City of Jefferson Public Utilities

WATER AND SEWER STANDARD SPECIFICATIONS

DECEMBER 2023

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ABBREVIATIONS/DEFINITIONS

PART 1 GENERAL

1.1 SCOPE OF SERVICE

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.

1.2 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
DOT	Department of Transportation
EPA	Environmental Protection Agency
EPD	Environmental Protection Division
FS	Federal Specifications
ICEA	Insulated Conductor Engineers Association.
IEEE	Institute of Electrical & Electronic Engineers.
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
MUTCD	Manual on Uniform Traffic Control Devices
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
RTU	Remote Telemetry Unit

SSPC	Steel Structures Painting Council
UL	Underwriters Laboratories, Inc.
WEF	Water Environment Federation

1.3 DEFINITIONS

A. CITY: Refers to the CITY.

B. CONTRACTOR: The licensed utility contractor performing construction work on behalf of the DEVELOPER.

C. DEVELOPER: The person, partnership, firm, or corporation who is executing the project and that has officially applied for permitting through the CITY.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 GENERAL

1.1 SCOPE OF WORK

A. DEVELOPER 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 this project.

C. Upon completion of work, warning devices shall be removed by the DEVELOPER.

1.2 SAFETY

A. The governing factor in the execution and staging of work for this project is to provide the public with the safest possible travel conditions along the roadway through the construction zone. The DEVELOPER 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 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 is to clear the roadway of all dirt and debris and add additional safety devices to maintain safe travel lanes.

E. When not in use, all traffic control devices shall be removed, placed or covered so as not to be visible to traffic.

1.3 REFERENCES

A. Manual for Uniform Traffic Control Devices (MUTCD) (latest edition).

B. Georgia Department of Transportation (GDOT) Standard Specifications for Construction of Roads and Bridges (latest edition), Section 150.

C. Georgia Department of Transportation (GDOT) Standard Construction Details (latest edition).

PART 2 PRODUCTS

2.1 TRAFFIC CONTORL 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 shall conform to the approved construction drawings, GDOT Construction Details and Specifications (latest edition), and MUTCD (latest edition).

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

3.1 PLAN AND PERMITS

A. DEVELOPER is responsible for preparing his/her own traffic control plan an instituting the plan in compliance with all applicable Georgia DOT requirements.

B. The DEVELOPER 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 shall cover all Traffic Control Devices which are inconsistent with detour or lane assignment patterns during the transition from one construction stage to another.

C. Construction signs referring to daytime lane closures during working hours shall be removed or covered during non-working hours.

D. The DEVELOPER shall ensure all Traffic Control Devices are operational 24 hours a day, including weekends and holidays. Provide additional inspections at regular intervals.

E. When traveling in lanes open to public traffic, the contractor's vehicles shall always move with, and not against or across, the flow of traffic. These vehicles shall enter or leave work areas in a manner which will not be hazardous to, or interfere with, traffic and shall not park or stop, except within designated work areas. Personal vehicles shall not park within the right of way, except in specific areas designated by the CITY.

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

G. If trenches are to remain open overnight, or for an extended period of time, DEVELOPER shall provide heavy duty cover plates to allow vehicles access.

H. When flaggers are required, they are to be adequately trained, qualified and certified by the GDOT.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 GENERAL

1.1 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.

1.2 QUALITY CONTROL

A. DEVELOPER will employ a Land Surveyor registered in the State of Georgia and acceptable to the CITY.

1.3 SUBMITTALS

A. Submit name, address, telephone number and registration number of surveyor prior to beginning work. the CITY may or may not require attendance at meeting.

1.4 PRE-CONSTRUCTION MEETINGS

A. Prior to any work beginning the DEVELOPER shall contact the CITY to schedule and conduct a pre-construction meeting.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 SURVEY REQUIREMENTS

A. Construction Staking

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

3.2 RECORD DOCUMENTS

A. Prior to final acceptance of a development, or before issuance of a Certificate of Occupancy, DEVELOPER is required to provide the CITY with construction record documents.

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

a. These exact layer names shall be used. If additional layers are needed, they shall be named and a description shall be provided. This description must be included on the media with the drawing and must be in .TXT (ASCII Text) format.

b. Layer names beginning with EX define conditions **as they existed PRIOR to beginning of construction**.

c. Layer names beginning with AB reflect the **site condition at the conclusion of the project**.

END OF SECTION

SECTION 02 01 00
PROTECTION, RELOCATION AND RESTORATION OF EXISTING UTILITIES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. DEVELOPER 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 state-wide toll-free number: 1-800-282-4711**.

B. DEVELOPER 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, 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.

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 to use a particular method of construction DEVELOPER 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.

1.2 GENERAL CONDITIONS

A. DEVELOPER 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.

PART 2 PRODUCTS

2.1 NONE

PART 3 EXECUTION

3.1 RELOCATION OF WATER MAINS

A. Only when approved by the CITY shall any water mains, service lines, or water meters be relocated.

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 at his expense.

3.2 RELOCATION OF SANITARY SEWERS

A. Only when approved by the CITY shall any sanitary sewer lines or service laterals be relocated.

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 at his expense.

D. Allowing raw wastewater to flow onto the ground or into a receiving stream is strictly prohibited

3.3 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.

3.4 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.

3.5 RELOCATION OF TELEPHONE

A. Telephone cable and conduit are to be relocated by the local telephone company.

B. Cost of relocation of telephone cable and conduit shall be responsibility of DEVELOPER.

END OF SECTION

SECTION 02 01 50
SITE RESTORATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. 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.

1.2 QUALITY ASSURANCE

A. Any existing site improvements damaged during construction will be repaired at the DEVELOPER's expense, to its existing condition to the satisfaction of OWNER and CITY.

PART 2 PRODUCTS

2.1 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.

B. If material cannot be reused as determined by the CITY, it shall be replaced with **new material** of like type.

PART 3 EXECUTION

3.1 GENERAL

A. Particular care shall be taken to minimize disturbance to existing site improvements within the limits of construction. The DEVELOPER 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.

3.2 CONSTRUCTION

A. No excavations will be allowed to remain open overnight and they will either 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 CITY prior to acceptance.

3.3 MAINTENANCE

A. The DEVELOPER will notify the CITY 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., Jackson County, and the CITY property or Rights-of-Way, the DEVELOPER 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 them 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.

3.4 GRASSING

A. DEVELOPER is to provide all information necessary for the establishment of a good growth of grass at the time of development review submittal.

B. Information includes, but is not limited to, preparation of subsoil, placing topsoil, fertilizing, seed type and seeding, hydroseeding, seed protection, sod laying, and maintenance.

C. Grassing and mulching shall take place as soon as practical, but no more than 14 days, after grading, backfilling of trench excavations, or other land disturbing activities have ceased. In cases where grassing and mulching cannot be initiated within 14 days due to snow cover or other adverse weather conditions, grassing and mulching shall be initiated as soon as practical. Grassing and mulching activities do not have to be initiated on portions of sites where land disturbing activities are temporarily stopped for less than 21 days.

D. Coverage of grassed and sodded areas shall be considered to be acceptable when all soil disturbing activities at the site have been completed and at least 95% of the disturbed soil surface is uniformly covered with no bare spots exceeding one square foot and the ground surface is fully stabilized against erosion.

END OF SECTION

SECTION 09 97 01.01
INTERIOR PIPE COATING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. All ductile iron pipe and fittings conveying sanitary sewer or at sanitary sewer lift stations shall be coated on the interior with Protecto 401™ Ceramic Epoxy.

1.2 RELATED WORK

A. Section 33 31 00 – Sanitary Sewer Force Mains

B. Section 33 31 00 – Sanitary Sewer

1.3 CONDITION OF DUCTILE IRON PRIOR TO SURFACE PREPARATION

A. All ductile pipe and fittings conveying sanitary sewer or at sanitary sewer lift stations 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

2.1 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.

B. 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.

C. The following test must be run on coupons from factory lined ductile iron pipe:

1. ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.

2. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.

3. Immersion testing rated using ASTM D-714-87.

    a. 20% Sulfuric acid - No effect after two years.

    b. 140°F 25% Sodium Hydroxide - No effect after two years.

    c. 160°F Distilled Water - No effect after two years.

    d. 120°F Tap Water (scribed panel) - 0.0 undercutting after two years with no effect.

4. 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.

D. 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

3.1 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.

3.2 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.

3.3 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 09 97 01.02
EXTERIOR PIPE COATING

PART 1 GENERAL

1.1 SCOPE OF WORK

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.

1.2 RELATED WORK

A. Section 33 31 00 – Sanitary Sewer Force Mains

B. Section 33 31 00 – Sanitary Sewer

1.3 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

2.1 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

3.1 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 grove 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.

3.2 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.

3.3 JOBSITE REPAIR

A. Any areas where damage has occurred due to handling shall be repaired using Ceramawrap

B. Epoxy prior to installation to equal the original coating.

3.4 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

SECTION 09 97 23
COATINGS FOR BELOW GRADE CONCRETE WASTEWATER STRUCTURES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. A manufacturer certified Applicator shall provide all labor, materials, equipment, incidentals, and quality requirements for concrete for surface preparation, repair or resurfacing, and ultra-high build, Structural Epoxy lining work to the entire interior surfaces of the structures as shown on drawings and specified herein.

B. This Section's intent is to provide minimum requirements of an installation of an ultra-high build, high strength, structural epoxy system; and the lining of newly installed, existing, and/or defective specified concrete/masonry structures and surfaces exposed to municipal sanitary sewage by an applied and bonded application of high performance, 100% solids, ultra-high build, structural grade, applied fiber-reinforced-polymer (FRP) epoxy coating/lining system (Structural Epoxy).

C. This Section's intent is for concrete and/or other masonry structures which are exposed to or in contact with municipal sanitary sewage; constituting municipal sanitary sewage from collection systems (sanitary sewer and/or stormwater), where sewage contact and exposure to hydrogen sulfide are present. Not intended for non-sewage applications or industrial waste.

D. Basis of design are products of Epoxytec LLC (a Tnemec company, www.tnemec.com, +1-800-863-6321) www.epoxytec.com. Materials specified are those that have been evaluated for the specific service and are intended to provide the longest service life possible, lowest life cycle cost, and most sustainable solution.

E. Other acceptable manufacturers are the Carboline Company and Induron Coatings, Inc.

F. Types of Structural Epoxy lining for concrete Work required include but are not necessarily limited to the following:

1. Hydraulic water plug
2. Chemical grout
3. Cementitious repair mortar
4. Epoxy cementitious resurfacer
5. Structural epoxy lining
6. Manhole chimney joint sealant
7. Miscellaneous materials

1.2 CONTRACTOR PRE-QUALIFICATION

A. CONTRACTOR shall be a certified Applicator by the Structural Epoxy manufacturer prior to bid date. Submit proof of Applicator certification by manufacturer to ENGINEER.

B. Installation equipment shall be acceptable to the Structural Epoxy manufacturer. If spraying Structural Epoxy, Applicator must utilize equipment approved by Structural Epoxy manufacturer.

C. Applicator shall establish quality control procedures and practices to monitor phases of surface preparation, storage, mixing, application, and inspection throughout the duration of the project. CONTRACTOR to provide a full-time, on-site person whose dedicated responsibilities will include quality control of the Structural Epoxy linings and completed manufacturing certification training.

D. Applicator's quality control procedures and practices must include the following items:

1. Training of personnel in the proper surface preparation requirements.

2. Training of personnel in the proper storing, mixing, and application and quality control testing of the Structural Epoxy linings.

3. If spraying, training of personnel with the spray equipment to ensure proper film build, film quality, and ratio control.

1.3 WARRANTY

Structural Epoxy lining Manufacturer shall warranty its products as free from material defects for a minimum period of ten (10) years. Provide associated Warranty Certificate.

CONTRACTOR shall warranty the installed Structural Epoxy lining system as free from workmanship defects for a minimum period of ten (10) years.

PART 2 PRODUCTS

2.1 MATERIALS

A. Hydraulic Water Plug: hydraulic cement water plug shall be used for low pressure active leak stopping.

Manufacturer	Tnemec	Carboline	Induron
Products	Epoxytec Mortartec Hydrxx-1	Plug Resins Prime Plug	Mortarchem
	Epoxytec Mortartec Hydrxx-3	Plug Resins Prime Plug	Mortarchem

1. Cure – Press firmly pre-mixed paste or dry material into place, maintaining pressure until the material begins to harden and the leak is stopped. Continue until all active leaks cease.

B. Chemical Grout: Sanitary sewer grade chemical grouts shall be urethane-based, and formulated specifically for use in grouting pre-cast barrel joints, brick and CMU structures, and/or pipe penetrations and pinholes to stop aggressive flowing leaks.

Manufacturer	Aqulfin
Products	Eco-CUT
	Eco-LV
	Eco-SLV

1. Cure – Mixing and handling of all the chemical grout materials shall be in accordance with chemical grout manufacturer's recommendations. Application of materials shall be by injection method according to chemical grout manufacturer recommendation and industry defined standard ASTM F 2414, using appropriate pressure to ensure no damage to the structure.

2. Re-Blast - All excess chemical grout must be removed from the surface by mechanical means.

C. Cementitious Repair Mortar: cementitious repair mortar shall be used for structural repairs or surface repairs exceeding a depth 1/2 inch (12.7 mm) in accordance with Manufacturer's written instructions as outlined in the product data sheet and application guide.

Manufacturer	Tnemec	Carboline	Induron
Products	Tnemec Series 217 MortarCrete	Carbocrete 4000 4010 4020	Mortarchem

1. Thickness – Minimum ½ inch as required to re-establish original plane.

2. Cure – Ensure that the mortar while curing will remain moist, covered from direct sunlight, and if needed, covered by damp coverings to avoid mortar dry-out and to optimize curing.

3. Re-blast – Clean and profile the surface to remove the laitance layer and to uniformly profile the surface to produce a minimum ICRI CSP 6 surface profile amplitude.

D. Epoxy Cementitious Resurfacer: epoxy cementitious resurfacer shall be used for filling voids, bugholes, static cracks and joints, and for general concrete patching, and to provide a uniform, void free surface for Epoxy Lining application.

Manufacturer	Tnemec	Carboline	Induron
Products	Tnemec Series N218 MortarClad	Carboguard 510	Mortarchem

1. Thickness – Epoxy lining shall be applied to a minimum thickness of 1/16 inch (1.6 mm) to the entire surface.

2. Cure - Ensure that the mortar while curing will remain moist, covered from direct sunlight, and if needed, covered by damp coverings to avoid mortar dry-out and to optimize curing.

E. Structural Epoxy Lining: epoxy lining. Structural Epoxy coating shall be applied and applied in accordance with Manufacturer's written instructions as outlined in the product data sheet and application guide.

Manufacturer	Tnemec	Carboline	Induron
Products	Epoxytec CPP Sprayliner MH	Hydroplate 6500	Ceramasafe 90 or Permaclean 100
	Epoxytec CPP Trowel-Liner	Plasite 5371	Ceramasafe 90 or Permaclean 100

1. Thickness – Epoxy lining shall be applied to a minimum thickness of 125 mils (1/8" inch) dry film thickness.

F. Manhole Chimney Joint Sealant: Applied polymer elastomer sealant, shall be applied and in accordance with Manufacturer's written instructions as outlined in the product data sheet and application guide. Applied polymer elastomer material is applied after Structural Epoxy lining material is installed and cured.

Manufacturer	Tnemec	Carboline	Induron
Products	Epoxytec Uroseal 45V	Dubick Membrane 310	Ceramasafe 90 or Permaclean 100

1. Thickness – Manhole chimney joint sealant shall be applied to a minimum thickness of 250 mils (1/4" inch) dry film thickness.

2. Re-blast – Lightly abrade and clean the surface of the Structural Epoxy liner when applying manhole chimney joint sealant beyond the recoat window of the Structural Epoxy.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. All surface washing, abrasive blasting, water jetting, grinding, patching, filling and preparation shall be completed by the Applicator in accordance with the Structural Epoxy lining Manufacturer's recommendations.

B. Allow new cast-in-place concrete to cure for a minimum of 28 days at 75°F and with adequate air movement before installing the corrosion protection lining system. Concrete surfaces to be coated shall be free of curing compounds and form release agents, laitance and foreign particles that may inhibit bonding. Prior to start of Structural Epoxy coating systems application, pre-clean as required, and inspect the substrate in accordance with SSPC-SP13/NACE No. 6, Severe Service. Surface preparation procedures shall be in accordance with NACE No. 6/SSPC-SP13 and ICRI Guideline No. 310.2. Surface preparation shall expose aggregate and obtain a uniform surface texture resembling the minimum recommended concrete surface ICRI-CSP profile. Surface preparation will be required on new or existing concrete.

C. Stopping Active Leaks: After surface cleaning, any visible leaks or other water ingress shall be reported to the ENGINEER. Any water infiltration through minor leaks must be stopped using specified hydraulic cement water stop; should flows be aggressive, a chemical grout method shall be used. Surface and grouting material may require additional surface preparation prior to application of Structural Epoxy lining.

3.2 APPLICATION

A. All work shall be in strict accordance with the specifications and recommendations including mixing, handling, storage, and application of all products as required and in accordance with manufacturer's published technical instructions, safety data sheets, including manufacturer's published PDS, design guidelines, and/or other written specifications.

B. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, coating installation should be scheduled when the temperatures are falling versus rising.

C. All specified products must be installed by qualified and trained applicators in accordance with this specification.

3.3 CLEAN-UP

A. At the completion of the Work, CONTRACTOR shall remove all materials and debris associated with the Work of this Section.

B. Clean all surfaces not designated to receive Structural Epoxy coating. Restore all other work in a manner acceptable to ENGINEER.

C. All finished Structural Epoxy coating shall be protected from damage until Final Acceptance of the Work. Structural Epoxy coating damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.

3.4 SETTING/CURING

A. Setting and curing of specified products shall be in strict accordance with instructions detailed on manufacturer’s product data sheets. Verify curing of the coating materials in accordance with the Manufacturer's instructions.

3.5 SHELF LIFE

A. Consult manufacturer for specific details on shelf life and provide documentation that all products are within the shelf-life limitations specified by the manufacturer. Materials exceeding storage life as defined by the manufacturer shall be removed promptly from the site.

3.6 CAUTION

A. 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 26 00 00
LIFT STATION ELECTRICAL WORK

PART 1 GENERAL

1.1 SCOPE OF WORK

A. 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.

1.2 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.

1.3 POWER SERVICE

A. In general the power service to the pump stations shall be three phase as listed below in the preferred order:

1. 480/277V, 3 phase, 4 wire, Wye connected

2. 120/208V, 3 phase, 4 wire, Wye connected

3. 120/240V, 3 phase, 4 wire, Delta connected

4. 480V, 3 phase, 3 wire open Delta connected (contact the power company for motor horsepower limitation)

5. 120/240V; 3 phase, 4 wire, open Delta connected (contact the power company for motor horsepower limitation)

B. For pump stations with motors 10Hp and smaller, single phase power service may be provided with written approval from the CITY.

1. A letter from the power company states that three phase power is not available at the location must be submitted to the CITY with the request.

2. If the CITY approves the request for single phase power service, variable frequency drives shall be used in the pump control panel for the ump motors. The variable frequency drives shall have single phase input and three phase output. The pump motors shall be three phase.

C. Use of phase converters and single-phase pump motors will not be permitted.

PART 2 PRODUCTS

2.1 STATION APPURTENANCES

A. A main circuit breaker shall be provided in the pump station and shall be located inside the fenced area of the station. The circuit breaker shall meet the following requirements:

1. U.L. listed for service entrance.

2. In NEMA-4X stainless steel enclosure.

3. Capable of being padlocked in both “on” and “off” positions.

B. Underground conduits shall be scheduled 40 PVC. All exposed conduits shall be rigid galvanized steel.

C. No conduit runs or junction boxes shall be installed inside or on top of the wet well. Splicing of cables inside the wet well will not be permitted.

D. The power, lighting and control cables shall be copper conductors with 600V type ‘XHHW’ insulation, #12 AWG minimum size. The signal cables shall be copper conductors, 600V rated, twisted and shielded type, #16 AWG minimum size.

E. Each station shall be installed with a portable generator receptacle with a double throw switch ahead of the automatic transfer switch and permanent standby generator. Receptacle shall have reverse contacts. Receptacle shall be Arktite (Body Grounded) model AR20412-S22 or approved equal.

F. A surge suppressor shall be provided at the power service entrance. The surge suppressor shall have voltage characteristics to match the power service.

1. The surge suppressor shall be in NEMA-4X stainless steel enclosure and shall provide line to line, line to neutral, line to ground and neutral to ground protection modes as applicable for the power service.

2. The surge suppressor shall be provided with a disconnect. Minimum surge current rating shall be 100KA per mode, 200KA per phase per NEMA LS-1. The surge suppression system shall be duty cycle tested to survive 20KV, 10KA, IEEE C62.41 category surge current with less than 5% degradation of clamping voltage.

3. The surge suppressor shall have minimum repetitive surge capacity of 4500 impulses per mode. Status indicating lights and form 'C' dry alarm contacts shall be provided.

4. The surge suppressor shall be U.L. listed and labeled under UL1449 and UL1283. Acceptable manufactures are Liebert and Current Technology.

G. A mini-power center shall be provided in the pump station when the power service is 480 volts. The mini-power center shall be in an outdoor weatherproof enclosure which shall consist of a transformer with primary and secondary circuit breakers and a 120/240V panel board. The panel board shall have at least two spare branch circuit breakers.

H. The electrical equipment shall be mounted on an adequately sized galvanized steel or aluminum structure. Telemetry RTU shall also be installed on this structure. Large pump control panels shall be installed on concrete pad.

I. A ground fault circuit interrupter type outlet in weatherproof enclosure shall be provided on the mounting structure for the CITY's use.

J. A ground grid consisting of a minimum four ¾" diameter, 10' long copperweld rods at the corners of the fenced area connected with minimum #2 AWG bare stranded copper conductor run underground around the perimeter shall be provided. All the grounding connections shall be exothermic type. Mechanical connection are not permitted. The main circuit breaker, generator and the pump station fence shall be grounded to the ground grid.

K. Each site shall have an exterior hinged light pole with 250-watt metal halide luminaire, 120-volt ballast, photoelectric control, with heat and impact resistant lens. Pole is to be architectural brown and is to be supplied with lowering winch.

1. BRACKET: G.E. PART # RBSU2H6PP

2. POLE: G.E. PART # ASHTS202T-5.3-11PP

2.2 TELEMETRY SYSTEM

A. The system shall be Model Mission M800 as manufactured by Mission Communications, LLC to match the CITY's existing installations. The DEVELOPER shall pay upfront for three (3) years of monitoring service and provide proof of payment to the CITY prior to acceptance of the system.

B. The monitoring RTU shall be enclosed in a NEMA 4X enclosure equipped with sun shield. The RTU shall transmit all data and alarms via the Nextel or Sprint wireless data network. Such network(s) shall have 128-bit AES encryption. The RTU shall be powered by 120 volts AC and have a built-in battery backup capable of keeping the RTU powered for 24 hours in case of primary AC failure. All terminations inside the RTU enclosure shall be low voltage AC or DC (28 volts or less). The RTU shall be supplied with a U.L. recognized 120 VAC to 12 VAC step down transformer. The RTU shall have two (2) analog, 10-bit resolution, 4-20mA or 0-5 VDC inputs, with four (4) alarm thresholds per input. The analog input values shall be transmitted by the RTU to the central monitoring software at least every 2 minutes. The RTU shall have built in AC failure and low battery detection. The RTU shall have sixteen (16) digital inputs of which up to three (3) shall be capable of recording pump runtimes in one (1) minute resolution. Any change of the RTU digital inputs shall be transmitted to the central monitoring software within 10 seconds of occurrence. The RTU shall have at least three (3) remotely controllable relay outputs that may be controlled at will by the customer.

C. The following remote input contacts shall be connected to the RTU:

DI = High-High Level (From Float)
DI = Pump #1 Run
DI = Pump #2 Run
DI = Pump #1 Fail
DI = Pump #2 Fail
DI = Phase Monitor Alarm (from Control Panel)
DI = Control Power On (from Control Panel)
DI = ATS Emergency Position
DI = ATS Normal Position
DI = Generator Run
DI = Generator Common Fault (low oil, fail to start, etc.)
DI = Generator Low Fuel
AI = Continuous Wetwell Level

D. The RTU shall have up to two (2) optional pulse counting totalizers of which one can be programmed to report every two (2) minutes. The RTU shall have a built-in electronic key or card reader, which can be used to securely put the RTU in/out of alarm reporting mode and/or to accept in progress alarms.

1. The Telemetry RTU shall be a Mission Mydro 850 with expansion to 16 Discrete Inputs and shall include 3 years of Cellular Service.

E. The RTU shall be capable of reporting alarms and all supervisory information to a password protected customer web site, an OPC compliant customer HMI software package or both. The web site or HMI software package shall be capable of displaying all RTU alarms and supervisory data. This shall include alarms, individuals accepting alarms, RTU electronic key/card reads with user names and time of read, pump running status, pump run times with historical graphs, individual pump flow estimates, automatic daily analysis of pump runtimes for abnormalities with automatic customer notification of such abnormalities, pump starts, hourly analysis of excess pump starts with automatic notifications of excess pump starts, minute-by-minute radio health checks with automatic notification of non-reporting or poorly reporting RTU's, scaled and labeled pulse totalizations and if rainfall gauges are used, inter-day rainfall graphs. The customer web site or HMI software package shall be capable of performing and displaying volumetric inflow calculations from RTU supplied data for each pump cycle as they occur. Such volumetric calculations will utilize real-time pump start/stop data with simultaneously gathered level transducer data to perform the inflow and pump GPM calculations. The customer web site or HMI software package shall be capable of reporting alarms via phone dialup, numeric pager dialup, alpha numeric pager, fax or email or any combination of the above. The customer web site or HMI software shall produce an audit report of every alarm or notification event with accurate results of all notification attempts. The customer web site or HMI software shall produce and deliver weekly reports which summarize alarms and responses, pump runtimes and flow estimates and all electronic key or card uses at the RTU sites.

F. The RTU Supplier shall provide services of factory trained technician to check, start-up, instruct OWNER's personnel and put in operation the telemetry system. A certificate of successful commissioning of the system shall be provided to the CITY.

2.3 PUMP CONTROL PANEL

A. GENERAL

1. The power service will 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.

4. Pump control panel shall contain AC for temperature control.

B. ENCLOSURE

1. The enclosure shall be a NEMA-4X stainless steel; free standing panel with 24" legs. Use shorter legs to prevent panel from exceeding 6.5-feet. 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:

DI = High-High Level (From Float)
DI = Pump #1 Run
DI = Pump #2 Run
DI = Pump #1 Fail
DI = Pump #2 Fail
DI = Phase Monitor Alarm (from Control Panel)
DI = Control Power On (from Control Panel)
DI = ATS Emergency Position
DI = ATS Normal Position
DI = Generator Run
DI = Generator Common Fault (low oil, fail to start, etc.)
DI = Generator Low Fuel
AI = Continuous Wetwell Level

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 ensure 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.

PART 3 EXECUTION

3.1 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 26 32 13
STANDBY POWER GENERATOR

PART 1 GENERAL

1.1 SCOPE OF WORK

A. WORK described in this section shall consist of furnishing a portable standby power generator.

B. DEVELOPER shall furnish all material and labor to perform the work.

1.2 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

2.1 STANDBY GENERATOR

A. The standby generator shall be rated for continuous standby service for the full load demand of the station. This shall include running both pumps with staggered startups.

B. The generator shall be housed in a weatherproof enclosure. Quiet site soundproofing shall be provided to reduce noise to the following levels at a distance of 7 meters:

1. 60dB for Natural Gas Generators
2. 68dB for Diesel Generators up to 80KW
3. 74dB for Diesel Generators above 80KW

C. The entire standby generator set shall have a manufacturer’s warranty for a minimum period of five (5) years from the date of acceptance.

D. Outdoor weather-protective housing with critical grade exhaust 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. Generator shall be supplied with all auxiliary systems necessary for operation such as batteries, battery charger, block heater, etc.

F. The standby power system shall include an automatic transfer switch. Transfer switch shall be rated for 100% of full load of the main disconnect switch. Switch shall 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. Three complete sets of O & M manuals and keys shall be provided for generator and automatic transfer switch.

H. Generator control system must include a programmable control device to allow automatic start-up and test functions. Test functions can be programmed for daily, weekly or monthly testing. Connections for remote monitoring of function and failure must be provided.

I. Pump stations are required to have continuous standby power. Generators rated 100 KW and below shall be installed to operate on natural gas. All gas piping and connecting equipment shall be installed in accordance with the Georgia State Amendments to the Standard Gas Code, latest edition. All gas supply lines must include a drip loop as well as all other equipment required for a safe and complete hook-up.

J. If gas is unavailable, a letter of exception must be obtained from the CITY. Generators above 100 KW shall be diesel powered with 100 gallons minimum fuel storage capacity or 72-hour operating time, whichever is greater. Fuel storage shall be accomplished by the use of 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. The device contact shall be connected to the generator control panel terminals for telemetry.

K. Generators can be obtained from the following manufacturers/representatives:

    1. Caterpillar, Kohler, and Onan

L. Transfer switches shall be in NEMA-4 enclosures obtained from the manufacturer of the generator.

PART 3 EXECUTION

3.1 TESTING

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

B. Generator shall be load tested at 100% full load on site for a period of four hours using resistive load banks. Notify the City inspector prior to test, and provide certification letter from the manufacturer.

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.

3.2 INSTRUCTIONS

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

B. Provide three (3) sets of complete Operation and Maintenance Manuals and Keys.

3.3 SYSTEM SERVICE CONTRACT

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

END OF SECTION

SECTION 31 11 00
SITE PREPARATION

PART 1 GENERAL

1.1 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.

1.2 REGULATORY REQUIREMENTS

A. Conform to applicable code for disposal of debris.

B. Conform to local Fire Department Codes for burning debris on site. DEVELOPER shall obtain all necessary permits prior to burning on site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials used for tree and vegetation protection shall remain during clearing operations at DEVELOPER'S option. Materials chosen shall ensure maximum protection to vegetation and comply with the Georgia Manual for Erosion and Sediment Control.

B. Materials used for the repair of trees and vegetation damaged outside clearing limits shown on approved construction drawings shall be at DEVELOPER'S option but must be approved by the CITY prior to use.

C. Herbicides shall not be used unless written approval is given by the CITY.

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

3.1 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 at his expense, with landscaping approved by the CITY.

B. Limits of clearing shall be contained within the areas within Right-of-way, Easement and Construction limits as shown on the approved Development Drawings.

C. Existing fences that, at the direction of the CITY, can be reused 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.

3.2 GRUBBING

A. The limits of grubbing shall be contained within Right-of-way, Easement and Construction limits as shown on the approved Development 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.

3.3 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 shall make every effort to protect existing bench marks, 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 CITY, and any trees designated shall be protected from damage by DEVELOPER's construction operations.

D. Existing trees and other vegetation to remain shall be protected as directed by the CITY:

1. Trees shall be protected by fencing, barricades, or wrapping. Trees which are trimmed are to be treated with a tree dressing.

2. Shrub 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. If archaeological resources are uncovered, DEVELOPER shall notify the CITY prior to proceeding with any WORK.

F. DEVELOPER is to 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's responsibility to coordinate the removal and erection of fences with each affected property owner and to maintain any temporary and relocated fences throughout the contract period.

H. DEVELOPER 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'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.

3.4 DISPOSAL

A. DEVELOPER shall remove and dispose of all excess material resulting from clearing or site preparation operations. DEVELOPER shall dispose of such materials in a manner acceptable to the CITY at an approved location where such materials can be lawfully disposed.

B. DEVELOPER 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 CITY assumes no responsibility for protection or safekeeping of any materials so retained by DEVELOPER.

C. Burning will be permitted if the required permits have been acquired from the local Fire Department. 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 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.

D. Material to be removed from site shall be removed as it accumulates to prevent any unsightly spoil areas.

END OF SECTION

SECTION 31 23 16
EARTHWORK FOR UTILITIES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. 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.

1.2 RELATED WORK

A. Section 33 14 13 – Water Distribution System

B. Section 33 31 00 – Sanitary Sewer Force Main

C. Section 33 31 00 – Sanitary Sewer

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), Annual Book of Standards

1. ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

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 C150, American National Standard for the Thickness Design of Ductile-Iron Pipe

7. ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes

B. Occupational Safety and Health Administration (OSHA), Code of Federal Regulations CFR Part 1926, Subpart P – Excavation, latest revision.

PART 2 PRODUCTS

2.1 BEDDING AND HAUNCHING STONE

A. Class IA or IB aggregate materials in accordance with ASTM D 2321 for gravity sewer, wet trench conditions, under roads, structures and driveways.

2.2 BACKFILL

A. 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

3.1 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.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. When necessary, compact subgrade surfaces to density requirements for backfill material.

3.3 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 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.

D. Moving trench boxes or sheeting: When using moveable trench support, care should be taken so not to disturb the pipe location, joints, or embedment. Removal of any trench protection below the top of the pipe and within the dimensions of the trench shown on the construction details (for Class 2, 4, and 5 Bedding) shall be prohibited after pipe embedment is compacted. Therefore, moveable trench supports shall only be used in wide trench construction where supports extend below the top of the pipe, or on a shelf above the pipe installed in a narrow trench in accordance with construction details. Any voids left in the embedment material by support removal shall be carefully filled with Class IA or IB aggregate materials and compacted.

3.4 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. Final grading and cleanup shall be continuous throughout the project. CONTRACTOR shall backfill all trenches at the end of each day.

6. Unless otherwise specified herein or shown on Drawings, wherever pipe trenches are excavated below elevation shown on Drawings, CONTRACTOR, at his own expense, shall fill the void thus made to proper grade with bedding and haunching material in accordance with Part 2.01A.

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 CITY and ENGINEER of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

F. Trench widths shall be in accordance with construction details for Class 2, 4, and 5 Bedding.

3.5 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. When significant (more than 30 L.F. continuously in a trench) ground water is encountered in soils containing fines, the CONTRACTOR shall notify the CITY. In these areas, the trench shall be lined with an approved filter fabric between the bedding and haunching material and the trench walls to reduce the effects of migration of fines which can diminish pipe support.

C. Unless specifically authorized by CITY, 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.

D. 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.

E. CONTRACTOR 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 CITY.

F. 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.

G. 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 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.

H. Storm water runoff shall be controlled by means of temporary erosion control methods.

I. 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.

3.6 BEDDING/BACKFILLING

A. The backfilling of trenches shall be started immediately after construction. Bedding shall be aggregate and backfill material shall be earth or aggregate in accordance with Part 2 and the Details. Material shall be deposited in the initial horizontal layer to the spring line of the pipe (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. 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, except under roads, structures, and driveways.

B. Compact aggregate and soil backfill under roads, parking lots, 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. The top 12 inches shall be compacted to 100 percent of maximum dry density. Consolidation by saturation or ponding will not be permitted.

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 OWNER and then re-backfilled.

D. Backfilling shall not be done in freezing weather except by permission of the CITY, 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. Where directed by the CITY, the backfill shall be mounded slightly above the adjacent ground.

F. Leave stockpile areas completely free of excess fill materials. After construction and cleanup, stockpile areas shall be seeded.

G. Use "Class 5" bedding in all wet trenches and under roads/driveways, regardless of pipe material.

H. Use "Class 5" bedding for all PVC gravity sewer.

I. Use "Class 5" bedding for all HDPE force mains.

J. Use "Class 2" bedding for DIP water line.

3.7 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, without the approval of the CITY. If necessary, the CONTRACTOR 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 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 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 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 in strict accordance with the instructions given by the CITY or the utility involved.

3.8 BORROW EXCAVATION

A. 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 CITY. Any soil tests required for approval of the borrowed material shall be at the DEVELOPER's expense.

3.9 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'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 CITY, shall be removed from the work site and disposed of by CONTRACTOR 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, D1556 or other ASTM in-place density tests approved by the CITY. Maximum density determination and in-place density tests shall be performed by a registered geotechnical engineering representative employed by the DEVELOPER. Frequency and location of tests shall be adequate to ensure proper compaction has been achieved.

B. The CITY shall reserve the right to employ and assign its own a registered geotechnical engineering representative to verify and conduct compaction testing if so inclined.

C. Evidence/documentation of the DEVELOPER's testing shall be submitted to the CITY at the CITY's request.

D. Areas not meeting the required compaction shall be recompacted until the desired degree of compaction is achieved. All costs associated with **re-testing** failed areas of compaction shall be paid for by the DEVELOPER.

3.11 PROTECTION

A. 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 at his expense.

3.13 SETTLEMENT

A. CONTRACTOR shall be responsible for all settlement of backfill, fills, and embankments which may occur during warranty period.

B. CONTRACTOR shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from CITY.

END OF SECTION

SECTION 31 23 17
ROCK REMOVAL

PART 1 GENERAL

1.1 SCOPE OF WORK

A. All rock materials discovered during excavation for the purpose of construction shall be removed. 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 executed 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.

1.2 RELATED WORK

A. Section 31 23 16 - Earthwork for Utilities

1.3 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.

1.4 QUALITY ASSURANCE

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

1.5 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, never closer than allowed by the Safety Fire Commissioner.

PART 2 PRODUCTS

2.1 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 CITY.

C. Delay Devices: Type recommended by explosives firm to be used as accessory to explosives. Subject to review by the CITY.

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

3.1 NOTICE

A. CONTRACTOR shall notify CITY staff 24 hours (Monday-Friday) prior to any blasting work.

3.2 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

B. 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.

3.3 ROCK REMOVAL - MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.

B. Where pipes are constructed on concrete cradles, rock shall be excavated to bottom of cradle as shown on approved construction 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 CITY 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 31 23 16 (Earthwork for Utilities), at his own expense.

3.4 ROCK REMOVAL - EXPLOSIVES METHODS

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).

1. 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 shale 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.

3.5 FIELD QUALITY CONTROL

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

END OF SECTION

SECTION 32 01 16
RESTORING PAVEMENTS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Work included in this Section consists of repair and replacement of pavements including: concrete, asphalt, surface treatment, and crushed storm or gravel roadways; sidewalks, curbs and gutters; stabilized shoulders; and driveways.

1.2 RELATED WORK

A. Section 31 23 16 – Earthwork for Utilities

1.3 QUALITY ASSURANCE

A. Coring and testing of pavement shall be performed at DEVELOPER'S's expense.

1.4 REFERENCES

A. Standard Specifications, Construction of Roads and Bridges, Latest Edition – Department of Transportation, State of Georgia.

PART 2 PRODUCTS

2.1 GRADED AGGREGATE

A. Shall be sound, durable, graded aggregate base, all of which passes the following, free of organic matter and debris.

Sieve Size	Percent Passing By Weight
Group 1 Aggregates	
2 in (50 mm)	100
1 – ½ in (37.5 mm)	97-100
¾ in (19.0 mm)	60-95
No. 10 (2 mm)	25-50
No. 60 (250 □m)	10-35
No. 200 (75 □m)	7-15

From DOT Spec – 815 – 9.A.B.

2.2 CONCRETE

A. Shall be ready-mixed concrete, 3,000 psi.

2.3 BITUMINOUS PRIME

A. Shall conform to GDOT Standard Specifications Section 821.01, latest edition.

2.4 ASPHALTIC CONCRETE

A. Shall be Hot Mix Asphaltic Concrete conforming to Section 400 of GDOT Standard Specifications (latest edition), from a source approved, in advance, by the CITY.

PART 3 EXECUTION

3.1 GENERAL

A. Restore all pavement, base, sidewalks, curbs and gutters, shoulders, and driveways equal to or better than the original, but not less thickness than specified herein or shown on the Drawings.

B. Carefully backfill any excavated area on which pavement, sidewalks, or curbs and gutters are to be placed as specified in Section 31 23 16 of these Specifications.

C. All pavement restoration shall be done in accordance with the requirements of the authorities within whose jurisdiction such pavement is located. All highway utilities are to be maintained, and work shall conform to the rules and regulations of the authority, including the use of traffic control signage. The DEVELOPER shall provide all such bonds or checks which may be required by the highway authorities to insure proper restoration of paved areas, at no cost to the OWNER.

D. It is the DEVELOPER's responsibility to coordinate, communicate and comply with local authority that has jurisdiction. All work shall comply with the requirements of this local authority.

E. If, prior to the expiration of the period of maintenance, any pavement or gravel roadways, curbs, or storm drainage structures which have been damaged, due to undermining, or for any other cause which may be attributed to the work of the DEVELOPER, the DEVELOPER shall remove such damaged or injured surfaces, foundations of same, and all loose earth. DEVELOPER shall then backfill with graded aggregate base, properly compacted; and furnish, place and maintain the pavement, gravel roadway, curbs, or storm drainage structure as required.

F. Work which the DEVELOPER may perform in connection with the replacement and repair of damaged roadways or storm drainage structures 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 shall furnish evidence to the CITY that the work has been completed to the satisfaction of such authority.

G. Before placing any base, pavement, sidewalk or curb and gutter, cut the existing pavement along the trench line back from the top edges of the ditch line for a distance of at least twelve inches (12") on each side of the ditch to allow solid bearing edges for base and pavement.

H. All cuts shall be made by channeling machine, pneumatic tools, or such other methods that will furnish a clean cut in the pavement and pavement base without undue shattering.

1. For pipeline trenches, the repaired area should adhere to the following procedures:

a. Pavement and trench to be opened as shown in standard details. After the utility line and any required bedding have been placed, the backfill and overfill material shall be placed as described in the project specifications, up to the subbase. At this point, the pavement shall be cut back at least 12-inches on each side of the trench or to visible overbreaks, whichever is greater, to a depth of 2-inches with a concrete saw. Remove pavement as necessary. The subbase material shall be carefully placed and shaped. Water shall be added as necessary to provide a damp, but not wet, subbase before the concrete base is placed. The vertical face of the existing pavement shall be sprayed with a fine mist of water to moisten the surface. The new concrete base shall then be poured before this surface dries out. The base shall be placed with care, making sure it is worked back into all corners and into the rough surface of the existing pavement.

b. After the concrete base has cured, the surface of the concrete base and vertical edges of the existing paving must be clean and dry before the tack coat is applied. The tack coat shall be applied to the surface of the new concrete base and brushed into the corners and onto the vertical edges of the old pavement to provide a bond and to seal out water. The hot asphaltic plant mix surface material shall be immediately placed after the surface of the tack coat has dried to the point that it is sticky to the touch.

I. The DEVELOPER shall provide graded aggregate base over trenches in public streets promptly after completion of backfill to provide full use of the street with a minimum of delay. Steel plates shall be placed over the trenches until placement of concrete or asphalt, as directed on the Contract Drawings is complete.

J. Should settlement, cracks or other indications of failure appear in pavements, the paving shall be removed to the extent necessary to secure firm, undisturbed bearing and shall be relaid in a satisfactory manner.

K. Bituminous Paving

1. Transport bituminous concrete paving mixes from an approved mixing plant to the work site in tight vehicles with metal bottoms previously cleaned of all foreign materials. All such vehicles shall be suitably insulated to avoid heat loss. Each load shall be covered or otherwise protected to prevent cooling and loss of ingredients.

2. Prime base course and place surface course in accordance with Section 400 of the GDOT Standard Specifications. Surface course in place, compacted thickness shall be 1½" minimum unless otherwise shown on the Drawings.

3. Dump and spread mixture on primed base with a spreading and finishing machine so that after compaction, surface will be smooth, of uniform density, and meet requirements for typical cross-sections shown on the Drawings. Other placing means may be proposed.

4. Unless otherwise indicated or approved, place all bituminous concrete and complete initial rolling during daylight hours. Mixtures shall be at a temperature of between 225 degrees F. and 325 degrees F. when placed.

5. During application take care to prevent the splattering of adjacent curbs, gutter, concrete paving, and structures. Hand spreading may be employed where machine is impractical.

6. Bituminous concrete paving finish grades shall be approximately 6" below adjacent concrete sidewalks, and/or curbs, except as specifically straight within ½" in 10' when checked with a straight edge. No "bird baths" will be allowed.

7. Provide sufficient rollers to obtain the required pavement density. Continue rolling until no further compression can be obtained and all roller marks are eliminated.

8. Rollers shall not be permitted to stand on pavement which has not been fully compacted and which has not cooled to atmospheric temperature. To prevent adhesion of surface mixture to roller, keep wheels thoroughly moistened with water; however, an excessive use of water will not be permitted.

9. Maintain slow enough movement of roller at all times to avoid displacement of mixture. If any displacement occurs, correct at once by use of rakes and addition of fresh mixture.

10. Take precautions to prevent dropping of oil, gasoline, or grease on pavement.

11. Along edges of pavement along curbs, headers, aprons, manholes, valve boxes and similar places not accessible to roller, thoroughly compact asphalt with lightly oiled hand-operated vibrating rollers or mechanical tampers.

12. After final rolling, do not permit vehicular traffic on asphalt pavement until it has cooled and hardened, and in no case sooner than 6 hours.

L. Surface Treatment

1. Shall conform to triple surface treatment as defined in the GDOT Standard Specifications, Section 424.

2. DEVELOPER shall select the aggregates and bituminous material to be used subject to approval of CITY.

3. Aggregates and bituminous material shall conform to, and be applied in conformance with, Section 424 of GDOT Standard Specifications (latest edtion).

4. Spread materials at a uniform rate; use hand work where necessary to insure uniform, adequate cover.

5. Provide sufficient rolling to key the aggregate into bituminous material.

6. Broom surface as necessary.

7. Do not permit traffic on any course until the bituminous material has cooled and set.

M. Portland Cement Concrete Pavement

1. Shall conform to requirements of Section 430 of GDOT Standard Specifications (latest edition). Concrete shall be 4,000 psi.

2. Place concrete in such a manner as to require as little rehandling as possible.

3. Provide reinforcement equal the original pavement with sufficient ties to insure an integral slab.

4. Vibrate concrete over its full width and depth.

5. Finish by float or finishing machine, continuously following placement.

3.2 CLEAN UP

A. Before work is accepted by the CITY, remove excess material not used from job site.

B. Any subsequent settlement of pavement or backfill, or erosion over or in the trenches shall be replaced or repaired and the surface shall be brought to grade.

C. Any and all items disturbed by the construction shall be restored to original condition as soon as possible after completion of the work.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.1 SCOPE OF WORK

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

1.2 REFERENCES

A. ASTM A 392 Zinc-Coated Steel Chain Link Fence Fabric.

B. ASTM A 824 Metallic-Coated Marcelled 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

2.1 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.

2.2 FENCE MATERIAL

A. Posts and Fabric

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

	Fence Height 8 Feet
Fabric	2" Mesh / 9 Ga.
Corner Post	4"
Line Post	2"
Gate Post	4"
Top Rail and Brace	1 □"

2. 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.

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

C. 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.

D. Barbed wire supporting arms shall be at an angle of 45°, and shall be fitted with clips or other means for securing three lines of barbed wire, the top line 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.

E. Post Brace

1. 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 3/8" 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.

F. Stretcher Bar

1. 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.

G. Wire

1. 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. Wire Ties shall be 9 gauge.

3. Barbed wire shall consist of (3) strands of 12 gauge with 4 points at 5" o.c. per ASTM A-121.

H. Gate 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, that provides security against removal or breakage connections.

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 12" (NPS).

I. 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.

J. 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, 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 OWNER's direction.

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

2.3 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: Black color.

D. Vertical vinyl privacy slats: Black color.

E. Vinyl Components: Black color.

F. Accessories: Same finish as fabric.

PART 3 EXECUTION

3.1 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.

3.2 POST INSTALLATION

A. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings 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 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 PS-3.

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.

3.3 RAIL INSTALLATION

A. Top Rail: Connect securely to the posts using boulevard clamps or other suitable means, so that a continuous brace is formed.

3.4 CHAIN LINK FABRIC

A. 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 gage galvanized wire spaced 12" maximum.

3.5 TENSION WIRES

A. 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-inches on center.

3.6 BARBED WIRE

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

3.7 GATES

A. 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.

3.8 STRETCHER BARS

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

3.9 BRACE ASSEMBLIES

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

END OF SECTION

SECTION 33 05 07
HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section describes materials and equipment required to install potable water main, reclaimed water 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 approved construction drawings. Work shall include, but not be limited to, proper installation, testing, and environmental protection and restoration.

B. Protect all known underground utilities, structures, and drains using industry standard techniques.

C. Directional drilling 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, GDOT, and OSHA rules and guidelines for traffic control and safety.

1.2 REFERENCES

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

1.3 QUALITY ASSURANCE

A. The CONTRACTOR shall provide the City with 72 hours' notice (Monday – Friday) prior to any underground drilling operations.

B. At the request of the CITY, the CONTRACTOR shall provide an 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 CITY 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

2.1 HIGH DENSITY POLYETHYLENE PIPE FOR HORIZONTAL DIRECTIONAL DRILLING

A. See Specification 33 31 00.

2.2 TRACER WIRE

A. WIRE

1. Tracer wire for pipe HDD applications shall be 3/16" diameter 7x7 stranded copper clad steel extreme strength wire with 4,700 lb break strength with a minimum 50 mil HDPE insulation thickness made for direct bury.

2. Acceptable manufacturers are as follows:

   a. Soloshot Extreme by Copperhead Industries, LLC

   b. Or approved Equal

B. CONNECTORS

1. All mainline tracers wires shall be interconnected at tees, crosses, etc. using lockable connectors specifically manufactured for direct bury installation.

2. Connectors shall be dielectric silicon filled to seal our moisture and corrosion.

3. Twisted connections, wire nuts, etc. sealed with electrical tape are prohibited.

4. Acceptable manufacturers are as follows:

    a. Copperhead Industries, LLC

    b. Or approved equal

2.3 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.

2.4 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.

2.5 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

1. 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 12inches 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 form the drilling fluid and render the drilling fluid reusable. Spoil separated from the drilling fluid will be stockpiled for later use or disposal.

2.6 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.

2.7 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 of, and control, 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 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. The CITY 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.

3.2 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 CITY 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 CITY.

E. 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 CITY and CITY 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.

F. Upon completion of pilot hole phase of the operation, a complete set of "as-built" records shall be submitted in duplicate to the CITY. These records shall include copies of the plan and profile drawing, as well as directional survey reports as recorded during the drilling operation.

G. 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.

H. 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 bentontie 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.

I. The pipe shall be joined together according to manufacturer'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.

3.3 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.

3.4 TRACER WIRE INSTALLATION

A. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

B. Trace wire systems shall be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

C. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

D. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5’ intervals.

E. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.

F. In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

3.5 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 33 14 13 or 33 31 00.

C. The manufacturer's recommendations on bend radius and tensile strength shall be observed.

3.6 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 31 23 16.

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 to the satisfaction of the affected property owner.

3.7 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 CITY 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 33 05 08
BORING AND JACKING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. WORK covered in this section includes furnishing all labor, materials, accessories, equipment and service required to properly complete pipeline construction using tunneling or boring and jacking under railroads and state, county, or city highways and streets, as described herein and/or shown on CITY's Standard Details and Construction Drawings.

1.2 RELATED WORK

A. Section 31 23 16 - Earthwork for Utilities

B. Section 33 14 13 - Water Distribution Systems

C. Section 33 31 00 - Sanitary Sewer Force Mains

D. Section 33 31 00 - Sanitary Sewer

PART 2 PRODUCTS

2.1 MATERIALS

A. Boring and Jacking

1. 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 crossings shall be 0.375 inches. Minimum wall thickness for roadway crossings shall be 0.250 inches.

2. Steel casing shall be bituminous coated on the outside.

3. Minimum Steel Casing Diameters:

Pipe Diameter	Minimum Steel Casing Diameter
6-inch	12-inch
8-inch	16-inch
10-inch	20-inch
12-inch	20-inch

B. All carrier piping shall be installed through casing with restrained joints for water and gravity sewer in accordance with Section 33 14 13 (Fast-Grip Gasket" or "Field-Lok Gasket) or welded for HDPE force mains.

C. Concrete encasement shall be Class "D" (2500 psi).

PART 3 EXECUTION

3.1 GENERAL

A. Any solidification of embankments, boring heading, or sides shall be the DEVELOPER'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 02220 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 CITY.

D. DEVELOPER 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.

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 with brick bulkheads using brick and mortar.

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 wooden blocking/wedges or prefabricated pipe collars spaced radially around pipe and secured to remain firmly in place. Spacing of such blocking or collars shall be no greater than ten (10') feet on center longitudinally in casing pipe.

3.2 HIGHWAY/ROADWAY CROSSINGS

A. DEVELOPER is responsible for the 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 shall review and coordinate construction methods, materials, and safety measures with the affected OWNER.

C. For open trench cut installations, DEVELOPER 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 31 23 16 (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 wetboring.

J. No excavated materials or equipment shall be placed on the pavement or shoulders of roadways.

K. In no instance will DEVELOPER 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.

END OF SECTION

SECTION 33 05 61
MANHOLES

PART 1 GENERAL

1.1 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.

B. Construction of cast-in-place or precast manholes shall conform to ASTM C-478 (latest edition).

1.2 RELATED WORK

A. Section 31 23 16 - Earthwork for Utilities

B. Section 09 97 23 – Coatings for Manholes and Wastewater Structures

1.3 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.

H. ASTM C 990, Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.4 QUALITY ASSURANCE

A. 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.

1.5 DEPTH

A. The maximum manhole depth shall be 20 vertical feet from the ground to the lowest invert.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete

1. Concrete, cement, sand and water used in manhole construction shall conform to the applicable requirements stated in ASTM C-478.

2. Steel reinforcement shall conform to the applicable requirements of ASTM C-478.

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 with the typical manhole details as shown on Drawings, concrete to be Type II, 4,000 psi concrete.

2. All Precast manhole sections shall be wetcast and 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. Coring will only be permitted with approval of CITY when unknown field conditions arise.

6. Holes in precast bases to receive sewer pipes shall be provided with flexible manhole connectors of high quality synthetic or natural rubber and conform to ASTM C923. Approved products are ALOK-EX-CEl by ALOK Products, Inc. or KOR-N-SEAL by NPC, Inc. or approved equal.

7. Manhole inverts shall be constructed of 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. Lift inserts must be integrally cast into the structures. Holes will not be permitted to penetrate the entire wall thickness.

9. Manholes Connecting to Existing System

    a. When connecting a proposed sewer line to an existing sewer line, the existing line shall be cut and a new manhole with solid base shall be installed and reconnected to the existing sewer pipe upstream and downstream in accordance with this specification.

    b. Invert of the new line must be higher than springline of existing pipe if possible.

    c. A CITY inspector must be present when cutting the existing pipe.

    d. Doghouse manholes are not permitted.

10. Manhole Corings

    a. The DEVELOPER shall be responsible for performing manhole corings.

    b. The coring must not be backfilled until approved by the CITY inspector.

    c. Failure, for any reason, to have the CITY inspector approve the coring will cause all work to be halted until the cored manhole is excavated and the rubber boot exposed.

    d. Cores for “future development” or “future tie-ons” are only allowed when installed with a rubber boot, 10 feet of ductile iron pipe, and a mechanical joint plug.

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 equivalent to Neenah Foundry Co., No. R-1642. Where called for on drawings, frames and covers shall be equivalent to Neenah Foundry Co., No. R-1916-F (bolt down).

3. Covers:

   a. Watertight manhole covers, where indicated on Drawings, shall be equivalent to Neenah Foundry Co., No. R-1916-F (bolt down). All bolts or screws must be stainless steel.

   b. All manholes located outside of the street or the street right-of-way shall have bolt down covers.

   c. Contact surfaces of all manhole covers and corresponding supporting rings in rims shall be machined to provide full perimeter contact.

   d. Sanitary sewer manhole covers shall have cast on the top in letters 2 inches high, "Sanitary Sewer". Cover shall be Neenah Type "A".

4. 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., or approved equivalent, 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.

F. All manholes with drops of 24 inches or more shall be outside drop manholes. Inside drop manholes are not acceptable. All drop manholes shall include all exterior drop pipe additions to standard manholes complete with drop pipe encasement, excavation, and foundation cushion. All outside drop pipe materials to be ductile iron, including one (1) joint of ductile iron pipe entering the manhole.

G. Manhole coating shall comply with Section 09 97 23.

H. 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.

PART 3 EXECUTION

3.1 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 sealant. After joint has been made, joint opening shall be sealed with grout. Grout shall be applied from both sides of joint and shall be struck smooth and flush on the inside.

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 31 23 16 (Earthwork for Utilities).

G. Manholes are required to be installed at the following locations:

1. At the end of each line.

2. At all changes in grade, line size, or alignment.

3. At distances not greater than 400 feet.

4. At any location to assure the change in horizontal alignment is never less than 90°

H. Layout of manholes that connect to the existing system shall comply with items 3.01 A-G above as well as Details. Sewer lines must be properly plugged before being cut and a pump shall be provided to divert sewage from the manhole directly upstream of the cut line to a downstream manhole. BYPASSED SEWAGE SHALL NOT BE DIRECTED ONTO THE GROUND OR INTO ANY RECEIVING STREAMS.

I. All new manholes and wetwells shall be coated as per specification section 02603. When connecting to an existing manhole via force main said existing manhole shall be coated as per specification section 09 97 23.

3.2 INSPECTION

A. After completion of sanitary sewer systems, all manholes shall be visually inspected to insure all joints are slated, all lift holes are grouted, and all inverts are properly constructed. Insure all joints are properly seated, 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 cone section and the seal inflated in accordance with the manufacturer's recommendations.

5. 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 manhole shall pass if the time is greater than 60 seconds for 48-inch diameter, 75 seconds for 60-inches, and 90 seconds for 72-inch 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.

C. The system will not be accepted by the CITY until all manholes pass a vacuum test.

END OF SECTION

SECTION 33 14 13
WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 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.

1.2 RELATED WORK

A. Section 31 23 16 - Earthwork for Utilities

B. Section 33 14 13.01 - Water Service Connections

1.3 REFERENCES

A. 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.

1.4 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 so as to least interfere 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

2.1 GENERAL

A. All water distribution piping mains shall be ductile iron only. All materials shall be new and unused. 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).

2.2 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.

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-degrees of deflection.

E. Restrained Joints – DIP

1. Restrained joints shall be "Fast-Grip Gasket" by ACIPCO or "Field-Lok Gasket" by U. S. Pipe.

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

F. Retainer Glands for Restraint - DIP

1. Retainer gland restraints shall be "Mega-Lug 1100 Series" by EBBA Iron Sales, or approved equal.

2.3 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 cement mortar lined in accordance with AWWA C104 standard thickness.

B. Joints shall conform to AWWA C111.

C. Restrained joint for mechanical joints shall be accomplished with MJ Field Lok Gasket by U. S. Pipe or "Mega-Lug 1100 Series" by EBBA Iron Sales, or approved equal.

D. Fittings shall be mechanical joint unless otherwise specified on Drawings.

2.4 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. Shall be of iron body, bonded epoxy, and shall have non-rising bronze stem, and shall be wrench operated.

D. Valves shall open by turning counter-clockwise.

E. 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 to be spaced every 1000 feet and in every direction at intersections (i.e. three valves at 3-way intersections and four valves at 4-way intersection.)

J. Acceptable manufacturers are Mueller or M & H.

2.5 PRESSURE REDUCING VALVES

A. Pressure Reducing Valves and vaults shall be designed and sized by the DEVELOPER's engineer, and reviewed by the CITY. Pressure Reducing Valves shall be as manufactured by Cla-Val. Some installation may require high and low flow set-ups.

B. 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 CITY and ENGINEER at the Preconstruction Conference.

2.6 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.

B. Orifice size shall be as follows:

MAXIMUM OPERATING PRESSURE (PSI)						
PSI	50	100	150	200	250	300
ORIFICE	5/16"	5/16"	1/4"	3/16"	5/32"	1/8"

C. In most cases a 3/16" orifice will be adequate. However, DEVELOPER is to verify actual size with City prior to installation.

2.7 AIR/VACUUM VALVES

A. Shall be cast iron body with stainless steel (ASTM A240) trim and float equal to Crispin AL20 or approved equivalent.

B. Orifice size shall be 2” diameter.

C. Internal parts shall be stainless steel (ASTM A240) or bronze.

2.8 VALVE MARKERS

A. Valve markers shall be furnished with each valve and air valves installed as indicated on the drawings, with exception of fire hydrant valves.

B. Flexible valve markers shall be used when located in the clear zone as dictated by the GDOT.

1. Marker shall be reboundable, flexible post as per *USA Blue Book* the RHINO 3-RAIL marking post, color blue, 66”, catalogue no. 70456.

2. Label Decal shall be white with blue text, 2-7/8” X 14”, reading WARNING WATER VALVE. Decal shall also bear the name, CITY.

2.9 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. Base size and extension piece shall be as required for each individual size of valve and depth.

2.10 TAPPING VALVES

A. DEVELOPER/CONTRACTOR is to submit the manufacturer, size, and type of mechanical joint tapping sleeve and valve to the City for review and approval prior to installation.

B. Tapping machines and competent supervision shall be provided in presence of CITY personnel.

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 equal size of the existing main. 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.

2.11 SAMPLING STATION

A. If required by the CITY and depending on location, a water sampling station may be required on the proposed water lines. The sampling station shall be manufactured by Water Plus Corporation Model #301D-36-NL. The station shall be above-grade 36-inch dry barrel and lead-free. DEVELOPER shall submit shop drawings to the CITY for review and approval.

PART 3 EXECUTION

3.1 GENERAL

A. No water main may be installed on or in close proximity of an abandoned landfill site or any site used for waste disposal.

3.2 ALIGNMENT AND GRADES

A. Depth of Pipes

1. All water line shall be installed at a minimum depth of 48-inches of cover from the top of the pipe to finished grade or at a cover depth of 48-inches below the adjacent, parallel edge of roadway, whichever depth is greater shall govern.

2. Where obstructions are encountered, depth may be greater than 48-inches.

B. Valves

1. Shall be installed with stems vertical.

C. Pipe Curvatures

1. Pipe shall be installed within horizontal or vertical permissible deflection at joint, as specified by manufacturer or AWWA Specification C600 (Latest Edition).

3.3 INSTALLING PIPE

A. General

1. Pipe and appurtenances shall be installed only when trench conditions are suitable.

2. Trenches must be dry.

3. Proper implements, tools, and facilities shall be provided by DEVELOPER for safe and convenient performance of the work.

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 City, 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.

    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.

3.4 CUTTING PIPE

A. 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.

3.5 DETECTION OF ALL PIPE

A. 12-gauge, solid strand detection wire shall be installed 18-inches above all waterlines, not connected to the pipe, with waterproof connectors and connection at every valve and hydrant.

B. Marking tape showing “caution buried waterline” shall be installed 24-inches above all waterlines.

3.6 JOINTING

A. Pipe, fittings, and valve joints shall be in strict compliance with manufacturer's printed instructions.

B. Mechanical Joints

1. Thoroughly clean outside of spigot and inside of bell.

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 adaptors if required to join bells and spigots of different sizes.

2. Thoroughly clean inside of bell and outside of spigot end.

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.

3.7 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. **F**or 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 in the Standard Detail drawing.

3.8 THRUST BLOCKING

A. Plugs, caps, tees, bends, and valves, unless otherwise specified, shall be provided with reaction blocking and joint restraint. Concrete reaction blocking shall conform with these specifications and the applicable standard details. Joint restraint shall be as specified in Part 2.

B. Concrete reaction blocking shall conform with 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 approved construction drawings.

E. Blocking shall, unless otherwise shown or directed, be so placed that pipe and fitting joints will be accessible for repair.

F. All fittings shall be restrained and blocked.

3.9 CONNECTION TO EXISTING MAINS

A. Connections to existing water mains shall be made under the supervision of CITY personnel.

B. DEVELOPER shall coordinate with the CITY regarding connections to existing mains.

C. Connection to existing mains shall be made at such time as to minimize disruption of water service to public.

D. Connections to existing mains shall be made using proper fittings and materials to suit actual conditions.

E. Existing pipes which are cut or damaged by CONTRACTOR shall be repaired, reconnected, and returned to service in equal or better condition.

3.10 SEPARATION OF WATER MAINS AND SEWERS

A. Parallel Separation

1. Water mains shall be laid at least ten (10) feet horizontally, measured edge-to- edge, from any existing or proposed sanitary sewer, storm sewer, or sewer manhole.

2. When local conditions prevent a horizontal separation of 10 feet, the water main may be laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at an elevation such that the bottom of the water main is at least 18 inches above the top of the sewer.

B. Crossings

1. Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. At any crossing, one full joint of water pipe shall be centered over sewer line.

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

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

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

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

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

d. Both the sewer and the water main shall be constructed of water pipe and subjected to hydrostatic tests, as prescribed in paragraph 3.12 of this Section.

3.11 STREAM AND UTILITY CROSSINGS

A. Pipe shall be placed beneath stream beds 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 stream beds or ditches, unless approved by ENGINEER in writing.

3. Provide a minimum of 18-inch earth or sand cushion between proposed water line and any other utility or structure, or as indicated on drawings.

B. 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 CITY'S' review. The DEVELOPER's ENGINEER shall consider the soils, creek flow, pressure, topography, thrust restraint, construction techniques allowed, etc. to design and specify appropriate layout and pipe joints.

C. The DEVELOPER shall be responsible for all and any necessary permitting by all authorities having jurisdiction for stream crossings or crossing of state waters including but not limited to EPD, Jackson County, and the Army Corps of Engineers.

D. Gate valves shall be provided at both ends of a stream crossing to allow the section to be isolated for testing or repair.

3.12 HYDROSTATIC TESTS

A. Pressure and leakage tests will be required on each section of line between valves and shall be conducted in accordance with AWWA C600.

B. General Procedure

1. Furnish and install corporation stops at high points on line to release air as line is filled with water.

2. Furnish suitable pump, connections, and necessary apparatus including means for accurately measuring water introduced into line during testing.

3. 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.

a. Test pressures shall be as directed by the CITY.

b. Test shall be conducted for a minimum of 2 hours.

c. Pressure shall not vary by more than 5 psi during test.

4. Testing Allowance.

a. 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.

b. The maximum allowable makeup water shall be based on the following formula 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.

$$L = \frac{S \times D \times (P^{0.5})}{148{,}000}$$

c. No pipe installation shall be accepted if the amount of make-up water required exceeds the amount determined in the formula above.

5. Locate, remove, and replace any defective pipe, valves, fittings, or hydrants.

6. Repeat tests until results are satisfactory to the CITY.

3.13 DISINFECTION

A. 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, and EPD Minimum Standards for Public Water Systems.

B. Procedure

1. Flush line prior to disinfection. Flushing shall produce minimum velocity of 2.5 feet per second in pipe.

2. The “tablet method” of disinfection consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is complete. In accordance with EPD Minimum Standards for Public Water Systems, the tablet method is not allowed.

3. The chlorine solution used for disinfection of water mains shall have a free chlorine residual concentration not less than 25 mg/L. This heavily chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants shall be operated to ensure disinfection of the appurtenances. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine. Re-chlorination if required results are not obtained on all samples.

4. 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/1.

5. 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 water discharges to a State Water, a reducing agent shall be used to neutralize the chlorine residual thoroughly.

6. In accordance with AWWA C651, cross connection / backflow prevention measures shall be taken before and during disinfection of constructed water mains to prevent backflow into active portions of the distribution system or into sections that have already been disinfected but not yet placed into service.

7. All samples shall be collected in the presence of CITY personnel. DEVELOPER shall have sample analyzed by a certified laboratory.

C. Repeat disinfection procedures until bacteriological analysis results are acceptable to the CITY.

END OF SECTION

SECTION 33 14 13.01
WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. WORK covered by this Section consists of furnishing all materials and installation of all service connections to the water system.

B. All new service connections shall be metered.

1.2 RELATED WORK

A. Section 33 14 13 – Water Distribution System

1.3 REFERENCES

A. Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inch, for Water Service (AWWA C901)."K" Soft Temper Copper Tubing (ASTM B88)

B. Copper Tubing (AWWA 78-CR Type "K")

C. Cold Water Meters – Displacement Type, Bronze Main Case (AWWA C700).

D. Cold Water Meters – Compound Type (AWWA C702)

E. Cold Water Meters – Electromagnetic and Ultrasonic Type

F. Specifications for Gray-Iron Castings (ASTM A-48).

G. Underground Service Line Valves and Fittings (AWWA C800)

PART 2 PRODUCTS

2.1 SERVICE TUBING

A. Up to 2-inch diameter shall be copper tubing conforming to ASTM designation B88 for Type "K". Soft temper or AWWA 78-CR Type "K". Tubing may be in 20-foot straight lengths or 60 to100-foot coils.

B. Services 3-inches or greater diameter shall be ductile iron, as specified in Section A above, conforming to AWWA C110.

C. Tubing O.D. shall be compatible with accessories specified herein below.

2.2 WATER METERS 1-INCH OR LESS

A. Residential meters up to 1-inch shall be R-900 radio-read by Neptune, Model T-10® positive displacement type conforming to AWWA C700 latest edition or Model MACH 10® Ultrasonic Meter conforming to AWWA C715. The CITY shall determine which meter is applicable for each application or development.

B. All meters shall comply with NSF and the Safe Drinking Water Act. Meters shall read in gallons. Meters shall be compatible with meter yokes specified herein below.

2.3 COPPER SETTERS

A. Copper Setters shall be Ford 70 Series or AY McDonald sized for the appropriate meter with dual check valve on outlet, and locking by-pass for meters up to and including 2” in size.

1. Setters ¾-inches and 1-inch shall be Ford 70 Series or AY 724-207WDTD 33.

2. Setters 2-inches shall be Ford 70 Series or AY 724-212WDTD 33, each with telescoping flanges.

2.4 METER BOXES

A. Residential and small commercial meter boxes shall be Carson Industries plastic box, size 18-inches long x 9-1/2-inchds wide x 11-inches deep.

B. Meter Box Cover shall be Carson Industries cast iron cover, size 16-3/4-inches long x 11-inches wide with circular cut-out for electronic reading pad. Where a water meter box is subject to vehicular traffic a Quazite meter box or approved equivalent and lid shall be used.

2.5 ACCESSORIES

A. Services shall be compatible with pipe and service tubing furnished.

B. Service saddles shall be Smith-Blair or Romac for all pipe, 3/4" tap size.

C. Corporation stop shall be Ford Catalog Number F1000, 3/4-inch size.

D. Cut-off valve shall be a Watts Series WBV brass ball valve.

E. Valve box for cut-off valve shall be a Carson Industries, 6-inch circular box – plastic.

2.6 TWO-INCH AND LARGER METERS

A. There are two meters approved for meters two-inches and larger, Compound or Ultrasonic. The City will determine which type is applicable for each site or development.

B. Compound Meters

1. Compound Meters shall be R-900 Neptune electronic/ radio read Compound Meter Model Tru/Flo®. Compound meters shall consist of a combination of an AWWA Class II turbine meter for measuring high rates of flow and a nutating disc type positive displacement meter for measuring low rates of flow enclosed in a single maincase. An automatic valve shall direct flows through the disc meter at low flow rates and through the turbine meter at high flow rates. At high flow rates, the automatic valve shall also serve to restrict the flow through the disc meter to minimize wear.

2. All meters shall comply with AWWA C702, NSF and the Safe Drinking Water Act. Meters shall read in gallons.

C. Ultrasonic Meters

1. Ultrasonic Meters shall be R-900 Neptune electronic/ radio read Model Mach 10®. The measurement technology shall be based on ultrasonic sensing featuring no moving parts.

2. All meters shall comply with AWWA C715, NSF and the Safe Drinking Water Act. Meters shall read in gallons.

D. The meter serial number shall be imprinted on the meter flange.

E. Higher risk connections must specify an RPZ type backflow preventor (i.e. medical, process manufacture, etc.)

2.7 FIRE METERS

A. There are two meters approved for fire meters, Compound and Ultrasonic. The City will determine which type is applicable for each site or development.

B. Compound Meter

1. Compound Fire Meters shall be R-900 Neptune electronic/ radio read HP PROTECTUS III® FIRE METER, (touch read),pro-read auto detect reading in gallons. Meters shall consist of a combination of an AWWA Class II inline horizontal axis turbine for measuring high rates of flow and a positive displacement bypass meter conforming to AWWA C700 for measuring low rates of flow. An automatic valve shall direct the flow from the bypass meter to the mainline meter as flow rates increase and back to the bypass meter as flow rates decrease. All components of the meter assembly shall be both UL (Underwriter's Laboratory) Listed and FM (Factory Mutual) approved for fire service use. Meters shall be certified to NSF/ANSI 61 and NSF/ANSI 372 requirements.

2. All meters shall comply with AWWA C703, NSF and the Safe Drinking Water Act. Meters shall read in gallons.

C. Ultrasonic Meters

1. Ultrasonic Meters shall be R-900 Neptune electronic/ radio read Model Mach 10®. The measurement technology shall be based on ultrasonic sensing featuring no moving parts.

2. Meter shall be UL listed and FM approved.

3. All meters shall comply with AWWA C715, NSF and the Safe Drinking Water Act. Meters shall read in gallons.

D. The meter serial number shall be imprinted on the meter flange.

E. Clearly show all of the proposed metering locations and arrangements on the plans for the fire meter and back flow preventor.

F. The DEVELOPER shall furnish all required materials and labor and install said meters, BFP and vaults. Submit shop drawings of the meter, BFP and vault to the CITY for review and approval.

1. DEVELOPER shall pay CITY for all required connection fees.

2. Detailed design drawings and dimension of meter and meter vault, BFP and vault shall be submitted to the CITY for review and approval prior to installation.

PART 3 EXECUTION

3.1 GENERAL

A. Service connections shall be installed in the same manner as water distribution mains, and in accordance with Section 33 14 13 of these Specifications, except for depth which shall be 24 inches at the meter box.

B. Meter boxes shall be placed as shown on the construction drawings or as directed by CITY.

C. Service connections shall be made where directed by the CITY.

D. Jack and bore service tubing under pavement. Service tubing shall be from one (1) continuous tube. No pavement cutting will be permitted.

E. Water meters are to be set in Ford 70 series copper setters or approved equivalent. The backflow preventor is to be located on the customer side of the meter. Copper setters are to be plumb.

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.

G. All meters, fittings, piping and accessories shall be approved by the National Sanitation Foundation (NSF) with the seal of approval for potable water.

END OF SECTION

SECTION 33 14 19
FIRE HYDRANTS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work to be done under this Section of the Specifications consists of furnishing all materials and performing all labor necessary for the complete construction of fire hydrants, as indicated on the Contract Drawings and/or specified.

1.2 REFERENCES

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

PART 2 PRODUCTS

2.1 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/HS or M & H Model 129.

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-inches.

E. Hydrants shall have name of manufacturer, year manufactured, and nominal valve size in legible, raised letters cast on barrel of bonnet.

F. Hydrant Security Check Valve

1. For Mueller Super Centurion 250/HS High Security Fire Hydrant, the hydrant shoe shall incorporate a fabric and steel reinforced elastomeric flapper check valve located inside the fire hydrant inlet, allowing normal operation and access to the hydrant main valve through bonnet or ground flange.

2. For M & H Model 129 Fire Hydrant, a Kennedy Valve Patriot Hydrant Check Valve shall be connected to the fire hydrant boot. The hydrant check valve shall incorporate an alum-bronze clapper with resilient seat and stainless steel spring.

G. 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 "0" ring which shall serve as a pressure seal.

H. Operating Nut

1. Shall be of regular pentagon shape measuring 1" 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.

I. 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.

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

K. 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, light weight disassembly wrench without excavation.

L. 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.

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

2.2 SPARE PARTS

A. DEVELOPER shall provide the CITY with two (2) sets of maintenance wrenches and five (5) breakaway repair kits for each type of hydrant provided.

PART 3 EXECUTION

3.1 SETTING HYDRANTS

A. Hydrants to be installed so the finish grade is at the hydrant bury line.

B. Spacing between hydrants shall not exceed 500 feet minimum with 300-foot hose lays to all buildings.

C. Hydrants shall be oriented towards the curb or away from the curb depending on other proposed utilities within the development. The City shall determine this on a case-by-case basis.

D. Extension required to bring hydrant to proper grade shall be furnished and installed by DEVELOPER at his expense.

E. Fire hydrant assembly shall consist of the ductile iron tee, gate valve, ductile iron lead pipe, and hydrant. Hydrant anchor couplings shall be used. PVC IS NOT ALLOWED FOR HYDRANT ASSEMBLY.

3.2 PAINTING, COATING AND LUBRICATING

A. Iron parts of hydrant shall be thoroughly cleaned inside and outside.

B. All fire hydrants shall be painted “Safety Yellow” coated at factory.

C. 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.

D. Hydrants shall be covered with two (2) coats of paint, the first being allowed to dry thoroughly before applying second coat.

E. 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 to CITY specifications.

G. Bronze, threaded and contact moving parts shall, during shop assembly, be lubricated and protected by coating of rust proof compound to prevent damage in shipment.

END OF SECTION

SECTION 33 31 00
SANITARY SEWER

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work to be done under this of the Specifications consists of furnishing all materials and equipment and performing all labor necessary for the complete construction of the gravity sewer system including all sewer pipe, house service lines and other appurtenances as indicated on the Contract Drawings and/or specified.

1.2 RELATED WORK

A. Section 31 23 16 - Earthwork for Utilities

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

B. American Water Works Association (AWWA).

C. American National Standards Institute (ANSI).

D. Uni-B-6-98 - Recommended Practice For Low Pressure Air Testing of Installed Sewer Pipe, Uni-Bell PVC Pipe Association.

1.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

A. DEVELOPER 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 so as to least interfere 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

2.1 GENERAL

A. Pipe and fittings shall be new materials which have not been previously used.

B. Minimum depth for sanitary sewer shall be four (4) feet except under pavement; then, the minimum depth shall be seven (7) feet.

C. No changes in pipe material shall be allowed between manholes.

2.2 BEDDING AND BACKFILL

A. Bedding material shall be as specified in Section 31 23 16 Earthwork for Utilities.

B. Backfill material shall be as specified in Section 02200 Earthwork.

2.3 PVC GRAVITY SEWER PIPE

A. MATERIALS

1. PVC sewer pipe and fittings shall be plastic gravity sewer pipe with integral wall bell and spigot joints for the conveyance of domestic sewage. Pipe and fittings shall meet the strength minimum of DR 18 and AWWA C900.

2. Pipe and fitting markings shall include the appropriate ASTM and Cell Classification Numbers (12454-B or 12454-C or other ASTM approved classifications) and be any color. Unmarked pipe and fittings will be rejected.

3. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested, and date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture and the classes of pipe with which it can be used.

4. PVC pipe shall be joined with a rubber gasket or PVC ring which is designed to prevent inflow and ex-flow. Mechanical compression joints shall be molded plastic or similar material (with or without the use of rubber or elastic plastic compression rings) as described in ASTM C425 for polyvinyl chloride (slip joint). Precast joints or rubber push-type gaskets for compression joint sealing (ASTM D3312 or F477) are all acceptable. (PVC pipe shall not be joined by a solvent cement joint in which the pipe spigot wedges into the tapered socket and the surfaces fuse together.)

5. In cases where pipe joints are required to be restrained the pipe shall utilize an internal restraint system suitable for C900/905 PVC pipe such as the CertainTeed Certa-Lok C900/RJ Restrained Joint System, Diamond Plastics Diamond Lok-21, JM Eagle Eagle Loc900, RieberLOK or approved equal.

B. CLEANOUTS

1. 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. An 18" diameter or square by 4" thick concrete cleanout marker shall be provided for each cleanout.

2.4 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.

2.5 GREASE TRAPS

A. Grease Traps are required to be designed and installed at any commercial, municipal, industrial, and/or business services where fats, oil, and grease are discharged. These include but are not limited to restaurants, businesses of food ingredient processing, and cafeterias. Grease traps shall be sized and installed as per the City’s Standard Details.

B. All grease traps shall be installed with a test manhole immediately downstream to allow for testing of the discharge by the CITY.

C. In cases where a new establishment will generate fats, oil, and grease is being proposed to occupy an existing building and site with existing sewer service which does not have a grease trap on the sewer service discharge; and the DEVELOPER of said establishment can demonstrate that there is inadequate space, property, and grade to allow for a conventional grease trap as per City details; and the proposed discharge flow is not significant, the City may allow a that a grease trap be installed inside the establishment as a retrofit to the plumbing in lieu of the City's standard. This decision shall be at the sole discretion of the City Public Works Department. Any grease traps inside the buildings on the DEVELOPER's plumbing shall be permitted through the local Health Department.

PART 3 EXECUTION

3.1 PIPE LAYING

A. Sewer pipe shall be bedded and backfilled in accordance with Section 31 23 16 (Earthwork For Utilities).

B. 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.

C. Excavation and pipe bedding shall be performed in accordance with (Section 31 23 16 (Earthwork For Utilities).

D. 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.

E. 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.

F. Water shall not be allowed to run or stand in trench while pipe laying is in progress or before the joints are completely set or before trench has been backfilled.

G. 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.

H. 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.

I. Backfilling of trenches shall not begin until pipe inspector has observed and approved the pipe in the trench. Backfilling of trenches shall start immediately after the pipe installation has been approved by the pipe inspector. Backfill shall be deposited and compacted as provided under Section 31 23 16 (Earthwork for Utilities).

J. Piping shall have a minimum slope as shown below.

Nominal Sewer Size	Minimum Slope in ft/100f
8-inch	0.50
10-inch	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

1. Maximum slopes and velocities shall be in accordance with the Ten States Standards as follows:

2. Where design velocities exceed 15 feet per second, special provisions incorporated to protect against displacement by erosion and impact.

3. 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.

3.2 DETECTION TAPE

A. Detector marking tape shall be non-metallic and shall be installed minimum 18-inches 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, installed the entire length of the sewer main and the sewer laterals. Wire shall be installed 24” above pipe.

3.3 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 DEVELOPER. 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 Drawings.

D. Replace the pipe with a section of pipe the same diameter and length as that removed. Material is to be PVC, SDR 35 min, or Ductile Iron, AWWA C150 or C151.

E. Insert the flexible couplings and tighten in accordance with the manufacturer’s 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 the return to the pipe and check for leaks.

H. Backfill the trench in accordance with Section 31 23 16 - Earthwork for Utilities.

I. Video and perform pressure tests in accordance with Section 33 31 00 - Sanitary Sewer.

3.4 SERVICE CONNECTIONS

A. Service connections to the main sewer shall be provided by inserting a 4" or 6" tee-wye at the correct location. The tee-wye shall be tilted upward on an angle of not less than 11-degrees (See Standard Detail Nos. S-17 and S-18 installation 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° and 45° 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. The ends of all service laterals and service stubs not hooked to an existing structure will be plugged and marked with a pressure treated 2 x 4 painted red. The marker shall be at least 6 feet long with 2 feet protruding from the ground.

C. 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 cove. "Knock-outs" will NOT be allowed. All cores are to be performed in the presence of a representative of the City.

3.5 JOINT CONSTRUCTION

A. 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.

3.6 INSPECTION

A. The CITY inspector shall be notified no less than 48 hours (Monday through Friday) before installed pipe is scheduled to be buried, tested, or inspected.

B. 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.

C. 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.

D. Once final grade has been established, the DEVELOPER may request and schedule inspection and testing with the CITY. Testing shall not commence until the CITY is satisfied that the above criteria and the intentions of said criteria have been met.

E. No testing shall occur until all visible leaks are repaired.

F. 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 the inside of the pipe.

G. Low Pressure Air Leakage Testing

1. A low-pressure air test shall be conducted on each section of sewer line in accordance with ASTM F-1417 once backfilling to final grade has been completed.

2. Testing shall include the following equipment:

   a. Plugs – mechanical or pneumatic

   b. Above Ground Control Panel – to include shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge, and continuous monitoring gauge.

   c. Separate Hoses – one connected to the control panel for input to sealed line and one connected to sealed line for constant monitoring of air pressure build-up. If pneumatic plugs are used, a third hose shall be supplied to inflate the plug from the above ground control panel.

3. All service laterals, stubs, and fittings in the test section shall be properly capped or plugged. Pipe connections at manholes shall be visually inspected to determine if pipe shear has occurred due to differential settlement of pipe and manhole.

4. Low pressure air shall be slowly introduced into the sealed line until internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water that may submerge the pipe. Groundwater back pressure shall be determined per item 7 below.

5. At least two (2) minutes shall be allowed for temperature stabilization before proceeding further.

6. At a reading between 3.5 and 4.0 psig above the average groundwater back pressure, a stopwatch shall be used to measure the time it takes for the pressure in the line to drop 0.5 psig. If this time equals or exceeds the minimum test time as given in Table 1 below, the pipe line is considered acceptable. If there is no pressure loss after one hour of testing, the pipe line is considered acceptable.

7. If groundwater is present, the starting air pressure should be adjusted as follows:

   a. A one-half inch threaded pipe nipple shall be installed through the manhole wall directly above one of the pipes entering the manhole. The pipe shall extend no more than 2 inches on the inside of the manhole and be at least 4 inches longer than the thickness of the manhole wall. The pipe shall be non-corrosive and be sealed watertight. The pipe end shall be sealed with a threaded one-half inch cap.

b. Immediately before testing, the groundwater level shall be measured by attaching a clear plastic tube to the end of the pipe nipple. Once the water in the tube has stopped rising, the height, in feet, of water over the sewer pipe invert shall be measured.

c. The starting pressure shall be calculated by dividing the height of water over the sewer pipe invert by 2.31 and adding to the normal starting pressure of 3.5 psig. The starting pressure shall not exceed 9 psig. This adjusted starting pressure shall be used as the starting point for the test detailed in item 6 above.

8. If pipe installation fails to meet these requirements, DEVELOPER shall determine source or sources of leakage and shall repair or replace all defective materials or workmanship.

9. Final acceptance of each section or run of sewer tested will not be issued until leakage has been reduced to rates not exceeding the maximum values specified herein.

H. Mandrel Testing

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

a. Mandrel shall be pulled through all gravity sewer pipe while CITY's representative is present.

b. Mandrel shall be sized to allow 7-1/2% maximum deflection in pipe dimension for all materials other than PVC. Maximum 5% deflection shall be allowed for PVC pipe.

c. Minimum specified test time required for a 0.5 psig pressure drop is shown in the table below.

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft.)	Time for Longer Length (sec.)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	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
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	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

15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	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
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	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
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	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
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	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
42	39:48	57	41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85.476 L	213:41	213:41	284:55	356:09	427:23	498:37	569:50	641:04

I. Video Recording

1. DEVELOPER is to provide the City with a color DVD system video of the inside of every reach of sanitary sewer installed.

2. DVD shall record the following information:

   a. Manhole number to manhole number

   b. Date of recording

   c. Distance record from start of run

3. DVD shall include a distance and location description of every service line connection installed.

4. The manhole numbering system shall be the same as shown on the approved Development Drawings.

J. 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.

    d. Low pressure testing pressures shall not exceed 9 psi.

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. Material for bracing is required when necessary that plugs be braced as an added safety factor.

    d. NOTE: List presented above is a partial list and other equipment may be required. DEVELOPER shall furnish all equipment and personnel required for performing low pressure air test.

END OF SECTION

SECTION 33 32 00
SUBMERSIBLE SEWAGE PUMP STATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The lift station shall be designed at a minimum in accordance with standards and references set forth by the Georgia Department of Natural Resources-Environmental Protection Division (EPD), and in accordance with the CITY's minimum requirements as well.

B. For subdivisions, apartment complexes, shopping centers, and similar developments, the CITY requires the use of submersible-type lift stations. All wastewater lift stations shall be reviewed by the CITY and/or the Georgia Department of Natural Resources on a case-by-case basis.

C. For the CITY's review, the DEVELOPER 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 CITY may require any additional information at its discretions in order to complete its review.

D. Each lift station design and site are unique and shall be reviewed by the CITY 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 CITY at their discretion as a result of review during plan submittals and/or construction.

1.2 PUMPS

A. The CITY accepts only submersible sewage pumps: heavy duty, vertical shaft, non-clog type passing 3-inch sphere, submersible centrifugal pumps manufactured by FLYGT. All Flygt pumps shall be of the N-series.

B. 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.

C. Refer to Section 26 00 00, Electrical Plans for electrical equipment requirements.

1.3 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 access drive, maintenance friendly layout and grading, motors, permanent discharge elbows, mix flush valves, 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 8-feet.

D. Wetwell shall be coated as per specification section 09 97 23.

E. Each station shall be furnished and installed with a permanent standby generator in accordance with specification section 26 32 13.

F. Each lift station shall be furnished and installed with the CITY's most current SCADA. See electrical specifications.

G. Check valves shall be swing type with cushion chamber and counterweight for closing speed adjustment.

H. See lift station details for reference.

I. All phases of construction shall be inspected as per the CITY's requirements.

J. Entire Lift Station site (50'x50') shall be paved with concrete, access road shall be paved concrete.

K. All Ductile Iron Pipe at conveying sewage shall have an interior coating, as specified in Specification 09 97 23.

L. All Ductile Iron Pipe inside the wetwell conveying sewage shall have an exterior coating, as specified in Specification 09 97 01.02.

1.4 WORK INCLUDED

A. The DEVELOPER shall furnish and install at the locations shown on the Approved Drawings, as specified or as directed, electrical submersible pump(s) required to complete the project.

B. The DEVELOPER shall be responsible for any and all details and special construction required whether or not shown in the City's Standards or on the Approved Drawings or called for in these specifications. The DEVELOPER shall be responsible for the complete installation and responsibility for the proper operation of the various components of this section. It shall also include painting, field testing and additional services of the equipment supplier.

1.5 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.

1.6 SUBMITTALS

A. Shop drawings, minimum 3 copies each, for the pumping station, associated equipment, and generator shall be submitted to the CITY for review and comment prior to installation by the DEVELOPER. The shop drawings must bear the stamp and approval of the design engineer prior to submitting to the CITY. The DEVELOPER shall provide to the CITY as a minimum the submittals listed below. Submittals shall be submitted to the CITY and approved prior to fabrication, shipment or work specified under this section begins. Submittals shall be in PDF format.

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.

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 1.7 of this Specification.

7. Extended warranty as specified in Section 3.8 of this Specification.

B. The DEVELOPER 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.

C. 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.

D. The DEVELOPER shall also furnish under this section two (2) bound copies and a PDF file 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.

1.7 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.

B. Testing shall also include, but not be limited to, the following:

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

2.1 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.

2.2 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.

2.3 EQUIPMENT FEATURES

A. COOLING SYSTEM

1. If required by FLYGT, each unit shall be provided with an integral stainless steel motor cooling system. A 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. For the NP-model pumps:

a. 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. For the NP-model pumps:

a. 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. For the NP-model pumps:

a. 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-IronTM (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 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 locally 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. Each pump shall be furnished and installed with the ITT 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

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 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 my apply. Guards shall be designed to facilitate access for lubrication, maintenance, and/or belt replacement.

3.4 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.

3.5 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.

3.6 FIELD TEST AND START-UP SERVICE

A. The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer for 8-hour working day(s) at the site to inspect the installation and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the contractor shall have the manufacturer do the following:

1. Megger stator and power cables.

2. Check seal lubrication.

3. Check for proper rotation.

4. Check power supply voltage.

5. Measure motor operating load and no-load current.

6. Check level control operation and sequence.

7. 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

8. Compliance with operating conditions specified for flow rate and TDH: At least 2 draw down tests will 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.

3.7 ADJUSTING, TESTING, TRAINING AND ADDITIONAL SERVICES

A. In addition to the tests listed under this Section, each pump together actual motors shall be fully tested in water at the pump manufacturers' works to establish that all rating conditions have been met. The 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.

B. 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 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.

3.8 PUMP WARRANTY

A. The pump manufacturer shall submit the proper documentation demonstrating that the pump manufacturer warrants 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.

END OF SECTION

SECTION 33 34 00
SANITARY SEWER FORCE MAINS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work to be done under this Section of the Specifications consists of furnishing all materials and performing all labor necessary for the complete construction of the force mains, including all piping and fittings, as indicated on the Drawings and/or specified.

1.2 RELATED WORK

A. Section 31 23 16 – Earthwork for Utilities

B. Section 33 05 07 – Horizontal Directional Drilling

C. Section 02 01 00 – Protection, Relocation and Restoration of Existing Utilities

D. Section 33 31 00 – High Density Polyethylene Pipe

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

B. American National Standards Institute (ANSI).

1.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

A. DEVELOPER 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.

C. Unload material at site of work, near place where it will be placed in trench.

1. Materials shall be placed so as to least interfere 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

2.1 GENERAL

A. Pipe and special fittings shall be furnished in sizes, types and classes at locations shown on the Development Drawings, and/or specified herein.

B. Pipe and fittings shall be new materials that have not been previously used.

C. All force mains shall be high-density polyethylene pipe (HDPE) ductile-iron pipe size (DIPS) DR 11.

2.2 HIGH DENSITY POLYETHYLENE MATERIALS

A. Resin and Material Requirements – All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

B. HDPE Pipe

1. Pipe shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. The manufacture of the HDPE resin shall certify the cell classification indicated.

2. Pipe sizes 3” and large shall have a manufacturing standard of ASTM F 714, while pipe smaller than 3” shall be manufactured to the dimensional requirements listed in ASTM D 3035.

3. Dimension Ratio (DR) shall be DR 11.

4. Pipe shall be Ductile Iron Pipe Size (DIPS)

5. Pipe shall meet AWWA C901 (3/4" to 3") or AWWA C906 (4" to 63").

6. When required by the owner, pipe shall be color coded for the intended service. The color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe's manufacturing process. Color coding shall be green for sanitary sewer.

C. HDPE Fittings

1. Butt Fusion Fittings: Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350 and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D 3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

2. Electrofusion Fittings: Fittings shall be PE 3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

3. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D 3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans

4. Fittings shall have the same pressure rating as HDPE Pipe.

2.3 PLUG VALVES

A. All plug valves shall conform to AWWA C517 and shall be of the tight closing, resilient faced plug type and shall be of the bi-directional shut off for 175 psi. The plug valve shall provide 100% full port area.

B. Valve bodies shall be constructed of cast iron ASTM A-126 Class B with chloroprene plug face, and shall have integrally cast mechanical joint ends or flanged ends as per the application shown on the construction drawings. End connections shall meet the following specifications: 125# ANSI B16.1 flange drilling, mechanical joint per AWWA C-111.

C. Actuators for above ground service shall be Dezurik G-series or approved equal, manual hand wheel. Actuators for buried application shall be G-series with 2-inch nut, and valve box, with valve cap labeled, “sewer”.

D. Plug valves shall be installed every 2,500 LF along force mains from lift station site to the discharge.

E. Model shall be Dezurik PEF 100% Port, or approved equal.

2.4 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 be able to be 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.

2.5 COMBINATION AIR RELEASE AND AIR/VACUUM VALVES

A. Combination Air Release and Air/Vacuum valve shall be Cla-Val Model 36WW, 2” (inlet) x 1” (outlet), with backwashing kit, or approved equivalent.

B. Combination Air Release and Air/Vacuum valve shall be able to function fully in normal operating pressures less than 10 psi.

C. Body and cover shall be of cast iron conforming to ASTM A126 Class B. Float and internal parts shall be stainless steel. Seal shall be Buna-N®Rubber.

2.6 DETECTION WIRE AND WARNING TAPE

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 Force main".

B. Detection wire shall be size #12 AWG solid strand, installed the entire length of the piping.

C. Wire shall be installed minimum 18–inches above the pipe, not connected to the pipe, and with waterproof connectors and connections at every valve so line can be relocated with a pipe finder after burial.

PART 3 EXECUTION

3.1 ALIGNMENT AND GRADES

A. Depth of Pipes

1. All force mains shall be installed at a minimum depth with 48-inches of cover from the top of the pipe to finished grade or at a cover depth of 48-inches below the adjacent, parallel edge of roadway, whichever depth is greater shall govern.

2. Where obstructions are encountered, depth may be greater than 48 inches.

B. Valves

1. Shall be installed with stems vertical.

C. Pipe Curvatures

1. Shall be within horizontal or vertical permissible deflection at joint, as specified by manufacturer or AWWA Specification C600 (Latest Edition).

3.2 INSTALLING PIPE

A. General

1. Pipe and appurtenances shall be installed only when trench conditions are suitable.

2. Trenches must be dry.

3. Proper implements, tools, and facilities shall be provided by DEVELOPER for safe and convenient performance of the work.

4. Where force mains encounter water lines, a minimum horizontal separation of ten (10') feet and minimum vertical separations of 18" must be provided. At crossings, one full length of force main pipe must be located so that both joints are as far from the water as possible. Force main shall be installed below water line.

B. Installation

1. Lower pipe, fittings, valves, and carefully into trench piece by piece by means of derrick, ropes, or other suitable tools or equipment.

2. Prevent damage to pipe line materials and protective coatings and linings.

3. Do not drop or dump pipe 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. 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.

6. 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.

7. Open ends of pipe shall be closed by watertight plug, or other means approved by the City, 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.

8. Force mains shall be installed so that a minimum grade of 1.0% is always maintained downhill away from a sewage air release valve so that entrapped air will always accumulate at the air release valve and air locking of the force main will be avoided.

3.3 CUTTING PIPE

A. 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.

3.4 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.

3.5 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.

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 adaptors if required to join bells and spigots of different sizes.

2. Thoroughly clean inside of bell and outside of spigot end.

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.

3.6 THRUST

A. Plugs, caps, tees, bends, and valves, unless otherwise specified, shall be provided with reaction blocking and joint restraint. Concrete reaction blocking shall conform with these specifications and the applicable standard details. Joint restraint shall be as specified in Part 2.

B. Concrete reaction blocking shall conform with 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 approved construction drawings.

E. Blocking shall, unless otherwise shown or directed, be so placed that pipe and fitting joints will be accessible for repair.

F. All fittings shall be restrained and blocked.

3.7 STREAM AND UTILITY CROSSINGS

A. Pipe shall be placed beneath stream beds 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 stream beds or ditches, unless approved by ENGINEER in writing.

3. Provide a minimum of 18-inch earth or sand cushion between proposed water line and any other utility or structure, or as indicated on drawings.

B. Where pipelines are installed below free flowing streams, the DEVELOPER is responsible for adequate pipeline design of each crossing subject to the CITY review and approval. The DEVELOPER's ENGINEER shall consider the soils, creek flow, pressure, topography, thrust restraint, construction techniques allowed, etc. to design and specify appropriate layout and pipe joints.

C. The DEVELOPER shall be responsible for any and all necessary permitting by authorities having jurisdiction for stream crossings or crossing of state waters including but not limited to EPD, Jackson County, and the Army Corps of Engineers.

D. Plug valves shall be provided at both ends of a stream crossing to allow the section to be isolated for testing or repair.

3.8 HYDROSTATIC TESTS

A. Pressure and leakage tests will be required on each section of line between valves and shall be conducted in accordance with AWWA C600.

B. General Procedure

1. Furnish and install corporation stops at force main high points to release air as line is filled with water.

2. Furnish suitable pump, connections, and necessary apparatus including means for accurately measuring water introduced into line during testing.

3. 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 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.

   a. Test pressures shall be as directed by the CITY.

   b. Test shall be conducted for a minimum of 2 hours.

   c. Pressure shall not vary by more than 5 psi during test.

4. Testing Allowance.

a. 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.

b. The maximum allowable makeup water shall be based on the following formula 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.

$$L = \frac{S \times D \times (P^{0.5})}{148{,}000}$$

c. No pipe installation shall be accepted if the amount of make up water required exceeds the amount determined in the formula above.

5. Locate, remove, and replace any defective pipe, valves, fittings, or hydrants.

6. Repeat tests until results are satisfactory to the CITY.

END OF SECTION