repair

1. Protecto 401™ Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

3.02 INSPECTION AND TESTING

A. Inspection

1. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.
2. The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

B. Certification

1. The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

3.03 HANDLING

- A. Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.
- B. Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

END OF SECTION

SECTION 18001

EXTERIOR PIPE COATING

PART 1 GENERAL

- A. All ductile iron pipe and fittings inside the wetwell of a sanitary sewer lift station shall be coated on the exterior with Ceramawrap Epoxy by Induron.

1.01 RELATED WORK

- A. Section 02732 – Sanitary Sewer Force mains
- B. Section 02736 – Sanitary Sewer

1.02 CONDITION OF DUCTILE IRON PRIOR TO SURFACE PREPARATION

- A. All pipe shall be delivered to the coating applicator bare. Because removal of old coatings may not be possible, the intent of this specification is that the entire exterior of the ductile iron pipe or fitting shall not have been coated with any substance prior to the application of the specified coating material.

PART 2 PRODUCTS

2.01 LINING MATERIAL

- A. The required coating is Ceramawrap Epoxy. Ceramawrap Epoxy is a very high solids, solvent free, fast curing two- component epoxy formulated especially to coat the exterior of ductile iron pipe for aggressive atmospheres or liquids. Ceramawrap is a chemical resistant product that will protect ductile iron pipe in salt Water, high pH, low pH, and aggressive liquids and atmospheres. Applied at 20-25 mils for maximum protection on ductile iron pipe, Ceramawrap Epoxy is produced using the technology developed for Protecto 401. This proven technology results in low permeability, high impact resistance, and superior adhesion properties. Ceramawrap was designed with the installation and protection of ductile iron pipe as the foremost consideration (including handling, repairs, and superior exterior corrosion resistance)

PART 3 EXECUTION

3.01 APPLICATION

- A. Surface Preparation
 - 1. The entire surface to be coated shall be abrasive blasted. The intent of this specification is that 100% of the surface be struck by the blast media so that all loose oxides and rust are removed.

- B. Coating of Pipe
 - 1. After surface preparation and within 8 hours of surface preparation the entire exterior surface up to the gasket groove with the exception of the spigot end, shall receive an average of 25 mils, 20 mils minimum, of Ceramawrap Epoxy. If any rusting is apparent prior to coating the surface, the entire area must be reblasted as specified.

- C. Coating of the Spigot Ends
 - 1. Due to the tolerances involved, the spigot end from the gasket area to the end of the spigot must be coated with 6 mils average, 10 mils maximum of Ceramawrap Epoxy. Care should be taken that the Ceramawrap Epoxy is smooth without excess buildup on the spigot end.

3.02 INSPECTION AND TESTING

- A. The film thickness of the coating shall be checked using a magnetic film thickness gauge. Measurements shall be taken per SSPC PA2 Section 5.1.
- B. The coated areas of the pipe from the socket edge area of the spigot back to the bell face shall be tested for pinholes using a 2000 volt pinhole detection test. Any pinholes found shall be repaired prior to shipment.

3.03 JOBSITE REPAIR

- A. Any areas where damage has occurred due to handling shall be repaired using Ceramawrap Epoxy prior to installation to equal the original coating.

3.03 HANDLING

- A. All pipes shall be handled with belt slings and padded forks to avoid damage. All shipping timbers and straps should be padded when shipping pipe.

END OF SECTION