

Utility Department Specifications

for



Adopted June 20, 2002
(As amended March 12, 2020)

SECTION 311000 - ROUTE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Standard Drawings, Zoning Ordinance, Subdivision Regulations, Sewer Use Ordinance, and Building Codes, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, abandoning designated utilities in place, and removing designated utilities.
7. Protecting above grade and underground improvements.
8. Restoring damaged improvements.
9. Temporary erosion and sedimentation control measures.

B. Related Sections:

1. Section 312000 "Trenching and Backfilling" for excavation and backfilling trenches for utility installation.

1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain the City's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the City and other authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by the City or other authorities having jurisdiction.
- B. Improvements on Private Property: Obtain authority for performing route clearing indicated on private property before beginning Work.
- C. Salvageable Improvements: Carefully remove items indicated to be salvaged and delivered to City's Public Works facility.
- D. Utility Locator Service: Before commencing any route clearing work, notify the Utilities Protection Center "Call Before You Dig" to permit marking existing utilities on the ground in advance of the work. Do not begin any work until the required utility marking time has passed.
- E. Do not commence route clearing operations until temporary erosion and sedimentation control measures are in place at least three hundred (300) feet in advance of clearing operations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Trenching and Backfilling."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Provide barricades, coverings, or other types of protection necessary to prevent unnecessary damage to existing improvements.
 - 2. Protect improvements on adjoining properties as well as those along the project route.
 - 3. Restore damaged improvements to their original condition, as acceptable to the City or authorities having jurisdiction.
 - 4. Replace property line monuments (such as iron pins) removed or disturbed by route clearing operations.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control plan, specifically prepared for the project, that complies with the City of Loganville Erosion and Sediment Control Ordinance.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established and are effective.
- D. When permanent controls are established and effective, remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. Protect existing trees and other vegetation against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip lines, excess foot or vehicular traffic, or parking of vehicles or equipment within drip line. Provide temporary fences, barricades or guards as required to protect trees and other vegetation to be left standing.
- B. Provide protection for ornamental tree roots over one and one half (1½) inches diameter that are cut during any construction operation. Coat the cut faces with an emulsified asphalt, or other acceptable coating, especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots of ornamental trees with wet burlap to prevent roots from drying out; provide earth cover as soon as possible.

- C. Repair or replace unnecessarily damaged trees and vegetation, as determined by the City, resulting from any construction operation, in a manner acceptable to the property owner and the City. Tree damage repair shall be performed by a qualified nurseryman. Replace unnecessarily damaged trees which cannot be repaired and restored to full-growth status, as determined by the tree surgeon.

3.4 ADJACENT PROPERTY PROTECTION

- A. Protect improvements, trees and other vegetation on adjoining property as well as those on property requiring route clearing work.
- B. Remove conflicting fences and provide effective temporary measures to prevent stock, cattle or other domestic animals from wandering to other lands. Reconstruct fences promptly.
- C. Execute work so as not to create a nuisance to persons utilizing adjacent property.
- D. Use work methods and provide temporary facilities as necessary to prevent washing, erosion, siltation or dust damage, or hazard to persons and property, within and off the work area.

3.5 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by the City or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify the City not less than two (2) days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without the City's written permission.

3.6 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction. Accurately determine limitations of construction easements or right-of-way, and keep operations within such limits. Limit removal to the minimum practicable extent.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods or air spade for grubbing within protection zones.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.7 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil. Cut into maximum size which can be handled without tearing, striping sod and underlying topsoil, and stockpiling for use in restoring the surface area. Water sod and otherwise maintain sod in viable, growing condition.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within protection zones.
 - 3. Dispose of surplus topsoil per City directions. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.8 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically. Should pavement breakage occur beyond the original saw cut, make a new saw cut beyond the furthest point of breakage
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Project site and City's property.
 - 1. Accomplish disposal of cleared materials daily, so as to maintain work route in a safe and neat condition throughout the construction period.
- B. On-site Disposal Limitations:

1. Unless property owner requests complete removal, cut tree trunks and limbs, over two inches in diameter, into eighteen (18) inch lengths and neatly stack within work limits having same property ownership as that on which the tree originally grew.
2. On undeveloped property, process brush, trees and limbs less than two (2) inches in diameter, through a chipper and distribute evenly over the construction limits in a way as not to be objectionable to the property owner.
3. On developed property, remove all such clearing and grubbing waste and legally dispose of it off site.
4. Burning of cleared materials on the work site is not permitted.

END OF SECTION 311000

SECTION 312000 – TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Sewer Use Ordinance, and Building Codes apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- 2. Excavating and backfilling associated with utility abandonment and modification.

B. Related Sections:

- 1. Section 311000 "Route Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
- 2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

- 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- 2. Final Backfill: Backfill placed over initial backfill to fill a trench.

- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Excavation: Removal of whatever type of material encountered above subgrade elevations and to lines and dimensions indicated.

- F. Fill: Soil materials used to raise existing grades.

- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Perform trenching and backfilling work, including blasting, in compliance with applicable requirements of governing authorities having jurisdiction where such requirements exceed those specified in this Section.

1.5 FIELD CONDITIONS

- A. Verify existing site grades to be substantially consistent with grades on Project Plans before commencing work. Report any significant conflict in grades to the City before proceeding with the work.
- B. Subsurface conditions presented, if any, are not intended as representations or warrants of continuity of such conditions between soil borings or pits. It is expressly understood that the Contractor is solely responsible for interpretations or conclusions drawn there from. Data when made available are for the convenience of the Contractor who may perform additional test borings and other exploratory operations at the Contractor's expense, provided such operations are acceptable to the City and the property owner.
- C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the City and other authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by the City or other authorities having jurisdiction.
 - 3. Provide flaggers, barricades, warning signs, warning lights and other warning means as appropriate. When flaggers are utilized, individuals must meet requirements of Georgia Department of Transportation.
 - 4. Maintain traffic on all roads and streets which must be crossed by trenching by making two separate cuts so that at least one traffic lane is open at all times.
 - 5. All traffic controls during construction must conform to Part 6 of the *Manual on Uniform Traffic Control Devices*.
- D. Improvements on Adjoining Property: Obtain authority for performing trenching and backfilling indicated on private property before beginning Work.

- E. Utility Locator Service: Before commencing any route clearing work, notify the Utilities Protection Center “Call Before You Dig” to permit marking existing utilities on the ground in advance of the work. Do not begin any work until the required utility marking time has passed.
 - 1. Should unexpected piping or other utilities be encountered during excavation, consult utility owner immediately for direction. Cooperate with the City and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.
 - 2. Do not interrupt existing utilities serving occupied facilities except when authorized by the utility owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. Sand: ASTM C 33/C 33M; fine aggregate.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six (6) inches wide and four (4) mils thick, continuously inscribed with a description of the utility; colored as listed below in subparagraph 2.2.B.1-5.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls, which are specified in Section 311000 "Route Clearing," during earth-moving operations.
- C. Open excavations within the roadway shall be covered with steel plates capable of handling H-20 loading at the end of each working day. Barricade open excavations outside of roadway limits and post warning lights for safety of persons. Operate warning lights during hours from dusk to dawn each day.
- D. Take precautions and provide necessary bracing and shoring to guard against movement or settlement of existing improvements or new construction. Contractor is entirely responsible for strength and adequacy of bracing and shoring, and for safety and support of construction from damage or injury caused by the lack thereof or by movement or settlement.
- E. Use work methods and provide temporary facilities as necessary to prevent washing, erosion, siltation or dust damage, or hazard to persons and property, within and outside the work area.
- F. Place excavated material compactly alongside of trenches, and keep such material trimmed up so as to present the least practicable inconvenience to the public. Where necessitated by traffic conditions, remove from the roadway the first material excavated from a working length of trench so that further excavation is immediately used for backfilling, and thereby avoid stockpiling of material up on the roadway. Afterward, return first excavated material if needed for final backfilling.

- G. Maintain all streets, sidewalks, crossings, fire hydrants, water and gas valves, fire alarm boxes, and other utilities accessible for their intended use except while the work is steadily advancing in the immediate vicinity of each such facility.
- H. Keep every drain, gutter, culvert, sewer, and surface drainage route encountered, open for both temporary and permanent flow unless other effective provision for drainage is made.
- I. Do not permit any hazardous condition to result from trenching and backfilling operations.

3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Remove water using dewatering methods which will prevent detrimental effects to stability of subgrades and foundations.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 3. Limit opening of additional trench to that which can be dewatered with available equipment or methods.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- E. Should sewage or any other odorous liquids be encountered during the work in the excavation, the City Utilities Department shall be immediately notified. The City will then determine if actions by the Contractor have caused the source of the odorous liquids to leak and will promptly notify the appropriate regulatory agencies, if necessary. In addition, the City will instruct the Contractor as to what actions, if any, the Contractor can and cannot perform prior to any directives that may be issued by the regulatory agencies. Any sewage will be pumped and hauled to a manhole, pump station, or water reclamation facility, as directed by the City. Any other liquids will be properly disposed of as directed by the City and/or any regulatory agencies having jurisdiction

3.3 EXPLOSIVES

- A. Explosives: Use explosives only as legally permitted and when other work methods are impractical.

- B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
 - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
 - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.
 - 3. Provide proof of licensing for explosives use to the City prior to engaging in blasting activities.
- C. Assume sole responsibility for handling, storage, and use of any explosive materials.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. If excavated materials intended for backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. Six (6) inches beneath pipe in trenches, and twenty-four (24) inches wider than pipe.

3.5 PAVEMENT REMOVAL

- A. Remove all pavement, including curb and gutter, sidewalk and the like, which must be disturbed by trenching operations.
- B. Saw cut edges of bituminous pavement. For concrete pavement, saw cut edges or remove and replace to nearest joint when distance from cut edge to joint is less than eight (8) feet.
- C. At sidewalks, curbs and gutters, and the like, remove entire sections between joints at trench crossing.

3.6 EXCAVATION FOR UTILITY STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus one (1) inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. General: Trenching consists of removal and disposal of material encountered to obtain required subgrade elevations, usually, but not necessarily limited to that incidental to the installation or modification of underground pipelines, structures and appurtenances.
- B. Excavate trenches to indicated gradients, lines, depths, and elevations.
- C. Excavated Material Storage: Locate and retain materials away from edge of the trench. Place satisfactory excavated material neatly alongside the trench, and keep such material trimmed up so as to present the least practicable inconvenience to the public. Where necessitated by traffic conditions, remove from the roadway the first material excavated from a working length of trench so that further excavation is immediately used for backfilling, and thereby avoid stockpiling material upon the roadway. Afterward, return first excavated material if needed for final backfilling.
 - 1. Dispose of excess soil material and waste materials, such as rock, unsatisfactory excavated soil material, trash and debris, as specified hereinafter.
- D. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- E. Stability of Excavation: Slope sides of excavations to comply with Subpart P of Part 1926 of the Occupational Safety and Health Act as amended. Should any provision of a governing local code be more stringent than the preceding national standard, follow the local code. Shore and brace or use trench box where sloping is not possible either because of space restrictions or stability of material excavated.
- F. Shoring and Bracing: Provide portable trench boxes and materials for shoring and bracing, such as sheet piling, uprights, stringers, wales, and cross-braces, in good serviceable condition.
 - 1. Maintain shoring and bracing and/or portable trench boxes in excavations regardless of time period excavations will be open. Carry down shoring and bracing and/or portable trench boxes as excavation progresses.
 - 2. Provide trench boxes and/or shoring and bracing to comply with Subpart P of Part 1926 of the Occupational Safety and Health Act as amended. Should any provision of a governing local code be more stringent than the preceding national standard, follow the local code.
- G. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to twelve (12) inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: Twelve (12) inches each side of pipe or conduit.
- H. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes or conduit as determined by pipe or conduit foundation (bedding) requirements.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- I. Limit open trench excavation to a maximum of one hundred fifty (150) feet ahead of completed backfill.

- J. Maintain a horizontal separation of at least ten (10) feet between sanitary sewers and any existing or proposed water main. Where sewer and water main crossings occur, maintain a vertical separation of at least eighteen (18) inches between the crown of sanitary sewers and the invert of existing or proposed water mains with the sewer located below the water main. Where a vertical separation of eighteen (18) inches cannot be provided and the water main cannot be relocated to provide adequate clearance, center one full length of water main over the sewer so that both joints of the water main will be as far from the sewer as possible.
- K. Remove rock, masonry and concrete material to a distance of at least twenty-five (25) feet in advance of pipe laying and at least six inches from all parts of pipe and appurtenances being installed.

3.8 SUBGRADE INSPECTION

- A. Notify the City when excavations have reached required subgrade.
- B. If the City determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the City.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavations under other construction, pipe, or conduit as directed by the City.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 UTILITY TRENCH BACKFILL

- A. Place satisfactory soil backfill material in uniform layers, to required elevations. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing and/or trench boxes.
- D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than one (1) inch in any dimension, to a height of twelve (12) inches over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

- F. Warning Tape: Install warning tape directly above utilities, twelve (12) inches below finished grade. Use detectable warning tape for all non-metallic utility lines.

3.12 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than eight (8) inches in loose depth for material compacted by heavy compaction equipment and not more than four (4) inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each utility.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
1. Rights-of-way: Conform with the more stringent requirements of the permit issuing authority or right-of-way owner but not less than herein specified.
 2. Roadways: Under and within five (5) feet horizontal distance of traffic using surfaces, compact each layer of backfill material to ninety-five (95) percent of maximum dry density.
 3. Walkways: Under and within two (2) feet horizontal distance of paved walks, compact top six (6) inches of subgrade and each layer of backfill material to ninety-five (95) percent of maximum dry density.
 4. Driveways and Parking Lots: Under and within two (2) feet horizontal distance of traffic using surfaces, compact each layer of backfill material to ninety-five (95) percent of maximum dry density.

5. Under Lawn or Unpaved Areas: Compact each layer of backfill or fill soil material to eighty-five (85) percent of maximum dry density.

3.14 FIELD QUALITY CONTROL

- A. Provide quality control testing during construction as necessary to assure the entire earthwork, including all fill layers, subgrades, and bases meets specified minimums. Remove and reconstruct, or otherwise correct work which falls below specified density or is outside other specified limits.
- B. Employ, at Contractor's expense, an independent testing agency to perform quality control testing during trenching and backfilling operations. The independent testing agency must be qualified according to ASTM E 329 to conduct soil materials testing, as documented according to ASTM D 3740 and ASTM E 548.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Perform tests at the following locations and frequencies:
 1. Under structures, pavements, and driveways at least every 100 linear feet or less of pipeline, but in no case fewer than two tests.
 2. Under walkways at least every 100 linear feet or less of pipeline, but in no case fewer than two tests.
 3. Under turf of unpaved areas at least every 100 linear feet or less of pipeline, but in no case fewer than two tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
- E. The City may perform sampling, surveying, inspection or testing activity during construction for City's use, but such activity does not relieve the Contractor from responsibility to achieve specified results.
- F. When requested by the City, the Contractor shall provide quality control test reports including field density test reports and optimum moisture-maximum density curves to the City.

3.15 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of it in a manner acceptable to the City and in a manner that will not adversely impact the environment.
- B. Transport surplus satisfactory soil to designated storage areas on City's property when directed by the City. Stockpile or spread soil as directed by the City; otherwise remove from the project work area and legally dispose of such material which cannot be acceptably distributed within the project work area.
 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Project site and City's property.

3.17 RESTORATION

- A. Plan and execute total work so as to minimize damage to property. Restore all surface materials, shrubbery, fences, lawns, walls, structures and other improvements to a condition no less desirable than that which existed before construction began.
- B. Conduct all construction operations such that upon completion of any part of the work, the contour and topography of the construction area has not been substantially altered. No alteration of previously established storm drainage patterns will be permitted unless such alteration can be proven to the City's satisfaction to improve the drainage pattern.
- C. When necessary to temporarily remove or damage improvements of any significance, take good quality color photographs of such improvements before disturbing them. Make copies of such photographs available to the City on request.
- D. Restore work area and accomplish site cleanup immediately after backfilling operations. Replace property line monuments damaged, disturbed or removed by trenching and backfilling operations.

END OF SECTION 312000

SECTION 320119 – PATCHING OF RIGID PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Standard Drawings, Zoning Ordinance, Subdivision Regulations, Sewer Use Ordinance, Water Main Design and Construction Standards, and Building Codes apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Patching of all removed or damaged pavement.
- 2. Repair of paved roads, streets, highways, walkways, driveways, patios, slabs on grade, and parking lots and other pavements.
- 3. Repair of walls, curbing, gutters and headers, and appurtenances.

B. Related Requirements:

- 1. Section 312000 “Trenching and Backfilling” for excavation and backfilling trenches for utility installation, and required compaction parameters.
- 2. Section 331100 “Water System” for utility installation requirements.

1.3 PROJECT CONDITIONS

- A. Traffic Control: Schedule and conduct Work in a manner, which will minimize inconvenience to vehicular and pedestrian traffic. Provide flaggers, barricades, warning signs, warning lights, and other warning means as appropriate.
- B. Weather Limitations: Conduct all operations during weather conditions appropriate to the Work being performed.
- C. Grade Control: Establish and maintain lines and elevations, which will assure finished pavement patch having desirable appearance, function and strength.
- D. Pavement referred to under this Section, refers to asphaltic, cementious, brick, cobble or other large stone pavement materials together with underlying construction, irrespective of its composition.
- E. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.

4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

1.4 SUBMITTALS

- A. Submit detailed material descriptions when requested by the City.

PART 2 - PRODUCTS

2.1 GENERAL

- A. For products not described below, use materials and gradations which have locally exhibited a satisfactory record of previous usage, and which for finished visible surfaces will permit obtaining appearance, color and texture reasonably matching remaining adjacent pavement of the same type.

2.2 ASPHALT CONCRETE

- A. Bituminous plant mixture of asphalt cement and aggregates complying with Type E or F hot plant mix of Section 828 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Constructions".

2.3 GRADED AGGREGATE BASE

- A. Uniform graded aggregate material complying with Section 815 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Construction".

2.4 BITUMINOUS PRIME

- A. Cutback asphalt complying with Section 821 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Construction".

2.5 BITUMINOUS TACK COAT

- A. Asphalt material complying with Section 413, topics 413.01 through 413.04 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Construction".

2.6 PORTLAND CEMENT CONCRETE

- A. Concrete mix of Portland cement, aggregates, water, and air entraining admixture to produce the following properties: 3500 psi minimum compressive strength at 28 days per ASTM C39, 4 inches maximum slump per ASTM C143, and air content between 3% and 6%.

2.7 COLD MIX

- A. Uniform bituminous mixture of aggregate, asphaltic material and, if it is required, mineral filler complying with Type E or F cold mix of Section 401 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Construction".

PART 3 - EXECUTION

3.1 PAVEMENT CUTS

- A. Saw cut trench edges in paved areas to neat, straight lines before starting to break the pavement slab. Completely backfill the open half before opening the other half of pavement.

3.2 BACKFILL PLACEMENT

- A. Place trench backfill materials in layers not more than six inches compacted thickness. Commence backfill immediately after utility is installed. Complete new replacement base construction immediately after trench backfill.

3.3 BACKFILL INSPECTION

- A. Examine areas and conditions under which pavement patching will be conducted, giving special attention to stability of subbase. Do not proceed with pavement patching work until unsatisfactory conditions have been corrected.

3.4 PREPARATION

- A. Saw cut any ragged edges of existing pavement, or in the case of concrete work, remove existing pavement to nearest joint. Remove all loose material from underlying and adjacent surfaces.
- B. Verify that subgrade is dry and in suitable condition to begin paving.

3.5 STRENGTH AND STABILITY

- A. Use materials and construction techniques as necessary to obtain strength, stability and durability of pavement patch at least equal to that of remaining adjacent pavement of the same type. As a minimum, conform with pavement patch details, if any, required elsewhere by the Contract Documents; and where such details are not provided, accomplish pavement patching utilizing strengths, thicknesses, etc. not less than that of remaining adjacent pavement of the same type.

3.6 PLACING

- A. Construct pavement using methods and equipment in general use for the type of work being performed.
- B. Immediately after new base construction, cover pavement cut with steel plates or similar devices of sufficient thickness to span the cut without noticeable deflection. Maintain plates in place for not less than 24 hours and not more than 7 days and until the concrete base (if used) has gained sufficient strength to withstand traffic loads. Traffic may resume after installation of metal plates.
- C. Upon removal of the metal plates or similar devices, provide new pavement surface in accordance with one of the following options:
 - 1. Immediately apply new permanent pavement surface materials indicated or
 - 2. Immediately apply bituminous cold mixture over bond breaker paper over new base. Monitor performance and repair or replace materials regularly to maintain smooth traffic surface until placement of permanent pavement surface materials. At Contractor's time selection prior to substantial completion, remove cold mix and bond breaker paper and

provide new permanent pavement surface materials. If performance or maintenance of cold mix patch is unsatisfactory in the opinion of the City, remove materials and provide new permanent pavement surface materials within 72 hours of notice by the City.

- D. Traffic control devices in lieu of cover plates are permitted for pavement patching longitudinal to the street centerline in excess of 20 feet. Use traffic barricades, warning signs and lights, flagmen, and other means as appropriate to continuously control traffic 24 hours per day. Use devices such that at least 12 feet wide, one-way through traffic access is provided at all times. Upon removal of traffic control devices, install permanent pavement surface.
- E. Contractor assumes all responsibility for maintaining repairing and or replacing concrete base that may be damaged during curing period.
- F. For existing surface of Portland cement concrete, furnish new Portland cement concrete structure thickness, including base and pavement surface, of not less than eight inches; except for driveways and sidewalks which shall be not less than four inches thick.
- G. Provide not less than eight inches thickness of new graded aggregate base for replacement of asphalt concrete pavement at driveways, sidewalks and parking lots.
- H. For repair of asphalt concrete pavement, clean base and adjacent surfaces and apply bituminous tack coat or bituminous prime (as appropriate) to such surfaces before placing new asphalt concrete surface.
- I. For longitudinal pavement cuts greater than 100 feet on an existing City street, place concrete base flush with pavement surface and resurface entire width curb to curb with 1.5 inches asphalt topping to match existing pavement.

3.7 FINISHES

- A. Accomplish pavement patching using materials and techniques which result in visible, finished surfaces having appearance, color, and texture reasonably matching remaining adjacent pavement of the same type. Do not permit the finished surface to have dips, objectionable roughness or discontinuity or non-draining areas. Do not create any unsafe pavement condition.

3.8 REPAIR OF WORK

- A. If pavement patch or adjacent pavement settles or shows evidence of other distress resulting from the Work prior to final project acceptance or during the one year warranty period, cut pavement out, repair subgrade, and reconstruct patch. Commence repairs or replacements within five business days of notification by the City. Do not place additional pavement material on top of unsatisfactory previously repaired surfaces. At expense of Contractor, repair any pavement which he damages beyond that minimum amount necessary to construct the Work.

END SECTION 320119

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Standard Drawings, Zoning Ordinance, Subdivision Regulations, Sewer Use Ordinance, Water Main Design and Construction Standards, and Building Codes apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Seeding.
- 2. Hydroseeding.
- 3. Sodding.
- 4. Turf renovation.

B. Related Requirements:

- 1. Section 311000 "Route Clearing" for topsoil stripping and stockpiling.
- 2. Section 312000 "Trenching and Backfilling" for excavation, filling and backfilling, and rough grading.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

- G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and lawn establishment.
 - 1. Pesticide Applicator: State licensed, commercial.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- C. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.7 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 - 1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: thirty (30) days from date of planting completion.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the AOSA's "Journal of Seed Technology; Rules for Testing Seeds". Provide seed meeting the requirements of Georgia Seed Law and Rules and Regulations with minimum of 70% germination and hard seed, minimum 90% purity, and maximum 2% weed seeds. Use seed with maximum noxious seeds of 300 seeds per pound subject to limitations of Table 1 of Georgia D.O.T. Standard Specifications Section 890. Furnish seed of grass species shown on the Drawing. Sow seeds according to GA DOT and Georgia Manual for Erosion and Sediment Control.

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
- B. Furnish Turfgrass Species as per latest edition of the "Manual for Erosion and Sediment Control in Georgia" published by the Georgia Soil and Water Conservation Commission.

2.3 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

- C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
- E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- F. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- G. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.5 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
- B. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Provide topsoil spreading, seeding, sod replacement, fertilizing, mulching, and related work as required to restore ground surfaces disturbed by Contractor operations to conditions equal to or better than existing prior to the Work.
- D. Replace existing maintained lawn areas with the same type of grass or sod as was established prior to the Work.

3.3 TURF AREA PREPARATION

- A. Limit grassing subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off City property.
 - 1. Apply Commercial Grade fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 3. Spread planting soil to a depth of four (4) inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately ½ the thickness of planting soil over loosened subgrade. Mix thoroughly into top four (4) inches of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply Commercial Grade fertilizer directly to surface soil before loosening.
 2. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
 3. Legally dispose of waste material, including grass, vegetation, and turf, off City property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain City's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
1. Do not use wet seed or seed that is moldy or otherwise damaged.
 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate as required by the latest edition of the "Manual for Erosion and Sediment Control in Georgia" published by the Georgia Soil and Water Conservation Commission.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- F. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch, peat mulch, or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.5 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - 1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF RENOVATION

- A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off City and adjacent property owner's property.

- G. Apply seed and protect with straw mulch as required for new turf.
- H. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of four (4) inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow Bermudagrass to a height of 1/2 to 1 inch.
 - 2. Mow perennial ryegrass to a height of 1 to 2 inches.
 - 3. Mow Kentucky bluegrass to a height of 1-1/2 to 2 inches.
 - 4. Mow turf-type tall fescue to a height of 2 to 3 inches.
- D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer or City:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, and with coverage

exceeding 98% of the total area with no bare spots exceeding one (1) sq. ft. and the ground surface is fully stabilized against erosion.

2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with the City's operations and others in proximity to the Work. Notify the City before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

END OF SECTION 329200

SECTION 330523 – TUNNELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Standard Drawings, Zoning Ordinance, Subdivision Regulations, Sewer Use Ordinance, and Building Codes apply to this Section.

1.2 SUMMARY

- A. Tunneling pertains to the installation of carrier pipe or tunnel liner below ground by means other than open cut excavation.
- B. Tunnel liner and pipe sizes indicated on the Drawings and elsewhere in the Contract Documents are minimum nominal diameters. Use appropriate size and type of tunnel liner and pipe sizes and construction methods as necessary to provide a complete tunnel liner and pipe installation.
- C. Related Sections:
 - 1. Section 311000 “Route Clearing” for topsoil stripping and stockpiling.
 - 2. Section 312000 “Trenching and Backfilling” for excavation of pits or trenches for tunneling operations.
 - 3. Section 331100 “Water Systems” for installation of water mains, fittings, and appurtenances.
 - 4. Section 333000 “Sanitary Sewer Systems” for installation of gravity sewers, force mains, fittings, and appurtenances.

1.3 JOB CONDITIONS:

- A. Subsurface conditions presented, (if any), are not intended, as representations or warrants of continuity and it is expressly understood that the Contractor is solely responsible for any subsurface conditions that may arise.
- B. Traffic Control: Schedule and conduct Work in a manner which will minimize inconvenience to vehicular and pedestrian traffic. Provide flagmen, barricades, warning signs, warning lights, and other warning means as appropriate. Maintain traffic on all roads and streets which must be crossed by utility lines. When flagmen are utilized, individuals must meet requirements of Georgia Department of Transportation. All traffic controls during construction must conform to Part 6 of the Manual on Uniform Traffic Control Devices.
- C. Weather Limitations: Conduct all operations during weather conditions appropriate to the work being performed.

1.4 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with applicable provisions of the following, unless otherwise indicated:
 - 1. AASHTO, Standard Specifications for Highway Bridges, Section 16 "Specification for Steel Tunnel Plates".
 - 2. AISC, "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", including the Commentary.
 - 3. AREA, Manual for Railway Engineering, Section 4.12 "Specification for Steel Tunnel Liner Plates."
- B. Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the City, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

1.5 SUBMITTALS

- A. When requested by the City or other authority having jurisdiction, submit copies of all product data, schedules, and shop drawings for proposed procedures prior to their installation. Include size and location of bore pits, sheeting and shoring plans, and existing adjacent structures or utilities that may be affected by the work.
- B. For sectional plate tunnel liner, submit complete calculations required to analyze and design the tunnel liner plate system including applicable diagrams, nomographs, charts, and other data, each with appropriate explanations.
- C. Where necessary to conform to Department of Transportation and railway company criteria, design data submitted must consist of the following:
 - 1. Design data as required in AASHTO Design Specifications for Tunneling or AREA Manual for Railway Engineering as applicable.
 - 2. Subsoil surveys including the elevation of the water table and the classification and relative density of the soils from the ground line to 3' below the tunnel liner.
 - 3. Where required, rock coring data including rock type and core recovery.
 - 4. Water control plans where required.
- D. Shop Drawings: For sectional plate tunnel liner construction, submit shop drawings showing complete details and schedules for fabrication and field erection.
- E. Experience Submittals: Tunneling is deemed to be specialty contractor work. Provide evidence of a minimum of five continuous years of experience in tunneling construction for tunneling installer. Evidence of this experience must be provided with the shop drawings for review by the City.

1.6 STORAGE AND PROTECTION

- A. All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the City.

PART 2 - PRODUCTS

2.1 CARRIER PIPE

- A. Install all pipe in casings with restrained joint pipe meeting requirements specified in Section 331100 "Water Systems" and Section 333000 "Sanitary Sewer Systems." Where carrier pipe is installed without tunnel liner by tunneling methods, conform with carrier pipe material specifications unless otherwise indicated.

2.2 CASING PIPE TUNNEL LINER

- A. Where tunnel liner is installed using jacking or boring construction methods, comply with the following material specifications for tunnel liner:
1. Steel Pipe Tunnel Liner, four (4) Inches and Smaller: ASTM A 53 material specifications. Use galvanized steel, Schedule 40 minimum, with threaded couplings.
 2. Steel Pipe Tunnel Liner, Larger than 4 Inches: Conform to ASTM A53 or A139 material specifications, except hydrostatic testing is not required. Join pipe sections with full strength, continuous welds in accordance with procedures approved by the American Welding Society to obtain a watertight seal.
 3. Unless otherwise indicated, use pipe with the minimum thickness requirements in the chart below. Actual thicknesses shall be determined by the casing installer, based on its evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired.
 4. The nominal diameters of casing shown in the chart below are minimums. Larger casings, with the City's approval, may be provided at Contractor option whether due to casing size availability, line and grade tolerances, soil conditions, or other reasons.
 5. Casing Sizes:

Under Railroads		
Carrier Pipe Diameter, inches	Minimum Casing Diameter, inches	Minimum Wall Thickness, inches (Uncoated)
6	16	0.375
8	18	0.375
10	20	0.375
12	22	0.375
14	24	0.407
16, 18	30	0.469
20, 24	36	0.532

Under State, County, or City Roadways		
Carrier Pipe Diameter, inches	Minimum Casing Diameter, inches	Minimum Wall Thickness, inches
6	16	0.375
8	18	0.375
10	20	0.375
12	22	0.375
14	24	0.375
16, 18	30	0.375
20, 24	36	0.375

6. Reinforced Concrete Pipe Tunnel Liner: Conform to ASTM C76, Class V material specifications for withstanding in-place vertical loads. Provide additional reinforcement or strength required to withstand jacking pressure. Except for end closures, provide pipe in eight foot minimum lengths. Use self-centering tongue and groove joints such that outside of tunnel liner is uniform in diameter at all locations. Seal pipe joints with butyl based sealant manufactured for that purpose

2.3 SECTIONAL PLATE TUNNEL LINER

- A. Where carrier pipe is installed in tunnel liner and mining methods are utilized, comply with the following specifications:
 1. Materials: Fabricate tunnel liner sections of ASTM A569 corrugated steel plate especially manufactured for tunnel liner service. Design liner sections and fasteners in consideration of tunnel location. For liner plate design purposes, use soil, wheel, and surcharge loads of sufficient magnitude to insure a safe liner plate system in actual use conditions.
 2. Provide tunnel liner plate having a minimum thickness of 0.179 inches and liner plate fasteners having a minimum diameter of 0.625 inches.
 3. Fabrication: Tunnel diameters are in terms of the required minimum clear inside diameter of the erected liner plate tunnel. Fabricate liner plate sections so as to allow complete installation from within the tunnel, and with alternate liner plate rings in the erected tunnel containing two threaded grout holes in the vicinity of the tunnel invert and two grout bleed holes in the vicinity of the tunnel crown.
 4. Galvanized Coating: After tunnel liner plate sections have been formed, punched, etc., hot dip galvanize plate sections with at least a two ounce coating of spelter per square foot total for both sides. Galvanized liner plates must not be warped, and the spelter coating must be free from defects such as blisters, flux, abrasion, poor adhesion and uncoated spots.
 5. Bituminous Coating: After galvanizing, fully coat both sides of liner plate sections with an asphaltic bituminous coating not less than 0.05 inch thick and conforming to AASHTO N 190 for bituminous protected corrugated metal pipe.

2.4 VENT PIPING

- A. Conform to ASTM A53 or A120 material specifications. Use two inch minimum Schedule 80 steel pipe with butt welded joints for vent construction.
- B. Provide enamel primer and two coats exterior enamel paint in color(s) selected by the City for above grade piping.

2.5 CASING SPACERS

- A. Provide casing spacers meeting one of the following requirements:
 - 1. Type I Casing Spacers: Flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Attach runners to stainless steel risers properly welded to the shell. Manufacture the height of the runners and risers such that the pipe does not float within the casing.
 - 2. Type II Casing Spacers: Two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware.

2.6 GROUT

- A. Cement conforming to ASTM C 150, Type I or Type II. Grout shall have a minimum compressive strength of 100 psi attained within 24 hours. One part Portland Cement; two parts masonry lime; four parts mortar sand; two percent of an approved admixture of Bentonite, Septamin Stearex, or Hydrocide Liquid; and where required, a retardant. Use sufficient mixing water that will produce a workable mixture of grout capable of being pumped into the voids created by the tunneling.

2.7 CONCRETE

- A. Conform with ASTM A 94 having minimum twenty-eight (28) day compressive strength of three thousand (3,000) psi.

2.8 CLAY BRICK

- A. Conform with ASTM C 32, Grade MS or ASTM C32 sewer and manhole brick or ASTM C216 facing brick, Grade MW or SW, of nominal size 8 x 2-1/4 x 3-3/4 inches. Color and texture as selected by Contractor.

2.9 CONCRETE BRICK

- A. Conform with ASTM C 55, Grade P-II, of nominal size 8 x 2-1/4 x 3-3/4 inches; gray-white concrete color with smooth formed natural texture.

2.10 Mortar Materials:

- A. Cement: Portland Cement ASTM C 150, Type I or II.
- B. Sand: ASTM C 144, well screened, clean, hard sharp, siliceous, free from loam, silt and other impurities. Provide the following grain size distribution:
 - 1. #10 sieve, passing 95-100 percent
 - 2. #50 sieve, passing 15-40 percent
 - 3. #100 sieve, passing 0-10 percent
 - 4. Removal by decantation 0-5 percent
- C. Water: Clean, fresh, free from oil, acid, organic matter and other deleterious substances.
- D. Mortar Mix Proportions: Provide mortar mixed in the proportion of one part cement to three parts sand with only enough water to allow good workability of the mix. Hydrated lime may be added in amounts not exceeding 10 percent of the cement weight.

2.11 CASING PIPE END SEALS

- A. Flexible synthetic rubber boot conforming to ASTM C923 or sleeve seal modular penetration seal with insulating plastic plate, galvanized bolts and nuts, and EPDM rubber interlocking links manufactured by Thunderline Corporation (Link Seal) or approved equal.

2.12 SURFACE SETTLEMENT MARKERS

- A. Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

PART 3 - EXECUTION

3.1 GENERAL

- A. Tunneling construction shall be performed so as not to interfere with, interrupt or endanger roadway or railway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the tunneling. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the tunneling, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from tunneling operations and shall repair and restore damaged property to its original or better condition at no cost to the City.
- B. Face Protection: Protect the face of the excavation from the collapse of the soil into the tunnel liner or pipe.
- C. Tunneling Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. Due to restrictive right-of-way and construction easements, casing lengths less than the nominal 20 foot length may be necessary.

D. State, County, or City Roadway Crossing

1. The Contractor shall be held responsible for the coordinating and scheduling of all construction work within the roadway right-of-way and posting of appropriate permits.
2. Work along or across the transportation department rights-of-way shall be subject to inspection by such transportation department.
3. Perform all installations to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the roadway, street or its connections.
4. Do not place excavated material or equipment on the pavement or shoulders of the roadway without the express approval of the transportation department.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Place construction materials to be installed, which are placed on the right-of-way in advance of construction, in such a manner as not to interfere with the safe operation of the roadway.
6. The Contractor shall be responsible for providing sufficient information to obtain a blasting permit from authorities having jurisdiction in a timely manner. The Contractor or subcontractor shall provide evidence of proper licenses prior to performing any blasting.

E. Railroad Crossings

1. Unless noted otherwise, the City will obtain the encroachment permit from the Railroad with supplemental information supplied by the Contractor as needed. However, the Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
2. Additional insurance is required for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed, cost of the same shall be borne by the Contractor.
3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.
4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.
5. No blasting shall be permitted within the Railroad right-of-way.

3.2 EXCAVATION:

A. The following requirements are supplemental to the excavation section(s) of these specifications.

1. When required, excavate suitable pits or trenches for tunneling operations. Provide all necessary bracing, sheeting and/or other temporary means to insure safety of persons and property.
2. Maintain excavation free from water, mud and debris which will interfere with an efficient tunneling operation. Neatly dry-excavate material of whatever nature encountered within the tunnel. Do not use sluicing or jetting excavation techniques.

3. Limit excavation to the minimum diameter required for tunnel liner or casing pipe installation.
4. Pressure grout all excessive voids which may develop about the tunnel liner exterior.
5. Promptly backfill all pits and trenches.

3.3 GROUNDWATER CONTROL

- A. Control the groundwater throughout the construction of the tunnel liner or casing pipe.
- B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the City immediately and take such action as necessary to maintain safe conditions and prevent damage.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Perform dewatering in such a manner that removal of soil particles is held to a minimum.

3.4 SAFETY

- A. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadway or railway or interfere with normal traffic over it.
- B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadway or railway.
- C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".
- D. Bore pits shall not be left unattended unless proper safety barriers are in place.

3.5 SURFACE SETTLEMENT MONITORING

- A. Provide surface settlement markers for tunnel liner and casing pipes 24-inches in diameter and larger. Place marker as specified and as directed by the City. Place settlement markers outside of pavement area, along the centerline of the casing at 20 foot intervals and offset 10 feet each way from the centerline of the casing. Also place markers at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the tunnel liner and casing pipe. Tie settlement markers to bench marks and indices sufficiently removed as not to be affected by the tunneling operations.
- B. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the City. In the event settlement or heave on any marker exceeds 1-inch,

immediately cease work and using a method approved by the City and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.

- C. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. Use the following schedule for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the City's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.
- D. Cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.
- E. Promptly report any settlement and horizontal movement immediately to the satisfaction of jurisdictional personnel and the City and take immediate remedial action.

3.6 CASING PIPE INSTALLATION

A. Shaft

- 1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
- 2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform dewatering pumping operations as necessary.
- 3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if necessary due to soil conditions.

B. Jacking Rails and Frame

- 1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
- 2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
- 3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

C. Accomplish boring and jacking of casing pipes by the dry auger boring method without jetting, sluicing or wet boring.

D. Auger the hole and jack the casing through the soil simultaneously.

- E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- F. At contractor's option and to minimize abandoned tunnel liner, conduct initial boring using a pilot hole approximately 2 inches in diameter for the entire installation length. Verify required line and grade and use pilot hole as the center line of the larger hole to be bored. If rock is encountered in pilot hole, withdraw equipment and relocate tunnel location. Conduct pilot hole installation in revised location and repeat procedure. No extra payment will be considered for installations that encounter rock and must be abandoned.
- G. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.
- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the City, or removed and replaced at Contractor's own expense.
- I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- L. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.
- M. Perform tunneling such that the final tunnel liner position is within the following limits:
 - 1. Lateral Alignment: Within one (1) percent of tunnel liner length.
 - 2. Vertical Elevation: Within one half (0.5) percent of tunnel liner vertical grade, provided that the final grade of flow line is in the direction indicated on the drawings.
- N. Maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- O. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, remove the sheeting, shoring and bracing, unless otherwise approved by the City.
- P. Remove all surplus material from the right-of-way and finish the excavation flush with the surrounding ground surface.

- Q. Use grout backfill for unused holes or abandoned pipes.
- R. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

3.7 MINING:

- A. When installing tunnel liner by mining methods, handle, maintain, and install liner plate sections in such manner as to avoid damage to plates and surface coating thereon. Install liner plates immediately after excavated material is removed from the tunnel. Do not permit liner plate installation to fall more than 24 inches behind the tunnel working face. Do not leave more than 12 inches of unlined tunnel at the end of the day's operation.
- B. Provide all necessary bracing bulkheads and/or shields required to insure safety of persons and property. Provide well braced, temporary bulkhead against excavation face during each cessation of work while the heading is within 20 feet of railroad tracks or roadway pavement.
- C. Pressure grout voids between excavated tunnel bore and liner plate at least daily as tunnel excavation and liner plate installation proceeds. In addition, do not extend liner plate installation more than 10 feet without placing grout. Introduce grout through all grout holes in tunnel liner plate at or near tunnel invert, continue grouting until grout mixture bleeds through grout holes located at tunnel crown. Use grouting pressure sufficient to fill all voids.
- D. Perform tunneling such that the final tunnel liner position is within 0.2 feet of specified position, both laterally and vertically.

3.8 FREE BORING

- A. Where the Drawings indicate a pipeline is to be installed by boring without casing, construct the crossing by the free bore method. Accomplish the free bore method by the dry auger boring method without jetting, sluicing, or wet boring.
- B. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside diameter plus 1-inch, whichever is greater.
- C. Free boring, where indicated on the Drawings, is to be performed at the Contractor's option. The Contractor may choose to construct the crossing by the conventional bore and jack casing pipe method without any additional cost than required for free boring.
- D. The Contractor shall be responsible for any settlement of the roadway caused by the free bore construction activities.
- E. Do not exceed a distance of forty (40) feet for any free bore.

3.9 ABANDONMENT:

- A. Should it become necessary to abandon a tunnel for any reason, pressure grout the abandoned hole to prevent damage to surrounding earth and structures. When the tunnel liner is retained, fill entire tunnel with grout and pressure grout any voids about the tunnel liner exterior.

3.10 TUNNEL LOCATIONS:

- A. Locate tunnels as indicated, or as directed by the City.
- B. To facilitate construction, changes in tunnel location may be permitted. Proposed changes must be submitted by the Contractor. Changes in location must be acceptable to the City, and any utility company or public agency having jurisdiction over the location.

3.11 VENTILATION AND AIR QUALITY

- A. Provide, operate and maintain for the duration of tunneling activities a ventilation system to meet safety and OSHA requirements.
- B. Construct vents for tunnel liners or casing pipe of all natural gas crossings as indicated and as required by any utility company or public agency having jurisdiction over the location.

3.12 ROCK EXCAVATION

- A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the City, cannot be removed through the casing, the City may authorize the Contractor to complete the crossing by an alternate method established in a change order.

3.13 INSTALLATION OF PIPE

- A. After construction of the tunnel liner or casing pipe is complete, and has been accepted by the City, install the carrier pipeline in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the tunnel liner or casing pipe and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- C. Hold the carrier pipe in the casing pipe by one of the following methods:
 - 1. Use hardwood blocks spaced radially around the pipe and secured together so that they remain firmly in place. The spacing of such blocks longitudinally in the casing pipe shall not be greater than 10 feet.
 - 2. Use casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of one casing spacer per nominal laying length of pipe. Attach casing spacers to the pipe at maximum 18 to 20 foot intervals.

3.14 END SEALS

- A. Seal ends of tunnel liner or casing pipe to prevent debris and moisture from entering the annular space between the carrier pipe and tunnel liner. For casing pipe tunnel liner, provide casing pipe end seals complying with specifications. .

END OF SECTION 330523

SECTION 330525 – DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Sewer Use Ordinance, and Building Codes, apply to this Section.

1.2 SUMMARY

- A. Directional drilling operations include, but are not limited to, all earthwork associated with the installation of pipe, protection of all underground utilities and appurtenances and restoration of any damaged improvements:
- B. The directional drilling method of installation shall be used at the locations shown on the drawings and at locations where the Contractor elects to utilize directional drilling out of convenience.
- C. Related Sections:
 - 1. Section 311000 "Route Clearing" for site stripping, grubbing, and stripping and stockpiling topsoil.
 - 2. Section 312000 "Trenching and Backfilling" for excavation of pits or trenches for directional drilling operations.
 - 3. Section 331100 "Water System" for installation of water mains, fittings, and appurtenances.
 - 4. Section 333000 "Sanitary Sewer System" for installation of gravity sewers, force mains, fittings, and appurtenances.

1.3 JOB CONDITIONS:

- A. Verify existing site grades to be substantially consistent with grades shown on the Drawings before commencing work. Report any significant conflict in grades, which would alter work as specified in specifications and shown on drawings to the City before proceeding.
- B. Subsurface conditions presented, (if any), are not intended, as representations or warrants of continuity and it is expressly understood that the Contractor is solely responsible for any subsurface conditions that may arise.
- C. Weather Limitations: Conduct all operations during weather conditions appropriate to the work being performed.
- D. Traffic Control: Schedule and conduct Work in a manner which will minimize inconvenience to vehicular and pedestrian traffic. Provide flagmen, barricades, warning signs, warning lights, and other warning means as appropriate. Maintain traffic on all roads and streets which must be crossed by utility lines. When flagmen are utilized, individuals must meet requirements of Georgia Department of Transportation. All traffic controls during construction must conform to Part 6 of the Manual on Uniform Traffic Control Devices.

1.4 QUALITY ASSURANCE:

- A. The requirements set forth herein include a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined herein. Adherence to the Specifications contained herein, or the City approval of any aspect of any directional bore operation covered by this Specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.
- B. Directional Drilling is considered to be a specialty contractor work. The Contractor shall provide evidence of its ability to perform the Work by documentation of successful completion of drills similar to that shown on the Drawings. Utilize drilling machines of sufficient capacity as needed to perform the specified drilling.
- C. Contain all drilling fluids and loose cuttings. No fluids shall be allowed to enter any unapproved areas or natural waterways. Upon completion of the directional drill project, all excess drilling fluid and material shall be removed by the Contractor.

PART 2 - PRODUCTS

2.1 General:

- A. Directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this Project.

2.2 Product Pipe, Joints and Fittings:

- A. Provide all materials, products, and accessories required for complete properly functioning system.
- B. Pipe: Refer to Specification Section 331100, Water Systems and Specification Section 333000, Sanitary Sewer System.
- C. Field Joints: Refer to Specification Section 331100, Water Systems and Specification Section 333000, Sanitary Sewer System.

2.3 Directional Drilling Piping System:

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. 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. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.

- B. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
- C. Mud motors shall be of adequate power to turn the required drilling tools.
- D. The drill pipe shall be constructed of high quality 4130 seamless tubing, grade D or better with thread.
- E. Drilling Alignment: As per Drawings and as per pipe manufacturer's recommended bend radius.
- F. Drilling Tolerances: Provide a plan and profile drawing of the proposed directional drilling route prior to commencing this operation if it differs from the Drawings. The Contractor must receive approval from the City on the new proposal prior to commencing work. In no case shall the Contractor's proposal or final alignment be at a higher elevation than shown on the Drawings.

2.4 Guidance System:

- A. The method of guidance utilized in locating and steering the pilot string from entry to exit shall be state of the art. Readings shall be recorded after the advancement of each successive drill pipe segment and the readings plotted. Access to all recorded readings and plan and profile information shall be made available to the City or its representative at any time.

2.5 Drilling Fluid (MUD) System:

- A. Provide a self-contained, closed, drilling fluid mixing system of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be a minimum of five hundred (500) 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 - 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate. The water and bentonite clay shall be mixed thoroughly and be free of any clumps or clods. No additional material may be used in drilling fluid without prior approval from the City. Contractor is responsible for provisions to obtain clean water for the fluid.
- C. The Bentonite mixture used shall have the following minimum viscosities as measured by a Marsh Funnel:
 - 1. Rock, Clay - 60 sec.
 - 2. Hard Clay - 40 sec.
 - 3. Soft Clay - 45 sec.
 - 4. Sandy Clay - 90 sec.
 - 5. Stable Sand - 80 sec.
 - 6. Loose Sand - 110 sec.

7. Wet Sand - 110 sec.

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

- D. Additives to drilling fluid such as drill soap, polymers, etc. shall be “environmentally safe” and be approved for such use. No diesel fuel will be allowed.
- E. The mud pumping system shall have a minimum capacity of 50 GPM and be capable of delivering the drilling fluid at a constant minimum pressure of 1000 psi. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, or equivalent, 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 trucks of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and facilities.

2.6 Drilling Fluid (MUD):

- A. Drilling fluid shall be composed of a carrier fluid (water) and drilling fluid additives (bentonite and/or polymers). Bentonite is a naturally occurring clay mineral that forms a mud when mixed with water.
- B. The composition of the drill fluid is determined by the contractor using results of their geological investigation executed in line with the framework of the project planned before construction.
- C. The principal functions of drilling fluids used in horizontal directional drilling are:
 - 1. Transporting drill cuttings to the surface by suspending and carrying them in the fluid stream flowing in the annulus between the borehole wall and the drill pipe/product.
 - 2. Cleaning build-up on drill bits or reamer cutters by directing fluid streams at the cutters.
 - 3. Cooling the down-hole tools and electronic equipment.
 - 4. Lubricating to reduce the friction between the drill pipe/product pipe and the borehole wall.
 - 5. Stabilizing the borehole, especially in loose or soft soils by building a low permeability filter cake, and exerting a positive hydrostatic pressure against the borehole wall. The filter cake along with positive hydrostatic pressure reduces collapse of the borehole and prevents formation fluids (i.e. groundwater) from flowing into the borehole or drilling fluids from exiting the borehole into the formation (loss of circulation).
- D. Provide hydraulic power to the bore-hole with a down-hole mud motor.
- E. The Contractor will be responsible for the following fluid properties and testing which are considered as minimum requirements to assure compatibility between the drilling fluid mixture and the native soil after proper identification and characterization. These fluid properties are density, viscosity, pH value, circulation, volume and solid content.
- F. Continuously monitor and record the drilling fluid pressures and flow rates at the pump and within the annular space within thirty (30) feet of the drilling head.

2.7 Other Equipment:

- A. Pipe rollers shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe. Rollers shall be used as necessary to assist in pull back operations and in layout/fusing of material.
- B. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Interpreting subsurface investigation reports and data, investigating the project site and determining the site soil conditions is the sole responsibility of the Contractor. Any subsurface investigation by the Contractor must be approved by the authority having jurisdiction over the site. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.
- B. The Drawings are generally schematic, and it is required that the Contractor extend and/or modify construction details, as approved by the City, when field conditions necessitate such changes to achieve a safe and properly functioning system.
- C. Conduct operations in such a manner as to assure a system free of leakage and protection of pipe during installation.
- D. Unless otherwise instructed, install pipe by accepted industry standards for drilling and installation of pipe.

3.2 PIPE HANDLING:

- A. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe and pipe coating. If the pipe must be stacked for storage, such stacking should be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe should be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.
- B. Where directional drilling is required under railroads, highways, streets, or other facilities, construction shall be done in the manner that will not interfere with the operation of the facility, and shall not weaken the roadbed or structure. No roadway pavement, subgrade, roadbed, paved shoulder, or unpaved median shall be disturbed or excavated as part of the pipe placing operation for any reason without written authorization by the City. In the above areas, any broken or damaged boring rod/stem, boring head (including transmitter/transponder locating heads and cutter heads), couplings (including backreaming, swivel or connector couplings), or any other material that cannot be retrieved as part of the pullback operation shall become the property of the property owner and shall be abandoned in place unless otherwise authorized in writing by the City. There shall be no additional payment for abandoned material.

- C. Once the directional boring is begun, the operation shall be carried on without interruption, insofar as practical.

3.3 METHOD OF DRILLING:

- A. Employ a horizontal directional drill machine of sufficient size to complete the untrenched crossing. Drill pilot hole through the soil at the proper entrance angle and follow the drill profile to the exit location.
- B. In unconsolidated soil formations, pump a drilling fluid or slurry of at least 10% high grade Bentonite, or approved equal, to consolidate excavated materials, to seal the walls of the hole and to furnish lubrication for subsequent materials and equipment. Continuously monitor and adjust the pressure of the drilling fluid to ensure that ground surface disruption and fluid migration and spillage is prevented.
- C. Contain and/or remove excess drilling spoils from both ends of the directional drill and any surface “break-outs” with the use of a vacuum truck and holding tanks or other acceptable means. Utilize relief holes and other measures to obtain controlled “break-outs”.
- D. Any voids that develop and are deemed by the City to be detrimental to the Work or adjacent facilities or environment are to be pressure grouted with an acceptable mix.
- E. Enlarge the pilot hole to a suitable size for the pipe to be installed by pulling a reamer back through the hole. For larger diameter pipes, prereaming the hole by pulling successively larger reamers through the hole may be required.
- F. After reaming the hole to a sufficient size, attach the length of line pipe to be installed to the reamer. Utilize a swivel attached to the reamer to prevent excessive rotation of the line pipe. During pullback, rotate drill pipe while circulating drilling fluid, as needed. Place line pipe on rollers above the ground or lift pipe with side booms. Inspect pipe coating for holidays using a holiday detector. Repair and reinspect holidays until none are present.
- G. If the drill rod and line pipe becomes stuck in the hole, forcing the pipe through the hole by pushing on the exposed end of the pipe will not be permitted. All forces required to pullback the pipe must be generated by the drilling machine.
- H. After pipe pullback is complete, check pipe coating on first ten-foot section of pipe for holidays in the presence of the City’s representative. If a holiday is detected, the directional drill will not be accepted.
- I. After completion of successful pipe installation, backfill excavation and clean up staging areas as soon as possible.
- J. Provide accurate Record Drawings of each directional drill installation. Provide plan and profile showing location and elevation at 50-foot intervals for the length of the directional drill installation. Record data for the profile during the drilling with capable locating equipment.

END SECTION 330525

CITY OF LOGANVILLE
DEPARTMENT OF UTILITIES
WATER MAIN DESIGN & CONSTRUCTION STANDARDS

INTRODUCTION

The "Water Main Design & Construction Standards" consists of current policies and procedures of the City of Loganville Department of Utilities. Included herein are design regulations, submittal policies, inspection and acceptance procedures, construction installations, and other pertinent information. Construction specifications are also part of the standards as referenced in Article 4 and are furnished separately.

The "Water Main Design & Construction Standards" was created to provide design information for both Department of Utilities Department capital improvement projects, and private development projects; and to provide construction guidance, specifications, policies, standards and other information necessary to construct water system improvements that meet all requirements of the Department.

Changes, revisions, additions, or corrections to the "Water Main Design & Construction Standards" may be made at any time without prior notification.

ARTICLE 1

GENERAL DESIGN PROCEDURES

1.1 GENERAL WATER

1.1.1 CONSTRUCTION DOCUMENTS

- a. It is the intention of the City of Loganville that water and sewer systems and improvements installed by a private entity should be substantially equal to those installed by the City of Loganville with respect to materials, installation, performance, and durability. While the City of Loganville strives to assure the quality of the final installed products, it is not the intention of the City of Loganville to direct the specific construction methods to be used during the implementation of the work performed on privately owned property. However, these specifications contain instances wherein limitations or qualifications may be applied to the Contractor's operations and methods when those activities extend to areas that are publicly accessible or when the construction interacts with publicly owned and maintained areas or systems. Such additional requirements or limitations to operations or methods shall be included into the plans submitted for approval and implemented by the Developer in such locations as appropriate.
- b. Construction documents must be submitted through the current plan review process to the City of Loganville Department of Planning and Development.
- c. All water plans shall be sealed by either a Georgia Registered Professional Engineer or a Georgia Registered Professional Land Surveyor as per EPD rule 391-3-6-02.

1.1.2 Plans will generally be submitted through the plan review process (Department of Planning and Development) to be routed to the City of Loganville Public Utilities Department.

1.1.3 Each drawing, plat(s) or subdivision map(s) required by ordinance or policy will be delivered digitally to the City of Loganville. Final as-built plan(s) will meet these requirements as well.

1.1.4 Digital file requirements consist of

- a. A completed digital drawing in one of the following preferred file formats:
 - DXF: Drawing Exchange Format, popular with most CAD software
 - DWG: Native AutoCAD file format
 - SHAPE: Popular geographic file format
- b. An Adobe compatible PDF file of the drawing that will plot to scale must be submitted. A geoPDF is acceptable format as well.
- c. This data must be provided on standard transfer media or by electronic transfer (CDROM, USB drive, E-mail attachment or other suitable internet transfer, e.g. "dropbox".) The submitted transfer media shall be labeled with the project name (subdivision name or accepted job name, etc.) filing date, registered land surveyor or professional engineer's name and any other established project identifier.

1.1.5 Drawing Data Standards:

- a. All drawings will be constructed in the Georgia State Plane West Coordinate System in feet using the NAD83 Datum and vertical datum using NAVD88 Datum.
- b. All data shall be completed using standard graphics that require no “third party” software.
- c. Digital line work must be topologically clean. Lines must be geometrically continuous and boundaries must be geometrically closed with no “undershoots” or “dangles” where boundaries intersect. The digital linework must not include “sliver polygons” (gaps or overlaps between properties.) Essentially, the digital version of the map must be of a high precision so it can be easily converted to a GIS format.

1.1.6 All water design reviews and acceptance of water main systems will be approved by City of Loganville Department of Utilities and administered by City of Loganville Planning Office.

1.1.7 Plans will be reviewed and written comments will be provided indicating required corrections and/or changes.

If a betterment or up-sizing of the pipe is required, City of Loganville Planning Office will coordinate with City of Loganville Department of Utilities and will so indicate. The Engineer will be responsible for the design in accordance with City of Loganville Planning Office design criteria.

1.1.8 All construction on State right-of-way or any roadways under the jurisdiction of the Georgia Department of Transportation (GDOT) requires a GDOT permit or equivalent GDOT approval. City of Loganville will process the necessary application during the plan review process. All documents necessary for said application must be provided by the Developer’s Engineer.

1.1.9 The Director of Utilities for City of Loganville or designee is authorized to approve a variance for any significant deviation from the technical or procedural specifications of these standards, before installation.

1.1.10 Prior to final approval of the design drawings, the Owner/Developer must sign all required paper documentation from City of Loganville Planning Office.

1.1.11 Any subdivision which is submitted and approved as one project must either be constructed as one project, or if subsequently phased out and constructed in multiple phases or units, must be resubmitted and receive approval from City of Loganville Planning Office for each phase or unit individually prior to any further construction. In the instance of multiple phases or units, separate construction permits and Owner/Developer agreements must be obtained for each phase or unit.

1.1.12 Digital copy of the design drawings shall be submitted to City of Loganville Planning Office for final approval. If the plans are acceptable, they will be stamped by City of Loganville Planning Office upon approval and the Development Permit can be signed off.

1.1.13 If needed, attend a "pre-design" meeting with City of Loganville to discuss project scope and parameters.

1.1.14 All designs shall be produced in a digital format meeting the Department's requirements.

- 1.1.15 Conduct a field review of both sides of the road(s) for which the proposed water main is to be installed to develop plans of project area showing road centerline and edge of pavement, all side streets, creek crossings, large rock outcroppings, existing sanitary sewer manholes, existing storm drains and headwall structures, exceptional trees (30" or greater in diameter, ornamental or obviously cared for as ornamental by property owner), densely wooded areas or areas which would require substantial clearing, linear footage of sodded lawns, existing driveways and types, existing water meters, existing fences within and adjacent to the rights-of-way, power poles within the rights-of-way, existing fire hydrants and valves, and any other structures located within or adjacent to the rights-of-way which may impact the proposed construction.
- 1.1.16 Contact all utility companies, including but not limited to, gas or petroleum pipelines, natural gas, buried electric lines, buried phone cables, etc. to obtain locations of those utilities within the project limits of both sides of the rights-of-way, including side streets. (NOTE: Although the "One-Call" Utility Protection Center provides notification service to subscribing utilities for "design" locates, individual notification is also required by this Department to insure all available information concerning other utilities facilities are included on the project design.)
- 1.1.17 Place property lines and street numbers, land lot and district lines on the plan. If design contract includes right-of-way research, place all existing rights-of-way and prescriptive easements on the plan.
- 1.1.18 Plans will be marked up by City of Loganville Utilities Department to show existing water and sanitary sewer mains if not indicated on plan. If the design contract must include right-of-way research, City of Loganville Utilities Department will mark up all existing rights-of-way and prescriptive easements. Any required future stubs, City of Loganville Utilities Department and side of road will be indicated.
- 1.1.19 Meet with City of Loganville Utilities Department to review plans and determine the side of road on which the main is to be installed. The normal location is the north side of east-west streets, and the west side of north-south streets. However, field conditions and obstacles identified on the field review may dictate a deviation from this standard. **NOTE: Water main location must maintain 10-foot separation from existing parallel sanitary sewer mains, and 18-inch vertical separation from any existing perpendicular crossing of sanitary sewer mains.**
- 1.1.20 **If proposed water line crosses private property, a 20 foot wide permanent easement must be provided by the responsible party.** Prepare any required easement plats.
- 1.1.21 Prepare submittal package, including any required drawings, plans, or details, for application of Ga. D.O.T. permits, or any other necessary permit applications and submit to the City of Loganville for processing.
- 1.1.22 Plans will be submitted through the plan review process (Loganville Department of Planning & Development) to be routed to City of Loganville Department of Utilities.
- 1.1.23 Design the proposed water line to include alignment, all creek and bridge crossings, all tie-ins, future stubs, fire hydrants and valves, and abandonment of any existing water mains, if necessary.

- 1.1.24 If no water main of sufficient to serve the proposed development exists at the project entrance, the engineer shall design a water line to City of Loganville Utilities Department approved size, from a source specified by City of Loganville Department of Utilities, in accordance with City of Loganville Utilities Department design criteria.
- 1.1.25 Plans will be reviewed and written comments will be provided indicating required corrections and/or changes.
- 1.1.26 Digital copy shall be submitted to the City of Loganville for final approval and if the plans are acceptable, they will be signed off by the Director of Department of Utilities, Director of Planning & Development and the City Engineer.
 - a. The "Development Permit" can be signed off. City of Loganville will retain two (2) copies of the stamped plans, the others will be returned to the engineer. If the project plans use a CAD system, the CAD plans shall also be submitted at this time (see Article 1.1.4 for compatible file format).
- 1.1.27 A plan bearing the original signed City approved stamp must be presented by the approved water contractor in order to obtain a water main construction permit.
- 1.1.28 As-built Drawings for non-residential projects shall be submitted to City of Loganville Planning Office a minimum of 10 business days prior to request for Certificate of Occupancy. As-built Drawings for residential projects shall be included with the final plat submittal.
- 1.1.29 As-built Drawings must be sharp, clear, clean, legible, and suitable for scanning and filing.
- 1.1.30 As-built Drawings shall include a site plan and any supplemental or shop drawings as may be required by City of Loganville Planning Office.
- 1.1.31 As-built Drawings must be stamped by a Professional Engineer or Registered Land Surveyor registered in the State of Georgia.
- 1.1.32 Record drawings (as-builts) must be submitted and approved before a project can receive final acceptance, and/or Certificates of Occupancy.

ARTICLE 2

DESIGN CRITERIA

2.1 PROPOSED WATER LINE

- 2.1.1 City of Loganville Utilities Department standard location for water line placement is on the north side of east-west streets, and on the west side of north-south streets.
- 2.1.2 For subdivisions, the proposed water line shall be located on the north side of east-west streets, and on the west side of north-south streets.
- 2.1.3 For existing city roads, the proposed water line will generally be located 5' inside the right-of-way. For existing Ga. D.O.T. roads, the proposed water main must be located 5' inside the right-of-way. Unusual circumstances such as embankments, obstructions, other utilities, etc. may warrant deviation.
- 2.1.4 For private developments/subdivisions the water main shall be located 7' from the back of the curb.
- 2.1.5 For non-subdivision streets, the side of the road the proposed water main will be located on may be primarily determined by the location of any existing lines to be tied into at the beginning and/or end of the project.
- 2.1.6 For non-subdivision streets, the location may also be determined by existing rights-of-way, or lack thereof. Water main must be installed within deeded rights-of-way. Installations within "prescriptive" easements are not permitted.
- 2.1.7 For non-subdivision streets, generally avoid designing the location on the same side of the road as the gas lines. In projects where any existing gas lines have "active" cathodic protection for corrosion prevention, the water main **must** be designed on the opposite side of the road, and may require additional protective measures as specified by the City of Loganville.
- 2.1.8 For non-subdivision streets, if none of the above govern, then design the water line for the side of the road that has the fewest conflicts, i.e. rock outcroppings, trees, side roads, fences, structures, involved landscaping, embankments, prescriptive easements, etc. **NOTE: Water main location must maintain 10-foot separation from existing parallel sanitary sewer mains, and 18-inch vertical separation from any existing perpendicular crossing of sanitary sewer mains.**
- 2.1.9 The proposed water lines shall be shown on the plans as solid lines.
- 2.1.10 The existing water lines shall be shown a dashed lines on the plans.
- 2.1.11 All existing City road crossings shall be shown to be bored, and shall be noted as follows:

"ALL CITY ROAD CROSSINGS TO BE BORED WITH STEEL CASING UNLESS OTHERWISE APPROVED BY THE CITY OF LOGANVILLE PRIOR TO CONSTRUCTION". All Ga. D.O.T. roads will be bored with steel casing.

- 2.1.12 **Water Mains piping material installed should be PVC AWWA C900, Pressure Class 235, DR 18 standard unless specified in certain areas. Ductile Iron Pipe is required along state highway routes or within state right-of ways, under intersections, stream crossings, over and under all cross drains and at all other locations specified by the Utilities Department. Piping materials requirements may be changed at the discretion of the Department of Utilities.**
- 2.1.13 A minimum pipe size of 8" will be installed in all residential developments/subdivisions, including connection to existing mains. A minimum pipe size of 12" will be installed in all commercial developments/subdivisions, including connection to existing mains. If adequate volumes for fire flow requirements and pressures are not available at the point of connection, a larger main and/or additional improvement may be required. Determination of volume or pressure inadequacy will be hydraulically modeled and calculated by design engineer and submitted to the City of Loganville utilizing fire flow test performed by design engineer, and shall be at the sole discretion of City of Loganville Utilities Department for approval.
- 2.1.14 Standard depth of cover is four (4) feet below the elevation of the edge of pavement of existing or proposed roadway surfaces, unless authorized by the City of Loganville Department of Utilities. In the event the shoulder of the roadway is below the elevation of the edge of pavement, then a minimum of four (4) feet of earth cover is to be maintained at all times.
- 2.1.15 A chlorination tap is to be indicated on the plan approximately 3 to 5 feet from the beginning of the project. Separate project "phases" must have chlorination taps indicated for each phase.

2.2 FIRE HYDRANTS

- 2.2.1 Installed Fire Hydrants shall have 5 inch front steamer and 2 inch outlets on each hydrant.
- 2.2.2 Fire hydrants, within residential developments or along existing City roads, are generally located every 400 feet, starting at the beginning of the project, or as dictated by existing fire hydrant locations. Hydrants can be spaced a minimum of 350 feet to an **absolute maximum** of 450 feet, and should be located on property lines where possible. For commercial developments, the fire hydrant spacing cannot exceed 300 feet, and location at property lines is preferred, but is not mandatory.
- 2.2.3 Each fire hydrant shall be installed utilizing a fire hydrant tee and 6" isolation valve, and shall be so identified on the plan.
- 2.2.4 Place a fire hydrant near the end of each main. At the end of each main an automatic flushing station will be required to be installed. Where this is not feasible due to spacing requirements, provide a 1-inch blow-off on 8-inch mains, and 2-inch blow-off on 12-inch and larger mains, for use in flushing.
- 2.2.5 All existing fire hydrants on mains to be abandoned as part of the submitted project are to be labeled as follows: "Existing fire hydrant to be salvaged and returned by contractor to the City of Loganville Utilities Department".
- 2.2.6 Each fire hydrant shall be capable of providing a minimum flow of 1,000 gallons per minute (GPM) at 20 pounds per square inch (psi) residual pressure. Verification of water flow and

pressure availability at the development shall be provided prior to permit approval with a report of hydrant test results conducted in accordance with NFPA 291, Fire Flow Testing and Marking of Hydrants. Prior to issuing a certificate of occupancy, a second hydrant test report conducted per NFPA 291 shall be provided after completion of the system improvements to show compliance with the above minimum flow and pressure.

2.3 VALVES

- 2.3.1 Valves shall be depicted on the plans.
- 2.3.2 In-line valves are to be generally located every 1,000 feet, or every third fire hydrant, and are to be located at intersections in such a manner to enable isolation of various streets within the development without shutting down adjacent streets. (See Details W-1 and W-2)
- 2.3.3 For 8 inch mains within residential developments, in-line gate valves located at fire hydrants should be installed approximately 10 feet away from the hydrant on the side opposite the water source. 12 inch mains and larger shall have two (2) butterfly valves located approximately 10 feet away from either side of the hydrant (See Details W-4 and W-5)
- 2.3.4 For future stubs, the valve is to be located approximately 20 feet (one full joint of ductile iron pipe) from the plugged end.
- 2.3.5 All proposed valves smaller than 12 inch shall be gate valves.
- 2.3.6 All proposed valves 12 inch and larger shall be butterfly valves (except tapping valves), or resilient seated gate valves for 12 inch only.
- 2.3.7 On City of Loganville contract projects all proposed valves (with the exception of the 6 inch fire hydrant isolation gate valve) shall have a "Rhino Marking System" installed during construction (see detail W-20, W-21, W-22). Any existing valves which will remain in service as part of the project, and which are exposed in the course of constructing the project, shall also have an electronic marker installed.

2.4 TIE-INS TO EXISTING MAINS

- 2.4.1 Tie-ins are usually made as follows:
 - a. Proposed main is tied straight into existing main using a solid sleeve or transition sleeve. (See Details W-6)
 - b. Proposed main is tied straight into existing main using a reducer, or other fitting, and a solid sleeve.
 - c. Proposed main is laid parallel to existing main and is tied in using smallest degree bends possible for conditions.
 - d. Proposed main is laid parallel to existing main and is tied in using a tee on the proposed main and cutting in a 90-degree bend into the existing main, thus leaving a future stub on the proposed main.
 - e. Proposed main is laid parallel to the existing main and is tied in using a tap on the proposed main and cutting in a 90-degree bend into the existing main, thus leaving a future stub, (generally used only to tie into existing 2" mains).

2.5 HOUSE SERVICE CONNECTIONS IN RESIDENTIAL CUL-DE-SACS

- 2.5.1 Residential cul-de-sacs shall be designed to include a live 1-inch service to each lot not immediately adjacent to the water main from the neck of the cul-de-sac. The water main at any location shall be kept out from under any paved or concreted surfaces within the streets. The water main shall end at the neck of the cul-de-sac with a fire hydrant and a 2" main connected with valve ran around the perimeter of the cul-de-sac to allow each lot in cul-de-sac to have separate service. At the end of the 2" main, a blow off is provided for flushing.
- 2.5.2 1-inch live services shall be located at the property lines to avoid conflict with driveway construction.
- 2.5.3 Water meters shall be placed on property lines opposite from sewer connections. All driveways must be a minimum of 3 ft. from property line when in right-of-way or easements. No taps or service lines will allowed to be under concrete or asphalt of driveways. Each service shall terminate in an approved curb-stop, located within a standard meter box. Must show all location of stubs on plans. Meter boxes must be set 11 ft. from backside of the curb. Curb stop valves installed at backside of the meter box. Meter boxes shall be left flush with finished grade. (See Details W-12 and W-13)
- 2.5.3 One-inch live services shall be installed utilizing materials and techniques described in Specifications Section 331100 Water System. (See Details W-14)

2.6 EASEMENTS

- 2.6.1 It is the policy of City of Loganville Department of Utilities that water mains are to be installed only in dedicated rights-of-way. Decisions as to use of easements will be made by City of Loganville Utilities Department on a project-specific basis. Generally, use of easements will only be permitted along existing City roads where there is no right-of-way, or there is structural conflict within the right-of-way.
- 2.6.2 Water Mains must be centered within the required permanent easement. Exceptions can be approved by City of Loganville Department of Utilities, but will only be approved in special circumstances and when City of Loganville Department of Utilities determines that future repairs and maintenance can be accomplished without unreasonable difficulty.
- 2.6.3 Development projects with city utilities are required to either provide an installed water main to the adjoining property line(s) for future use or the final plat must show a 40' permanent perpetual utility easement. All developments, including non-water or non-sewer projects, must include on the final plat a 30' permanent perpetual utility easement and 40' construction easement for future use paralleling any stream or drainage way. The discretion of where Utility easements for adjoining properties is required shall lie solely with City of Loganville Utilities Department. Easements for future use shall comply with stream buffer and wetland requirements.
- 2.6.4 Water System utility easements off the street right-of-way shall be clearly defined on the Final Plat or Boundary Survey Plat. Such easements are for ingress and egress to reach facilities and for the purposes of installing, servicing, replacing, repairing, removing, maintaining, and improving the underground utility uses as determined by the City. The property owner will be

required to keep the easement free of obstruction in such a way as to assure the maximum accessibility at all times. The property owner shall not alter any utility improvements without the prior written approval from the City. Permanent structures, except paved driveways, shall not be constructed or erected in an easement or any part thereof without the prior written approval from the City. Driveways shall cross an easement as close to perpendicular as practical. Property owners may plant landscaping in an easement; however, the City is not responsible for replacing the landscape material located in the easement when it is removed to maintain, repair, replace, remove, or improve the utility system. The City is not responsible for replacing or repairing existing structures or structure damage located in the easement when it is removed to maintain, repair, replace, remove, or improve the utility.

2.7 STATE HIGHWAY D.O.T PERMITS

2.7.1 If any portion of a proposed project enters a State of Georgia controlled right-of-way, then a Ga. D.O.T. permit application is required. This is to be submitted to City of Loganville Utilities Department for processing by the Ga. D.O.T. Pages must be 8 1/2" X 11", but drawings need not be to scale. All measurements indicated on the permit application must be submitted in Imperial (American) units. Generally, portions of the project design can be reduced in size match lined, if necessary, as long as the text is still legible. Compaction notes must be included on every page of the application drawings (see "Georgia D.O.T. Utility Accommodation Policy and Standards"). Application must include four each of the following: plan, profile, traffic control plan, and section from D.O.T. city map. See Ga. D.O.T. Permit Application Checklist for required forms, and examples.

2.8 TEXT

2.8.1 All proposed water mains shall be labeled for size and material.

2.8.2 All existing water mains shall be labeled for size, material, under which they were installed. This information can be obtained through City of Loganville Utilities Department.

2.8.3 For all side streets and intersections, indicate whether existing water mains are one-way fed or, if not, the location of the next in-line valve. This information can be obtained through the City of Loganville Utilities Department.

2.8.4 Any existing water mains to be abandoned as part of the proposed project shall be so noted and reflect the required symbology on plans

2.8.5 All fire hydrants shall reflect the required symbology on plans and shall be stationed to the nearest 5-feet. Information regarding depth, length of lead, and manufacturer shall be provided on the "as-built" drawing.

2.8.6 All valves shall reflect the required symbology on plans labeled as to size and whether gate valve or butterfly valve (GV or BFV), and stationed to the nearest 5-feet. Manufacturer's name shall be provided on the "as-built" drawing.

2.8.7 Water meter information will be provided by the City of Loganville in an ASCII format, and shall be imported into the drawing file and placed above the respective water meter symbol for

account identification.

- 2.8.8 1" fonts or larger shall be used for most text. 2" fonts or larger shall be used for road names and rights-of-way.

2.9 LINE WEIGHTS

- 2.9.1 Proposed water main and right-of-way should be equivalent to a #3 pen.
- 2.9.2 Existing utilities should be equivalent to a #2 pen.
- 2.9.3 Edge of pavement, driveways, property lines, fences, etc. should be equivalent to a # 1 pen.

2.10 RECORD DRAWINGS (ASBUILTS)

- 2.10.1 Record drawings (as-builts) must be submitted to the City of Loganville before a project can receive final approval, and/or Certificates of Occupancy. (NOTE: In order to avoid delays in the "approval process" of developments/subdivisions, as-built drawings should be submitted as soon as the water main installation is complete to allow sufficient time for review).
- 2.10.2 Refer to Article 1.1.29 through 1.1.32 for additional requirements.

ARTICLE 3

DIGITAL FILE FORMAT

NOTE: The following section is mandatory for engineering firms designing system expansion and replacement/improvement projects. The City of Loganville prefers a digital copy of any development/subdivision record drawings for incorporation into the City G.I.S. mapping system, along with the required hard-copy documents.

3.1 FORMAT

- 3.1.1 Refer to Article 1.1.2 through 1.1.5 for additional requirements.
- 3.1.2 Project is to be submitted as an AutoCAD release 12 or later .DWG or .DXF file format. No solid fill is to be used in .DXF file, as this attribute is lost during the translation. Instead, hatching or patterning may be used. See also item #8, "Compatibility with the City of Loganville Utilities Department CAD/CAE Systems", in Appendix "I".

3.2 LEVELS OR LAYERS

- 3.2.1 A list of utilized levels or layers, and designation of which items are located on each level will be required. A minimum of seven (7) levels will be required: right-of-way; edge of pavement; property lines; existing utilities; existing water mains; proposed water mains; and text. Logical grouping of related items under the same level is acceptable, i.e., property lines, land lot lines, and district lines.

3.3 CELLS OR BLOCKS

- 3.3.1 A listing of all cells or blocks and their names is required.

ARTICLE 4

CONSTRUCTION INSTALLATION

4.1 PRIOR TO CONSTRUCTION

- 4.1.1 At no time will any water main construction commence prior to approval of all plans, receipt of any required agreement documents, and issuance of a Construction Permit.
- 4.1.2 Only City of Loganville approved contractors may install water mains.
- 4.1.3 All water mains, valves, fire hydrants, and other appurtenances to be dedicated to or owned by the City of Loganville Utilities Department shall be installed according to the "approved" design. **All** field changes **must be pre-approved** by the City of Loganville Department of Utilities. Contractor must have a set of the "approved" design containing an original stamp and a copy of the Water Main Design & Construction Standards on site at all times. (See Details W-16 and W-19)
- 4.1.4 Contractor shall adhere to all Federal, State, City, and local laws, ordinances, and regulations which in any manner affect the conduct of work, including, but not limited to, initiating, maintaining, and supervising all safety precautions and programs in connection with the work.
- 4.1.5 Throughout the construction, the Contractor shall fully comply with the applicable requirements of local, State, and Federal agencies in the control and containment of soil erosion, including post-construction maintenance of erosion control devices.

4.2 CONSTRUCTION SPECIFICATIONS

- 4.2.1 Provide all construction work in compliance with the separately published Construction Specification Sections tabulated below

<u>Section Number</u>	<u>Title</u>	<u>Pages</u>
311000	Route Clearing	6
312000	Trenching and Backfilling	11
320119	Patching of Rigid Pavement	4
329200	Turf and Grasses	9
330523	Tunneling	12
330525	Directional Drilling	6
331100	Water System	26

4.3 **GUARANTEE OF WORK COMPLETED**

- 4.3.1 The Contractor (and Developer in private developments) shall guarantee for a period of twelve (12) months from the date of final acceptance (from date of final plat approval or Certificate of Occupancy in private developments), all water mains, appurtenances, trenches, roadway and surface restorations, landscaping, and any other areas disturbed by the construction of the project, to be free from defects, and to be installed in compliance with all regulations, specifications, plans, directions, and construction practices which govern said installations. In private developments, the conditions stated in the "Owner/Developer Agreement" shall govern.
- 4.3.2 The Contractor (and Developer in private developments) shall be responsible for repairs to any leaking pipe, fittings, etc. Should trenches settle during the warranty period, he shall promptly furnish and place fill to the original grade and restore any damaged landscaping. Should any leaks or trench settlement occur under new pavement, the Contractor will be held responsible for the cost of all repairs, including pavement replacement. The determination of the requirement for the Contractor to perform work under this guarantee shall be at the sole discretion of the City of Loganville Department of Utilities.

SECTION 331100 – WATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Standard Drawings, Zoning Ordinance, Subdivision Regulations, Sewer Use Ordinance, Water Main Design and Construction Standards, and Building Codes apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Foundation preparation.
2. Furnishing and laying water pipe.
3. Furnishing and installing water line appurtenances.
4. Furnishing and laying services and accessories.
5. Cleaning and sterilizing constructed work.
6. Testing constructed work.

- B. Related Sections include the following:

1. Section 311000 “Route Clearing” for topsoil stripping and stockpiling.
2. Section 312000 “Trenching and Backfilling” for excavation and backfilling trenches for utility installation.
3. Section 320119 “Patching of Rigid Pavement” for pavement, sidewalks, and curb and gutter restorations.
4. Section 329200 “Turf and Grasses” for ground surface grassing and turf requirements.
5. Section 330523 “Tunneling” for utility line construction.
6. Section 330525 “Directional Drilling” for utility line construction.

- C. Utility furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

- A. DIP: Ductile iron pipe.
- B. PVC: Polyvinyl chloride plastic.
- C. HDPE: High –Density Polyethylene.
- D. PEX: Crosslinked Polyethylene.

- E. Wet Cut-In: The physical cutting into any existing water main which will result in the interruption of service to an existing customer, or which shall necessitate the removal of water contained within the existing main from the excavation which is caused by cutting into the pipe.

1.4 SUBMITTALS

- A. When requested by the City, submit lists of all pieces of pipe and fittings received on the project, including copies of shipping documents from the manufacturer/supplier. Furnish lists that includes the serial or mark number, weight, class, length, size, and description of each typical piece received.
- B. When requested by the City, submit three copies of the manufacturer's sworn affidavit of inspection and testing of all ductile iron pipe and fittings provided for the work.
- C. When requested by the City, submit copies of all product data and shop drawings for proposed valves prior to their installation.

1.5 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Furnish manufactured items, fittings, valves, and service components, from manufacturers having regularly produced such items as specified herein which have proven satisfactory in actual service, over at least a two (2) year period, as determined by the City.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- D. NSF Compliance:
 - 1. Comply with NSF 61 for materials for water system piping and specialties for potable domestic water.
- E. Imperfections:
 - 1. Irregardless of tolerances permitted by industry standards specified herein, the City may reject pipe or appurtenances at the manufacturing plant or project site, which have cracks, chips, blisters, lack of smooth interior or exterior surface, evidence of structural weakness, porosity, joint defect, significant variation from theoretical shape, or other imperfection which might, in the opinion of the City, contribute to a reduced functional capability, accelerated deterioration, or reduced structural strength. Failure to reject unacceptable materials shall not constitute an acceptance of said materials.
- F. Repairs:
 - 1. Do not install used, patched, or repaired pipe or appurtenances.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including yard hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including yard hydrants, according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- H. Store materials and equipment and in such a manner as to cause the least inconvenience to the affected property owners, insure traffic safety, and so as not to endanger the general public in any way. All active, existing fire hydrants must be kept unobstructed and accessible at all times. All water and gas valves, and underground power and telephone manholes must also be left uncovered by such storing of materials.
- I. Do not string pipe along the project within existing right-of-way, unless approved by the City and the authority having jurisdiction over the roadway.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by City or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify City no fewer than seventy-two (72) hours in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without City's written permission.
- B. Licensing:

1. All work specified in this section, except for water system service line installation, is to be performed by a contractor with a valid Utility Contractor's license issued by the State of Georgia. Water service line installation may be performed by either a contractor with a valid Georgia Utility Contractor's license or by an individual having a valid Master Plumber's license issued by the State of Georgia.
- C. Traffic Control:
1. Schedule and conduct Work in a manner which will minimize inconvenience to vehicular and pedestrian traffic. Provide flagmen, barricades, warning signs, warning lights, and other warning means as appropriate. When flaggers are utilized, individuals must meet the requirements of Georgia Department of Transportation. Maintain traffic on all roads and streets which must be crossed by water lines and making two separate cuts so that at least one traffic lane is open at all times. All traffic controls during construction must conform to Part VI of the Manual on Uniform Traffic Control Devices, latest edition.
- D. Connection to Existing Pipework:
1. Where it is required that connection be made to existing pipework, expose existing piping and determine the exact fittings and/or other appurtenances necessary to make the connection. Connections to existing pipework indicated on drawings (if any) are shown only for the purpose of illustrating the general type of connection desired, and no assurance exists that such illustration can be followed precisely. Unless noted otherwise, use tapping sleeves and valves for connections to existing mains.
 2. The closing of any existing mainline valves to isolate a particular pipe for a "wet cut-in" will be accomplished by the Contractor under the specific direction and presence of the City, and at such time as may be directed by the City. All such shut downs must be approved in advance by the City. The Contractor shall provide all labor and equipment sufficient to uncover valves and clean out valve boxes for access to any existing valves necessary to complete or repair work as part of the project. The City will provide all records and information available to assist in the locating of covered valves, and will also provide assistance in the form of electronic locating equipment. This assistance shall not relieve the Contractor of his responsibility to locate any necessary valve to accomplish the Work.
 3. The contractor will be responsible for notifying all customers who will be affected by the interruption of water service. Such notification must be made at least 24 hours in advance of the planned shut-down. No service may be interrupted without the City's prior approval.
- E. Weather Limitations:
1. Conduct all operations during weather conditions appropriate to the work being performed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide all materials, products and accessories required for complete, properly functioning system. Use only those pipe, fitting, valve and accessory materials that meet National Sanitation

Foundation Standard 61 (NSF 61) requirements. When requested, furnish evidence of NSF 61 compliance.

2.2 DUCTILE-IRON PIPE AND FITTINGS (DIP)

- A. General: Ductile Iron Piping System is to be used for locations within State and City roadway right of ways, at crossings under street intersections, at crossings under streams, when crossing over or under storm drain piping, in rock or unsuitable soil conditions, and at other locations specified by the City. Water main pipe material requirements may be changed at the discretion of the City.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Pressure Class: Min. 350 Pressure Class.
 - 2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110/AWWA C111, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 3. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and corrosion resistant alloy steel bolts. Gaskets shall not be made of natural rubber or any other material which will support microbial growth. Lubricants which support microbial growth shall not be used. The use of vegetable shortening to lubricate joints is prohibited.
 - 4. Provide mechanical joints for direct burial piping or concealed piping within structures, or, at Contractor opinion, for direct burial piping outside structures.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151/AWWA C111, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Pressure Class: Min. 350 Pressure Class.
 - 2. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 3. Gaskets: AWWA C111, rubber.
 - 4. Provide push-on joints for direct burial piping outside structures.
- D. Restrained Joint (RJ): AWWA C110/AWWA C111 Factory fabricated joint restraint system to resist pressurized pipe thrust forces.
 - 1. Push-on Type Joint: Use boltless system of rubber gasket embedded with equally spaced stainless steel segments to grip the pipe, with allowance for joint deflection, and rated for minimum 250 psi working pressure.
 - 2. Mechanical Joint: Use assembly of ductile iron retainer gland and corrosion resistant alloy steel bolts and nuts having a minimum 250 psi working pressure rating and permitting joint deflection and with a minimum safety factor of 2:1.
 - 3. Provide restrained joints for piping installed in tunnel liner, where indicated on the Drawings and, at Contractor option, for direct burial piping thrust restraint in lieu of concrete and metal tie rods and bands.
- E. Flanged Joint (FJ): ANSI/AWWA C115/A21.15 ductile iron flanged joint complying with ANSI B16.1 for class 125 pound drilling, unless class 250 pound drilling is indicated on drawings or is required for connecting valves.

1. Use corrosion resistant alloy steel bolts and nuts, and rubber gaskets complying with Appendix A to ANSI/AWWA C115/A21.15.
 2. Provide flanged joints for normally visible piping, unless noted otherwise.
- F. Grooved Joint, Ductile-Iron Pipe (GJ): AWWA C151, with cut, rounded-grooved ends. Where indicated on the drawings provide bolted coupling utilizing grooved and shouldered pipe ends complying with AWWA C606, and suitable for not less than 150 psig working pressure while permitting angular and restrained longitudinal flexibility of connecting pipe.
1. Use corrosion resistant steel alloy bolts and nuts, molded or extruded elastomeric gasket material recommended by manufacturer for actual service application required.
 2. Use malleable or ductile iron housing with fusion bonded epoxy outside coating.
 3. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.

2.3 DUCTILE- IRON PIPE AND FITTINGS NON-FLOATING (DIPNF)

- A. Pipe (Ball Joint): Ductile iron pipe conforming with ANSI/AWWA C151/A21.51, suitable for minimum 250 psig water working pressure and with wall thickness not less than tabulated below:

<u>Nominal Pipe Dia.-Inches</u>	<u>Min. AWWA C151 Special Thickness Class</u>
4, 6	54
8, 10	55
12, 14	56
16	57
18	58

1. Provide non-floating pipe with additional wall thickness, which with accessories and cement lining results in at least ten (10) percent negative buoyancy when pipe is under water and full of air.
- B. Pipe Lining: Provide cement mortar pipe lining complying with ANSI/AWWA C104/A21.4 and standard asphaltic coating over lining and pipe exterior. Do not use any material which imparts taste or odor to potable water, or which is toxic to humans.
- C. Joints: Boltless, flexible type joints permitting deflections up to fifteen (15) degrees without damage to pipe or joint. Construct joints of high strength, corrosion resistant, alloyed cast steel or ductile iron with flexible gasket which safely permits high end-pull forces required for handling and installing pipe. Utilize joint design which under actual service conditions is free of measurable leakage of water into or out of piping installation.

2.4 COPPER TUBE AND FITTINGS (CUTW-1)

- A. Hard Copper Tube: ASTM B 88, Type L, water tube, annealed temper, working pressure up to 200 PSIG at 200°F water temperature. Use for all non-direct burial installations.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type, working pressure up to 160 PSIG at 100°F water temperature or cast bronze pressure fittings. Furnish only wrought-copper fittings if indicated.
- B. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper, working pressure up to 200 PSIG at 200°F water temperature. Use for underground direct burial installations.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type, working pressure up to 160 PSIG at 100°F water temperature or flare type cast bronze pressure fittings complying with ASME B16.26. Furnish only wrought-copper fittings if indicated.
- 2.5 POLYVINYL CHLORIDE PIPE AND FITTINGS (PVC AWWA Pipe):
- A. General: PVC AWWA Piping System is to be used for open cut installation of water main piping which is four (4) to twenty-four (24) inches in diameter, unless a different water main pipe material is specified in certain locations. Water main pipe material requirements may be changed at the discretion of the City.
- B. PVC, Class 235 (SDR 18) Pipe: Non-toxic, polyvinyl chloride compound conforming to the requirements of AWWA C900, with ductile iron outside diameter.
1. Furnish pipe with each section continuously and permanently marked with the following identifying data:
 - a. Nominal size and outside diameter.
 - b. Material code designation.
 - c. Dimension ratio number (SDR or DR).
 - d. Pressure class.
 - e. AWWA specification designation.
 - f. Manufacturer's name or trademark and production record code.
 - g. National Sanitation Foundation Seal (NSF) verifying suitability of pipe material for potable-water service.
 2. PVC Fabricated Fittings: AWWA C900, Class 305, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 3. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 4. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 5. Joints (PVC Pipe): Unless otherwise shown or required, use flexible elastomeric seals conforming to ASTM D 3139 and ASTM F 477. Provide compatible gaskets or adapters as required when joining to different type pipe material.

2.6 POLYVINYL CHLORIDE PIPE AND FITTINGS (PVC ASTM Pipe):

- A. General: PVC ASTM Piping System can only be used for pipe sizes under nominal four (4) inch diameter.
- B. PVC, Class 200 (SDR 21) Pipe: Non-toxic, polyvinyl chloride compound meeting ASTM D 1784, Class 12454-A or B material specification, and further meeting requirements of the National Sanitation Foundation.
 - 1. Furnish pipe with each section continuously and permanently marked with the following identifying data:
 - a. Nominal size and outside diameter.
 - b. Material code designation.
 - c. Dimension ratio number (SDR or DR).
 - d. Pressure class.
 - e. ASTM specification designation.
 - f. Manufacturer's name or trademark and production record code.
 - g. National Sanitation Foundation Seal (NSF) verifying suitability of pipe material for potable-water service.
 - 2. Fittings (PVC): Manufactured from same material compound as pipe, and in such configuration as necessary to achieve long term water pressure rating not less than the connecting pipe or not less than 160 PSI at 73 F with a safety factor of 2.5:1.
 - 3. Fittings (Gray or D.I. Fittings): Gray or ductile iron fittings complying with ANSI A21.10 or A21.11 for minimum 250 PSIG pressure rating. At contractor's option, ductile iron compact fittings complying with ANSI A21.53 for minimum 350 PSIG pressure rating may be used. Provide cement mortar interior lining complying with ANSI A21.4, and manufacturer's standard bituminous coating over lining and fitting exterior. Do not use any lining or coating which imparts taste or odor to potable water, or which is toxic to humans.
 - 4. Joints (PVC Pipe): Unless otherwise shown or required, use flexible elastomeric seals conforming to ASTM D 3139 and ASTM F 477. Provide compatible gaskets or adapters as required when joining to different type pipe material.
 - 5. Joints (Gray or D.I. Fittings): Comply with ANSI A21.11 and unless otherwise shown or required, use at contractor's option push-on type joint or mechanical joint utilizing corrosion resistant alloy bolts. Provide gaskets or adapters compatible with connecting pipe as required.

2.7 HIGH-DENSITY POLYETHYLENE PIPE AND FITTINGS (HDPE)

- A. General: HDPE Piping System is to be used for Horizontal Directional Drilling installation of plastic piping which is four (4) to eighteen (18) inches in diameter.
- B. Furnish pipe with each section continuously and permanently marked with the following identifying data:

1. Nominal size and outside diameter.
 2. Material code designation.
 3. Dimension ratio number (SDR or DR).
 4. Pressure class.
 5. ASTM or AWWA specification designation.
 6. Manufacturer's name or trademark and production record code.
 7. Blue color stripes or print lines to designate potable water.
- C. High Density Polyethylene Piping System Type DR-9 and conforming to the requirements of AWWA C906 and ASTM F714.
1. Molded Fittings: Molded Fittings shall be manufactured and tested in accordance with ASTM D3261, and tested in accordance with AWWA C-906.
 2. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings, and tested in accordance with AWWA C-906.
 3. Joints: Joints between plain end pipes and fittings shall be made by butt fusion.
 4. Unless otherwise shown or required, use thermal butt fusion per ASTM D2657 for plain end pipe and fittings and thermal saddle fusion for saddle branch fittings. Conduct thermal fusion by operators trained and qualified in the recommended procedures of the pipe and fusion equipment supplier.
 5. DIPW to HDPE Transitions: Polyethylene assembly consisting of stainless steel, chamfered edge, back-up flange complying with ANSI B16.1 for class 125 pound drilling and a polyethylene pipe flange by stub end. Thermal fuse stub-end to plain pipe. Use stainless steel bolts and nuts and red rubber gaskets.

2.8 STEEL PIPE AND FITTINGS (CSP)

- A. General: CSP Piping System is to be used with plain ends for mechanical couplings and only for special highway crossings, bridge/culvert crossings, or other special applications as determined by the City.
- B. Comply with AWWA C200 with minimum wall thickness as follows:
1. Pipe Diameters 8 Inches (200 mm) and Smaller: 0.375 inches (9 mm).
 2. Pipe Diameters Greater than 8 Inches (200 mm): 0.50 inches (13 mm)
- C. Fittings and Special Sections: Comply with AWWA C208.
- D. Flanges:
1. Comply with AWWA C207, Class D.
 2. Type: Slip-on
- E. Field Welding Materials: Comply with AWWA C206.
- F. Interior Cement Mortar Lining: Comply with AWWA C205
- G. Buried Steel Pipe Exterior Lining:

1. Description: Shop-applied prime coat and coal tar enamel protective coating.
2. Comply with AWWA C203.

2.9 WATER SERVICE TUBING (PEX TUBE AND FITTINGS)

- A. General: PEX Piping System is to be used for open cut installation of crosslinked polyethylene tubing which is one-half (1/2) to three (3) inches in diameter.
- B. Tube Material: Crosslinked polyethylene plastic according to AWWA C904 with material designation code PEX 3306, 160 pressure class, and SDR9.
- C. Fittings: ASTM F 2080, cold expansion fittings with metal compression-sleeves or insert-stiffener type compression joint complying with the material and performance requirements of AWWA C800.
- D. Bend Radius: Minimum bend radius for cold bending of PEX no more than five (5) times the outside diameter.

2.10 GATE VALVES

A. AWWA, Ductile Iron (GV) Gate Valves

1. Nonrising-Stem, Resilient-Seated Gate Valves:

- a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 250 psig.
 - 3) Interior Coating: Complying with AWWA C550.
 - 4) Operations: Counterclockwise opening, manual operator.
 - 5) Direct Burial Locations: Mechanical joint ends, o-ring seals, and square operating nut. Where depth of valve is too great for operation by standard wrench, provide suitable, permanently installed valve stem extension and guide. For each valve, furnish two-piece, cast iron roadway valve box, 5-1/4-inch min. shaft, cast iron top ring, drop type lid with "Stay Put" features, and extensions necessary to adjust to finish grade.
 - 6) All Except Direct Burial Locations: Flanged ends, o-ring seals, position indicators and operating handwheel.
- b. Valves under three (3) inch size are not defined by AWWA C509 or C515 but, when required, shall be manufactured to those standards.
- c. Manufacturers: For standardization of gate valves on the City system, furnish one of the following units:
 - 1) American Flow Control
 - 2) U.S. Pipe Valve & Hydrant
 - 3) Mueller Co.; Water Products Div.

2.11 BUTTERFLY VALVES

A. AWWA, Iron (BFV) Butterfly Valves.

1. Description: Cast iron body; mechanical joint connections, rubber seated.
 - a. Standard: AWWA C504.
 - b. Minimum Pressure Rating: 150 psig.
 - c. Actuation: Totally enclosed, oil bath lubricated, gear type reduction, counterclockwise open, square operating nut.
 - d. Use butterfly valves only on piping twelve (12) inches diameter and greater upon approval of the City.

2.12 CHECK VALVES

A. AWWA Check Valves:

1. Description: Iron body, bronze mounted, rubber faced disc, full opening check valves with flanged ends and stainless steel hinge pins.
 - a. Standard: AWWA C508.
 - b. Interior Coating: Complying with AWWA C550.
 - c. Pressure Rating: 175 psig.

2.13 DOUBLE DETECTOR CHECK VALVES (DCVW)

A. Double Detector Check Valves:

1. Description: Iron body, full opening detector check valve with flanged or grooved joint ends and by-pass meter complying with AWWA C510.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: 175 psig.
2. In addition to detector check valves, furnish gate valve on each side of check valves and on either side of meter.

2.14 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies (TSV):

1. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Mechanical joint split sleeve and gate valve assembly suitable for working pressures up to 200 psig. Cast- or ductile-iron, two-piece bolted sleeve with recessed flanged outlet for new branch connection.
 - c. Manufacturers: For standardization of tapping sleeves on the City system, furnish one of the following units:

- 1) American Flow Control
 - 2) Mueller Co.; Water Products Div.
 - d. Tapping Sleeve at Contractor's opinion, or due to existing pipe material: Stainless steel tapping sleeve and gate valve assembly complying with AWWA C223 and suitable for working pressures up to 150 psig and testing pressures up to 225 psig. Fabricate sleeve unit, including shell, lugs, nuts, bolts, flange and test plug, from 18-8 stainless steel. Provide sleeve lining gasket and flange gasket of styrene butadiene rubber suitable for potable water service
 - e. Manufacturers: For standardization of fabricated tapping sleeves on the City system, furnish one of the following units:
 - 1) Rockwell
 - 2) JCM
 - 3) Ford
 - f. Valve: Furnish gate valve and valve box complying with preceding Gate Valve (GV) specifications except provide one raised face flange mating tapping-sleeve flange.
 - g. For valve sizes 16 inch and greater, install valve in a horizontal configuration with a differential worm gear operator.
 - h. The use of strap-type tapping saddles for taps larger than 2" is not permitted. (see Details W-6)
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable slip-type extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter. Support box in such a manner as not to transmit shock, stress, or load directly to the valve or valve bonnet.

2.15 PRESSURE REGULATORS

A. Pressure Regulators Type 1 (PR1):

1. Description: All bronze, screwed ends, pressure reducing valve assembly with integral strainer and monel or stainless steel seat, suitable for reducing inlet pressures of up to 300 psig to adjustable reduced pressures between 25 psig and 75 psig.

B. Pressure Regulators Type 2 (PR2):

1. Description: Cast iron body, bronze trimmed, screwed ends, pressure reducing valve assembly of the hydraulic pilot-controlled diaphragm type with resilient disc. Include removable basket type strainer recommended by valve manufacturer. Furnish assembly suitable for reducing inlet pressures up to 300 psig to adjustable reduced pressures between 20 psig and 300 psig.

2.16 FLEXIBLE COUPLING (FCW)

A. Flexible Couplings:

1. Description: Bolted couplings, utilizing plain pipe ends, while permitting angular flexibility without longitudinal restraint of connecting pipe. Fabricate body of welded

rolled high strength steel of cylindrical shape with malleable or ductile iron flanges, coupling gaskets of molded synthetic rubber and bolts of corrosion resistant steel alloy.

- a. Standard: AWWA C219.
- b. Interior Coating: Complying with AWWA C550.
- c. Pressure Rating: 150 psig.

2.17 CORPORATION STOP AND CURB STOP

- A. Service-Saddle Assemblies: Comply with AWWA C800. Provide assemblies suitable for 200 psig cold water working pressure. Include dual strap saddles, Mueller threaded outlet for corporation stop, and valve compatible with tapping machine.
 1. Service Saddles For Ferrous Pipe: Extra heavy, hot dipped galvanized malleable iron bodies with galvanized or cadmium plated double straps and nuts, retained neoprene gasket, and threads mating those of the corporation stop used.
 2. Service Saddles For Non-Ferrous Pipe: Heavy cast bronze or waterworks brass body and straps, bronze, brass or stainless steel screws or nuts and bolts, retained O-rings seal, and threads mating those of the corporation stop used.
 3. For standardization of fire hydrants on the City system, furnish one of the following units:
 - a. Dresser Style No. 91
 - b. Smith-Blair Tyle No. 313.
- B. Corporation Stops: 1 inch minimum size, cast brass or bronze with end threads conforming with AWWA C800, and consisting of precision tapered, and individually lapped, key and body surfaces. Shop test each stop for leakproof shutoff at specified working pressure. Provide two spiral wraps of three mil PTFE (Teflon) tape wrapped clockwise around the inlet threads on the closed corporation stops. For standardization of fire hydrants on the City system, furnish one of the following units:
 1. Hays No. 5200.
- C. Curb Stops: Brass or bronze body with resilient plug, permanently non-grease lubricated, clockwise operation to close service, and with end connections appropriate to connecting tubing or pipe conforming with AWWA C800. Use stops rated not less than 175 psig working pressure at 180°F. For standardization of fire hydrants on the City system, furnish one of the following units:
 1. Hays No. 5060.
- D.

2.18 WATER METER BOXES

- A. Description: High-density, reinforced plastic body with one piece cast iron lid, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping, unless otherwise approved by the City. Provide box of size and height appropriate

to installation of meter and accessories required. Furnish a 1.75 inch diameter round opening in box cover to allow proper attachment of antenna for meter reading.

2.19 FIRE HYDRANTS

A. Manufacturers:

1. For standardization of fire hydrants on the City system, furnish one of the following units:
 - a. American Flow Control, 5-1/4" American-Darling B-84-B-5.

B. Dry-Barrel Fire Hydrants:

1. Description: Freestanding, traffic model ("breakable"), compression type, dry barrel 3-way fire hydrant, with one NPS 4-1/2 and two NPS 2-1/2 outlets, shut-off valve 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Furnish cast-iron body, with harnessing lugs for optional reaction bracing, and with 6 inch size inlet connection compatible with connecting pipe. Provide positive shut-off main valve whose minimum orifice diameter is at least 4- 1/4 inches.
 - a. Standard: AWWA C502.
 - b. Pressure Rating: minimum 150 psig.
 - c. Outlet Thread: NFPA 1963 external hose thread for use by local fire department. Include cast-iron caps with steel chains.
 - d. Operating and Cap Nuts: Pentagon, 1 inch point to flat.
 - e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
 - f. Exterior Finish: Shop paint above grade portion with silver enamel. Apply two field finish coats of bright silver enamel to hydrant barrel, or use other color code for hydrant as directed by the City for the flow and pressure rating of the system.
 - g. Installation: Select depth of bury appropriate to actual hydrant installation (forty eight (48) inches minimum unless otherwise indicated).
 - h. Additional: Furnish one (1) operating wrench for each ten (10) hydrants furnished, or fraction thereof.

2.20 WATER METER

A. Water Meters up to 2-inch size: AMR displacement type with flat nutting disc complying with AWWA C700, lead free bronze main case, solid state absolute encoder meter register by Neptune Technology Group, Inc.

1. Adaptable to field programmable absolute encoder register without interruption of the customer's service.
2. Metering information obtained through a remotely located receptacle or Meter Interface Unit (MIU).

B. Water Meters greater than 2-inch:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Neptune Technology Group, Inc.; Utility Management Systems

- C. Water meters greater than 2-inch size shall not be supplied by the City, but compliant to the manufacturers listed above.
- D. Bypass piping configuration and metering shall be provided for 2-inch and greater water meter configurations compliant with the standards and details of the Gwinnett County Department of Water Resources.

2.21 BACKFLOW PREVENTERS

- A. Backflow Preventers (BFP): Reduced pressure type suitable for 150 psig working pressure and complying with ASSE 1013 and AWWA C511 specifications. Use flanged cast iron body with bronze trim. Furnish complete unit including preventer, strainer, and test cocks.

2.22 ACCESSORIES:

A. Service Line Conduit:

- 1. 2 inch PVC Pipe complying with ASTM D1785, Schedule 40 and PVC socket fittings complying with ASTM D2466 for Schedule 40.
- 2. PVC Joining materials: Solvent cement for joining PVC piping complying with ASTM D2564 with primer according to ASTM F656.

B. Metal core Pipe Detection Tape:

- 1. Metal core enclosed 3 inch wide protective plastic jacket which can be readily detected by electronic pipe locator instruments in general use. Provide blue color jacket with block letters reading "Buried Water Line Below".

C. Pipe Tracer Wire:

- 1. No. 12 AWG solid soft drawn copper having not less than 98 percent conductivity with NEC type THHN, THWN or XHHW insulation jacket. For splices, use direct bury kit DBY/DBR as manufactured by 3M or approved equal.

D. Coarse Granular Material For Pipe Bedding:

- 1. Crushed stone, crushed gravel, natural gravel, crushed shell, or similar material complying with ASTM C33, and having No. 67 gradation (3/4 inch to No. 4 sieve) or No. 57 (1 inch to No. 4 sieve) gradation.

E. Valve Markers:

- 1. Concrete post measuring 4 inch square by 5 foot long with edges on top 18 inches chamfered 1/2 inch. Markers in city street right-of-way shall be fiberglass 4" wide and 5 feet long. The words "Water Valve" shall be cast vertically into the marker beginning 2" from the top of the marker. There shall also be a 1 1/4" brass plug cast into the marker 1"

below the letter "E" of the word "Valve", which shall be stamped in the field by the Contractor, after installation, with the distance, in feet, from the valve marker to the valve box. Concrete is to conform to ASTM C94 having a minimum compressive strength of 3,000 psi at twenty-eight (28) days.

2.23 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C857 and made according to ASTM C858.
 - 1. Ladder: ASTM A36/A36M, steel or polyethylene-encased steel steps.
 - 2. Manhole: ASTM A48/A48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
 - a. Dimension: 24-inch (610-mm) minimum diameter, unless otherwise indicated.
 - 3. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.24 ANCHORAGE/SUPPORT MATERIALS:

- A. Non-direct Burial Locations:
 - 1. Piping Anchorage/Support: Factory fabricated hangers and supports conforming to Manufacturers Standardization Society (MSS) SP-58.
 - 2. Metal Tie Rods, Bands and Accessories: 18-8 stainless steel or other acceptable corrosion resistant components which when combined as a system resist applied thrust at test and working pressures, with suitable allowance for water hammer.
- B. Direct Burial Locations:
 - 1. Concrete: Concrete conforming to ASTM C94 having a minimum compressive strength of 2,000 psi at twenty-eight (28) days.
 - 2. Metal Tie Rods, Bands and Accessories: 18-8 stainless steel or other acceptable corrosion resistant components which when combined as a system resist applied thrust at test and working pressures, with suitable allowance for water hammer.

2.25 CONCRETE BLOCKING – THRUST RESTRAINT ON EXISTING COMPONENTS

- A. General: Anchorage detailed on Drawings, if any, represents minimum anchorage to be installed. Field conditions may require additional anchorage, and it is the Contractor's responsibility to recognize such additional requirements and to provide appropriate additional anchorage.
- B. Provide concrete blocking on existing bends, tees, valves, and other existing components where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.

- C. Concrete shall have a compressive strength of not less than 2,000 psi, at twenty-eight (28) days. Provide mix with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the City. Mix and transport ready mix concrete in accordance with ASTM C 94. Use reinforcing steel conforming to the requirements of ASTM A 615, Grade 60.
- D. Provide all pipe, fittings, valves and accessories to be in contact with concrete with polyethylene encasement. Keep joints and hydrant drain openings clear and accessible.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings are generally schematic, and it is required that the contractor extend and/or modify construction details, as approved by the City, when field conditions necessitate such changes to achieve a safe and properly functioning system.
- B. Construct and, if necessary, reconstruct water system work as necessary to obtain system free of breaks or excessive leakage.
- C. Unless otherwise indicated, lay and join pipe in trenches and on foundations complying with methods proposed by the pipe manufacturer in writing and approved by the City. Methods will not be approved which are likely to result in lower quality of installation than that afforded by requirements contained in the following articles.
- D. Install PVC pipe in accordance with AWWA C605.
- E. Install ductile iron pipe in accordance with AWWA C600.
- F. Install HDPE pipe in accordance with ASTM D3261, ASTM F1962, and ASTM F2164.
- G. As each section is installed, it shall be pressure tested, disinfected, and samples taken for laboratory tests, and upon receipt of a "passed" Inspection Report from the project Inspector, the Contractor shall place the section in service immediately. Water shall be "carried forward" with the construction.

3.2 PROTECTIVE COATING

- A. After installation, paint all steel sleeves, tapping sleeves, threaded rods, straps, nuts, bolts, washers, couplings, or other connecting/restraining apparatus with either Roster Laboratories, Inc., "Roskote Mastic No. A-939", Koppers Company, Inc., "Bitumastic Superservice Black", or approved equivalent protective coating.

3.3 PIPE FOUNDATION AND LAYING

- A. Clean interior of pipe and all joints before laying. When pipe laying activity is not in actual progress, tightly cover open ends of pipe. Avoid permitting dirt, mud, or other material from entering pipe at any time.

- B. Avoid damage or shock in handling pipe and accessories. Inspect each length of pipe and reject any defective piece. Carefully protect pipe in place from damage or displacement until backfilling operations are complete.
- C. Cut pipe in a manner to avoid damage to pipe or lining, leaving a smooth end at right angles to pipe axis. Smooth and bevel edges of cut pipe for push-on, gasket type joints.
- D. Lay pipe at depth dictated by field conditions, but with distance from top of pipe to finished grade not less than forty-eight (48) inches unless otherwise shown or specified.
- E. Bed pipe on coarse granular material in flat bottom trench with entire pipe barrel bearing uniformly on coarse granular material, except for an approximately eighteen (18) inch gap at pipe balance point for sling removal. Hand excavate and backfill as required to provide uniform and continuous bearing and support for the pipe. Do not support pipe on hubs or end bells. Consolidate coarse granular material under and around pipe up to pipe centerline by tamping.
- F. Join pipe with bells facing direction in which laying operation is progressing. Lay pipe upgrade wherever line grade exceeds ten (10) percent.
- G. Control geometric position of pipe to ensure that pipe and fittings accurately conform with grade and alignment requirements. Lay pipe in a straight line or with uniform sweeping horizontal and vertical curves for proper alignment. Do not exceed manufacturer's recommended maximum joint deflection.
- H. Prevent water from accumulating or running in trench during pipe laying operations or before the trench has been backfilled.
- I. Adjust pipe depth or alignment to accommodate valve, hydrant or fitting setting, and as necessary to meet tie-in requirements or to avoid obstructions.
- J. Where authorized by the City to permit less than three feet of cover over the top of the pipe, construct a concrete cap over the top of the pipe for protection of the pipe for the entire length where the pipe has less than the minimum cover. Place concrete cap a minimum of four feet wide, four inches thick, and no less than one foot above the top of the pipe, and do not extend above the ground at any point.

3.4 SERVICE CONNECTION AND TUBING INSTALLATION

- A. For water system service connections, an individual water service connection assembly shall be supplied from the public water supply system to serve each individual dwelling unit or structure needing water service on private property, unless otherwise approved by the City. All service connections shall be made in accordance with the requirements stated in this specification.
- B. Use service line size matching the tap size, unless noted otherwise. Connect service lines to the main line prior to disinfection.
- C. For all 2" and smaller service lines, the line material from the corporation stop to the meter shall be crosslinked polyethylene (PEX) tubing. Fittings shall be high quality copper brass with approved compression type joints.

- D. For all service lines 4" and larger, use ductile iron pipe from the tapping valve to the meter. All ductile iron service pipes shall have approved mechanical or push-on type joints.
- E. Properties where underground vessels are being used or have been used for the storage of petroleum or other health hazard materials **MUST** use approved soft copper tubing. In addition, any property within 50 feet of a property with such underground vessels must also use approved soft copper tubing for the water service line.
- F. At roads, paved drives, retaining walls, and other paved areas, install service tubing by pushing, pulling, or augering techniques. Do not cut any paved surface without written authorization of the City.
- G. At all other locations, install service tubing by trenching and backfilling, unless otherwise noted.
- H. Lay tubing at depth dictated by field conditions, but with not less than 18 inches cover.
- I. Provide tracer wire for all service lines from the main to the building foundation.
- J. Bed tubing on firm soil. Remove any rocks, masonry, or any other objectionable material which could damage tubing.
- K. Lay tubing in compliance with manufacturer's recommendations.
- L. Restore ground surface to original condition. Replace or repair any damaged improvements.
- M. Drill and tap pipe or fittings to receive a threaded pipe connection. Drill holes accurately, with respect to the size and location of the pipe to be received, and at right angles to the axis of the pipe or fittings. Tapping shall be carefully and neatly done by skilled workers using the appropriate tools.
- N. Provide service line conduits across all proposed roadways, where drawings indicate, or in locations directed by the City for all future water connections. Install with a minimum 36 inches of cover and cap at each end to prevent entry of debris. Where conduits are installed across roadways that shall be constructed using curb and gutter, saw-cut a "W" in the curb immediately above the conduit location at the entry point and the point of exiting the conduit.
- O. Locate service corporation stops a minimum of eighteen (18) inches from all pipe joints, fittings, and valves. Install stops at 45 degrees or lower from the top center of the pipe and space 1 inch stops at least two feet from any other 1 inch stops and at least five feet from stops greater than 1 inch size.
- P. Provide curb stops at all meters on the inlet side of the meter box. Locate curb stops and meter boxes at least one foot deep and within the last foot of the right-of-way line.
- Q. Do not locate meter boxes or isolation valves in paved driveways or parking areas subject to vehicular traffic, unless specifically approved by the City.
- R. Set meter boxes flush to finished grade and obtain City approval of final installation. After inspection and approval, the City will install meter. The City will install backflow preventer on residential service only. Backflow preventer installation on commercial service is the responsibility of the property owner. If City arrives to set the meter and the site or meter box

installation is not ready for meter installation, the City will charge an additional \$30.00 fee for each additional request for meter setting.

- S. Provide a Watts 25 AUB or equivalent pressure regulator on all services before the meter is installed.
- T. All temporary and permanent relocations or replacements of house service connections necessary to prosecute the work shall be made at the Contractors expense. Any replacements made necessary due to negligent or careless operations by the Contractor shall be accomplished immediately if customer service is affected, shall be of first class workmanship, and shall be completed using only approved materials, as indicated elsewhere in these Standards, or as directed.
- U. Where indicated on the approved plans or when directed, existing water service connection, relocation, or replacement shall comply with the following:
 - 1. If existing service line is 1" or less, and either galvanized, polyethylene, or polybutylene pipe, which is greater than 10 years old or which shows evidence of significant corrosion internally or externally, the entire service line from the main to the meter shall be replaced.
 - 2. If existing service line is 1 1/2" or 2" and is either galvanized pipe which is greater than 10 years old or which shows evidence of significant corrosion internally or externally, or is PVC or polyethylene pipe, the entire service line from the main to the meter shall be replaced

3.5 BACKFLOW OR CROSS-CONNECTION CONTROL

- A. Backflow or cross-connection control is intended to prevent the contamination or pollution of the public and consumer's potable water system. Backflow check valves are required on all meters where any condition might exist that could cause a flow of water from the property to the City's water main.
- B. There shall be no arrangement or connection by which an unsafe substance may enter the public water supply.
- C. Non-compliance with any of the backflow prevention requirements may result in certain penalties including discontinuation or denial of water service until the consumer has eliminated the actual or potential risk of cross-connection to the satisfaction of the City.

3.6 PIPE CONNECTIONS

- A. Make all pipe connections with standard factory fabricated fittings except where special connection details (if any) are shown on drawings.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

3.7 INSTALLATION OF WATER PIPE IN TUNNEL LINER

- A. Tunnel Liner, 4 Inches and Smaller:

1. Insert water tubing into tunnel liner using methods which prevent damage to tubing.

B. Tunnel Liner, 6 Inches to 42 Inches:

1. Insert water pipe concentrically into tunnel liner by securing hardwood blocks radially or casing spacers around water pipe at no more than ten (10) foot longitudinal intervals. Use stainless steel banding or hardware for securing wood blocks or plastic spacers in place.
2. Use water main pipe in tunnel liner with push-on joints or, at the contractor's option, use mechanical joint type provided contractor coordinates actual tunnel liner size to provide at least one (1) inch clearance all around pipe joint gland outside diameter.
3. Restrain pipe and fittings at each end of tunnel liner in accordance with the Paragraph "Anchorage" in this specification section. If pipe is not restrained at each end, provide restrained joint piping within tunnel liner.
4. Seal ends of tunnel liner or casing pipe to prevent debris and moisture from entering the annular space between the carrier pipe and tunnel liner. For casing pipe tunnel liner, provide casing pipe end seals complying with specifications.

C. Tunnel Liner, 48 Inches and Larger:

1. Use the following procedure for installing water pipe in tunnel liner when adequate working room is available; otherwise follow same procedures as specified for tunnel liner, 6 inches to 42 inches.
2. Insert water pipe into tunnel liner after having grouted bottom of tunnel to exact grade required to support pipe in proper position.
3. Permanently secure water pipe in position by blocking each pipe length at top and sides with brick and mortar, followed by bedding water pipe to a depth equal to one-fourth the pipe outside diameter, with concrete.
4. Plug ends of tunnel with twelve (12) inch thickness of masonry, leaving weep holes at lower end of tunnel,

3.8 VALVES, FITTINGS, AND HYDRANTS

- A. Provide valves, fire hydrants, fittings and other appurtenances as indicated on the drawings, specified herein, and as requested by the City. Comply with applicable provisions of AWWA C600.
- B. Set fire hydrants plumb and with ground line index within one tenth (0.1) foot of actual final ground level. When fire hydrants are adjacent to streets, set pumper connection perpendicular to curb or edge of pavement.
- C. Set valves and valve boxes plumb, with valve box cover level with surface. Set lower section of valve box concentric with valve operating stem. Avoid contact at lower end of valve box with valve body or pipe.
- D. When valves are installed in areas not subject to vehicular traffic, provide 18 inch square by 4 inch thick concrete pad around top of valve box and a nearby valve marker. Install valve marker as close to the right-of-way opposite the valve as possible with the brass plug facing the valve. Locate marker to avoid damage by traffic and set the marker with 24 inches exposed above finished grade. The marker may be somewhat lower in areas where it may be considered

obtrusive, such as lawns, however, at no time shall the marker be installed at less than 18" above finished grade

3.9 TAPPING SLEEVES AND VALVES

- A. Verify the type, size, and O.D. and class of the existing pipe before ordering the tapping sleeve and valve. Furnish and install tapping sleeves and valves suitable for connection to the existing water mains at locations indicated on the approved plans. Provide the appropriate tapping machine and competent supervision for the making of water main taps.
- B. Prior to making the tap, hydrostatically pressure test, in the presence of the City representative, the complete tapping sleeve and valve installation at a test pressure of 150 PSI, or 50 PSI over *the* existing system static pressure, whichever is greater, (PNEUMATIC, OR AIR-PRESSURE TESTING IS PROHIBITED). Properly support the tapping sleeve and valve using bricks, blocks, wedges, or other substantial supporting materials, which will not permit the tapping valve or tapping machine to transfer any downward rotational force to the tapping sleeve.
- C. Backtaps shall not be permitted unless specifically authorized by the City. Any authorized backtaps shall be constructed using MJ fittings and "megalug" retainer glands, and single joints of pipe. Threaded rod shall only be permitted from the steel casing to the first fitting, and shall be welded for a minimum of 8-inches on each rod alongside the casing. Welding of I-bolts directly to the casing for the purpose of installing threaded rod is not permitted.

3.10 ANCHORAGE INSTALLATION

- A. Anchorage, General: Anchorage detailed on drawings, if any, represents minimum anchorage to be installed. Field conditions may require additional anchorage, and it is the contractor's responsibility to recognize such additional requirements and to provide appropriate additional anchorage.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.
- D. Non-Direct Burial Locations:
 - 1. Place hangers, anchors and other supports as required to prevent excessive sagging or undue strain on joints or equipment. Use factory fabricated hangers only, sized amply for imposed loads.
 - 2. Provide effective anchorage for all pressure piping as necessary to resist thrust caused by unbalanced pressure, giving due allowance for test pressures and water hammer.
 - 3. Install hangers and support in accordance with MSS SP-69 and SP-89.
- E. Direct Burial Locations:
 - 1. Anchor all bends, valves, tees, fire hydrants, reducers and other points of unbalanced pressure as necessary to resist thrust at test and working pressures, with suitable allowance for water-hammer. Also anchor piping system installed on steep slopes where gravitational

force might otherwise cause piping displacement. Accomplish piping system anchorage by use of concrete reaction bracing, metal tie rods and bands, and/or restrained joint systems. When using concrete reaction bracing, pour concrete against firm earth and allow it to cure for at least five days before placing main under pressure. Position concrete blocks of sufficient size to counteract the magnitude and direction of the resultant thrust force.

2. Accomplish fire hydrant assembly anchorage by use of metal tie rods and bands and/or restrained joint systems. Keep joints and hydrant drain openings clear and accessible. Provide special support blocks at plastic pipes according to manufacturer's recommendation. When using bands and tie rods in conjunction with reaction bracing, provide a separate band for each tie rod. Use corrosion resistant materials throughout. When using restrained joint systems, utilize methods and place these special joints at appropriate fittings and pipe joints in accordance with manufacturer's recommendation.

3.11 SPECIAL CONSTRUCTION

- A. Where constructing on piers, supporting pipe on bridges, or for other special work, use safe and generally accepted construction methods to accomplish the required work.
- B. When installing water mains across creeks, streams or other drainage channels with flowing water, make installation using directional drilling techniques.

3.12 PIPE DETECTION COMPONENTS

- A. Install pipe detection tape in trench, approximately two (2) feet above pipe. Provide pipe detection tape for all non-ferrous water mains unless otherwise directed by the City.
- B. Install pipe tracer wire on all non-metallic pipe systems. Tape tracer wire to the top center of the pipe at intervals which prevent wire displacement during backfilling operations. Stub tracer wire up six (6) inches above finished grade at all valves and fire hydrants. Completed tracer wire is to be electrically continuous between stub-ups. For splices, use direct bury kits. After backfilling is complete, test electrical continuity of each tracer wire segment and provide test results to City.

3.13 LINE CLEANING:

- A. Avoid permitting dirt, rubbish, construction materials, etc. to enter lines and appurtenances during construction. Use whatever means are necessary to obtain a clean and internally smooth system prior to final acceptance.
- B. Limit use of flushing water to rates and quantities which will not interfere with service to water customers.

3.14 RELOCATING AND RECONNECTING HYDRANTS, VALVES, AND LARGE METERS

- A. Reconnecting and/or relocating existing hydrants shall include disconnection from existing mains, replacing opening in main with new pipe and solid sleeves, and reconnecting to the new mains in accordance with installation instructions identified elsewhere in these specifications.

- B. Salvage hydrants and valves at the direction of the City and deliver to locations designated by the City.
- C. Relocating existing 4 inch and larger water meters and double-check backflow preventers shall include removal of the existing metering or backflow prevention device and vault, and reinstallation of these items to locations identified on the approved plans. If construction phasing requires such, existing devices and vaults shall be carefully removed and stored, and properly reinstalled in the work where indicated or required.
- D. If a wet cut-in is required for the relocation, the Contractor shall request City Inspector to perform a "trial shutdown" to verify that an existing line is actually shutdown before the work is permitted to take place.
- E. Perform the disconnecting, relocating, and reconnecting carefully so as to avoid damaging the materials or appurtenances. Materials or appurtenances damaged in the course of performing the relocation or re-connection shall be replaced or repaired by the Contractor at his own expense and to the satisfaction of City.

3.15 FIELD QUALITY CONTROL

A. General Leakage Requirements:

1. Make entire water line system as near watertight as practicable. Eliminate all detectable leakage regardless of test results hereinafter required.

B. Testing:

1. Furnish and use appropriate test equipment and methods. Include gage, meter, pump and connections.
2. Bleed all air from system prior to testing, providing any necessary corporation stops and piping installations.
3. Conduct successful testing in the presence of a City representative. The City shall verify that all valves, including fire hydrant branch valves, are fully open during the test.
4. The City shall furnish all water necessary for flushing and testing of the main. The Contractor shall meter all water use and is responsible for all costs related to flushing and testing.
5. The Contractor shall provide whatever means necessary to transport or convey the water from a designated source to the water main to be tested.
6. The use of fire hydrants as a connection for either hydrostatic testing or injection of chlorine solutions for disinfection is expressly prohibited.
7. Pressure test all elements of the piping system, including pipe stub-outs. Where piping is buried or otherwise concealed, maintain the pressure test for not less than two hours. Visible piping may be tested for a lesser time period, if approved by the City. Conduct pressure testing at 150 psig unless a lower pressure is recommended by a manufacturer of an element of the system. When a manufacturer does recommend a lower test pressure, furnish the City with a detailed written explanation before commencing test work. In no event may the lower test pressure be less than 110 percent of the nominal working pressure of the pipe comprising the system. Measure pressure for testing refers to the elevational datum of the lowest pipe of the line section being tested. Where static pressure exceeds 100 psig, use a test pressure equal to the static pressure plus 50 psig.

- 8. Where possible, use methods and perform construction work in such sequence as necessary to accomplish pressure testing as work progresses. Do not pressure test more than a one mile length of pipe at one time. Provide temporary piping and accessories if required to isolate test sections. If elevation differentials within a test section vary by more than 45 feet, break the test section into shorter lengths by inserting additional valves.
- 9. Makeup water required to maintain test pressure in gallons per hour per 1,000 feet of pipe under test, over the test period may not exceed the quantities shown in the following table:

<u>Pipe Size</u> <u>Inches</u>	<u>Quantity</u> <u>Gal. per Hour</u>	<u>Pipe Size</u> <u>Inches</u>	<u>Quantity</u> <u>Gal. per Hour</u>
2	0.16	16	1.26
3	0.24	18	1.42
4	0.32	20	1.58
6	0.47	24	1.89
8	0.63	30	2.37
10	0.79	36	2.84
12	0.95	42	3.31
14	1.10	48	3.79

- C. Repair all breaks, detectable leaks or other defects and retest as many times as necessary to obtain passing test.

3.16 DISINFECTING:

- A. Chlorinate all potable water lines on completion of construction, after flushing and prior to placing in service. Use precaution to prevent backflow to supply system. Comply with AWWA C651, including Section 9 procedures on final connections to existing mains. At Contractor's option, accomplish chlorination by either the tablet method, continuous feed method or the slug method.
- B. Fill lines with potable water containing sufficient chlorine to show a chlorine dose of at best 25 mg/l for the tablet method, a 10 mg/l minimum residual at the end of 24 hours retention period for the continuous feed method, or a 50 mg/l minimum residual at the end of 3 hours of exposure for the slug method.
- C. Provide and operate all equipment and provide all materials necessary for disinfecting water mains. Draw off at taps and hydrants along the line until a DPD test or approved chlorine test kit shows a strong indication of residual chlorine.
- D. Unless approved otherwise, apply disinfecting agent at the beginning of the pipeline extension or any valved section of it. Use a corporation stop and a tapping saddle on the new pipe for application.
- E. Retain chlorinated water in the system for a period of twenty-four (24) hours for either tablet method or continuous feed method. Test for specified residual. If residual is as specified or greater, flush the system with potable water, otherwise repeat entire procedure until satisfactory results are obtained. If the slug method of disinfection is used, dispose of heavily chlorinated water in a manner acceptable to Federal, state and local environmental regulatory agencies.

- F. Demonstrate lines to be free of contamination by having the City's laboratory representative draw samples therefrom on two successive days. Deliver samples to the City's environmental laboratory for examination. On receipt of satisfactory test report from the foregoing laboratory, and with the approval of the City, the lines so tested are to be considered free of contamination and placed in service. In the event contamination persists, re-sterilize as necessary until receipt of satisfactory test report. All costs of disinfecting and bacteriological tests are to be paid by the Contractor.
- G. If the City's laboratory representative notices any air, discolored water, debris, or too high or no chlorine residual during collection of the sample, no sample will be taken and the water main shall be flushed again.

3.17 INSPECTIONS & TESTING:

- A. All taps, meter sets, and inspections must be scheduled during regular working hours a minimum of two working days (24 hours) in advance through the Planning and Development department at (770) 466-1165.
- B. Unnecessary recall inspections or meter installations are subject to an assessment of \$30.00 for each event.

END OF SECTION 331100

CITY OF LOGANVILLE
DEPARTMENT OF UTILITIES
SANITARY SEWER DESIGN STANDARDS

INTRODUCTION

The "Sanitary Sewer Design Standards" state current policy and procedure of the City of Loganville Utility Department. Included herein are design regulations, submittal policy, construction installation requirements, inspection and acceptance procedures, and other pertinent information. Construction specifications are also part of the standards as referenced in Article 3 and are furnished separately.

These Standards are issued and revised pursuant to the authority established by City code. Failure to comply with these Standards constitutes an infraction of the Code of Ordinances of City of Loganville and may result in penalties or prosecution.

Specifications for pump stations are included in the construction specifications furnished separately.

Changes may be made to the Sanitary Sewer Design Standards at any time.

ARTICLE 1

GENERAL DESIGN PROCEDURES

1.1 GENERAL SEWER

1.1.1 CONSTRUCTION DOCUMENTS

- a. It is the intention of the City of Loganville that sanitary sewer systems and improvements installed by a private entity should be substantially equal to those installed by the City of Loganville with respect to materials, installation, performance, and durability. While the City of Loganville strives to assure the quality of the final installed products, it is not the intention of the City of Loganville to direct the specific construction methods to be used during the implementation of the work performed on privately owned property. However, these specifications contain instances wherein limitations or qualifications may be applied to the Contractor's operations and methods when those activities extend to areas that are publicly accessible or when the construction interacts with publicly owned and maintained areas or systems. Such additional requirements or limitations to operations or methods shall be included into the plans submitted for approval and implemented by the Developer in such locations as appropriate.
- b. Construction documents must be submitted through the current plan review process to the City of Loganville Department of Planning and Development.
- c. All sewer plans shall be sealed by either a Georgia Registered Professional Engineer or a Georgia Registered Professional Land Surveyor as per EPD rule 391-3-6-02.

1.1.2 Plans will generally be submitted through the plan review process (Department of Planning and Development) to be routed to the City of Loganville Public Utilities Department.

1.1.3 Each drawing, plat(s) or subdivision map(s) required by ordinance or policy will be delivered digitally to the City of Loganville. Final as-built plan(s) will meet these requirements as well.

1.1.4 Digital file requirements consist of

- a. A completed digital drawing in one of the following preferred file formats:

DXF: Drawing Exchange Format, popular with most CAD software

DWG: Native AutoCAD file format

SHAPE: Popular geographic file format

- b. An Adobe compatible PDF file of the drawing that will plot to scale must be submitted. A geo PDF is acceptable format as well.
- c. This data must be provided on standard transfer media or by electronic transfer (CDROM, USB drive, E-mail attachment or other suitable internet transfer, e.g. "dropbox".) The submitted transfer media shall be labeled with the project name (subdivision name or accepted job name, etc.) filing date, registered land surveyor or professional engineer's name and any other established project identifier.

1.1.5 Drawing Data Standards:

- a. All drawings will be constructed in the Georgia State Plane West Coordinate System in feet using the NAD83 Datum and vertical datum using NAVD88 Datum.
- b. All data shall be completed using standard graphics that require no “third party” software.
- c. Digital line work must be topologically clean. Lines must be geometrically continuous and boundaries must be geometrically closed with no “undershoots” or “dangles” where boundaries intersect. The digital linework must not include “sliver polygons” (gaps or overlaps between properties.) Essentially, the digital version of the map must be of a high precision so it can be easily converted to a GIS format.

1.1.6 All sewer design reviews and acceptance of sewer main systems will be approved by City of Loganville Department of Utilities and administered by City of Loganville Planning Office.

1.1.7 Plans will be reviewed and written comments will be provided indicating required corrections and/or changes.

If a betterment or up-sizing of the pipe is required, City of Loganville Planning Office will coordinate with City of Loganville Department of Utilities and will so indicate. The Engineer will be responsible for the design in accordance with City of Loganville Planning Office design criteria.

1.1.8 All construction on State right-of-way or any roadways under the jurisdiction of the Georgia Department of Transportation (GDOT) requires a GDOT permit or equivalent GDOT approval. City of Loganville will process the necessary application during the plan review process. All documents necessary for said application must be provided by the Developer’s Engineer.

1.1.9 The Director of Utilities for City of Loganville or designee is authorized to approve a variance for any significant deviation from the technical or procedural specifications of these standards, before installation.

1.1.10 Prior to final approval of the design drawings, the Owner/Developer must sign all required paper documentation from City of Loganville Planning Office.

1.1.11 Any subdivision which is submitted and approved as one project must either be constructed as one project, or if subsequently phased out and constructed in multiple phases or units, must be resubmitted and receive approval from City of Loganville Planning Office for each phase or unit individually prior to any further construction. In the instance of multiple phases or units, separate construction permits and Owner/Developer agreements must be obtained for each phase or unit.

1.1.12 Digital copy of the design drawings shall be submitted to City of Loganville Planning Office for final approval. If the plans are acceptable, they will be stamped by City of Loganville Planning Office upon approval and the Development Permit can be signed off.

1.1.13 If needed, attend a "pre-design" meeting with City of Loganville to discuss project scope and parameters.

1.1.14 All designs shall be produced in a digital format meeting the Department's requirements.

1.1.15 Conduct a field review of both sides of the road(s) for which the proposed sewer main is to be installed to develop plans of project area showing road centerline and edge of pavement, all side

streets, creek crossings, large rock outcroppings, existing sanitary sewer manholes, existing storm drains and headwall structures, exceptional trees (30" or greater in diameter, ornamental or obviously cared for as ornamental by property owner), densely wooded areas or areas which would require substantial clearing, linear footage of sodded lawns, existing driveways and types, existing water meters, existing fences within and adjacent to the rights-of-way, power poles within the rights-of-way, existing fire hydrants and valves, and any other structures located within or adjacent to the rights-of-way which may impact the proposed construction.

- 1.1.16 Contact all utility companies, including but not limited to, gas or petroleum pipelines, natural gas, buried electric lines, buried phone cables, etc. to obtain locations of those utilities within the project limits of both sides of the rights-of-way, including side streets. (NOTE: Although the "One-Call" Utility Protection Center provides notification service to subscribing utilities for "design" locates, individual notification is also required by this Department to insure all available information concerning other utilities facilities are included on the project design.)
- 1.1.17 Place property lines and street numbers, land lot and district lines on the plan. If design contract includes right-of-way research, place all existing rights-of-way and prescriptive easements on the plan.
- 1.1.18 Plans will be marked up by City of Loganville Utilities Department to show existing water and sanitary sewer mains if not indicated on plan. If the design contract must include right-of-way research, City of Loganville Utilities Department will mark up all existing rights-of-way and prescriptive easements. Any required future stubs, the City of Loganville Utilities Department and side of road will be indicated.
- 1.1.19 Sanitary sewer main location must maintain 10-foot horizontal separation from existing parallel water mains, and 18-inch vertical separation from any existing perpendicular crossing of water mains.
- 1.1.20 If proposed sanitary sewer crosses private property, a 20 foot wide permanent utility easement must be provided by the responsible party. Prepare any required easement plats.
- 1.1.21 Prepare submittal package, including any required drawings, plans, or details, for application of Ga. D.O.T. permits, or any other necessary permit applications and submit to the City of Loganville for processing.
- 1.1.22 Plans will be submitted through the plan review process (Loganville Department of Planning & Development) to be routed to City of Loganville Department of Utilities.
- 1.1.23 Plans will be reviewed and written comments will be provided indicating required corrections and/or changes.
- 1.1.24 Digital copy shall be submitted to the City of Loganville for final approval and if the plans are acceptable, they will be signed off by the Director of Department of Utilities, Director of Planning & Development and the City Engineer.
 - a. The "Development Permit" can be signed off. City of Loganville will retain two (2) copies of the stamped plans, the others will be returned to the engineer. If the project plans use a CAD system,

the CAD plans shall also be submitted at this time (see Article 1.1.4 for compatible file format).

- 1.1.25 A plan bearing the original signed City approved stamp must be presented by the approved contractor in order to obtain a construction permit.
- 1.1.26 As-built Drawings for non-residential projects shall be submitted to City of Loganville Planning Office a minimum of 10 business days prior to request for Certificate of Occupancy. As-built Drawings for residential projects shall be included with the final plat submittal.
- 1.1.27 As-built Drawings must be sharp, clear, clean, legible, and suitable for scanning and filing.
- 1.1.28 As-built Drawings shall include a site plan, plan and profile sheets, permanent easements, and any supplemental or shop drawings as may be required by City of Loganville Planning Office. Each as-built drawing set must include a listing of the quantity, size, and type of pipe, and number of manholes.
- 1.1.29 As-built Drawings must be stamped by a Professional Engineer or Registered Land Surveyor registered in the State of Georgia.
- 1.1.30 Record drawings (as-builts) must be submitted and approved before a project can receive final acceptance, connection of service laterals, and/or Certificates of Occupancy.

ARTICLE 2
DESIGN CRITERIA

2.1 EASEMENTS

2.1.1 Easement Standards:

- a. "On-site" easements are those easements falling within the boundaries of the current phase of the project. For subdivisions, these are shown on the plat and are dedicated through the process of recording the final plat. If not dedicated by final plat, they must be dedicated by an easement document on a Standard City easement form.
- b. "Off-site" easements are those easements falling outside the boundaries of the current phase of the project. Off-site easements which will be included in later phases of the same project and which cross property owned by and titled to the exact same entity as the one developing a subdivision may be dedicated by the final plat of the current phase of the project. All others must be dedicated by a separate easement document from each property owner on a standard City easement form.
- c. Optional "Rights-of-entry" for off-site easements must be submitted to the CITY OF LOGANVILLE UTILITY DEPARTMENT prior to issuance of off-site construction permits by the City of Loganville. All easements, either off-site for all projects or on-site commercial projects, must be submitted and approved prior to final inspection.
- d. All easements must be in the approved format. Blank easement forms will be provided by the CITY OF LOGANVILLE if needed.
- e. Conditional easements or easements with special stipulations shall not be granted to or assigned to the City.
- f. Separate easement documents with plats and/or legal descriptions are required when obtaining easements from more than one land owner.
- g. Construction of off-site lines shall not begin until all off-site easements are acquired and submitted to the CITY OF LOGANVILLE UTILITY DEPARTMENT. Construction of on-site lines, prior to acquiring off-site easements, is at the developer's own risk.
- h. Off-site easements are to be negotiated by the developer with the property owner. As a last resort, if the developer is unable to acquire necessary easements through negotiation, the CITY OF LOGANVILLE UTILITY DEPARTMENT may request the City Council's approval to assist acquisition through condemnation at the developer's expense. Final decision whether or not to condemn rests with the Council.
- i. The City can only condemn property for easements if the line to be installed is a gravity line eight inches in diameter or larger or a force main from a city pump station and is to be dedicated to the City.

- 2.1.2 Sewer lines must be centered within the required permanent easement. Exceptions can be approved by the City of Loganville Utility Department, but will only be approved in special circumstances and when the City of Loganville Utility Department determines that future repairs and maintenance can be accomplished without unreasonable difficulty.
- 2.1.3 A minimum 20-foot wide permanent utility easement is required. Lines deeper than 16 feet require wider permanent easements as follows: 17' through 22' depths require 30 foot width; 23' through 28' depths require 35 foot width; 29' through 33' depths require 40 foot width.
- 2.1.4 Sanitary Sewer System utility easements off the street right-of-way shall be clearly defined on the Final Plat or Boundary Survey Plat. Such easements are for ingress and egress to reach facilities and for the purposes of installing, servicing, replacing, repairing, removing, maintaining, and improving the underground utility uses as determined by the City. The property owner will be required to keep the easement free of obstruction in such a way as to assure the maximum accessibility at all times. The property owner shall not alter any utility improvements without the prior written approval from the City. Permanent structures, except paved driveways, shall not be constructed or erected in an easement or any part thereof without the prior written approval from the City. Driveways shall cross an easement as close to perpendicular as practical. Property owners may plant landscaping in an easement; however, the City is not responsible for replacing the landscape material located in the easement when it is removed to maintain, repair, replace, remove, or improve the utility system. The City is not responsible for replacing or repairing existing structures or structure damage located in the easement when it is removed to maintain, repair, replace, remove, or improve the utility.
- 2.1.5 For any easement that is acquired for less than \$10,000, a release from lien holders is not required. Entities having ownership must sign the easement as stated below:
 - a. FOR CORPORATIONS, Georgia law requires that documents transferring interest in real property must be signed by the president or vice president of the corporation and be attested by the secretary or treasurer of the corporation or have the corporate seal affixed.
 - b. FOR LIMITED LIABILITY COMPANIES, Georgia law requires that documents must be signed by a member.
 - c. FOR LIMITED PARTNERSHIP, Georgia law requires that documents must be signed by the general partner. If the general partner is a corporation, set up the "by" signature block in accordance with laws for corporations.
 - d. FOR GENERAL PARTNERSHIP, Georgia law requires that documents must be signed by every partner.
 - e. FOR TRUSTS, Georgia law requires that documents must be signed by every trustee for the trust.
 - f. FOR INDIVIDUALS, Georgia law requires that documents must be signed by every individual holding title exactly as each took title.
 - g. Every signature on a document must be witnessed by an unofficial witness and notarized. Notary's seal must be affixed.

- 2.1.6 A plat (8-1/2" x 14" maximum) which shows the boundary of the easement area or a written legal description that can be followed on a submitted site plan must be attached to each easement document and labeled as ATTACHMENT "A".
- 2.1.7 Development projects on sewer are required to either provide an installed sewer main to the upgrade property line(s) for future use *or the final plat must show a 40' permanent sanitary sewer easement. All developments, including non-sewered projects, must include on the final plat a 20' permanent sanitary sewer easement and 40' construction easement for future use paralleling any stream or drainage way. The discretion of where sewer for uphill properties is required shall lie solely with the City of Loganville Utility Department. Easements for future use shall comply with stream buffer and wetland requirements.*

2.2 PARTICIPATION BY CITY

- 2.2.1 Development projects situated other than at the highest part of a drainage basin may be required to install a larger size sewer main to serve the entire basin. The extra cost associated with increasing the gravity main size beyond that required to serve the project shall be paid by the City under a "City Participation Agreement". The conditions relating to method of payment will be negotiated by City of Loganville on a case-by-case basis during the development review process.
- 2.2.2 A development project situated in a sub-basin that drains to a Sewage Lift Station designed to serve the project may be required to install a larger pump station and/or force main to serve the entire sub-basin. The extra cost associated with increasing the gravity main size beyond that required to serve the project may be paid by the City under a "City Participation Agreement." The conditions relating the method of payment will be negotiated by the City of Loganville, in a case-by-case basis during the development review process.
- 2.2.3 Any proposed development that will discharge sewage to an existing pump station must indicate which pump station is involved. If said pump station was installed by a developer, a revised pump station design analysis must be provided. Any modifications for upgrade's to the existing station must be performed as a part of the new project at the developer's expense.

2.3 SANITARY SEWER LINES

2.3.1 Location

- a. Shall be located in center line of street, where applicable.
- b. Maximum distance between manholes for sewer lines under 24 inches: 300 feet.
- c. Maximum distance between manholes on lines 24 inch to 36 inch: 400 feet.
- d. Maximum distance between manholes on lines over 36 inches: 800 feet.
- e. **Any proposed sewer line must be outside the 75 feet buffer of any city stream. Any proposed sewer line must show top of manhole elevations above flood plain levels and be submitted for approval by the Utility Department.**

2.3.2 Minimum Cover from Finished Grade

- a. Within paved area: 7 feet (cover less than 7 feet within paved area requires ductile iron pipe (DIP) and will only be approved when site conditions dictate).
- b. In non-paved area: 4 feet (cover less than 4 feet in non-paved areas requires ductile iron pipe (DIP) and will only be approved when site conditions dictate).
- c. Sewer lines must avoid passing through a detention pond whenever possible. Any sewer line that passes under a detention pond must be ductile iron pipe and must have a minimum of 4 feet of cover. Any sewer line that passes under a detention pond and unavoidably has less than 4 feet of cover must be ductile iron pipe and have a. concrete cap 6 feet wide and 6 inches thick

poured above the pipe. Pipe shall not be located within the dam or outlet structure. All manholes must be located outside of the detention pond.

- d. Any sewer line parallel to a creek or stream shall be designed such that the top of the proposed pipe is 1 foot below the bottom of the creek bed. The elevation of the creek bed must be indicated on the plans. *Any sewer line adjacent to a creek or lake must indicate same on plans. Creek crossings shall be made only when absolutely necessary and should be nearly perpendicular. Creek crossings shall be stabilized with rip-rap and/or other stabilizing material upon completion as directed by the City of Loganville Utility Department. Sewer lines shall be designed to cause minimum impact to waters of the United States.*
- e. *All sewer designs must comply with U.S. Army Corp of Engineers regulations pertaining to construction in streams, wetlands and nationwide permits. When applicable, plans must show jurisdictional wetland boundaries.*
- f. Sewer line location must maintain 10-foot horizontal separation from parallel water mains, and 18-inch vertical separation from any perpendicular crossing of water mains.

2.3.3 Maximum Cover: As Per Standard Details

- a. For diameters greater than 16 inches, the maximum cover shall be as required by the City of Loganville.
- b. Depths of cover should not exceed 18 feet. CITY OF LOGANVILLE UTILITY DEPARTMENT may grant exceptions on a case-by-case basis if there are no reasonable alternatives.

2.3.4 Minimum Size Sewer Main: 8 inches.

2.3.5 Minimum Size Sewer Stub: 6 inches.

2.3.6 Slope Requirements

- a. Recommended minimum slopes can be submitted without design calculations.
- b. Recommended minimum slopes will be required on all piping. Absolute minimum slopes will be allowed only with design calculations showing a velocity of 2.0 feet per second.

SLOPE REQUIREMENTS

Pipe Diameter	Absolute Minimum	Recommended Minimum
8-inch	0.4%	0.70%
10-inch	0.29%	0.50%
12-inch	0.22%	0.40%
15-inch	0.15%	0.30%
16-inch	0.15%	0.30%
18-inch	0.12%	0.24%
21-inch	0.10%	0.20%
24-inch	0.08%	0.16%

27-inch	0.07%	0.14%
30-inch	0.06%	0.12%
36-inch	0.05%	0.10%

- d. When approved by City of Loganville, DIP may be used with slopes of 15 % to 25 % with the addition of concrete anchors (deadman). Minimum size of concrete deadman shall be:

Height	3x pipe diameter
Length (along pipe)	3x pipe diameter
Width (perpendicular to pipe)	2x trench widths.

- e. Whenever possible, designs for jack and bore installations should include a drop in the upstream manhole of not less than 6 inches and should allow a slope through the bore three times as steep as the recommended minimum slope for that size pipe.

2.3.7 All lines (8 inches and above) shall terminate in a manhole.

2.3.8 Bedding and Trench Width

- a. Required bedding is dependent upon pipe type, trench width and depth of cover, and shall be as specified in the standard details
- b. Bedding for pipe greater than 16 inches diameter shall be as specified by City of Loganville.
- c. For 8 inch diameter pipe, the pipe material and bedding class need not be shown on the plans unless DIP is required. For pipes larger than 8 inches in diameter, the pipe material, bedding class and the maximum trench width must be shown on the plans.
- d. Trench width is defined as the actual width of the trench one foot above the top of the pipe

2.3.9 Acceptable Pipe Materials for gravity sewers lines (see Sanitary Sewer System Standard Specifications bound separately for specific pipe specifications).

- a. Vitrified Clay Pipe (VCP) – Not allowed
- b. Polyvinyl Chloride (PVC) - Up to 24 inches in diameter
- c. Ductile Iron Pipe (DIP) - Up to 64 inches in diameter
 - (1) On any design utilizing DIP greater than 10-inch diameter and having slopes less than the "RECOMMENDED minimum", the design engineer must submit flow calculations. If, in the City's opinion, the line is subject to hydrogen sulfide gas generation, such pipe shall be required to be lined with Protecto 401 Ceramic Epoxy or equal.
 - (2) Pipe class for DIP greater than 18" diameter shall be determined by the City of Loganville Utility Department.
- d. PVC TRUSS – Not allowed
- e. CONCRETE - Not allowed.

f. STEEL - (Casing and aerial)

g. RIBBED PLASTIC PIPE - Not allowed.

2.3.10 For private developments, the developer is responsible for demonstrating in the design plans that the proposed sanitary sewer laterals/system will not have conflicts with the tie-in elevation of existing sanitary sewer main in elevation. If there is an elevation conflict, the developer will be responsible for re-establishing proposed elevations or re-constructing the proposed sanitary sewer system to provide positive drainage to the sewer main.

2.4 SEWER SERVICE STUBS - RESIDENTIAL & COMMERCIAL

2.4.1 During design, the developer shall be responsible for ensuring all lots can be served. On any lot where the service stub cannot be found, the developer shall install or be responsible for the cost of the installation of a service stub. The developer may either install a complete wye or tee in the main with the approval of the City. The service stub shall be low enough to serve the ground level floor elevation and, where grades permit, low enough to serve the basement. The sewer stub becomes the CITY OF LOGANVILLE UTILITY DEPARTMENT property and is maintained by CITY OF LOGANVILLE.

2.4.2 **Connections (Taps) to Sewer Mains for Existing Properties:** The property owner is responsible for paying a licensed contractor for all prep work, digging up the stub, uncovering the sewer main, materials and any road patching. The city will install the tap, which is included in tap fees.

2.4.3 **Connections (Taps) to Sewer Mains for New Construction:** For new construction, any proposed connections at the sewer main shall be installed by a licensed contractor and all costs are the responsibility of the property owner or developer.

2.5 SEWER LATERAL LINES (pipe system from building to sewer service stub)

2.5.1 *The sewer lateral line located on private property shall remain in private ownership. Its maintenance shall be the responsibility of the owner.*

a. There is no maximum length limitation for privately maintained lateral lines.

2.6 TEST MANHOLES

2.6.1 Shall be required for certain non-residential buildings and installed at locations to be approved by Loganville Utility Department.

a. *Certain categories (list is available upon request) of non-residential buildings may be exempted from the requirement of test manholes based upon the type of business operation. Determination of such exemptions shall be made by variance request submitted through City of Loganville development review.*

b. *Test manholes will be required at certain categories of business requiring grease traps, at all industrial and manufacturing locations, and at all locations where the flow from several*

businesses is combined prior to entering the city system, such as "strip-type" retail centers.

2.7 AERIAL LINES

- 2.7.1. Aerial lines shall be designed to avoid or minimize stream blockage during normal high water events. When requested, the Engineer shall delineate on the plans, the "two year" flood level as defined by the State of Georgia Storm Water Division, for determination of the proposed elevations of the aerial span. City of Loganville request piers to be placed a minimum of 5ft behind two (2) year flood storm level.

2.8 PUMP STATIONS/FORCE MAINS

- 2.8.1 Pump stations, when acceptable to the City, are to be installed in accordance with the requirements of the City's *Sanitary Sewer Standards for Pump Stations and Forcemains*, available from the City.

2.9 SPECIAL INTERCEPTORS (Grease Traps, Separators)

- 2.9.1 Grease interceptors shall be provided according to the current SBCCI plumbing code and City of Loganville General Ordinances, Chapter 34, Article V, Grease Traps and Sand/Oil Separators on new installations including all restaurants, commercial kitchens, and whenever in the opinion of City of Loganville they are necessary. Interceptors must be installed on existing facilities if it is determined by inspection that a problem exists, and/or as mandated in the City of Loganville General Ordinances, Chapter 34, Article V, Grease Traps and Sand/Oil Separators.
- 2.9.2 All grease traps/interceptors shall be sized by City of Loganville as a gallon capacity requirement. All restaurants and commercial kitchens shall install one 1,500-gallon interceptor (See Standard Drawing Sheet 1028) if required capacity is less than or equal to 1,500-gallons. Any additional capacity shall be obtained or exceeded by installing additional 1,500-gallon interceptors in a series.
- 2.9.3 Mechanical grease separators (skimmers) may not be installed in lieu of trap/interceptor.
- 2.9.4 Oil and flammable liquid separators, and sand interceptors shall be provided according to the current SBCCI plumbing code and City of Loganville General Ordinances, Chapter 34, Article V, Grease Traps and Sand/Oil Separators on new installations, including all car washes and automotive service centers, and; whenever in the opinion of City of Loganville they are necessary. They must be installed on existing facilities if it is determined by inspection that a problem exists, and/or as mandated in the City of Loganville General Ordinances, Chapter 34, Article V, Grease Traps and Sand/Oil Separators.
- 2.9.5 Oil and flammable liquid separators, and sand interceptors shall be sized according to the current SBCCI plumbing code and City of Loganville General Ordinances, Chapter 34, Article V, Grease Traps and Sand/Oil Separators.

ARTICLE 3

CONSTRUCTION INSTALLATION

3.1 PRIOR TO CONSTRUCTION

- 3.1.1 At no time will any sewer construction commence prior to approval of all plans, submittal of required documents *including necessary easements*, issuance of permits and a pre-construction conference held with the City Inspector (24 hours advance notice required).
- 3.1.2 All sewer lines, manholes and other appurtenances to be governed by CITY OF LOGANVILLE UTILITY DEPARTMENT shall be installed according to approved plans and profiles. If a field change must occur, the redesigned area(s) must be submitted for approval prior to installation, in accordance with Georgia Environmental Protection Division's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.02 (10). Contractor to have a set of approved plans on the project site at all times.
- 3.1.3 A set of approved plans, stamped by City of Loganville, must remain on job site at all times.
- 3.1.4 Contractor shall adhere to all Federal, State, City and local laws, ordinances and regulations which in any manner affect the conduct of the work, including but not limited to initiating, maintaining and supervising all safety precautions and programs in connection with the work.
- 3.1.5 The contractor must comply with all requirements of the City of Loganville Soil and Erosion and Sediment Control Ordinance, the provisions of the 'Manual for Erosion and Sediment Control in Georgia, "and any special conditions required by the EPD associated with any variances issued by the same, and any special conditions required by the City inspector.

3.2 CONSTRUCTION SPECIFICATIONS

- 3.2.1 Provide all construction work in compliance with the separately published Construction Specification Sections tabulated below

<u>Section Number</u>	<u>Title</u>	<u>Pages</u>
311000	Route Clearing	6
312000	Trenching and Backfilling	11
320119	Patching of Rigid Pavement	4
329200	Turf and Grasses	9
330523	Tunneling	12
330525	Directional Drilling	6
333000	Sanitary Sewer System	26

3.3 GUARANTEE OF WORK COMPLETED

- 3.3.1 The Contractor (and Developer in private developments) shall guarantee for a period of twelve (12) months from the date of final acceptance (from date of final plat approval or Certificate of Occupancy in private developments), all sewer and force mains, appurtenances, trenches, roadway and surface restorations, landscaping, and any other areas disturbed by the construction of the project, to be free from defects, and to be installed in compliance with all regulations, specifications, plans, directions, and construction practices which govern said installations. In private developments, the conditions stated in the "Owner/Developer Agreement" shall govern.
- 3.3.2 The Contractor (and Developer in private developments) shall be responsible for repairs to any leaking pipe, fittings, etc. Should trenches settle during the warranty period, he shall promptly furnish and place fill to the original grade and restore any damaged landscaping. Should any leaks or trench settlement occur under new pavement, the Contractor will be held responsible for the cost of all repairs, including pavement replacement. The determination of the requirement for the Contractor to perform work under this guarantee shall be at the sole discretion of the City of Loganville Department of Utilities.

3.4 CONTRACTOR'S RESPONSIBILITIES

- 3.4.1 It shall be the Contractor's responsibility to understand and comply with CITY OF LOGANVILLE UTILITY DEPARTMENT specifications and requirements throughout the installation and inspection proceedings.
- 3.4.2 No Contractor shall be allowed to commence installation until an application for inclusion on the Approved Contractor List has been received and approved by CITY OF LOGANVILLE UTILITY DEPARTMENT and the appropriate construction permit has been issued by City of Loganville.
- 3.4.3 During any phase of installation, the CITY OF LOGANVILLE UTILITY DEPARTMENT and/or Inspector has the authority to order the construction stopped, call for any type of inspection of installed work, call for a test dig or alter installation proceedings to insure proper construction requirements.
- 3.4.4 All projects shall be tested upon completion of installation and prior to paving.
- 3.4.5 Approval of a project will not be granted by CITY OF LOGANVILLE UTILITY DEPARTMENT until all inspections are conducted with no defects noted and all appropriate documents have been received and accepted by City of Loganville.

3.5 FINAL APPROVAL

- 3.5.1 CITY OF LOGANVILLE UTILITY DEPARTMENT may "sign-off" on the final subdivision plat without off-site sewers being complete under the following conditions:

- a. The developer has made reasonable and diligent effort to obtain easements and complete the sewers.
- b. A hold shall be placed upon certificates of occupancy and/or building permits.
- c. The developer must present a cash bond equal to the value of the uncompleted work as determined by City of Loganville Utility Department.
- d. All requirements for sewers "within" the project have been complied with.

3.6 VARIANCE

- 3.6.1 Minor exceptions to these Standards may be granted by City of Loganville. Significant exceptions to these Standards may be granted in the form of a written variance by the CITY OF LOGANVILLE UTILITY DEPARTMENT Director when, in their opinion, undue hardship may result from strict compliance. Any such determination shall be based fundamentally on the fact that unusual topographical or other exceptional conditions require such variance and that the granting of the modification will not adversely affect the general public welfare or nullify the intent of these Standards.
- 3.6.2 Request for a variance from these Standards shall first be submitted by the developer in writing with supporting documents and shall explain in detail the reasons and facts supporting the request. The request shall be submitted to the CITY OF LOGANVILLE PLANNING AND DEVELOPMENT Director who shall review the request. If administrative approval cannot be granted consistent with the requirements of these Standards, the variance shall be forwarded to the city of Loganville Council for final action in their normal course of business.

3.7 VIOLATION/PENALTIES

- 3.7.1 Any responsible party or other persons convicted by a court of competent jurisdiction of violating any provision of these Standards shall be guilty of violating a duly adopted Sanitary Sewer Use Ordinance of City of Loganville and may be punished either by a fine or imprisonment, or both. The owner of any lands or parts thereof, where anything in violation of these Standards shall be placed or shall exist, and each responsible party or other person assisting in the commission of any such violation, shall be guilty of a separate offense.
- 3.7.2 The court shall have the power and authority to place any person found guilty of violating these Standards on probation and to suspend or modify any fine or sentence. As a condition of said suspension, the court may require payment of restitution or impose other punishment allowed by law. Each day a violation continues to exist shall constitute an independent and separate offense.
- 3.7.3 Any Contractor on the CITY OF LOGANVILLE UTILITY DEPARTMENT Approved Contractor's List discovered violating the provision(s) of these Standards shall be removed and subject to penalties imposed by the court.
- 3.7.4 Any Contractor found responsible for causing a sewerage overflow may be fined.
- 3.7.5 Any Contractor found negligent by creating a condition likely to result in a sewerage overflow

may be fined. The careless release of a pipe plug into the sewer system shall be considered negligence. By-pass pumping without adequate standby pumps available shall be considered negligence.

- 3.7.6 The Contractor will be held fully liable for all state and federal Clean Water Act penalties or fines and cost incurred by the City in the event of a sanitary sewer overflow caused by negligence on the Contractor's part, and may also be suspended from the Approved Contractors List.

ARTICLE 4

SEWER PETITION POLICY

4.1 GENERAL

- 4.1.1 The City may enact a sewer petition policy whereby the residents of an area may petition the City to install sewers.
- 4.1.2 The City Council may change the sewer petition policy, the assessment rate and the payment requirements at any time.

SECTION 333000 - SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. City Code, including Development Regulations, Standard Drawings, Zoning Ordinance, Subdivision Regulations, Sewer Use Ordinance, Section 34 Article V on Grease Traps and Sand/Oil Interceptors, Sanitary Sewer Design and Construction Standards, Building Codes and Industrial Pretreatment Program, apply to this Section.

1.2 SUMMARY

- A. This Section includes gravity-flow, non-pressure and pressurized force-main sanitary sewers, and appurtenances with the following components:

1. Foundation preparation.
2. Furnishing and laying gravity sewer pipe.
3. Furnishing and laying force-main pipe.
4. Furnishing and/or constructing sewer structures and appurtenances.
5. Cleaning and/or televising constructed work.
6. Testing constructed work.

- B. Related sections include the following:

1. Section 311000 "Route Clearing" for topsoil stripping and stockpiling.
2. Section 312000 "Trenching and Backfilling" for excavation and backfilling trenches for utility installation.
3. Section 320119 "Patching of Rigid Pavement" for pavement, sidewalks, and curb and gutter restorations.
4. Section 329200 "Turf and Grasses" for ground surface grassing and turf requirements.
5. Section 330523 "Tunneling" for utility line construction.
6. Section 330525 "Directional Drilling" for utility line construction.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene-monomer rubber.
- B. PVC: Polyvinyl chloride plastic.
- C. PVCFM: Polyvinyl chloride plastic force main pipe.
- D. DIP: Ductile iron pipe.
- E. DIPFM: Ductile iron pipe force main.

- F. HDPE: High density polyethylene pipe.
- G. PE: Polyethylene plastic.

1.4 SUBMITTALS

- A. When requested by the City, submit lists of all pieces of pipe and fittings received on the project, including copies of shipping documents from the manufacturer/supplier. Furnish lists that includes the serial or mark number, weight, class, length, size, and description of each typical piece received.
- B. When requested by the City, submit three copies of the manufacturer's sworn affidavit of inspection and testing of all ductile iron pipe and fittings provided for the work.
- C. When requested by the City, submit copies of all product data and shop drawings for proposed manholes, frames and covers, and valves prior to their installation.
- D. Where temporary bypasses by gravity or pumped flow are needed, submit an emergency plan detailing procedures to be followed in the event of pump failures, sewer overflows, service backups, and sewage spillage. Maintain a copy of emergency plan on site for duration of project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe, pipe fittings, and seals from dirt and damage.
- B. Do not store plastic manholes, pipe, and fittings in direct sunlight. Support pipes from sagging and bending.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Store materials and equipment and in such a manner as to cause the least inconvenience to the affected property owners, insure traffic safety, and so as not to endanger the general public in any way. All active, existing fire hydrants must be kept unobstructed and accessible at all times. All water and gas valves, and underground power and telephone manholes must also be left uncovered by such storing of materials.
- E. Do not string pipe along the project within existing right-of-way, unless approved by the City and the authority having jurisdiction over the roadway.

1.6 PROJECT CONDITIONS

- A. Licensing: All work specified in this section, except for sewer system service line installation and sewer line cleaning and televising, is to be performed by a contractor with a valid Utility Contractor's license issued by the State of Georgia. Sewer service line installation may be performed by either a contractor with a valid Georgia Utility Contractor's license or by an individual having a valid Master Plumber's license issued by the State of Georgia.
- B. Connection to Existing Pipework and Manholes: Where it is required that connection be made to existing pipework and manholes, expose existing piping and structures and determine the exact

fittings and/or other appurtenances necessary to make the connections. Connections to existing pipework indicated on Drawings (if any) are shown only for the purpose of illustrating the general type of connection desired, and no assurance exists that such illustration can be followed precisely.

- C. Traffic Control: Schedule and conduct Work in a manner which will minimize inconvenience to vehicular and pedestrian traffic. Provide flaggers, barricades, warning signs, warning lights and other warning means as appropriate. When flaggers are utilized, individuals must meet requirements of Georgia Department of Transportation. Maintain traffic on all roads and streets which must be crossed by trenching by making two separate cuts so that at least one traffic lane is open at all times. All traffic controls during construction must conform to Part 6 of the *Manual on Uniform Traffic Control Devices*
- D. Weather Limitations: Conduct all operations during weather conditions appropriate to the work being performed.
- E. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify City no fewer than seventy-two (72) hours in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without City's written permission.

1.7 QUALITY ASSURANCE

- A. Imperfections: Regardless of tolerances permitted by industry standards specified herein, the City may reject pipe or appurtenances at the manufacturing plant or project site, which have cracks, chips, blisters, lack of smooth interior or exterior surface, evidence of structural weakness, porosity, joint defect, significant variation from theoretical shape, or other imperfection which might, in the opinion of the City, contribute to a reduced functional capability, accelerated deterioration, or reduced structural strength.
- B. Repairs: Do not install used, patched, or repaired pipe or appurtenances.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include specified manufacturers or approved equal.

2.2 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS (DIP)

A. Push-on-Joint Piping:

1. Pressure Class: Min. 350 Pressure Class for 18 inch diameter and less. Use higher pressure class where required to suit cover depth and trench bedding on chart included herein.
2. Pipe: AWWA C151, for push-on joints.
3. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
4. Compact Fittings: AWWA C153, ductile iron, for push-on joints.
5. Gaskets: AWWA C111, rubber.
6. Coatings: All ductile iron pipe and fittings shall be asphaltic coated at the point of manufacture in accordance with AWWA C151. Provide cement mortar lining per AWWA C104 with standard asphaltic coating over lining and pipe exterior.
7. Where the pipe slope is below the recommended minimum slope and is subject to hydrogen sulfide gas generation in the opinion of the City, provide Protecto 401 Ceramic Epoxy interior lining in place of the asphaltic and cement mortar lining.
8. Provide ductile iron pipe for all sewers over 16 feet of cover depth.

2.3 PVC, GRAVITY SEWER PIPE AND FITTINGS (PVC)

- A. General: PVC Gravity Sewer Pipe may be used for sewer services of minimum 6 inch size and sewer mains of 8 inch to 24 inch size where depth of cover above pipe is greater than 7 feet under paved surfaces, greater than 4 feet under unpaved surfaces, or less than 16 feet total cover.
- B. Basic specification: ASTM D 3034 type PSM or ASTM D 3033 type PSP PVC bell and spigot sewer pipe with ratio of barrel outside diameter to wall thickness (SDR) no greater than 35.0, with pipe material meeting ASTM D 1784 12454 B or C and pipe stiffness at 5 percent deflection per ASTM D 2412, no less than 46.0 psi.
- C. Fittings, couplings and adaptors: Provide standard fittings, couplings and adaptors specifically designed to connect the PVC pipe to manholes or to other pipe materials. Manhole adaptors must provide a positive bond between the piping system and the mortar or concrete of the manhole structure. Protect all couplings and adaptors by fully encasing in concrete. Use wye or tee fittings for services, saddles are prohibited.
- D. Joints: ASTM D 3212 elastomeric gasket system comprised of material suitable for use with domestic sewage and conforming to ASTM F 477.

2.4 STEEL PIPE AND FITTINGS (CSP)

- A. General: CSP Piping System is to be used with plain ends for mechanical couplings and only for aerial spans or other special applications as determined by the City.
- B. Comply with AWWA C200 with minimum wall thickness as follows:
 1. Pipe Diameters 8 Inches (200 mm) and Smaller: 0.375 inches (9 mm).
 2. Pipe Diameters Greater than 8 Inches (200 mm): 0.50 inches (13 mm)
- C. Fittings and Special Sections: Comply with AWWA C208.

D. Flanges:

1. Comply with AWWA C207, Class D.
2. Type: Slip-on

E. Field Welding Materials: Comply with AWWA C206.

F. Interior Coal Tar Enamel Lining: Comply with AWWA C203

G. Buried Steel Pipe Exterior Lining:

1. Description: Shop-applied prime coat and coal tar enamel protective coating with factory applied glass fiber mat outerwrap.
2. Comply with AWWA C203.

2.5 PVC PRESSURE PIPE AND FITTINGS, FORCE MAIN (PVCFM)

A. PVC Pressure Pipe (For Open Trench Installations): AWWA C900, Class 235, for gasketed joints and using ASTM F 477, elastomeric seals.

1. PVC Fabricated Fittings: AWWA C900, Class 305, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
2. Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern and using AWWA C111, rubber gaskets.

2.6 WALL PENETRATION PIPE SLEEVE

A. Wall-Penetration Pipe Sleeve Seals (PSS): Modular, mechanical type with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve or opening and provide a water tight seal. Provide insulating glass reinforced pressure plates and stainless steel bolts and nuts. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

- a. The Metroflex Company.
- b. Linkseal/Thunderline Corporation.
- c. Or approved equal.

2.7 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.

5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section:
 - a. 48-inch Diameter Manholes: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
 - b. 60-inch Diameter Manholes: Typical flat-slab-top type, typical for force main Discharge Manholes.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber with cement grout on the inside grouted smooth.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101 polypropylene, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
10. Adjusting Rings: Interlocking cast iron rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Infra-Riser, rubber composite adjustment ring by EJ Group Inc. or approved equal is acceptable with City approval. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
12. Protective Coating: Plant or field-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint ten (10) mil minimum thickness applied to exterior and/or interior surfaces when indicated.

B. Special Design Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
4. Joint Sealant: ASTM C 990, bitumen or butyl rubber with cement grout on the inside grouted smooth.
5. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
6. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101 polypropylene, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
7. Adjusting Rings: Interlocking cast iron rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Infra-Riser, rubber composite adjustment ring by EJ Group Inc. or approved equal is acceptable with City approval. Include sealant recommended by ring manufacturer.

8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
9. Protective Coating: Plant or field-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint ten (10) mil minimum thickness applied to exterior and/or interior surfaces when indicated.

C. Standard Manhole Frames and Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - a. EJ Group, Inc.; Product No. V-1357.
 - b. Or approved equal.
2. Description: AASHTO M306, Ferrous; 24-inch ID by 6-inch riser, with 4-inch-minimum-width flange and 23 ¾-inch diameter cover. Comply with City of Loganville Standard Drawing, Sheet No. 1009.
 - a. Attachment: Attach manhole frame to manhole by adhesive capsule anchor with four (4) stainless steel 7/8" diameter bolts.
 - b. Lettering: Include indented top design with 1 ¼" sharp face gothic lettering cast into cover, using wording to "CITY OF LOGANVILLE."
 - c. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

D. Bolt Down Manhole Frame and Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - a. EJ Group, Inc.; Product No. V-2358.
 - b. Or approved equal.
2. Description: AASHTO M306, Ferrous; 24-inch ID by 5-inch riser, with 3-inch-minimum-width flange and 23 ¾-inch diameter cover. Comply with City of Loganville Standard Drawing, Sheet No. 1008.
 - a. Bolts: Four (4) 5/8" x 2" stainless steel hex with four (4) stainless steel washers and 1/8" thick flat neoprene gasket.
 - b. Attachment: Attach manhole frame to manhole by adhesive capsule anchor with four (4) stainless steel 7/8" diameter bolts.
 - c. Lettering: Include indented top design with ½" sharp face gothic lettering cast into cover, using wording to "LOGANVILLE SEWER."
 - d. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.
 - e. Protective Coating: Foundry-applied, coat of asphaltic paint.

2.8 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:
 1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 3,000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3,000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths ($\frac{3}{4}$) of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: One tenth (0.1) foot minimum drop through manhole.
 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Force Main Discharge Manhole:
1. Field form concrete within the base of manhole to support incoming force main discharge piping, fittings, and outgoing gravity sewer piping without inhibiting sewage flows or resulting in leakage from the manhole.
 2. A concrete channel shall be formed to the same width as the connecting gravity sewer pipe, sloping upward from the pipe invert to the force main discharge piping to result in positive drainage to the gravity sewer.
 3. Concrete fill shall be formed to promote positive drainage to the gravity sewer channel from any location within the discharge manhole.
 4. See Drawing for further discharge manhole details.
- E. Ballast and Pipe Supports: Portland cement design mix, 3,000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.
- 2.9 COARSE GRANULAR MATERIAL FOR PIPE BEDDING:
- A. Crushed stone, crushed gravel, natural gravel, or crushed shell meeting ASTM D 448, and having No. 67 gradation ($\frac{3}{4}$ inch to No. 4 sieve).

2.10 FINE GRANULAR MATERIAL FOR PIPE BEDDING:

- A. Uniformly graded natural or manufactured sand composed of hard, durable particles with 100 percent passing a No. 4 sieve, not more than 25 percent passing a No. 100 sieve, and containing no more than 25 percent total of silt and clay.

2.11 PUMP STATIONS

- A. Pump stations, when acceptable to the City, are to conform to the requirements of the City's *Sanitary Sewer Standards for Pump Stations and Forcemains*, available from the City.

2.12 SEWER LINE CLOSED CIRCUIT TELEVISION (CCTV) EQUIPMENT

- A. Use television inspection equipment having an accurate footage counter that displays on a remote monitor the exact distance of the camera from the centerline of the starting manhole. Furnish a remotely operated pan and tilt type camera with optical focus power control from the viewing station. Provide a rotating camera and lighthouse configuration with 240 degrees of pan and tilt angle measuring centerline to centerline and 70 degree lens viewing angle.
- B. Utilize a color camera providing a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. Provide the image pick-up device containing in excess of 379,000 picture elements (pixels). Do not exceed one percent geometrical distortion of the image.
- C. Have a tractor drive available to transport the video camera for inspecting dead end sewers and other situations where manhole access at both ends of sewer may not be available.
- D. Furnish lighting on video camera suitable to allow proper illumination and a clear video image of the entire periphery of the pipe.

2.13 PIPE DETECTION TAPE AND WIRE:

- A. Pipe Tracer Wire: No. 12 AWG solid soft drawn copper having not less than ninety-eight (98) percent conductivity with NEC type THHN, THWN or XHHW insulation jacket. For splices, use direct bury kit DBY/DBR as manufactured by 3M or approved equal.
- B. For splices, use direct burial, water and corrosion proof, silicone-filled, pipe detection wire connector kits.
- C. Warning Tape: Provide non-metallic warning tape with the words "BURIED SEWER LINE BELOW" or similar phrase printed continuously. Warning tape shall be 3-inch wide, polyethylene material, with printed lettering of black ink on yellow tape, or APWA approved color, and to meet or exceed industry standards.

2.14 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

- B. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- C. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 Section "Trenching and Backfilling."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited unless specially approved by the City.
- E. Unless otherwise indicated, lay and join pipe in trenches and on foundations complying with methods proposed by the pipe manufacturer in writing and approved by the City. Methods will not be approved which are likely to result in lower quality of installation than that afforded by requirements contained in the following articles.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.
- G. Provide complete piping systems including pipe, fittings, adapters, valves, sleeves, jointing, gaskets, caulking, hangers, supports, blocking, inserts, and other components necessary for safe and properly functioning use.
- H. Construct and if necessary reconstruct all piping systems as necessary to obtain systems free of breaks, detectable leakage and other defects.
- I. Install piping at indicated slopes; free of sags and bends.

- J. Cut pipe in a manner to avoid damage to pipe or lining, leaving a smooth end at right angles to pipe axis.
- K. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping with 7 feet minimum cover in paved areas. Where cover depth less than 7 feet is indicated or unavoidable, provide ductile iron pipe.
 - 2. Install piping with 48-inch minimum cover in non-paved areas. Where cover depth less than 48-inches is indicated or unavoidable, provide ductile iron pipe.
 - 3. Install ductile iron piping with 48-inch minimum cover when unavoidable to pass through stormwater detention facilities. Where cover depth less than 48-inches is indicated or unavoidable, provide ductile iron pipe with a concrete cap 6 feet wide by 6 inches thick above the pipe.
 - 4. Provide ductile iron sewer pipe for the following locations:
 - a. When vertical clear distance between the sewer and underground utilities is less than 4 feet.
 - b. For 8 inch and larger sewer mains, at all crossings above water mains or drainage pipes and for all crossings below water mains or drainage pipes unless the sewer main is more than 4 feet below the other pipe.
 - c. Crossings of any open stream, bodies of water, or stormwater ponds.
 - d. Where minimum or maximum cover limits are exceeded as specified elsewhere herein.
 - e. Carrier pipe inside tunnel liner pipe.
 - f. All pipe within the right-of-way of GDOT jurisdiction roadways, commercial and industrial streets, and certain City streets as specified by the City.
 - g. Aerial crossings up to 30 feet long using flanged end pipe specially fabricated for long spans.
 - h. Under the concrete footing of any retaining wall.
 - i. At other locations as required by the City.
 - 5. Install ductile iron pipe and special fittings according to AWWA C600 and as herein specified.
 - 6. Install PVC gravity sewer service piping according to ASTM D 2321 and ASTM F 1668.
 - 7. Install pipe tracer wire on all non-metallic gravity-flow, nonpressure, sewer piping.

3.3 SEWER SERVICE STUBS INSTALLATION

- A. A separate and independent building sewer tap shall be provided for every building except where one building stands at the rear of another and sewer is not available or cannot be constructed to the rear building through an adjoining alley, courtyard or driveway, the building sewer from the front building may be extended to the rear building considered as two (2) building sewer taps.
- B. Install service stub to comply with the following:
 - 1. Locate all residential sewer services within 5 feet of the property line on the opposite property line from the water service.
 - 2. Residential location to extend 5 feet outside the right of way.
 - 3. Commercial location as determined by the City.

4. Place at a minimum 30 degrees above the horizontal axis of the sewer (See Standard Drawing Sheet No. 1019).
- C. Use minimum 6 inch pipe size for all sewer service stubs from the sewer main to the edge of the right of way or easement.
 - D. Install service wyes or tees at points indicated, herein specified or as requested by the City. If service wyes are not connected to a building service under this Work, close end of pipe with removable factory fabricated plug or stopper sufficient for low pressure air testing. Provide cleanouts in services at not more than 75-foot intervals and where pipe horizontal deflection exceeds 45 degrees.
 - E. Service stubs can enter the system either at a manhole or at a "wye" or "tee". All stubs entering a manhole must be cored and sealed with a rubber boot. A maximum of four stubs are allowed into a manhole without special approval of the City of Loganville Utility Department.
 - F. Maximum length of stubs in road right-of-ways shall not exceed 75 feet. Maximum length of stubs in easements shall not exceed 125 feet. Sewer systems should be designed with stubs not over 35 feet long. Longer stubs will not be allowed solely to avoid the cost of extending the main.
 - G. Stub end locations shall be brought to grade level of property with 6" cleanout and plug set just below grade surface elevation. Stub end and cleanout locations shall be clearly marked at grade using a shroud enclosure, locatable cap, and pivoting marker pole by Utility Defender or equal installed at grade surface to protect cleanout and plug.
 - H. Install service piping pitched down in direction of flow, at minimum slope of two percent and with a minimum cover at finished grade of:
 1. 5.5 feet at curbline.
 2. 4 feet at end of stub.
 3. Cover less than 5.5 feet at the curb or under any pavement requires DIP and will only be approved when site topography dictates.
 4. Maximum cover shall not be deeper than is obviously necessary.
 - I. Provide one sewer service stub per building. Connection of two or more units to the same stub is prohibited.
 - J. Sewer service stubs shall have straight alignment. Whenever practical, sewer service stubs shall be installed perpendicular to the main. Whenever possible the main shall extend near enough to the last property served such that the service stub is no more than 30 degrees from perpendicular to either the main or the edge of the right of way.
 - K. Provide pipe bedding of service stubs as specified for main line pipe bedding.
- 3.4 SEWER LATERAL LINES INSTALLATION (pipe system from building to sewer service stub)
- A. The sewer lateral line located on private property shall remain in private ownership. Its maintenance shall be the responsibility of the parcel owner.

B. Residential Lateral Line:

1. Minimum Size: 4 inches, (per plumbing code).
2. Minimum Slope (grade): 1/8 inch per foot, (per plumbing code).
3. Cleanout Locations:
 - a. Minimum 4 inch cleanout outside building and within 10 feet of building, (per plumbing code).
 - b. Minimum 6 inch cleanout will be placed at the tie in of the lateral to the City sewer system stub.
 - c. Locate City sewer stub cleanout outside of any paved driveway or parking area subject to vehicular traffic.
 - d. Under extenuating circumstances, with approval by the City, sewer stub cleanouts are permitted to be located within any paved area subject to vehicular traffic, with the stipulation that the property plat notes that the property owner is responsible for all costs associated with the repair and/or replacement of the sewer line between the City sewer main and the sewer cleanout.
4. Backflow preventer required on every building regardless of the finished floor elevations. Backflow must be placed a minimum of 3 feet from foundation.
5. Maximum of one lateral system per building (per plumbing code)
6. A 4" to 6" PVC glue coupling will be used on all laterals except for any clay pipe which an adapter gasket and Fernco type coupling shall be used at connection to service stub (per plumbing code).
7. Damaged ends of 6" stub must be sawed square prior to connection of house service.

C. Commercial Lateral Line:

1. Minimum Size: 6 inches, (a maximum of 10 feet of 4 inch is allowed out of the building).
2. Minimum Slope (grade): 1/8 inch per foot, (per plumbing code).
3. Test Manhole: must be located on lateral system in non-paved area where possible and must be on property (see section on test manholes). Connect other sewer lines after the test manhole.
4. Backflow preventer required on every building regardless of the finished floor elevations. Backflow must be placed a minimum of 3 feet from foundation.
5. Maximum of one lateral system per building (per plumbing code)

3.5 PIPE JOINT CONSTRUCTION

- A. Make all pipe connections with standard factory fabricated fittings except where special connection details (if any) are shown on Drawings.

- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- D. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 PIPE FOUNDATION:

A. Definition of Pipe Foundation Terms:

1. Trench depth is the vertical distance from pipe invert or flow line to finished ground surface.
2. Trench width is the horizontal distance between trench walls at any point from one foot above top of pipe to trench bottom.

3.7 DUCTILE IRON PIPE EMBEDMENT:

A. Ductile Iron Pipe Bedding: Use ductile iron pipe bedding embedment of the following laying condition type in compliance with ANSI/AWWA C600.

1. Type 5 consists of the following construction method: Bed pipe in carefully placed compacted coarse granular material placed on a flat trench bottom. Thickness of granular bedding must be at least one-eighth the outside pipe diameter, but not less than 4 inches thick under pipe barrel, and extend at least halfway up the pipe barrel at the sides. Spade and shovel-slice embedment material to fill and support pipe haunch area. Place compacted select backfill material or coarse granular material above the coarse granular material up to the top of the pipe. Select backfill material is native soil excavated from the trench that is free of foreign material, frozen earth, organic material, and large stones. Achieve compaction not less than 90% of maximum dry density per ASTM D698 (Standard Proctor) for all material.
2. Type 4 consists of the following construction method: Bed pipe in carefully placed compacted coarse or fine granular material placed on a flat trench bottom. Thickness of granular bedding must be at least one-eighth the outside pipe diameter, but not less than 4 inches thick under pipe barrel, and extend at least one-sixth of the outside diameter up the pipe barrel haunches at the sides. Spade and shovel-slice embedment material to fill and support pipe haunch area. Place compacted select backfill material or coarse granular material above the granular material up to the top of the pipe. Select backfill material is native soil excavated from the trench that is free of foreign material, frozen earth, organic material, and large stones. Achieve compaction not less than 80% of maximum dry density per ASTM D698 (Standard Proctor) for all material.
3. Type 2 consist of the following construction method: Bed pipe on a flat trench bottom with select backfill lightly consolidated to centerline of pipe. Spade and shovel-slice backfill material to fill and support pipe haunch area. Select backfill material is native soil excavated from the trench that is free of foreign material, frozen earth, organic material, and large stones.

- B. Unless otherwise indicated, lay pipe in trenches and embedments prepared as selected by the Contractor in conformance with the pressure class, laying condition type, trench depth, and pipe size tabulated below. Provide trench width sufficient to place and compact embedment material, but not less than nominal pipe diameter plus 2-feet. If trench width at top of pipe is greater than six (6) pipe diameters, compact embedment material below the pipe springline for a distance at least 2.5 pipe diameters each side of pipe for 10- inch size pipe or less and at least one (1) pipe diameter or 2- feet (whichever is greater) each side of pipe for 12- inch size pipe and larger.

Maximum Trench Depth in Feet					
Type 5 Laying Condition					
Pipe	Pressure	Pressure	Pressure	Pressure	Pressure
Size	Class	Class	Class	Class	Class
Inches	150	200	250	300	350
4 thru 8	--	--	--	--	51.6
10	--	--	--	--	46.2
12	--	--	--	--	46.0
14	--	--	37.6	43.4	45.9
16	--	--	35.7	40.5	46.0
18	--	--	32.7	38.4	43.0
20	--	--	32.0	36.9	40.7
24	--	27.2	31.2	34.9	39.4
30	24.7	26.9	29.8	32.4	36.6
36	24.7	26.4	29.1	31.8	35.9

Maximum Trench Depth in Feet					
Type 4 Laying Condition					
Pipe	Pressure	Pressure	Pressure	Pressure	Pressure
Size	Class	Class	Class	Class	Class
Inches	150	200	250	300	350
4 thru 6	--	--	--	--	48.4
8	--	--	--	--	35.1
10	--	--	--	--	29.5
12	--	--	--	--	29.2
14	--	--	25.0	27.7	29.1
16	--	--	25.5	27.8	30.2
18	--	--	24.5	28.0	30.1
20	--	--	23.9	28.1	30.0
24	--	19.6	23.1	26.5	30.5
30	17.4	19.4	22.0	24.3	28.1
36	17.4	19.0	21.4	23.8	27.5

Maximum Trench Depth in Feet					
Type 2 Laying Condition					
Pipe	Pressure	Pressure	Pressure	Pressure	Pressure
Size	Class	Class	Class	Class	Class

Inches	150	200	250	300	350
4 thru 6	--	--	--	--	32.3
8	--	--	--	--	21.4
10	--	--	--	--	16.4
12	--	--	--	--	16.0
14	--	--	12.0	14.8	16.1
16	--	--	12.2	14.9	16.8
18	--	--	12.6	15.0	17.0
20	--	--	12.8	15.1	17.3
24	--	10.1	13.3	15.3	17.6
30	--	11.2	13.7	15.4	17.8
36	--	11.3	14.1	16.0	18.4

3.8 THERMOPLASTIC (PVC) PIPE EMBEDMENT

- A. Unless otherwise indicated, lay pipe in trenches and embedments complying with ASTM D2321 and the following requirements. Bed pipe in carefully placed and compacted Class IB, II, or III flexible pipe bedding materials placed on a stable flat trench bottom and under the pipe haunches. Thickness of flexible pipe bedding must be at least one-eighth the outside pipe diameter, but not less than 4 inches thick under pipe barrel, and extend at least halfway up the pipe barrel at the sides. Spade and shovel-slice embedment material to fill and support pipe haunch area. Achieve compaction not less than 85% of maximum dry density per ASTM D698 (Standard Proctor) for all bedding and haunching material. Place initial backfill of compacted Class IB, II, or III flexible pipe bedding material to a minimum depth of 6 inches over the top of pipe. Achieve compaction not less than 85% of maximum dry density per ASTM D698 (Standard Proctor) for all Class IB and II initial backfill material and not less than 90% of maximum dry density per ASTM D698 (Standard Proctor) for all Class III initial backfill material. Use only Class IA or IVA flexible pipe bedding materials where authorized by the Engineer. Do not use Class IVB or V flexible pipe bedding materials for pipe embedment under any circumstances.
- B. Provide trench width sufficient to place and compact embedment material, but not less than the values tabulated below. If trench width at top of pipe is greater than six pipe diameters, compact embedment material below the pipe springline for a distance at least 2.5 pipe diameters each side of pipe for 10 inch size pipe or less and at least one pipe diameter or two feet (whichever is greater) each side of pipe for 12 inch size pipe and larger.

Pipe Size, In.	Minimum Trench Width, Ft.-In.
4	1-10
6	2-0
8	2-2
10	2-4
12	2-6
15	2-9
18	3-0
24	3-9

30	4-4
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3.9 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated. Set units plumb to exact grade on a minimum of 6- inches of compacted coarse or fine granular pipe bedding material. Use eccentric manhole cones for all manholes.
- B. Locate manholes a minimum of 4 feet clear of drainage culverts and other underground utilities and along centerline of sanitary sewer easements, unless noted otherwise.
- C. New pipe entry shall be at no less than a 90 degree angle from direction of flow of existing manhole, unless the minimum inside drop is equal to the diameter of the lower pipe.
- D. Where indicated or necessary for future connections, install stub pipe in manhole for future consisting of 3 feet of ductile iron pipe with mechanical joint plug.
- E. Install precast concrete manhole sections with sealants according to ASTM C 891. Use materials and construction techniques necessary to achieve permanent watertight joints and connections. Fully seal with grout all lift holes and trowel smooth inside and outside.
- F. Obtain City approval of any field coring for manhole wall openings prior to backfilling cored opening. Failure to have the City approve the cored opening will cause the work to be halted until the cored opening is excavated and the pipe connector exposed for inspection.
- G. Form continuous concrete channels and benches between inlets and outlet. Shape inverts and channels neatly for smooth hydraulic flow. Shape the invert channel to the same radius as the effluent pipe and extend up to the springline of the influent and effluent pipes. Full grout the entire perimeter of manhole wall pipe connectors.
 - 1. Provide a minimum 0.2 feet drop across the manhole invert to prevent solids deposition. Drops of 0.1 feet or less across inverts will only be permitted when site topography prevents drops of 0.2 feet.
- H. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Make frames, subject to traffic, firm and stable under actual traffic conditions. Set tops not in pavements with bolt-down water tight covers as indicated below, unless directed otherwise by the City:
 - 1. In wooded or unmaintained areas, place a minimum of 18 inches above ground level measured from highest grade side of manhole.
 - 2. In flood plain areas, place at least 12 inches above flood plain elevation as approved by the City.
 - 3. Cast frame integral with the concrete manhole cone.
 - 4. In maintained grassed areas, place not more than 12 inches above grade and not covered by any type of landscape.
- I. Install a drop connection in manhole for all pipes, including 6 inch pipe, with an influent invert of 4-feet or greater elevation difference from discharge invert. Comply with City of Loganville Standard Drawing, Sheet No. 1002 for installation. For influent sewer lines 12-inch and less,

install at Contractor's opinion outside or inside drop connection. Inside drop connections require a minimum 5 feet diameter manhole. For influent sewer lines greater than 12-inch, install outside drop connection only.

1. Use ductile-iron piping for all drop connection materials.
2. Provide at least one pipe joint minimum 18 feet long on the incoming line to reach a solid, undisturbed pipe foundation.
3. Place concrete thrust blocking below outside 90 degree elbows.

J. Install manholes over existing sewers (Doghouse Manhole) in accordance with City Standard Drawing, Sheets No. 1004 and 1005.

1. Conduct any cutting of the existing sewer only after authorization from the City and in the presence of the City representative.

3.10 TEST MANHOLE INSTALLATION

- A. General: Provide test manholes as required by the City and install test manholes generally in accordance with previous manhole specifications.
- B. Construct manhole depth no less than 4 feet deep and no greater than 12 feet deep, unless otherwise approved by the City.
- C. Locate test manholes in a non-paved area whenever possible and within the property limits of the building.
- D. Provide bolt-down frame and covers for manholes and modify manhole inverts to permit measuring capability if required by the City.
- E. Neither inside drops nor outside drop connections are permitted for test manholes.

3.11 ADJUSTMENT TO EXISTING MANHOLE

- A. General: Where indicated on the Drawings or instructed by City, adjust existing manhole frame and cover to grade by adjustment ring, grade ring, or riser sections.

3.12 PUMP STATION AND FORCE MAIN INSTALLATION

- A. Pump stations, when acceptable to the City, are to be installed in accordance with the requirements of the City's *Sanitary Sewer Standards for Pump Stations and Forcemains*, available from the City.
- B. Install force-main, pressure piping according to the following:
 1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 2. Install piping with 48-inch minimum cover.
 3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.

4. Install PVC pressure piping according AWWA 605 or ASTM D 2774 and ASTM F 1668.
5. Install pipe tracer wire on all force mains.

3.13 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.14 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use ductile iron pipe or PVC pipe and similar fittings in sewer service lines at branches for cleanouts and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use light-duty, top-loading classification cleanouts in unpaved foot-traffic areas. Set cleanout and plug just below grade surface elevation. Clearly mark stub end and cleanout locations at grade using a shroud enclosure, locatable cap, and pivoting marker pole by Utility Defender or equal installed at grade surface to protect cleanout and plug.
 2. Use extra-heavy-duty, top-loading classification cleanouts in paved areas. Set cleanout tops 2 to 3 inches below finished grade within a heavy duty, vehicle traffic rated box mounted flush with pavement surface.

3.15 CONNECTIONS

- A. Make all pipe connections with standard fittings, manholes, structures, or special construction detail on Drawings. Locate building service lines and connect thereto with standard fittings.
- B. At manholes and other structures, neatly cut all connecting piping flush with inside surface, and provide flexible pipe joint within 18- inches of outer surface. Provide PSS pipe sleeve around opening. If necessary, use supplemental materials and techniques to obtain a watertight connection.
- C. Make connections to existing piping and underground manholes.
 1. At the start of construction, install a plug in the first pipe laid out of the entrance manhole and in the downgrade side of the first newly installed manhole. Said plugs shall remain in place until final inspection and approval is given by the City. The Contractor must exercise extreme caution to insure that plugs are not lost into the sewer system. (See Standard Drawing Sheet No. 1021).
 2. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping with nonpressure-type coupling.
 3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
 4. When field pipe connections to existing manholes are required, core necessary holes sized to install new pipe and allow watertight seal with use of non-shrink grout, rubberized boot, or other acceptable materials and/or systems. Replace any existing manhole units excessively damaged by connection operations.

3.16 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8- inch thick, concrete and/or brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
 - 1. Remove and salvage frame and cover.
 - 2. Abandon all sewers connecting to manhole and seal openings with at least 8-inch thick, concrete and/or brick masonry bulkheads.
 - 3. Remove top of manhole down to at least 36-inches below final grade.
 - 4. Cut minimum of two (2) openings in manhole bottom 6-inches in diameter for groundwater passage.
 - 5. Fill remaining manhole structure to grade as follows:
 - a. Manholes Under Pavement: Fill manhole with coarse granular material. Patch pavement in accordance with the appropriate pavement patch detail.
 - b. Fill manhole with stone, rubble, gravel, and compacted earth. Restore surface as required by the specifications.
- C. Backfill to grade according to Section 312000 "Trenching and Backfilling."

3.17 SPECIAL CONSTRUCTION

- A. Where constructing on piers, supporting pipe on bridges, or for other special work, use safe and generally accepted construction methods to accomplish the required work. (See Standard Drawing Sheets No. 1022, 1023, 1024)
- B. Provide pipe support piers at every joint directly behind the bell or as directed by the City and at least 5 feet beyond the two year flood storm level whenever possible.
- C. Locate stream crossing aerial lines to avoid or minimize stream blockage during normal high water events. Delineate two-year flood level elevation on the plans.
- D. When installing force mains across creeks, streams or other drainage channels with flowing water, make installation using directional drilling techniques.

3.18 ANCHORAGE

- A. General: Anchorage detailed on Drawings, if any, represents minimum anchorage to be installed for pressure piping. Field conditions may require additional anchorage, and it is the Contractor's responsibility to recognize such additional requirements and to provide appropriate additional anchorage.

B. Direct Burial Locations:

1. Anchor all bends, valves, tees, reducers and other points of unbalanced pressure as necessary to resist thrust at test and working pressures, with suitable allowance for water-hammer. Also anchor piping system installed on steep slopes where gravitational force might otherwise cause piping displacement. Accomplish piping system anchorage by use of concrete reaction bracing, metal tie rods and bands, and/or restrained joint systems of 18-8 stainless steel or other acceptable corrosion resistant components. When using concrete reaction bracing, pour concrete against firm earth and allow it to cure for at least five days before placing main under pressure. Provide concrete conforming to ASTM C94 having a minimum compressive strength of 2,000 psi (13.8 MPa) at 28 days. Position concrete blocks of sufficient size to counteract the magnitude and direction of the resultant thrust force as shown on the Drawings and in such a way that the pipe and fitting joints will be accessible for repair.
2. Provide special support blocks at plastic pipes according to manufacturer's recommendation. When using bands and tie rods in conjunction with reaction bracing, provide a separate band for each tie rod. Use corrosion resistant materials throughout. When using restrained joint systems, utilize methods and place these special joints at appropriate fittings and pipe joints in accordance with manufacturer's recommendation.

3.19 PAINTING

- A. Clean and prepare concrete manhole surfaces for field painting. Remove loose efflorescence, chalk, dust, grease, oils, and release agents. Paint the following concrete surfaces as recommended by paint manufacturer:
 1. Precast Concrete Manholes: All exposed exterior and/or interior as indicated.

3.20 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Trenching and Backfilling." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 1. Use warning tape over ferrous piping.
 2. Use pipe detection wire over nonferrous piping and over edges of underground manholes.
- B. Install continuous non-metallic warning tape in trench, approximately 12-inches below finish grade. Provide non-metallic warning tape for all pipe and tubing installed by open-cut methods.
- C. Install pipe tracer wire on all non-metallic pipe systems. Tape tracer wire to the top center of the pipe at intervals which prevent wire displacement during backfilling operations. Stub tracer wire up six (6) inches above finished grade at all manholes and force main valves with at least 24 inches of coiled wire. Completed tracer wire is to be electrically continuous between stub-ups. For splices, use direct bury kits. After backfilling is complete, test electrically continuity of each tracer wire segment and provide test results to City.

3.21 SEWER LINE CLOSED CIRCUIT TELEVISION INSPECTION (CCTV)

- A. Inspection of interior of piping via closed circuit televising (CCTV) is required for acceptance prior to placing sewer line in service. Permanently correct all sags, pipe material defects, joint defects, and any other identified defects determined by CCTV inspection and repeat operations until approved by City Inspector.
- B. When flow in a sewer line is plugged, blocked, or bypassed, protect the sewer lines from damage that might result from sewer surcharging. Ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.
- C. Do not exceed a video inspection traverse rate of 30 feet per minute so that sewer line can later be thoroughly examined by the City while viewing video recording. The video recording will include on-screen observation identifications that label continuous footages, defects, pipe diameter, direction of flow, direction of viewing, manhole and street reference locations.
- D. Make a color video recording on CD or DVD ROM of all sewers inspected and also provide a paper report generated by the video inspection software. Ensure inspection reports and videos are compatible with Microsoft Windows software. Index inspection videos on CD or DVD ROM to allow for faster viewing by the City. Video files must be formatted in mpeg, mpegII or mpeg4. Record video in a non-proprietary video format to allow for playback on any PC computer and/or DVD player. A computer, integrated with the video inspection equipment, will be used to eliminate errors from separate processes.
- E. Describe all defects and observations with a standard table of descriptions so that there is no variation caused by operator subjectivity. Provide a printed legend of defect classifications that identifies a color-coded rating system for defect observations and their severity. Attach the legend of defect classifications to each and every written report for easy evaluation. Record and rate the severity of each defect or observation according to the legend of classification published by the Contractor.
- F. Deliver one digital copy of report and video and one paper copy of report to the City.

3.22 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of the City.
 3. Schedule tests and inspections by City with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig. While maintaining test pressure, make a careful and systematic search for leaks. When rate of makeup water exceeds that which can reasonably be accounted for by observed leaks, continue the test period as necessary to locate the additional leaks. Eliminate leaks found and retest. Repeat the procedure until all detectable leaks have been eliminated and the piping system is as near watertight as practical.
 - a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
 - b. PVC Piping: Test according to AWWA C605, "Hydraulic Testing" Section.
- C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- D. Infiltration Testing:
1. On newly installed sewers 16 inches or less in diameter, no infiltration or leaks are permitted. Eliminate any infiltration flowing at low point of system prior to approval.
 2. On newly installed sewers greater than 16 inches in diameter, limit infiltration to no greater than 75 gallons/day/inch diameter/mile of pipe. Correct any visible or known leaks regardless of total infiltration amount.
- E. Air Testing:
1. Nominal 4 Inch to 24 Inch Pipe: After completing backfill of a sewer line section, conduct a low pressure air test depending on pipe material in accordance with ASTM C 924, ASTM C 828, ASTM F 1417, or UNI-B-6 guidelines for installation acceptance. Perform such tests using the following general procedures:
 - a. Temporarily plug line segment between two (2) manholes using plugs having air tight fittings through which low pressure air can be introduced into the pipe segment being tested.
 - b. Introduce low pressure air into the test pipe segment until the internal air pressure reaches 4.0 psig above ground water pressure, if any.
 - c. Wait at least two (2) minutes for air temperature in the test segment to stabilize while internal air pressure remains no less than 3.5 psig above ground water pressure.
 - d. Accurately determine the elapsed time for internal pressure to drop 1.0 psig.
 2. The air test is acceptable if elapsed time for an internal pressure drop of 1.0 psig is no less than shown in the following tables:

- a. For Thermoplastic or Ductile Iron Sewer Lines:

Pipe Diameter (inches)	Minimum Time (min:sec)	Maximum Length for Minimum Time (ft)	Minimum Time for Longer Length (sec) L = Total Length
4	3:46	597	.380 L
6	5:40	398	.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.218 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
20	19:50	114	10.470 L
24	22:40	99	13.674 L

3. Nominal 27 Inch and Larger Pipe: After completing backfill of a sewer line section, conduct a low pressure air test on each pipe joint in the section in accordance with ASTM C 1103 for concrete pipe sewer lines or by using methods and devices acceptable to the Engineer. Perform such tests using the following general procedures:
- Properly position and completely secure test unit over pipe joint being tested.
 - Introduce low pressure air into the pipe joint test area until the internal air pressure reaches 3.5 psig above ground water pressure, if any.
 - The joint air test is acceptable if the internal pressure drops less than 2 psi in 10 seconds.
4. At each manhole constructed where ground water is known to exist, install a small diameter pipe nipple through the manhole wall at the time that the sewer pipe is installed. Locate the nipple immediately above the lowest connecting sewer pipe, and grout the nipple in place concurrently with grouting the sewer pipe. Prior to placing the nipple, wrap it with a continuous length of heavy nylon chord which can be pulled out, thus permitting removal of the nipple after test work is complete. Just before commencing the air test, attach a clear plastic tube to the nipple, and hold the tube end vertically upward. After ground water has stopped rising in the plastic tube, measure the vertical distance from water level to pipe invert in feet. Average this distance observed at manholes on each end of the test segment, and divide the average distance in feet by 2.3 to obtain the ground water pressure to be used in computing required test air pressure.
5. Permanently correct excessive leakage determined by air testing, and repeat operations until City Inspector witnesses a successful test on each line segment or joint; then remove nipple through manhole wall without disturbing adjacent grout. Permanently caulk resulting hole watertight.

F. Deflection Testing:

- Conduct internal deflection testing on all installed PVC gravity sewer lines 6-inch size and larger, no sooner than 30 days after completion of trench backfilling and after pipeline is completely cleaned and flushed. Deflection testing consists of pulling an approved solid pointed mandrel through the completed pipeline from manhole to manhole without using mechanical pulling devices. Mandrel testing is successful when the mandrel device can be

pulled through the pipe between manholes in a continuous operation, without interruption. Repair or replace all defective pipe found during mandrel testing and conduct another deflection test to determine the extent and necessary repair of any additional deficiencies. After repairing all defects, perform successful mandrel testing no less than 30 days after completion of trench backfilling in the presence of the City.

2. Use a rigid, non-adjustable mandrel with odd number of legs or runners (not less than nine legs) and a length at least 75% of the inside diameter of the pipe being tested. Furnish mandrels sized as tabulated below using base inside diameters complying with ASTM D3034 and F679: table:

5 PERCENT DEFLECTION MANDREL			
(ASTM D 2412)			
Nominal	Mandrel	Tolerance	Nearest
Size, In	O.D., In	In	1/16"
6	5.45	0.01	5-7/16
8	7.28	0.01	7-4/16
10	9.08	0.01	9-1/16
12	10.79	0.01	10-13/16
15	13.20	0.01	13-3/16

3. Upon request by the City, certify the accuracy of the mandrel test gauges by sliding proving rings to an accuracy of 0.05 inches over the mandrel. Use proving rings complying with ASTM F679 and ASTM D3034.

G. Manhole Testing: Perform manhole vacuum testing on gravity sewer and force main discharge manholes as follows:

1. Plug all lift holes with non-shrink grout.
2. Temporarily plug all pipes entering the manhole and securely brace each plug to prevent them from being pulled into the manhole.
3. Place the vacuum test head at the top of the manhole in accordance with the testing equipment manufacturer's recommendations.
4. Draw a vacuum of 10-inches of mercury on the manhole and close the valve on the testing equipment vacuum line and shut off the vacuum pump. Measure the time for the vacuum to drop to 9- inches of mercury.
5. The manhole test passes if the time for the vacuum reading to drop from 10-inches of mercury to 9-inches of mercury meets or exceeds the values indicated in the following table:

Depth (feet)	Time in Seconds per Indicated Manhole Diameter		
	48" Dia.	60" Dia.	72" Dia.
0-8	20	26	33
8-10	25	33	41
10-12	30	39	49
12-14	35	46	57
14-16	40	52	67
16-18	45	59	73
18-20	50	65	81
20-22	55	72	89

6. If the manhole fails test, permanently correct excessive leakage determined by manhole vacuum testing and repeat vacuum test until a successful test is achieved.
 7. Leaks and loss in test pressure constitute defects that must be repaired.
 8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- H. Provide temporary piping ends, blind flanges, blocking test pumps, and other work necessary to safely and effectively perform hydrostatic testing.
- I. Remove or otherwise protect all pipe connected elements which might be damaged by hydrostatic testing. Provide temporary pipe ends as necessary to avoid extending hydrostatic testing into any electrical or control panel.
- J. Prepare reports of testing activities.

3.23 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.
- B. Avoid permitting dirt, rubbish, construction materials, etc. to enter lines and appurtenances during construction. Use whatever means are necessary to obtain a clean and internally smooth system prior to final acceptance.
- C. Clean and flush existing force mains and gravity sewers to be abandoned as follows:
1. Purge existing force mains and gravity sewers to be abandoned initially, with potable water before abandoning and disconnecting. Provide bypass pumping operations as necessary.
 - a. Purge line with enough water to remove any remaining sanitary sewerage waste and debris from line, to the pump station or storage ponds, without surcharging the pump station or storage areas. Utilize vacuum trucks as necessary to remove excess fluid, grit, and grease that cannot be drained.

3.24 INSPECTIONS & TESTING:

- A. All taps, tests, and inspections must be scheduled during regular working hours a minimum of two working days (24 hours) in advance by calling (770) 466-2633.
- B. Unnecessary recall inspections are subject to an assessment of \$30.00 for each event.

END OF SECTION 333000