# Table of Contents

**TECHNICAL SPECIFICATIONS** ............................................................................................................................... 2

1. GENERAL .......................................................................................................................................................... 2

2.0 GENERAL PLANS PREPARATION ..................................................................................................................... 4

3.0 GENERAL DESIGN AND CONSTRUCTION STANDARDS .................................................................................. 6

4.0 RAW WATER SPECIFIC PLAN PREPARATION, DESIGN AND CONSTRUCTION STANDARDS ................. 18

5.0 WATER SPECIFIC PLAN PREPARATION, DESIGN AND CONSTRUCTION STANDARDS .................. 22

6.0 SEWER AND FORCemain SPECIFIC PLAN PREPARATION, DESIGN, AND CONSTRUCTION STANDARDS ....... 30

7.0 LIFT STATION PLAN PREPARATION, DESIGN AND CONSTRUCTION STANDARDS ............................... 42

8.0 RECLAIM SPECIFIC PLAN PREPARATION, DESIGN, AND CONSTRUCTION STANDARDS .................... 54

9.0 PERVERIOUS CONCRETE CONSTRUCTION STANDARDS ......................................................................... 58

10.0 STORMWATER CONVEYANCE SYSTEMS CONSTRUCTION STANDARDS .................................................... 64
TECHNICAL SPECIFICATIONS

1. GENERAL

1.1. These specifications cover the design, review of plans, and specifications for the installation, inspection, testing, and acceptance of water distribution systems, water main extensions, sanitary sewage collection systems, sewage transmission force mains, sewer line extensions, reclaimed water distribution systems, and all appurtenant items, which are to be owned and maintained by the City of Titusville.

1.2. All improvements and modifications made to the Titusville Municipal Water System, Titusville Municipal Sewage Collection and Transmission System, and/or Titusville Reclaimed Water System shall be completed in accordance with the City approved site plans. Material and workmanship shall conform to the specifications that appear in this document as well as the approved drawings. No deviations from the approved specifications and drawings are permitted except for minor field changes in location and/or materials approved and documented in the field by the City Utility Inspector. Any significant change must be approved by a City Engineer. Any change made without prior approval is subject to rejection. If a situation arises where the plans and specifications are in conflict, the more restrictive requirement shall prevail.

1.3. The Contractor shall not remove any thrust block or mechanical restraint connected to any water mains or any sewage transmission force mains or operate water control valves, except under the direction and observation of the City Utility Inspector. NO WORK SHALL COMMENCE UNTIL THE CITY HAS BEEN NOTIFIED AT LEAST 48 HOURS IN ADVANCE.

1.4. Unless otherwise noted or approved by the City of Titusville (COT), all materials shall be manufactured in the United States.

1.5. An Underground Utility Contractor licensed in the State of Florida shall perform all underground utility work.
2.0 GENERAL PLANS PREPARATION

2.1. All water distribution systems, extensions, sanitary sewer (gravity), sewage transmission systems, reclaimed water distribution systems, reclaimed water extensions and appurtenant items, shall be designed in accordance with the applicable regulations of the City of Titusville, the Florida Department of Environmental Protection (FDEP), and the standards established herein. In addition, all distribution systems, transmission mains and system improvements shall be designed and constructed for a serviceable life of not less than 50 years.

2.2. LOCATION: Mains shall be located within dedicated rights-of-way or utility easements.

2.3. Mains shall extend at least ten (10) feet beyond the farthest point of ingress/egress to a subdivision, property site, or to property limits.

2.4. Easements: If piping is to be constructed within an easement, the centerline of the pipe shall be located within two (2) feet of the centerline of the easement. Mains and easements shall not be placed under buildings, retention ponds, courts, swimming pools, fountains or other structures. Placement of mains under pavement shall be kept to a minimum. Placement of mains along interior side or rear lot lines or stormwater retention pond berms are not approved. Exceptions may be allowed on a case-by-case basis if such configuration results in efficient placement and utilization of the system as determined by the COT. Services, air release valves, and other valves shall not be placed along interior side or rear lot lines or stormwater retention pond berms. Additional easement widths may be required on a case-by-case basis.

2.5. Foundations: All mains up to eight (8) inches in size shall be located at least ten (10) feet from any building foundation, or as determined by the City. Mains greater than eight (8) inches shall be located at least fifteen (15) feet from any building foundation, or as determined by the City.

2.6. REVIEW AND PERMIT STANDARDS

2.6.1. GENERAL: For all developments (subdivisions, condominiums, townhouses, etc.), the Developer shall comply with the City’s Land Development Regulations.

2.6.2. All drawings must include a location map referencing established landmarks to establish clearly the project location.

2.6.3. FDEP PERMITTING: The developer shall submit per the latest DEP submittal requirements including but not limited to:

2.6.3.1. Two (2) signed and sealed sketches of plans, calculations and specifications.

2.6.3.2. Two (2) executed Florida Department of Environmental Protection (FDEP) permit applications.
2.6.3.3. Appropriate filing fees.

2.6.4. A Construction Permit will be required prior to any extension, repair, rehabilitation or modification of any main owned and maintained by the City of Titusville. If an FDEP permit is required, it must be obtained prior to the issuance of a construction permit.

2.6.5. No changes to the City approved plans and specifications shall be made without the express written approval of the COT.
3.0 GENERAL DESIGN AND CONSTRUCTION STANDARDS

3.1. VALVES: All valves will meet or exceed all requirements of AWWA C509 Standards, latest revision. All valves shall be resilient wedge gate valves with stainless steel (SS) stems and hardware. All valves larger than 12 inches, with the exception of tapping valves, shall have bevel gears with side actuators.

3.2. TEST AND INSPECTION

3.2.1. Laboratory or Plant test: Pipe and materials shall be tested in accordance, and for conformity, with the latest editions of the following:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductile Iron Fittings</td>
<td>ANSI 121.10 (AWWA C111)</td>
</tr>
<tr>
<td>Ductile Iron Pipe</td>
<td>ANSI A21.51 (AWWA C151)</td>
</tr>
<tr>
<td>Polyethylene Encasement</td>
<td>ANSI A21.5 (AWWA C105)</td>
</tr>
<tr>
<td>Polyvinyl Chloride (PVC)</td>
<td></td>
</tr>
<tr>
<td>Pipe 4” &amp; Larger</td>
<td>AWWA C900/DR 18 or C905/DR 18</td>
</tr>
<tr>
<td>High Density Polyethylene (HDPE) Pipe</td>
<td>AWWA C906/Minimum Pressure Class 160</td>
</tr>
<tr>
<td>4” – 60”</td>
<td></td>
</tr>
<tr>
<td>Copper Pipe</td>
<td>Type “K” soft copper</td>
</tr>
<tr>
<td>1” – 2”</td>
<td></td>
</tr>
<tr>
<td>EndoTrace 2” Polyethylene</td>
<td>AWWA C901/SDR 9</td>
</tr>
<tr>
<td>Gate Valves 2” &amp; larger</td>
<td>Resilient seated AWWA C509</td>
</tr>
<tr>
<td>Gate Valves smaller than 2”</td>
<td>Fed. Spec. WW-V-54 (r.5.3.6)</td>
</tr>
</tbody>
</table>

3.2.2. Upon request, the Contractor shall submit to the City, a certificate of inspection stating that the materials furnished have been inspected at the plant, meet the requirements of these specifications, and that the pipe is marked in accordance with Section 3.19.

3.2.3. The entire product of any manufacturer may be rejected when, in the opinion of the City, the methods of manufacture fail to secure uniform results acceptable to the requirements of these specifications.

3.2.4. All pipe, valves and fittings shall be subject to inspection at time of delivery and in the field just prior to installation. All pipe, valves or fittings, which, in the opinion of the City, do not conform to these specifications, will be rejected and shall be removed by the Contractor at his expense.

3.2.5. HYDROSTATIC AND LEAKAGE TESTING:

3.2.5.1. All pipe installed for the purpose of conveying under pressure shall be tested after installation in accordance with the applicable portions of the hydrostatic tests as set forth in the latest revision of Section 5 of AWWA Standard C600 for ductile iron mains and Section 7.3 of AWWA Standard C605 for PVC mains, with leakage limited to that shown in equation below.
L = (SDP^{0.5})/148,000

L = Testing allowance in gallons per hour
S = Length of line being tested in feet
D = Nominal internal diameter in inches
P = Average test pressure in pounds per square inch (gauge)

Force mains are tested at 100 psi for 2 hours. All other pipes are tested at 150 psi for 2 hours.

3.2.5.2. The maximum length of water main to be pressure tested shall be limited to 2,000 linear feet of main, sectioned by control valves in the closed position. More than one section may be tested simultaneously. All service lines and appurtenances shall be tested.

3.2.5.3. All lines shall be tested to the required test pressure for two (2) hours duration. The Contractor shall furnish all necessary pumps, gauges, and appurtenance.

3.2.5.4. Contractors are required to pressure test all lines prior to scheduling the verification test witnessed by the City Utility Inspector. If the verification test fails with the City Utility Inspector, present, the Contractor shall be required to pay a retest fee, prior to the scheduling of a retest.

3.3. SEPARATION OF WATER AND SEWER LINES

3.4. DESIGN: The proximity of sewer lines and water mains (including appurtenances) and the type of material used for each system are important design considerations for minimizing the chance of contaminants entering the water distribution system. Refer to AWWA, Prevention of Groundwater and Sewer Backflow into Distribution Systems.

3.5. PARALLEL INSTALLATIONS: Water mains shall be laid to provide a horizontal distance of at least three (3) feet between the outside of the water main and the outside of any existing or proposed storm sewer, stormwater force main, or pipeline conveying reclaimed water regulated under Part III of Chapter 62-610, FAC. Water mains shall be laid to provide a horizontal distance of at least six (6) feet, and preferably ten (10) feet, between the outside of the water main and the outside of any existing or proposed gravity- or pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water not regulated under Part III of Chapter 62-610, FAC. The minimum horizontal distance between water mains and gravity-type sanitary sewers shall be reduced to three (3) feet where the bottom of the water main is laid at least six (6) inches above the top of the sewer. Water mains shall be laid to provide a horizontal distance of at least ten (10) feet between the outside of the water main and all parts of any existing or proposed on-site sewage treatment and disposal system as defined in Section 381.0065(2), F.S., and Rule 64E-6.002, F.A.C. Exceptions to the separation requirement will be on a case-by-case basis as approved by the City and the Florida Department of Environmental Protection in accordance with the Florida Administrative Code, Chapter 62-555.314, and are made only when there is no other reasonable alternative. For visual representation, see Table titled “Location of Public Water System Mains in Accordance with FAC Rule 62-555.314” in Appendix B.
3.6. CROSSINGS: Water mains crossing any gravity sanitary sewer or storm sewer lines shall maintain a separation of at least six (6), and preferably twelve (12), inches above or at least twelve (12) inches below the outside of the other pipeline. However, it is preferable to lay the water main above the other pipeline. Water mains crossing any existing or proposed pressure-type sanitary sewer, wastewater or stormwater force main, or pipeline conveying reclaimed water shall be laid so the outside of the water main is at least twelve (12) inches above or below the outside of the other pipeline. However, it is preferable to lay the water main above the other pipeline. Exceptions to the separation requirement will be on a case-by-case basis as approved by the City and the Florida Department of Environmental Protection in accordance with the Florida Administrative Code, Chapter 62-555.314, and are made only when there is no other reasonable alternative. Adequate structural support shall be made for the sewer mains to prevent excessive deflection of joints and settling on the water mains. For visual representation, see Table titled “Location of Public Water System Mains in Accordance with FAC Rule 62-555.314” in Appendix B.

3.7. At the utility crossings described above, one full length of water main pipe shall be centered above or below the other pipeline so the water main joints will be as far as possible from the other pipeline. Alternatively, at such crossings, the pipes shall be arranged so that all water main joints are at least three (3) feet from all joints in storm sewers, stormwater force mains, or pipelines conveying reclaimed water regulated under Part III of Chapter 62-610, F.A.C., and at least six (6) feet from all joints in gravity- or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water not regulated under Part III of Chapter 62-610, F.A.C. For visual representation, see Table titled “Location of Public Water System Mains in Accordance with FAC Rule 62-555.314” in Appendix B.

3.8. HOUSE SEWER LATERALS: The above requirements shall apply to house sewer laterals that cross above a water line, but not to those laterals that cross at least six (6) inches below a water line.

3.9. WATER SERVICE LINES: Water services and sewer lines shall be separated in accordance with the above guidelines for water mains and sewer mains. The minimum horizontal separation is six (6) feet or more and in no case shall they be laid in the same trench.

3.10. RECLAIMED WATER SERVICE LINES: Reclaimed water services and sewer lines shall be separated in accordance with the above guidelines. The minimum separation shall be maintained and in no case shall they be laid in the same trench.

3.11. PIPE INSTALLATION

3.12. TRENCH EXCAVATION

3.12.1. Make all excavations by open cut with banks of trenches at no greater than the maximum allowable slope as defined in OSHA 1926, Subpart P. Sheet and shoring, if required for depth of trench, will conform to OSHA safety standards. A trenching box or shield may be used in place of sheeting and shoring. Make trenches wide enough to allow approximately eight (8) inches clearance on each side of the main; bottom uniform to provide accurate and uniform bearing for as nearly the full length of pipe section as practical. Excavate bell holes after trench
has been graded. Perform all excavations of whatever substance encountered to the depths shown or indicated on plans. In the event unsuitable or unstable soil is encountered, such as refuse or organic matter, it shall be removed and replaced with approved material in six-inch compacted layers at a depth of twelve (12) inches below main. All excavated material shall be piled in a proper manner that will not obstruct sidewalks, roads or driveways. Fire hydrants, valve boxes and other utility controls shall be left unobstructed and accessible until work is completed. Street drainage shall not be obstructed.

3.12.2. The Contractor shall furnish all equipment and labor necessary to remove storm or subsurface waters from excavation areas to maintain the excavations free of water while construction is in progress. The dewatering of any excavation areas and the disposal of the water shall be in strict accordance with the latest revision of all local and state government rules, regulations and permits. The Contractor is responsible for obtaining any dewatering permits required from St. Johns River Water Management District. The Contractor shall utilize suitable equipment to dewater adequately the excavation so that it will be dry for work and pipe laying. A wellpoint system, or other dewatering method approved by the respective jurisdictional agencies, shall be utilized if necessary to maintain the excavation in a dry condition for preparation of the trench bottom and for pipe laying. Discharge to storm sewers, canals, streams, or wetlands is only allowable if specifically allowed for in the Dewatering Permit. In no case shall discharge result in turbidity reaching wetlands or any waterways. Construct temporary culverts, barricades and other protective measures to prevent damage to property or injury to any person or persons. Flooding of streets, roadways, driveways or private property will not be permitted. Engines driving dewatering pumps shall be equipped with residential type mufflers. Additional soundproofing may be required on a case-by-case basis. Some examples of additional soundproofing may include, but not limited to, silent packs or plywood encasements.

3.13. HANDLING AND CUTTING PIPE: Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused a fracture (even though no such fracture can be seen), shall be marked as rejected and removed at once from the work site. All repaired or replaced sections shall be joined by M.J. gasket fittings only.

3.14. PIPE LAYING

3.14.1. Mains shall be constructed of the materials specified and as shown on the approved drawings. Each section of the pipe shall rest upon the pipe bed for the full length of the barrel, with recesses excavated to accommodate bells and joints. Any pipe that has its grade or joint disturbed after placement shall be taken up and re-laid. No pipe shall be laid when the trench conditions or the weather is unsuitable for such work, except by permission of the City. Any section of pipe already laid which is found to be defective or damaged shall be replaced with new pipe without additional cost to the City. Excavation, trenching and backfilling shall be in accordance with the requirements of the applicable portions of these specifications. All iron pipe and fittings shall be laid in accordance with AWWA Standard C600.
3.14.2. The minimum cover over all pressure piping shall be thirty (30) inches except where specifically shown as otherwise approved. The maximum depth of cover shall not exceed forty-eight (48) inches except where specifically shown as otherwise approved.

3.14.3. A conscientious effort shall be made to keep the inside of the pipeline being installed as clean as possible. Before pipe is laid, all dirt and foreign materials shall be removed from the inside of the bell and from the outside spigot end.

3.14.4. During times when pipe laying is not in progress, all open pipe ends or fittings shall be closed by a water tight cap or plug, or other approved method. This requirement will pertain to any time during the working day that trench pipe laying is not in progress, including overnight or weekends. When water is present in the trench, the pipe seal shall remain in place until the trench is pumped completely dry.

3.14.5. After pipe is laid, care shall be taken to avoid the entrance of dirt or water into the trench by the use of tight bulkheads.

3.14.6. To provide the capability for routing the pipe to suit unusual laying conditions, around obstacles, and moderate changes in grade, all gasket slip joint pipe connections shall have a joint deflection of no more than 75% of the manufacturer’s recommendations.

3.15. JOINT RESTRAINT: Suitable mechanical joint (MJ) restraint shall be applied on all pressure pipelines (except for those having screwed or flange joints), all tees, plugs, caps and at bends deflecting 11-1/4 degrees or more. All mechanical joint restraints will be left uncovered for inspection before backfilling. If MJ restraints are backfilled prior to inspection, the City Utility Inspector, may request re-excavation for verification of construction methods. See Appendix A for the approved product list for acceptable materials.

3.16. STREET CROSSINGS

3.16.1. Mains crossing paved roadways shall use horizontal directional drilling, as per City of Titusville requirement, where open trenching is not permitted. See Appendix A for the approved product list for acceptable materials.

3.16.2. FDOT or Brevard county right-of-way permits may be required prior to starting street crossing construction. It is the Project Engineer’s responsibility to obtain the necessary permits for road crossings, horizontal directional drilling, or open cutting.

3.16.3. The Contractor shall be responsible for locating and verifying existing underground utilities, services, and structures in advance of construction. The Contractor shall conduct exploratory excavations in areas of potential conflict or connection. The directional drill operation shall be done sequentially and continuously for one machine setup. Correct line and grade shall be carefully maintained. Add-on sections shall be sealed together to provide watertight total pipe strength joints. The installation shall produce no upheaval, settlement,
cracking, movement or distortion of the existing or proposed roadbed or other facility. The maximum pull back (reamer) shall not be greater than two (2) inches greater than the pipe outside diameter to be installed. A minimum of thirty (30) inches of cover is required for all water service lines under roads. Required push/pull pits or shafts shall be excavated and maintained to a minimum dimension. The excavation shall be adequately barricaded, sheeted, braced, and dewatered as required, in accordance with applicable sections of these specifications.

3.17. BACKFILL

3.17.1. Excavated materials that are deemed unsuitable by the City Utility Inspector, shall not be used for backfilling purposes. The Contractor shall procure additional material, as necessary, with no additional cost to the City.

3.17.2. The material used for backfill shall be fine, loose earth, free from clods, stones, refuse and organic material; subject to the approval of the City Utility Inspector.

3.17.3. Backfilling: After pipe and conduit have been inspected and approved, backfill the trenches, carefully depositing the fill and compacting to the center line of the pipeline on both sides. Place the remainder of the backfill in maximum one-foot layers and compact in conformance to AWWA C600, Section 3.5. After backfilling, dress trenches to conform to adjacent contours. If trenches are improperly filled or if settlement occurs, they shall be refilled and re-dressed. All valves, fittings and restrained joints shall be left uncovered for inspection and acceptance by the City Utility Inspector. The Inspector has the authority to require excavation of any appurtenances for verification of construction techniques.

3.18. COMPACATION REQUIREMENTS: Place backfill in equal layers, compatible with equipment used, and compact each layer in accordance with Table 2 below and ASSHTO T-180.

| TABLE 2 |
|------------------|------------------|
| LOCATION OF BACKFILL | PERCENT OF MAXIMUM DENSITY AT OPTIMUM MOISTURE |
| Under paved areas: | |
| upper 12 inches   | 100              |
| below 12 inches   | 98               |
| Outside paved surface | 95              |

3.19. PIPE AND FITTINGS – MARKING: All main pipes, including fittings, shall be color-coded or marked using the predominant color of the respective utility to differentiate drinking water from reclaimed or sewer. Underground plastic pipe shall be solid-wall pipe, shall have a co-extruded external skin, or shall be black pipe with stripes incorporated into, or applied to, the pipe wall. Pipe striped during manufacturing of the pipe shall have continuous stripes that run parallel to the axis of the pipe, that are located at no greater than 90-degree intervals around the pipe, and that will remain intact during and after installation of the pipe. Potable pipe is to be blue, raw water is
to be white (stripes to be olive/light green with stenciled “RAW WATER MAIN”), wastewater pipe is to be green and reclaim is to be pantone purple.

3.20. PIPE AND FITTINGS – RESTRAINT: Provide mechanical restraint fittings at each valve, fire hydrant connection, and on pipe joints as required (see City standard detail, “Typical Mechanical Thrust Restraint WRE-#951243” in Appendix B). See Appendix A for the approved product list for acceptable materials.

3.21. DUCTILE IRON PIPE AND FITTINGS

3.21.1. PIPE: All sizes of pipe shall be a laying length of 18'-0” to 20'-0”. Ductile iron (DI) pipe shall conform to the latest revision of ANSI/AWWA C150/A21.50. When the installation of a main will cross storm drains, open ditches, or other pipelines, or in abnormal laying conditions, an increased pressure class of pipe may be required by the City on a case-by-case basis. Mains in an easement paralleling a common residential property line between two or more lots shall be constructed of D.I. pipe. Jack and bore carrier pipe shall be D.I. pipe. Polyethylene encasement (thickness: eight (8) mils; color: black or blue for potable, green for wastewater, pantone for reclaim.) conforming to the latest revision of AWWA/ANSI C105/ A21.5, shall be required.

3.21.2. FITTINGS: Cast iron fittings are not acceptable. Ductile iron fittings and special castings shall conform to the type of pipe for minimum working pressure of 150 psi. Fittings shall conform to ANSI Standard A-21.10 (AWWA C111). Short body pattern shall normally be installed unless otherwise approved by COT. Nuts and bolts shall be high tensile strength stainless steel for flanged fittings and COR-TEN® on mechanical joints with each type marked as such on the nuts and bolts.

3.21.3. LININGS AND COATINGS: All ductile iron pipe and fittings shall be thin cement lined. The lining shall comply with ANSI/AWWA C104/A21.4, latest revision. The exterior of all buried pipe shall have a standard asphaltic coating as provided by the manufacturer.

3.21.4. GASKETS: Lubricants which support microbiological growth shall not be used. EPDM rubber shall be used for gasket material.

3.21.5. Flanged joints shall conform to ANSI A21.15 (AWWA C115) ANSI B16.1, faced, and drilled 125 pounds. Nuts and bolts shall be made of high tensile strength Type 316 stainless steel having a minimum yield strength of 45,000 psi, and shall contain sufficient chromium to resist corrosion, oxidation and rust. U.S. manufacturers only unless otherwise specified. Threads shall be in accordance with ANSI B1.1, Unified Inch Screw Threads, and with B1.2, Screw Threads, Gauges and Gauging, conforming to the course thread series (UNC) Unified Coarse, with threads Class 2A external and Class 2B internal. Bolts 3/4” and smaller shall be furnished with heavy hex heads conforming to ANSI B18.2.1. Bolts larger than 3/4” may have either standard or heavy hex heads conforming to ANSI B18.2.1. Tee head or hex head shall be made of high tensile strength Type 316 stainless steel having a minimum yield strength of 45,000 psi and comply with the dimensions outlined in ANSI/AWWA C111/A.21.11.
3.21.6. **Sleeve type couplings**: Provide couplings where needed to make piping connections. Provide full-length mechanical joint ductile iron solid sleeve with 12” minimum length.

3.22. **POLYVINYL CHLORIDE (PVC) PIPE**

3.22.1. **Four (4) inch through twelve (12) inch PVC pipe** shall conform to the requirements found in AWWA Standard C900 (PVC Pressure Pipe), and fourteen (14) inch through forty-eight (48) inch PVC pipe shall conform to the requirements found in AWWA Standard C905. The pipe shall be Class 150 (DR 18), and shall bear the seal of a testing agency verifying the suitability of the pipe material for service. The pipe shall have the following markings: Manufacturer's name or trademark and production code or manufacturing date (day, month, and year); DR 18; Class 150; C900 or C905, as applicable; ASTM D-1784; NSF-PW for potable and raw water. NSF-DWV for wastewater and NSF-RW for reclaimed water.

3.22.2. All PVC pipe and fittings used in the sanitary sewer system shall meet extra strength requirements conforming to the latest ASTM D3034 standard, maximum SDR 35, for six inch (6") through fifteen inch (15") PVC and ASTM F679 standard, minimum PS 46 for eighteen inch (18") through forty eight inch (48") PVC. The uniform minimum pipe stiffness at five percent (5%) deflection shall be 46 psi. Pipe and fittings shall be marked in accordance with ASTM D3034 and ASTM F679, as applicable. The bell shall consist of an integral wall section with solid cross-section rubber ring factory assembled, which securely locks in place to prevent displacement and meets the requirements of the latest revision of ASTM D3212. Joints shall be factory tested in accordance with ASTM D3212 and all physical and chemical requirements of pipe and fittings are to pass all tests at 73 degrees (F).

3.22.3. All PVC pipe, fittings and adapters shall bear the seal of NSF International Standard No. 14 certification.

3.22.4. Bell and spigot PVC pipe shall have rubber ring gaskets, which conform to manufacturer's standard dimensions and tolerances, which meet the requirements of AWWA Specifications. Integral wall bell must meet the ASTM D-2122 (C900) requirement.

3.22.5. Solvent cement jointing of PVC pipe is not permitted on City owned main.

3.22.6. All PVC mains shall have a suitable conductive location wire. The wire shall be 14-gauge single-conductor copper with the respective insulation color. Only blue (potable), olive/light green (raw water), green (wastewater), and pantone (reclaim water) are acceptable. The wire shall be continuous between fittings. Where other lines or service lines join the main, the wire shall be secured to each line with a wire nut, taped, and sealed against moisture. All fire hydrants shall have the wire wrapped around the barrel section to grade level and connected to the wire on the main. All valves shall have a minimum of four (4) feet of wire into each valve box, connected to the main wire. See reference detail WRE-#090416 in Appendix B.
3.23. HIGH DENSITY POLYETHYLENE (HDPE) PIPE

3.23.1. Four (4) inch through sixty (60) inch diameter HDPE pipe shall conform to the requirements found in AWWA Standard C906; utilizing ductile iron pipe sizes (DIPS). The pipe shall be Pressure Class 160 at a minimum, and shall bear the seal of a testing agency verifying the suitability of the pipe material. The pipe shall have the following markings: Nominal size and diameter base (DIPS); Dimension Ratio (such as DR 11); manufacturer's name or trademark and production code or manufacturing date (day, month, and year); standard material code designation (such as PE 3408); Pressure Class; AWWA C906; NSF-PW for potable and raw water. NSF-DFW for wastewater and NSF-RW for reclaimed water.

3.23.2. All HDPE pipe, fittings and adapters shall bear the seal of NSF International Standard No. 14 certification.

3.23.3. All HDPE mains shall have two (2) separate strands of a suitable conductive location wire installed with the main. The wire shall be 10-gauge stranded copper with the respective insulation color. Potable water is blue, sewer is green and reclaim water is pantone purple.

3.23.4. Butt fusion shall be used for pipe joints using HDPE. For joints between HDPE and PVC pipe, a fused MJ adaptor shall be used.

3.24. GATE VALVES

3.24.1. All valves will meet or exceed all requirements of AWWA C509 Standards, latest revision. All valves shall be resilient wedge gate valves. All valves shall be equipped with a non-rising stem. All iron body parts will be full wall ductile iron conforming to the requirements of ASTM A395 or ASTM A536 and contain no more than 0.08 percent phosphorus and valves will be cast with a flat bottom design to allow them to stand upright during installation or storage. Outer valve body will have raised lettering cast in, providing manufacturer's name, valve size, year of manufacture, pressure rating, location of casting, and each part is to be clearly marked with either "D.I." or "ductile iron". All valves will be electro-statically fusion-bonded; epoxy coated, minimum either (8) mil thickness inside and out, conforming to ANSI/AWWA C550-01 Standards or latest revision. Resilient wedge to be ductile iron fully encapsulated with EPDM elastomer, including guide path, and will be US Food and Drug Administration approved for potable water and have an EPDM visible marking. All valves will have 250-psig working pressure and a 500-psi static test pressure. Valve stem material will be Grade 18-8 stainless steel, Type 304, ANSI 420/ASTM A276 with no measurable level of lead content. Valves will have two upper o-ring seals on the stem above the thrust collar and at least one o-ring seal below the collar so designed to allow for replacement of the upper o-rings with the valve under full operating pressure. Valves will have thrust washers located above and below the thrust collar to insure a smooth frictionless operation. All valves are to be opened Left (counter-clockwise). All valves will have a 2" Ductile Iron wrench nut with the direction of valve operation clearly visible when looking down on the nut. Hold down nut or bolt will be Type 316 stainless steel. All exterior bonnet and thrust collar bolting, whether recessed or exposed, is to be Type 316 Stainless Steel and marked by
type. The waterway seat area will be smooth without ridges or cavities and valves will have full size bore throughout the flow-way. All valves will be hydrostatically pressure tested prior to shipment in compliance with AWWA C509 Standards, and will be covered by the manufacturer’s Ten Year Limited Warranty from date of purchase by the end user. Joint connections as specified will conform to ANSI/AWWA Standards as follows:

3.24.1.1. Flanged outlets will conform to dimensions and drillings of ANSI B16.1 Class 125 or ANSI/AWWA C110/A21.10 and will not be considered equal to Tapping Outlets.

3.24.1.2. Mechanical Joint outlets shall conform to ANSI/AWWA C111/A21.11

3.24.1.3. Tapping Valves shall have an alignment boss on the flanged outlet with a mechanical joint outlet conforming to ANSI B16.1, Class 125 and ANSI/AWWA C111/A21.11. (Flanged outlets are not an acceptable substitute for tapping purposes.)

3.24.1.4. Threaded outlets will be NPT threads conforming to ANSI B1.20.1.

3.24.2. Provide stem extensions on all valves where the top of the operator nut is located greater than thirty-six (36) inches below the top of the valve box and shall be bolted onto valve nut.

3.24.3. All valves installed in the distribution system and main extensions shall be protected by an adjustable 5-1/4” cast iron valve box similar, or equal, to Industry Standard #461-S or 562-S. Covers will be marked and painted appropriately. The box must be full length with bell end over operating nut. Cut pipe sections will not be allowed as valve box extensions.

3.24.4. Future access line valves, located at a temporary dead end, shall conform to the City of Titusville standard blow-off detail WRE-#060104.

3.24.5. VALVE LOCATION MARKING: Curbs shall be etched with the letter “V”, three (3) inches in height, with the point of the “V” facing the valve, to designate location.

3.25. TAPPING

3.25.1. Tapping PVC Pipe: Only shell cutters will be used to tap PVC pipe. The removal of the tapping coupon is required. No other tapping methods will be accepted.

3.25.2. The tapping saddle and corporation stop must be installed by the Contractor and inspected by the City Utility Inspector, prior to making the tap.

3.26. TAPPING SLEEVES

3.26.1. These specifications are according to application, size and engineering requirements.

3.26.2. Acceptable tapping sleeves shall be all stainless steel Type 304/ Grade 18-8 for sleeve, body (shell), branch, bolts and nuts. All fitting parts are heli-arc welded.
Full 360 pipe coverage gasket sealing. Flange is to be recessed per MSS SP-60. Notification to the City Utility Inspector, is required before installation for material inspection. After application of the tapping sleeve and valve, pressure test verification is required prior to drilling. Saddles will be tested at 150 PSI for 15 minutes with no allowable leakage witnessed by the Inspector. See Appendix A for approved vendor list for acceptable materials.

3.27. TAPPING VALVES

3.27.1. Tapping valves shall be field disinfected as required in Section 5.18 for potable water. In addition, tapping valves are tested at 150 PSI for 15 minutes with no allowable leakage witnessed by the Inspector.

3.27.2. Tapping valves shall be resilient seated, non-rising stem, open left, two (2) inch square operating nut, for vertical mounting in approximately level setting on buried water lines. The valves shall conform to AWWA Standard C500 or C509, latest edition. All resilient seat tapping valves shall be full port size waterway.

3.27.3. The valve inlet shall be flange Class 125, with ring guide as per MSS SP-60. Outlet shall be mechanical joint as per AWWA C110.

3.27.4. Proper trench support of the tap valve is required during the drilling operation.

3.28. FINAL ACCEPTANCE BY THE CITY

3.28.1. Final acceptance of the water distribution, reclaimed distribution, force main distribution, sanitary gravity systems, lift station and pervious concrete systems will be made only after:

3.28.1.1. All tests have been completed, passed, and approved by the City Utility Inspector,

3.28.1.2. A final walk-through has been completed and the improvements are found to be in accordance with the applicable regulations of the City, the Florida Department of Environmental Protection, Florida Department of Transportation, Brevard County and the standards contained herein.

3.28.2. The City is furnished with all of the following applicable items:

3.28.2.1. Three (3) certified paper copies of as-built drawings by a Florida Registered Surveyor or Engineer, with elevations based on the NAVD 1988, and an electronic copy in AutoCAD format, in state plane coordinates, in accordance with the “City of Titusville Minimum Requirements for As-Built Drawings” checklist.

3.28.2.2. Executed Easement(s).

3.28.2.3. Executed Right-of-Way Deed.

3.28.2.4. Certification of Substantial Completion noting any deviations from the Engineer of Record.
3.28.2.5. A maintenance bond, based on 10% of the construction cost. It shall be the responsibility of the Developer/Contractor to rectify any and all deficiencies which occur within two (2) years after the date of acceptance by the City of Titusville.

3.28.2.6. Warranty Deed for City owned lift stations.

3.28.2.7. Private Lift Station agreement for all privately owned lift stations.

3.28.2.8. Pretreatment Agreement for all grease traps and oil/water separators.

3.28.2.9. Pervious Concrete Agreement for all pervious concrete systems.

3.28.2.10. A Bill of Sale transferring ownership of the city utilities to the City of Titusville.
4.0 RAW WATER SPECIFIC PLAN PREPARATION, DESIGN AND CONSTRUCTION STANDARDS

4.1. RIGHTS-OF-WAY: Raw water mains shall maintain a consistent alignment with respect to the centerline of the road. In residential developments, mains should be installed as illustrated on the City’s “Utility Placement Within a 50’ Public Road Right-of-Way” detail WRE-#060945. Exceptions will be made on a case-by-case basis. In all cases, mains shall be installed along one side of the road, with crossings kept to a minimum.

4.2. DESIGN CALCULATIONS: The Project Engineer shall submit signed, sealed and dated design calculations with the plans for all water transmission projects. Calculations shall show that the water mains will have sufficient hydraulic capacity to transport flows while meeting the requirements of Section 4.4. Minor head losses through flow meters, backflow devices, fittings, valves, etc shall also be included in the calculations.

4.3. PRESSURE: All raw water mains shall be designed in accordance with Section 4.2 above. The design pressure within the system should be verified with the Water Resources Department (WRD) prior to beginning any calculations.

4.4. DESIGN FRICTION LOSS: Friction losses through mains shall be based on the Hazen and Williams formula. In the use of the Hazen and Williams formula, the value for “C” shall be 120 for ductile iron pipe and 130 for PVC and HDPE pipe. “C” values greater than 130 shall not be allowed.

4.5. RAW WATER: All pipe and fittings for raw water distribution shall be ductile iron or polyvinyl chloride (PVC) pipe. Refer to Sections 3.21 and 3.22. High Density Polyethylene (HDPE) pipe can be used for directional boring purposes only. Refer to Section 3.23.

4.6. DISINFECTION- BACTERIOLOGICAL TESTING:

4.6.1. All raw water pipe, fittings, and valves shall be thoroughly disinfected prior to being placed in service. Disinfection shall follow the applicable procedure established as set forth in AWWA C651, latest revision. Samples shall be collected by a representative of an approved State Certified Testing Laboratory, with the City Utility Inspector, present, from fittings provided by the Contractor for that purpose.

4.6.2. Flows for chlorination purposes are to be controlled from the downstream or blow-off end of the water line. The location of sampling points shall comply with the conditions of the Florida Department of Environmental Protection (FDEP) permit. The sample points must have a stainless steel or brass, non-threaded, smooth-nosed, downward spouted hose bib mounted on a rigid stand pipe at least three feet above the finished grade. Warning tags will be attached to each sample point by the City.
4.6.3. The chlorine residual is to remain in all lines for a minimum period of 24 hours. After notification from the City Utility Inspector, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows a free chlorine residual not in excess of that normally carried in the system.

4.6.4. After flushing, water samples collected on two successive days from the treated piping system, as directed by the City Utility Inspector, shall show acceptable bacteriological results. All bacteriological testing shall be performed by a State Certified Laboratory contracted by the Contractor. Proper chain of custody procedures must be followed and samples shall only be collected by state certified laboratory personnel. Any samples collected by the Contractor will not be accepted.

4.6.5. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure and bacteriological testing shall be repeated by the Contractor until satisfactory results are obtained.

4.6.6. Copies of all testing results and all related correspondence from the FDEP shall be submitted to the City of Titusville.

4.7. TAPPING

4.7.1. Testing service saddle placement for sampling purposes on raw water main shall be at least 45 degrees off vertical and not to exceed horizontal positioning.

4.7.2. Corporation stops shall be CC thread to CTS. Corporation stops will be used only for one (1) inch taps. See Appendix A for approved vendor list for acceptable materials.

4.8. TAPPING SLEEVES

4.8.1. Tapping sleeves and valves will be field tested at 150 PSI for 15 minutes with no allowable leakage as witnessed by the Inspector. Field disinfection procedures shall be utilized for the installation of tapping sleeves and tapping valves to the existing raw water mains. The tap sleeve and valve shall be disinfected immediately prior to the installation of the appliances to the raw water main. The application of a concentrated solution of hypochlorite (minimum, 1% available chlorine) shall be applied to the inside of the sleeve and valve. Methods of application of disinfection solution shall be by swabbing or by pressure spraying.

4.9. A temporary jumper connection, with an approved, tested and certified backflow preventer assembly, is required at all connections between existing active water mains and proposed new water main improvements. Certification is required on site even if previously certified by the manufacturer. In addition, any relocation or disassembly of the temporary jumper connection will require recertification. All filling of new mains of any size from existing active water mains shall be completed through the jumper connection. All flushing of new mains less than ten (10) inches in diameter shall be completed through the jumper connection. If greater than 10 inches in diameter, a main valve may be used. The jumper connection shall be maintained until after filling, flushing, testing and disinfection of the new main has been successfully
completed and clearance for use from the Florida Department of Environmental Protection (FDEP) has been received. The jumper connection shall also be used to maintain a minimum pressure of 20 psi in new mains at all times after disinfection and until the FDEP clearance letter is received.
5.0 POTABLE WATER SPECIFIC PLAN PREPARATION, DESIGN AND CONSTRUCTION STANDARDS

5.1. The configuration and location of any proposed/extended water main and service line shall be at the sole discretion of the COT to maximize supply/service pressure, minimize maintenance, and ensure water quality. Water service connection points shall be located on water mains providing best water quality.

5.2. The City of Titusville shall own and maintain all portions of the water system up to the water meter. See City detail in Appendix D.

5.3. The water distribution system and/or water main extensions shall be designed and constructed in accordance with the fire protection requirements as approved by the Fire Department.

5.4. RIGHTS-OF-WAY: Water mains shall maintain a consistent alignment with respect to the centerline of the road. In residential developments, mains should be installed as illustrated on the City’s “Utility Placement Within a 50' Public Road Right-of-Way” detail WRE-#060945. Exceptions will be made on a case-by-case basis. In all cases, mains shall be installed along one side of the road, with crossings kept to a minimum.

5.5. The minimum water line easement width shall be twenty (20) feet. Additional easement widths shall be provided at the discretion of the City based on the depth of the pipe.

5.6. SIZING WATER SERVICE LINES, METERS, AND BACKFLOW PREVENTERS: Sizing of water service lines and meters shall be per American Water Works Association “Manual of Water Supply Practices, Sizing Water Service Lines and Meters, AWWA M22”, latest edition. In accordance with Table 3 shown below, the sizing of water service lines, meters and backflow preventers shall be:

<table>
<thead>
<tr>
<th>SERVICE LINE SIZE</th>
<th>METER SIZE</th>
<th>BACKFLOW PREVENTER SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>5/8&quot; x 3/4&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Larger than 4&quot;</td>
<td>Larger than 4&quot;</td>
<td>As approved by the COT</td>
</tr>
</tbody>
</table>

5.7. AVERAGE DAILY FLOW: Average daily water flow shall be calculated by referencing the equivalent residential connection (ERC) flow rates as outlined in “Code of Ordinances City of Titusville, Florida, Land Development Regulations Section 63-133”. Maximum daily water flow shall be calculated as two (2) times the average daily water flow, and the peak hourly flow shall be calculated as four (4) times the average daily water flow.
5.8. FIRE FLOW REQUIREMENTS: All fire hydrants are to be designed to operate at a minimum of 1,000 gpm at 20 psi at the farthest fire hydrant from the initial point of connection to the residential development. Commercial and Industrial fire flow requirements shall be determined in accordance with the Florida Fire Prevention Code which includes NFPA 1 and NFPA Life Safety Code 101. Where fire flow requirements exceed the anticipated available fire flow from the central water system, an on-site fire protection system, or other Fire Department approved mitigation, shall be utilized.

5.9. DESIGN CALCULATIONS: The Project Engineer shall submit signed, sealed and dated design calculations with the plans for all water distribution projects. Calculations shall show that the water mains will have sufficient hydraulic capacity to transport peak hourly flows and the combination of maximum daily flows and fire flows while meeting the requirements of Section 5.11. Minor head losses through meters, backflow devices, fittings, valves, etc shall also be included in the calculations.

5.10. PRESSURE: All water mains shall be designed in accordance with Section 5.9 above. The system shall be designed to maintain a minimum pressure of 20 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high-density residential areas. The design pressure within the system should be verified with the COT prior to beginning any calculations. For excessive pressures, pressure reducing provisions may be required.

5.11. DESIGN FRICTION LOSS: Friction losses through mains shall be based on the Hazen and Williams formula. In the use of the Hazen and Williams formula, the value for “C” shall be 120 for ductile iron pipe and 130 for PVC and HDPE pipe. “C” values greater than 130 shall not be allowed.

5.12. POTABLE WATER: All pipe and fittings for potable water distribution shall be ductile iron or polyvinyl chloride (PVC) pipe. Refer to Sections 3.21 and 3.22. High Density Polyethylene (HDPE) pipe can be used for directional boring purposes only. Refer to Section 3.23.

5.13. TEST AND INSPECTION:

5.14. DISINFECTION- BACTERLOGICAL TESTING:

5.14.1. All potable water pipe, fittings, valves and service lines shall be thoroughly disinfected prior to being placed in service. Disinfection shall follow the applicable procedure established as set forth in AWWA C651, latest revision. Samples shall be collected by a representative of an approved State Certified Testing Laboratory, with the City Utility Inspector, present from fittings provided by the Contractor for that purpose.

5.14.2. Flows for chlorination purposes are to be controlled from the downstream or blow-off end of the water line. The location of sampling points shall comply with the conditions of the Florida Department of Environmental Protection (FDEP) permit. The sample points must have a stainless steel or brass, non-threaded, smooth-nosed, downward spouted hose bib mounted on a rigid stand pipe at
least three feet above the finished grade. Warning tags will be attached to each sample point by the City.

5.14.3. The chlorine residual is to remain in all lines for a minimum period of 24 hours. After notification from the City Utility Inspector, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows a free chlorine residual not in excess of that normally carried in the system.

5.14.4. After flushing, water samples collected on two successive days from the treated piping system, as directed by the City Utility Inspector, shall show acceptable bacteriological results. All bacteriological testing shall be performed by a State Certified Laboratory contracted by the Contractor. Proper chain of custody procedures must be followed and samples shall only be collected by state certified laboratory personnel. Any samples collected by the Contractor will not be accepted.

5.14.5. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure and bacteriological testing shall be repeated by the Contractor until satisfactory results are obtained.

5.14.6. Copies of all testing results and all related correspondence from the FDEP shall be submitted to the City of Titusville.

5.15. FIRE HYDRANTS

5.15.1. FIRE HYDRANT SPACING AND LOCATION: Fire hydrants in single-family residential areas shall be located so that they are not over 500 feet apart (as measured along a street) and shall be connected to water mains no less than six (6) inches in diameter and to looped water mains whenever possible. Dead end streets or cul-de-sacs shall not have a length greater than 200 feet from the nearest fire hydrant. Fire hydrants in commercial (business, industrial, institutional, and apartment) districts shall be located so that they are not over 250 feet part (as measured along a street) and shall be connected to water mains no less than eight (8) inches in diameter and to looped water mains whenever possible. Hydrant valves shall be located at a distance not greater than 5 feet from the hydrant, unless otherwise approved by the City. All fire hydrant locations and fire line requirements shall be reviewed and approved by the Fire Department.

5.15.2. All hydrants shall meet or exceed ANSI/AWWA C502’s latest edition for dry-barrel fire hydrants and shall, in addition, meet the specific requirements and exceptions which follow. Hydrants shall be assembled and tested in a certified manufacturing facility within the United States, unless otherwise stated. Hydrants shall be listed by Underwriters Laboratory and approved by Factory Mutual for fire line service. UL and FM trademarks shall be cast on the hydrant nozzle section.

5.15.3. Hydrant valve opening shall have an area equal to the area of a 5 1/4-inch minimum diameter circle and be obstructed only by the valve rod. Hydrant main
valve closure shall be of the compression type opening against pressure and closing with pressure. Main valve shall be EPDM rubber.

5.15.4. All internal operating parts shall be removable without requiring excavation. Hydrants shall be hydrostatically tested as specified in AWWA C502 and shall be rated at 250 psi minimum working pressure. Hydrant bonnets, weather cover, nozzle section, caps and shoe shall be cast or ductile iron. Hydrants shall consist of one (1) 4.5” NST pumper nozzle and two (2) 2.5” NST hose nozzles. Nozzles threaded into the nozzle section shall have Never-Seez® White Food Grade, or COT approved equal, applied at the factory while being assembled. Cap threads shall be lubricated with Never-Seez® White Food Grade, or COT approved equal, before delivery.

5.15.5. Hydrant shoe shall have an electrostatic applied, fusion bonded, epoxy coating internally and externally. The coating shall meet or exceed the requirements of AWWA C550. Coating to be applied only at the manufacturer’s facility. The standpipe shall be Bitumen coated or fusion bonded epoxy coated internally and externally with a bury line present below the break flange to indicate proper installation depth. Bury depth shall be clearly marked on standpipe. All hydrants shall be clearly stenciled “Titusville” on the standpipe.

5.15.6. The hydrant’s upper and lower stem, as well as its break coupling and internal pins and clips shall be manufactured of stainless steel, Type 304 or 316 with no measurable level of lead content. Breakaway coupling may be fusion bonded epoxy coated cast/ductile iron with stainless steel pins. All external bolting shall be manufactured of stainless steel, Type 304 or 316.

5.15.7. All hydrants shall be of the traffic breakaway type and allow 360-degree rotation to position the pumper nozzle in the desired direction after installation. A lubrication port shall be provided for the installation of lubrication without disassembly of the bonnet section. The reservoir shall be filled with NSF/FDA approved food grade grease at the manufacturer’s facility.

5.15.8. The main valve shall not bottom out onto the shoe section. Travel stop nuts may be used in bonnet section to prevent this. Operating nut shall be a 1-1/2” pentagon bronze nut and shall open counter clockwise and have a protective weather cover. Drain holes will not be permitted. If hydrant is manufactured with drain holes, then drain holes shall be plugged with brass plugs.

5.15.9. All hydrants shall be covered by a Manufacturer’s Ten (10) Year Limited Warranty from the date of purchase by the end user and delivered within thirty (30) days from receipt of purchase order.

5.15.10. All hydrants will have an external sprayed on epoxy coating applied at the factory. Epoxy coating shall be Sherman-Williams Acrolon 218 HS, an Aliphatic Acrylic Polyurethane, or COT approved equal. The color for all City owned and maintained hydrants shall be #95-8002 Safety Yellow (Color #330). The color for all privately owned and maintained hydrants shall be painted with Sherman-Williams Acrolon 218 HS, an Aliphatic Acrylic Polyurethane, or COT approved equal in Red. All hydrants are to receive an additional field coating prior to final
acceptance by COT. All chains on hydrants are to be removed prior to acceptance by COT.

5.15.11. Non-operational hydrants shall be clearly identified by the Contractor as being out of service. The non-operational hydrant will have an out of service tag on the hydrant provided by the Contractor. The out of service tag shall be placed on the 4.5 inch pumper nozzle upon installation.

5.15.12. All hydrants shall stand plumb with the pumper nozzle facing the street curb and the bury line of the hydrant at the finished grade. The break-away flange and bolts must not be in contact with the ground or the concrete hydrant protection pad. A 24” x 24” x 6” pad must be poured around the barrel bury line or no deeper than 12” below grade. Proper soil compaction shall be done before pouring pad. In unstable soil as determined by the City Utility Inspector, the hydrant shoe shall be placed directly on a concrete pad, 18” x 18” x 4”, prior to mechanical restraining. Various means of mechanical blocking are acceptable, re: hydrant tees, M.J. anchor couplings, retainer glands and threaded tie-rods (see City standard detail).

5.15.13. All hydrants shall be a minimum of six (6) inches inside diameter and be provided with a six (6) inch valve between the hydrant and the main. The hydrant valve shall be installed within five (5) feet of the hydrant. Fire hydrants shall be located as shown on the approved plans in a completely accessible location, maintaining a minimum of three (3) feet and a maximum of eight (8) feet from the back of curb to the centerline of the hydrant. In residential locations, hydrants are usually to be located at intersections or property corners. Hydrant locations on or near state highways shall be in accordance with Department of Transportation requirements. City of Titusville personnel, Brevard County Fire Department, and Department of Transportation have the final authority to mandate fire hydrant placements and/or relocations. The centerline pumper nozzle must be a minimum of 18 inches or a maximum of 24 inches above finished grade.

5.16. WATER SERVICES

5.16.1. All installations shall be in accordance with City of Titusville Specification details for single and double service lines. All water service lines one (1) inch in diameter shall be constructed of Type “K” soft copper, which shall conform to the requirements of AWWA Standard C800. Two (2) inch diameter service lines shall be constructed of Type “K” copper tubing or SDR 9 EndoTrace blue polyethylene with tracer wire as manufactured by Endot Industries, Inc., Rockaway, NJ, utilizing copper tube sizes (CTS) and compression adapters.

5.16.2. Location: All service lines will be located in the right-of-way. Service lines shall not be terminated in the sidewalk or within two (2) feet adjacent to driveways. Location of service lines in single family and townhouse developments shall be at alternating lot lines. Multiple service line installations shall be located in common areas, and curb stops spaced no more than 18-20 inches apart in single file. Curb stops shall be mounted in a horizontal position at a depth of no greater than ten (10) inches from finished grade.
5.16.3. Meter boxes must be installed at the time of service line installation, prior to final inspection.

5.16.4. Service saddles: Service saddles shall be used for all connections to PVC pipe. Saddle body for C900 pipe shall be nylon/epoxy coated ductile iron and tapped for AWWA/CC threads. Body and bands must be factory pre-sized for C900 pipe diameter. Bands shall be stainless steel. Brass saddles are also acceptable. See Appendix A for approved vendor list for acceptable materials.

5.16.5. Curbs shall be etched with the letter “W”, three (3) inches in height, to designate the location of the water service.

5.16.6. Water service lines crossing paved roadways shall be installed by horizontal directional drilling method. The Contractor shall furnish all material, equipment, transportation, tools and labor, and shall comply with all regulations of the governing authority to install the service lines.

5.17. TAPPING:

5.17.1. Service saddle placement on main shall be at least 45 degrees off vertical and not to exceed horizontal positioning. No vertical tapping will be allowed except at temporary jumper connections.

5.17.2. Corporation stops shall be CC thread to CTS. Corporation stops will be used only for one (1) inch taps. See Appendix A for approved vendor list for acceptable materials.

5.17.3. Curb stops shall be CTS to meter swivel nut. No H pattern or roundway type will be permitted. Curb stops will be used only for one (1) inch service lines. See Appendix A for approved vendor list for acceptable materials.

5.17.4. Meter protection boxes shall be according to size of service line. Meter boxes are to be injection molded of structural foam recycled polyolefin material with cast iron reader cover. When new service lines are installed, meter boxes shall be placed over curb stops with sufficient space for the installation of the water meter by the City. The top of the meter box shall be adjusted to grade and shall be in undamaged condition. Water meters will not be installed by the City unless all requirements of service line and meter box installations are acceptable. If it is necessary to locate meter boxes near concrete or paved areas, steel meter box covers with reader lids shall be required. See Appendix A for approved vendor list for acceptable materials.

5.17.5. Large meter installations: All meters three (3) inches and larger shall be constructed with Class 125 flange fittings and shall be installed above ground. All flange fittings and valves will be restrained and tested prior to the large meter installation. The meter will be supplied by the City and may be installed by the licensed plumber or utility contractor. All meter valves are to be non-rising stem, hand wheel operation. Meters up to four (4) inches are to have a two (2) inch bypass line; meters six (6) inches and larger are to have a three (3) inch bypass line.
5.18. TAPPING SLEEVES: Tapping sleeves and valves will be field tested at 150 PSI for 15 minutes with no allowable leakage as witnessed by the Inspector. Field disinfection procedures shall be utilized for the installation of tapping sleeves and tapping valves to the existing water mains. The tap sleeve and valve shall be disinfected immediately prior to the installation of the appliances to the potable water main. The application of a concentrated solution of hypochlorite (minimum, 1% available chlorine) shall be applied to the inside of the sleeve and valve. Methods of application of disinfection solution shall be by swabbing or by pressure spraying.

5.19. FIRE LINES: Fire lines for commercial, industrial, residential or other buildings may be required by the City of Titusville Fire Department. All new fire line systems connected to the City of Titusville water distribution system shall have an approved backflow prevention device installed at the water source. This device shall be a Double Detector Check Valve Assembly with OSY resilient gate valves with a bypass monitor meter. As per Fire Department requirements, the device shall be installed above ground. Location of the device inside structures shall be reviewed for acceptance by the COT (see City standard detail). The installation of the DDCVA device will be inspected by the City Utility Inspector, and test results shall be submitted to the COT. All device locations shall be reviewed for approval by the COT. Inspection and testing of the fire line by the Fire Inspector shall begin at the outlet valve connection.

5.20. BACKFLOW PREVENTERS: The City of Titusville has the primary responsibility of protecting the potable water distribution system against possible contamination or pollution resulting from a source of cross connection or backflow conditions. In consonance with the above, the City shall require backflow preventers as needed.

5.20.1. All construction and all major modification will be reviewed for the requirement of a backflow preventer. The determination of the type of backflow preventer required will be based upon the “degree of hazard” of on-site facilities or equipment. When a required backflow preventer device is not installed, or is removed or by-passed, non-compliance with these requirements by law may result in the termination of water services to the premises. Two main types of backflow preventers are acceptable:

5.20.1.1. the Double Dector Check Assembly, and

5.20.1.2. the Reduced-Pressure Zone Backflow Preventer.

5.20.2. These devices shall meet the requirements of AWWA Standard C510, “Double Check Valve Backflow Prevention Assembly”, or AWWA Standard C511, “Reduced-Pressure Zone Backflow Prevention Assembly”, as applicable, and be approved by the Foundation for Cross Connection Control and Hydraulic Research.

5.20.3. Following is a partial list of facilities requiring backflow preventer installation at the water meter: manufacturing, processing, and fabricating plants; supermarkets and food processing businesses (restaurants); schools, laundries, piers, medical, health or beauty businesses; booster pump and other pressure systems (water and sewer); boilers, water-cooled A/C systems, irrigation systems, multi-story
buildings over two stories, etc. Contact the City’s Field Operations Division with questions.

5.20.4. These requirements are in compliance with laws and regulations of the E.P.A. Safe Drinking Water Act of 1974; the Florida Statutes, Rules of the Department of Environmental Protection (DEP) Section 62-555-360; Florida Building Code; and the "City of Titusville Water Resources Department Cross-Connection Control Program Manual". All devices 3/4” through 1-1/2” shall have threaded ends. All BFP devices are to have ball valve or resilient seated inlet and outlet valves. All devices must be testable in-line. Two (2) backflow prevention assemblies in a parallel mounting system may be installed for facilities that require full-time, uninterrupted water service during device testing or maintenance. It is the City's responsibility to install (or have installed), operate and maintain the approved backflow prevention device, as directed by the COT. The devices shall be installed only by a licensed Underground Utility Contractor, Master Plumber, Certified Backflow Prevention Device Technician, or the City's Field Operations Division in the case of retro-fitting existing customers only. Refer to City standard details.

5.21. A temporary jumper connection, with an approved, tested and certified backflow preventer assembly, is required at all connections between existing active water mains and proposed new water main improvements. Certification is required on site even if certified by the manufacturer. In addition, any relocation or disassembly of the temporary jumper connection will require recertification. All filling of new mains of any size from existing active water mains shall be completed through the jumper connection. All flushing of new mains less than ten (10) inches in diameter shall be completed through the jumper connection. If greater than 10 inches in diameter, a main valve may be used but may only be operated by a City Employee. The jumper connection shall be maintained until after filling, flushing, testing and disinfection of the new main has been successfully completed and clearance for use from the Florida Department of Environmental Protection (FDEP) has been received. The jumper connection shall also be used to maintain a minimum pressure of 20 psi in new mains at all times after disinfection and until the FDEP clearance letter is received. (See City standard detail WRE-#951137 for temporary jumper connection.)

5.22. VALVES: On straight run mains, valves shall be placed no more than 800 feet apart and at intersections, or as determined by the COT. Additional valve placement for operation or maintenance purposes may be required by the COT.
6.0 SEWER AND FORCE MAIN SPECIFIC PLAN PREPARATION, DESIGN, AND CONSTRUCTION STANDARDS

6.1. The COT will approve plans for new sewage collection and transmission systems and extensions only when designed as separate systems in which precipitation, runoff, groundwater and other prohibited discharge types are excluded, as specified in the City of Titusville Code of Ordinances Section Sec. 21-101. Prohibited Discharge Standards.

6.2. Sanitary sewer and sewage transmission systems shall be designed for the estimated ultimate tributary wastewater flows, based on acreage density as delineated in the City of Titusville Sanitary Sewer Master Plan (latest edition).

6.3. When a Developer desires to construct a project in phases, a master development plan is required and the wastewater system shall be designed for the estimated ultimate build out, as approved by the COT.

6.4. Sewage transmission force mains shall not connect to gravity manholes except as approved in accordance with section 6.18.1 of this document.

6.5. A 15-foot wide access road stabilized to a Florida Lime rock Bearing Ratio (LBR) value of 100 must be provided to access all manholes not directly accessible from paved surfaces. The size of this easement may be increased at the discretion of the City based on pipe size and depth of cover. The contractor shall provide density tests from a Florida Department of Transportation (FDOT) certified testing laboratory for the stabilized access road.

6.6. If a sanitary sewer or sewage transmission force main is located adjacent to a road right-of-way, a minimum fifteen (15) foot additional easement shall be provided. Additional easement widths shall be provided at the discretion of the City based on the depth of the pipe.

6.7. DAILY FLOWS: Average daily sewer flow shall be calculated by referencing the Equivalent Residential Connection (ERC) flow rates as outlined in the City of Titusville Land Development Regulations (LDR) Sec. 63-133. In addition, the Water Resources department's "Water Demand, Meter Sizing and Sewer Demand Calculations" sheets shall be completed and submitted.

6.8. Peak flow demands shall be based on the following:

<table>
<thead>
<tr>
<th>Flow Range (ADF)</th>
<th>Peak Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 0.100 MGD</td>
<td>4.0</td>
</tr>
<tr>
<td>0.101 to 0.250 MGD</td>
<td>3.5</td>
</tr>
<tr>
<td>0.251 to 1.000 MGD</td>
<td>3.0</td>
</tr>
<tr>
<td>1.001 to 4.000 MGD</td>
<td>2.5</td>
</tr>
</tbody>
</table>

6.9. If the above design criteria is not used, the Project Engineer will be required to submit signed, sealed and dated design calculations with the plans for sanitary sewer projects, with sufficient detail to show that the sanitary sewers will provide sufficient
cleansing velocity at peak flow to avoid creation of septic conditions resulting in the formation of hydrogen sulfide, as well as have sufficient hydraulic capacity to transport all design flows.

6.10. MINIMUM COVER: The minimum cover over sanitary sewer and sewage transmission force mains shall be no less than thirty (30) inches, calculated from the finished grade. In special cases, any gravity main less than thirty (30) inches deep shall be ductile iron pipe, but at least twenty-four (24) inches.

6.11. SLOPE

6.11.1. All sanitary sewers shall be designed and constructed to give minimum velocities at the ultimate designed capacity of not less than 2.0 feet per second (fps) nor greater than 10 fps based on Manning's formula using an "n" value of 0.012 for PVC and 0.013 for other pipe materials. The following minimum slopes shall be provided:

<table>
<thead>
<tr>
<th>Sanitary Sewer Size (in.)</th>
<th>Minimum Slope Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0.40%</td>
</tr>
<tr>
<td>10</td>
<td>0.28%</td>
</tr>
<tr>
<td>12</td>
<td>0.22%</td>
</tr>
<tr>
<td>15</td>
<td>0.17%</td>
</tr>
<tr>
<td>18</td>
<td>0.12%</td>
</tr>
<tr>
<td>21</td>
<td>0.10%</td>
</tr>
<tr>
<td>24</td>
<td>0.08%</td>
</tr>
<tr>
<td>27</td>
<td>0.07%</td>
</tr>
<tr>
<td>30</td>
<td>0.06%</td>
</tr>
<tr>
<td>36</td>
<td>0.04%</td>
</tr>
</tbody>
</table>

6.11.2. Approval of slopes less than those shown above will only be considered if the Project Engineer provides detailed calculations showing the velocity attained at minimum, average and peak flow conditions and where the depth of flow will be 0.3 times the diameter or greater for design average flow.

6.11.3. Sanitary sewers shall be laid with uniform slope between manholes.

6.12. FUTURE EXTENSIONS

6.12.1. All sanitary sewer extensions for future connections shall terminate at a manhole. The City may allow extensions without a terminal manhole on a case-by-case basis subject to all of the following conditions:

6.12.1.1. Total sanitary sewer extension length shall be limited to 50 feet and shall be plugged with a permanent watertight plug to the satisfaction of the City.

6.12.1.2. Sanitary sewer extension location at the initiating manhole shall be plugged with a watertight plug to the satisfaction of the City.

6.12.1.3. Such sanitary sewer extensions shall not be a part of the accepted sanitary sewer facilities. This shall be clearly delineated on the plans.
6.12.1.4. All such sanitary sewer extensions shall be inspected and tested for acceptance as part of the future construction phase.

6.12.1.5. No laterals shall be constructed on the extension line.

6.12.1.6. Inverts and direction of extensions shall be shown on the construction plans, witnessed by the City Utility Inspector, and verified on the as-built drawings.

6.13. VALVES: On straight run force mains valves shall be placed no more than 2,000 feet apart and at intersections, or as determined by the COT. Additional valve placement for operation or maintenance purposes may be required by the COT.

6.14. MANHOLES

6.14.1. Manholes shall be installed at distances no greater than every 400 feet, at all changes in grade, size or alignment, at all sewer intersections, and at the end of each sanitary sewer line.


6.14.3. The cone shall be centered over the manhole.

6.14.4. The casting shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Bricks shall be a maximum of five (5) courses. The brick shall be solid clay or shale brick, sound, hard and uniform in size meeting the requirements of ASTM Standard Specification for Sewer Brick, Designation C-32, Grade MM.

6.14.5. Mortar shall be composed of one part Portland cement (ASTM C150, Type II) and two parts washed silica sand (ASTM C144). No lime shall be used.

6.14.6. The top of manhole castings located in pavement, shouldered areas, and sidewalks shall be set flush with grade. The top of manhole castings located outside these areas shall be placed three (3) inches above grade and surrounded with a concrete pad that slopes down to ground level.

6.14.7. After curing, and before the application of the WrapidSeal®, as manufactured by Canusa-CPS, The Woodlands, TX, the plaster shall be carefully checked for bond and soundness by being tapped. Unbonded or unsound plaster shall be removed and replaced.

6.14.8. Residential sanitary sewer manholes shall have all interior surfaces coated with two coats of red-gray acrylic epoxy Coronado paint, including adjusting bricks, bench, and inverts. Each coat shall have a dry film thickness of 8-mils for a total of 16-mils dry. There will be no inside exposed raw concrete.

6.14.9. Commercial or industrial sewer manholes shall have a fiberglass liner. See Appendix A for approved vendor list for acceptable materials. Depending on the
operating conditions, the City may require additional liners in downstream manholes.

6.14.10. The exterior shall be coated with two coats of ConSeal CS-55. Each coat shall have a dry thickness of 3.8 mils.

6.14.11. WrapidSeal®, or COT approved equal, must be used on all joints, adjusting bricks, casting and riser rings. WrapidSeal® must be used in accordance with manufacturer’s recommendations.

6.14.12. For sanitary sewer mains ten (10) inches in diameter and smaller, the minimum inside diameter of manholes shall be forty eight (48) inches. A minimum access lid diameter of twenty seven (27) inches shall be provided. For sanitary sewer mains greater than ten (10) inches in diameter the minimum manhole inside diameter shall be five (5) feet.

6.14.13. Manholes twelve (12) feet or deeper, shall be five (5) feet in diameter with a six (6) inch wall thickness.

6.14.14. Where the difference in elevation between the incoming sewer invert and the manhole invert is less than twenty four (24) inches, the manhole invert shall have a built-up flow channel from the higher invert to the lower invert to provide a smooth flow transition and prevent solids deposition.

6.14.15. The flow channel through manholes shall be made to conform in shape and slope to that of the connecting sanitary sewer main.

6.14.16. Flow direction changes in excess of ninety (90) degrees shall not be included in sanitary sewer alignments without special consideration. Minimum flow line elevation drop of 0.1 feet across manholes shall be provided.

6.14.17. A bench, constructed of Type II Portland Cement mortar at least two (2) inches thick over brick, shall be provided, which shall have a minimum slope of two (2) inches per foot.

6.15. DROP MANHOLES

6.15.1. Drop manhole connections shall be used on an incoming sanitary sewer whenever the invert of the incoming sanitary sewer is at least two (2) feet higher than the outgoing sanitary sewer invert.

6.15.2. Drop manhole connections shall be constructed as shown in the City standard detail drawing WRE-#050315.

6.15.3. All drop manholes shall be external only.

6.16. SEWER LATERALS

6.16.1. All service laterals and fittings shall be a minimum of six (6) inches in diameter and are not to exceed seventy five (75) feet in length as measured from the
sewer main or terminus manhole, and shall be of the same material as that specified for the trunk sanitary sewer (i.e., ductile iron or PVC).

6.16.2. Double and multiple (manifold) service wyes are not allowed. All service laterals must be single service laterals directly connected to either a sanitary sewer main or a terminal manhole.

6.16.3. All laterals to single-family residential lots shall be centered on the lot.

6.16.4. Each lateral shall be supplied with a wye fitting and a forty five (45) degree bend at the main and laid at a minimum slope of one (1) percent.

6.16.5. The depth of the lateral at the property line shall be at least thirty (30) inches and not greater than four (4) feet.

6.16.6. The ends of the laterals shall be securely sealed with a factory manufactured watertight cap.

6.16.7. An inspection/site tee shall be required at the property line. See the City’s “Typical Sewer Service Connection” detail (drawing WRE-#080102).

6.16.8. All laterals located within driveways are to have traffic bearing inspection tee covers.

6.16.9. Service laterals shall not be allowed to discharge directly into sanitary manholes except at the invert of terminal manholes. A maximum of three (3) laterals are allowed in terminal manholes.

6.16.10. Curbs are to be etched with the letter “S”, three (3) inches in height, to designate the location of the sewer lateral.

6.17. ELECTRONIC PIPE MARKER (EMS)

6.17.1. The 3M™ EMS 1258 as manufactured by Minnesota Mining and Manufacturing Company, or COT approved equal, shall be placed eight (8) inches over the end of every lateral within the right-of-way in a level position and over other sewer facilities as required.

6.18. CONNECTIONS TO EXISTING SEWAGE SYSTEMS

6.18.1. Force Main Connections: Force mains shall not terminate directly into a sanitary sewer line. Force mains shall connect directly to force mains. Connection of a force main to a sanitary sewer system may be approved only when the Project Engineer demonstrates to the satisfaction of the City that a force main connection is not feasible. Any such requests shall be submitted to the City and approved by the COT, and shall include the following design considerations:

6.18.1.1. Detailed construction plans must include plan and profile details of the excavation, connection, backfilling and restoration.
6.18.1.2. Two (2) downstream manholes and one (1) upstream manhole shall be repaired or replaced as deemed necessary by the City.

6.18.1.3. The receiving manhole, two (2) downstream manholes, and one (1) upstream manhole shall be lined with a COT approved liner.

6.18.1.4. An electrical engineer must size a generator properly and provide signed and sealed plans and specifications.

6.18.2. Sanitary Sewer or Force Main Connections: The City shall inspect the receiving wastewater pump station to determine if it has capacity for additional flows. Any required upgrades shall be the responsibility of the Developer.

6.18.3. Connection of Private Sanitary Sewer Systems: Private sanitary sewer systems must be separated from the City sanitary sewer system by a manhole located at the right-of-way line. If the manhole separating the private system from the public system is required to be located on private property, a twenty (20) foot wide easement centered on the manhole will be required.

6.19. SANITARY SEWER SYSTEM CONNECTIONS

6.19.1. Sanitary sewer mains connecting to other sanitary sewer mains shall include the installation of a new manhole added to an existing sanitary sewer main and shall be constructed of precast concrete. The backfilling around the new base shall be performed and compacted in such a manner that the existing sanitary sewer pipe is adequately supported and protected from settlement of adjacent or nearby backfill.

6.19.2. No doghouse or mouse hole manholes are allowed.

6.19.3. Connection to an existing manhole shall be made by core drilling the manhole and utilizing a Kor-N-Seal® flexible pipe to manhole connector as manufactured by NPC, Inc., Milford, NH, or COT approved equal. The condition of the existing manhole will be evaluated by the City prior to approval of the connection and any repairs or upgrades to the manhole will be the responsibility of the developer as part of the conditions of approval of the connection.

6.20. OWNERSHIP

6.20.1. Single-family subdivision sanitary sewer systems shall be owned and maintained by the City.

6.20.2. Privately owned systems that connect to the City sewage system shall meet City standards and must be approved by the COT.

6.20.3. If an Owner/Developer wants to keep a system private, they must submit a written request to the City prior to submitting an FDEP Application Permit Package. The Owner/Developer will be advised in writing by the COT.
6.20.4. If the property will not remain under single ownership, the Owner/Developer shall provide documentation that the private sewage system is specifically included as the maintenance responsibility of the owners.

6.20.5. If a proposed utility system will connect to a privately-owned utility system to obtain service, the Developer shall obtain a contractual agreement with the Owner of the existing system, providing perpetual rights to service through the property. An executed agreement shall be submitted to the City with the plans.

6.20.6. It is the responsibility of the Owner/Developer to obtain the necessary easements for private sewer lines. Private sewer lines shall not be installed in public easements or rights-of-way.

6.21. No sanitary sewer main conveying wastewater shall be less than eight (8) inches in diameter nor shall any City owned force main be less than four (4) inches in diameter.

6.22. FORCE MAIN TESTING AND INSPECTION:

6.22.1. All force mains shall be pressure and leakage tested in conformance with the requirements of Section 13- Hydrostatic tests of AWWA Specifications C600 using a hydrostatic guage pressure of 100 PSI.

6.22.2. No force main will be acceptable to the City unless the leakage is less than the amounts listed in the following table:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Allowable Leakage in Gallons Per Hour Per 100 pipe joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>0.99</td>
</tr>
<tr>
<td>4&quot;</td>
<td>1.33</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1.98</td>
</tr>
<tr>
<td>8&quot;</td>
<td>2.65</td>
</tr>
<tr>
<td>10&quot;</td>
<td>3.31</td>
</tr>
<tr>
<td>12&quot;</td>
<td>3.96</td>
</tr>
<tr>
<td>14&quot;</td>
<td>4.64</td>
</tr>
</tbody>
</table>

Note: This table is based upon an allowable leakage of 23.3 GPD per mile of pipe per inch of nominal diameter for mechanical and push-on joints.

6.22.2.1. Polyvinyl chloride (PVC) pipe force mains shall be tested in general, the same as ductile iron force mains, and specifically in accordance with the testing requirements as established by the pipe manufacturer.

6.22.2.2. No force mains will be accepted by the City unless the leakage is less than the amounts listed in Table 4 above; or, less than the maximum allowable leakage requirement established by the pipe manufacturer, whichever of the leakage requirements is more stringent shall apply.

6.23. TEST AND INSPECTION:

6.24. All newly installed and modified sanitary sewer systems will be tested by the Contractor utilizing the following tests and video inspections. The Contractor shall
perform testing of all sanitary gravity sewers, as set forth in the following, and shall conduct said tests in the presence of City of Titusville personnel with a minimum of two (2) business days advance notice provided.

6.25. LEAKAGE TESTING

6.25.1. All new and modified sanitary sewers shall be tested for leakage. This may include appropriate water or low-pressure air testing. The testing method selected shall properly consider the existing groundwater elevations during the test. The air test, if used, shall be conducted in accordance with one of the following Standards:


6.25.1.2. UNI-B-6, “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe,” published by the Uni-Bell PVC Pipe Association.

6.25.2. If the test section does not pass the test as defined in the above Standards, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the City.

6.25.3. If a water test is used, the test shall be performed with a minimum positive head of two (2) feet, and the exfiltration or infiltration leakage shall not exceed the equivalent of one hundred (100) gallons per inch of pipe diameter per mile per day for the given test section.

6.25.4. If the installation fails to meet these requirements, the Contractor shall, at no additional cost to the City, determine the source of leakage, make necessary repairs or replacements, and retest the failed section(s).

6.26. PIPE CLEANING

6.26.1. Prior to the video inspection, the Contractor shall remove any debris from the upstream to the downstream manhole.

6.26.2. Debris shall not be allowed to enter any pump station, wet well, or any portion of the existing sanitary sewer system. Any such debris shall be removed from the sanitary sewer system.

6.27. CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION

6.27.1. After completion of the pipe installation and all backfill and base work is compacted and has passed density testing, the Contractor will perform a video inspection of the sanitary sewer pipe(s). The following procedures will be followed:

6.27.2. The Contractor shall be required to use a pan and tilt color camera.

6.27.3. At the beginning of the inspection, the Contractor is to announce the name of the company performing the video inspection work, the operator name, date, project,
street, manhole number(s), length of sections of pipe, length of total run footage, the size and type of pipe material, weather conditions (sunny, raining, etc), and the purpose of the inspection.

6.27.4. Each run is to include audio commentary with the street, manhole number(s), length of total run, and is to include an accurate ongoing footage counter that displays on the monitor the exact distance of the camera (to the nearest tenth of a foot) from the centerline of the starting manhole.

6.27.5. All video inspection runs are to begin at the center of the upstream manhole, shall be continuous, and shall not exceed thirty (30) feet per minute.

6.27.6. As the video inspection progresses, the Contractor shall make audio and video log recordings of any defects, sags or low points in the pipe, service connections/laterals, point repairs, and joint misalignments, and shall include station numbers.

6.27.7. The camera operator shall slowly pan and tilt at each service connection, visible defect, and at pipe material transitions.

6.27.8. Noted defects shall be documented with numbered color digital files (.jpg) and color hard copy print-outs submitted with the inspection report. A sample inspection report with the minimum required information and a classification table for reporting observations is included in the exhibits.

6.27.9. The determination of a defined defect is at the sole discretion of the City. Defined defects include, but are not limited to, cracks, broken or defective pipe, pipe misalignment, vertical sags, or deviations from true grade alignment. The Contractor shall be required to repair or replace identified deficiencies.

6.27.10. Upon completion of all required repairs, the Contractor will again perform an internal video inspection of the sanitary sewer pipe to verify that the repairs meet the specifications.

6.27.11. Prior to repair or replacement of defective workmanship or material, the method of repair or replacement shall be submitted to the City for review and approval.

6.27.12. Acceptance of the CCTV inspection of the sanitary sewer main shall be given by the City in writing only after all defects have been corrected, retested and inspected to the satisfaction of the City. Approval from the COT stating that the CCTV is acceptable is required before an FDEP Sewer Clearance Request form will be signed by the COT and forwarded to the FDEP.

6.28. DEFLECTION AND ALIGNMENT TESTING (MANDREL TESTING)

6.28.1. All PVC sanitary sewer pipe(s) shall be subject to deflection testing to assure that the maximum deflection of 5% has not been exceeded. The Contractor will be required to perform a mandrel test, using the mandrel testing device at 95% of the diameter of the pipe being tested. When the mandrel cannot be pulled through the pipe line, the Contractor shall locate and correct the defect to the satisfaction of the City.
6.28.2. Deflection tests shall be performed no sooner than 30 days after completion of placement and densification of backfill. The pipe shall be cleaned and inspected for offsets and obstructions prior to testing.

6.28.3. The mandrel shall be rigid and nonadjustable with an odd number of legs (9 legs minimum), have an effective length not less than its nominal diameter, be fabricated of steel, and be fitted with pulling rings at each end. It shall be stamped or engraved, on some segment other than a runner, indicating the pipe material specification and nominal size and be furnished in a suitable carrying case labeled with the same data as that engraved on the mandrel.

6.28.4. Prior to use, the mandrel certification shall be verified by the City Utility Inspector. Use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate the test.

6.28.5. The mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded.

6.28.6. If, upon determination by the COT, the installed sanitary sewer pipe does not meet proper deflection and/or alignment, the Contractor will remove and replace as necessary, and then perform another internal video inspection and mandrel test of the sanitary sewer pipe.

6.28.7. After the defect is corrected and the trench is backfilled, the section of line shall then be retested to ensure compliance.

6.28.8. The replaced pipe shall be tested for deflection not sooner than 30 days after installation.

6.29. MANHOLE INSPECTION

6.29.1. No visible leakage in the manhole or pipe connections will be permitted.

6.29.2. Manholes shall also be vacuum tested at the discretion of the City. The vacuum test shall pass if the vacuum remains at 10” Hg or drops to 9” Hg in a time greater than one minute. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs.

6.29.3. All manholes failing to meet specifications, whether visual or vacuum, shall be reconstructed or replaced by the Contractor. Pressure grouting of manholes may be allowed on a case-by-case basis at the discretion of the COT.

6.30. SUBMITTALS

6.30.1. The Contractor shall submit to the City two (2) DVD’s of the CCTV inspection, two (2) copies of each sheet of the inspection report, and two (2) copies of a schematic plan of the inspected sanitary sewer system.

6.30.2. At the sole discretion of the City, if the DVD presented for review is found to be of poor quality (i.e. dim lighting, grainy and/or foggy picture, inconsistent data,
speed of run distracts from inspection, or dry pipe) the CCTV inspection will be rejected and shall be performed again.
7.0 LIFT STATION PLAN PREPARATION, DESIGN AND CONSTRUCTION STANDARDS

7.1. GENERAL

7.1.1. All wastewater pumping stations shall be designed in accordance with the applicable regulations of the City, the Florida Department of Environmental Protection (FDEP), and the standards established herein.

7.1.2. FLOOD PROTECTION: Wastewater pump stations shall be designed to remain fully operational and accessible during a 100-year flood. The top elevation of the wet well shall be six (6) inches or higher above a 100-year flood elevation or the elevation of the crown of the road, whichever is greater.

7.1.3. PUMP CURVES: Calculations provided shall include head capacity curves plotted on copies of the manufacturer’s pump curves, hydraulic analysis of the force main system, buoyancy calculations and operating cycle calculations with wet well sizing. Head capacity curves shall be prepared and submitted to the City of Titusville along with the pump station plans. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application.

7.1.4. SITE CONSIDERATIONS: Soil borings are to be performed at the location of the wet well extending at least five (5) feet below the bottom of the wet well. A licensed engineer in the State of Florida will be required to make construction recommendations addressing dewatering, bedding, compaction, and backfilling for the wet well construction. The construction plans need to incorporate the Engineer’s construction recommendations.

7.1.5. PUMP DESIGN: Pumping levels shall be set to provide a minimum capacity between operational water levels sufficient to allow a minimum of ten (10) minutes between successive starts of the pumps during peak flow events. The pump station shall be constructed as shown on the approved plans and shall comply with all manufacturers’ installation recommendations. All pump stations shall be submersible type.

7.1.6. GENERATORS: An on-site generator shall be required on any station with a Peak Design Flow capable of pumping one thousand (1,000) gallons per minute (GPM) or greater. Additionally, if the City deems the lift station is critical, is regional, or the station is located at a remote site, a generator shall be required.

7.2. PUMPS AND MOTORS

7.2.1. UNIT INTEGRITY: In order to ensure unit integrity, the pumps, motors, control panel, access covers, and guide rail system shall be supplied by the same company. The City of Titusville utilizes ITT Water and Wastewater Florida, LLC, Apopka, Florida.
7.2.2. **PUMP RATING:** Pumps are to comply with the National Electrical Code (NEC) requirements for Class I Group D, Division 1 locations, in accordance with Section 42.35 of the Recommended Standards for Wastewater Facilities (1997) as adopted by FDEP rule 62-604.300(5)(g), F.A.C. Equipment will be certified as such by one of the national rating agencies (Factory Mutual or Underwriters Laboratory).

7.2.3. **PUMP TESTS:** The Pump Supplier shall perform the following tests on each pump before shipment:

7.2.4. **Meg the pump for insulation breaks or moisture.**

- **7.2.4.1.** Prior to submergence, the pump shall be run dry and be checked for correct rotation.
- **7.2.4.2.** Pump shall be run in a submerged condition.
- **7.2.4.3.** Pump shall be removed from test tank and meged immediately for moisture.
- **7.2.4.4.** A written certified test report giving the above information shall be supplied with each pump at the time of shipment.
- **7.2.4.5.** The ends of the pump cables will be fitted with a rubber shrink fit boot to protect the cable prior to electrical installation.

7.3. **GUARANTEED PARTS STOCK PROGRAM**

7.3.1. The Pump Supplier shall have a guaranteed parts stock program in the State of Florida. These parts shall include at least one set of spare parts as listed below for each pump supplied on this contract. If the pump supplier does not have a published guaranteed part stock program, the contractor shall furnish the specified spare parts for each pump. The following are examples of spare parts included but not limited to:

- Upper Mechanical Seal
- Lower Bearing
- Lower Mechanical Seal
- Complete set of O-Rings
- Wear Rings
- Impeller Bolt
- Cable Entry Washer/Grommet
- Impeller Key
- Inspection Plug Washers
- Motor Cable
- Upper Bearing

7.4. The pump supplier shall have a service facility within a fifty (50) mile radius of Titusville, Florida. A factory trained service technician shall be available 24 hours a day, 365 days a year.

7.5. **WARRANTY:** The pump manufacturer shall warrant the pumps being supplied against defects in workmanship and materials for a period of five (5) years under normal use, operation, and service. The warranty shall be in published form and apply to all similar units.

7.6. **NUMBER OF PUMPS:** Each pumping station shall have a minimum of two (2) pumps for peak flows of one thousand (1,000) gallons per minute (GPM) or less. When the flow exceeds 1,000 GPM, three (3) or more pumps will be required. Standby pumping capability shall be provided such that if any one pump is out of service the
remaining pumps shall be capable of pumping out estimated peak flows.

7.7. PUMP SELECTION: Pump stations shall be capable of pumping the peak design flow with only one pump operational. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. In addition, a minimum five (5) HP motor shall be required unless otherwise approved by the COT, to be determined on a case-by-case basis. In cases where receiving force main systems are interconnected to additional pumping stations, pump and motor selection and head capacity curves shall reflect hydraulic conditions. All pumps shall be capable of passing a minimum three-inch (3”) sphere without clogging.

7.8. PUMP DESIGN: The pumps shall be automatically and firmly connected to the discharge connection, guided by two stainless steel guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet well. A machined watertight contact shall accomplish sealing of the pumping unit to the discharge connection. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

7.9. PUMP MOTOR

7.9.1. The motor and pump shall be designed and assembled by the same manufacturer. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, water tight chamber, NEMA B type. The motor shall be designed for continuous duty handling of pumped media 40°C (104°F) and capable of up to fifteen (15) evenly spaced starts per hour. The motor shall have a voltage tolerance of plus or minus ten (10) percent. The motor shall be designed for operation up to 40°C (104°F) ambient, with a temperature rise not to exceed 80°C (176°F).

7.9.2. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The rotor bars and short circuit rings shall be made of cast aluminum.

7.9.3. Thermal switches set to open at 125°C (257°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with, and supplemental to, external motor overload protection and shall be connected to the control panel.

7.9.4. An elastomer seal shall hermetically seal the junction chamber containing the terminal board from the motor.

7.9.5. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. Wire nuts or crimping type connection devices are not acceptable.

7.9.6. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15.
7.10. PUMP MATERIALS

7.10.1. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes or other irregularities. All exposed nuts or bolts shall be Stainless Steel AISI Type 316 construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings.

7.10.2. The cable entry seal design shall abide by manufacturer torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable.

7.10.3. The assembly shall provide ease of changing the cable when necessary using the same entry seals. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top.

7.10.4. All cables must have a minimum length of forty (40) feet unless the station design requires longer length.

7.10.5. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of sixty five (65) feet.

7.11. PUMP COOLING SYSTEM

7.11.1. On pumps twenty (20) HP and larger, each unit shall be provided with an adequately designed cooling system utilizing a water jacket. The water jacket shall encircle the stator housing. On pumps less than twenty (20) HP, motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

7.11.2. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions.

7.11.3. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104°F (40°C). Restrictions below this temperature are not acceptable.

7.12. PUMP MECHANICAL SEALS

7.12.1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. Each seal interface shall
be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall not depend on the direction of rotation for sealing. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate.

7.12.2. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside. Seal lubricant shall be FDA Approved non-toxic. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

7.12.3. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten carbide seal ring and one positively driven rotating tungsten carbide seal ring. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable.

7.13. PUMP BEARINGS

7.13.1. The pump shaft shall rotate on two bearings. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable. Motor bearings shall be permanently grease lubricated.

7.14. PUMP SHAFT

7.14.1. The pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable.

7.14.2. For pumps twenty five (25) HP and larger, the shaft shall be Carbon Steel AISI C1035 and shall be completely isolated from the pumped liquid. For pumps under twenty five (25) HP, the shaft shall be Stainless Steel AISI Type 420.

7.15. IMPELLER

7.15.1. The impeller shall be of Grey Cast Iron, ASTM A48 Class 35B, dynamically balanced, double shrouded, non-clogging design having a long throughlet without acute turns. Whenever possible, a full vaned, non-vortex, impeller shall be used for maximum hydraulic efficiency. The pump manufacturer, upon request, shall provide mass moment of inertia calculations. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

7.15.2. Impellers shall be retained with an Allen head bolt and shall be capable of passing a minimum three-inch (3") diameter solid. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.
7.16. PUMP WEAR RINGS

7.16.1. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.

7.16.2. Each pump shall be equipped with a brass or Nitrile rubber coated steel ring insert that is drive fitted to the volute inlet. On pumps twenty (20) HP and larger, a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller will also be provided.

7.17. RAILS

7.17.1. The guide rail system shall be Stainless Steel Type 316 and shall require two parallel guide rails. Minimum rail size shall be two (2) inches in diameter. Lower guide rail holders shall be integral to the pump discharge connection.

7.18. CABLE HOLDER

7.18.1. A cable holder shall be provided with an adequate number of hooks to secure the liquid level sensors. Pump cable holders shall be supplied at the top position of each pump guide rail and be sized to hold all excess pump cable. The cable holders shall be suitable for wall or access doorframe mounting, and their mounting hardware shall be Stainless Steel Type 316.

7.19. ELECTRIC SERVICE

7.20. GENERAL: Electrical service shall be 480-volt, three phase, 200-amp minimum for stations greater than 10,000 GPD. Electrical service for stations for single family residential of twenty five (25) lots or less shall be 480-volt, three phase, 100 amp. Meters shall have a manual bypass lever for removal of the meter. A fused NEMA Type 3R stainless steel disconnect shall be used between the control panel and the meter can.

7.21. CONTROL PANEL

7.21.1. The control panel shall be manufactured by Quality Controls, Inc., and the complete unit shall be UL listed.

7.21.2. The level control shall respond to liquid level float switches to automatically start and stop the pumps as well as sound an alarm and energize an alarm light upon high wet well levels.

7.21.3. All pump control operations shall be accomplished by a float type, liquid level control system with all control components mounted in one common enclosure. A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24-volt circuit. The wet well levels to be used in operation are as shown on the drawings.

7.21.4. The control panel shall be standard system of the manufacturer as modified for this application. The control panel shall consist of a main circuit breaker, an
emergency generator circuit breaker, a motor circuit breaker, a magnetic starter for each pump motor, and 15-ampere, 120-volt circuit breakers as illustrated on the “Typical City Standard Wastewater Pump Station Details WRE-#20316”. All control panel circuits shall be 120-volt AC.

7.21.5. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the “lead” and “lag” pumps after each pumping cycle.

7.21.6. The electrical control equipment shall be mounted within a NEMA Type 3R enclosure constructed of not less than 14-gauge Type 304 stainless steel. The enclosure shall be equipped with an aluminum dead front door and shall incorporate a removable back panel on which control components shall be mounted. Enclosures shall be equipped with a stainless steel drip lip and three-point latch.

7.21.7. All motor circuit breakers, motor starters and control relays shall be Square D and no other. All motor circuit breakers, motor starters and control relays shall be of highest industrial quality, and securely fastened to the removable back panels with screws and washers.

7.21.8. Back panels shall be secured to enclosure with collar studs. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

7.21.9. An open frame, across the line, NEMA rated magnetic motor starter as manufactured by Square D shall be furnished for each pump motor. All motor starters shall be equipped with solid state overload protection on all phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position.

7.21.10. A duplex 120-volt, 15-amp Ground Fault Circuit Interruption (GFCI) utility receptacle, with associated circuit breaker, shall be provided inside of the enclosure.

7.21.11. All operating controls and instruments shall be securely mounted on the control compartment door. All controls and instruments shall be clearly labeled to indicate function.

7.21.12. Pump mode selector switches shall be Hand-Off-Auto (HOA) types to permit override of automatic level control and the manual actuation or shutdown of either motor. HOA switches shall be as manufactured by Square D, providing three (3) switch positions, each of which shall be clearly labeled according to function. Operation of pumps in manual mode shall bypass all safety shutdowns.

7.21.13. Pump run indicator lights shall be equipped to operate at 120-volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position and shall incorporate a push to test function. Lead/Lag pump indicator lights shall be equipped to operate at 24-volt input.
7.21.14. The control panel shall include one completely enclosed solid-state electronic module per pump to automatically monitor the motor winding insulation resistance of each pump in a duplex pumping station. The monitoring device shall have two LED pilot lights to indicate power on and low megger reading. Emergency bypass and motor reset functions will be included.

7.21.15. The test voltage applied to the motor winding is to be a minimum of 500 Volts DC. Devices that use a lower voltage shall not be considered acceptable. The test device is to be the SubMeg® as manufactured by ITT Water and Wastewater Florida, LLC, Apopka, Florida. The test current is to be limited to less than 0.25 milliamps.

7.21.16. The test device is to measure the winding resistance of the motor prior to the motor operation, after it has been called to run. No monitoring is to occur when both motors are running or idle. If the motor winding leakage resistance falls below one (1) megaohm, an alarm circuit is to be activated.

7.21.17. Control terminal blocks shall be of the screw clamp type, rated 600 volts.

7.21.18. The control panel shall incorporate two (2) phase monitors as shown on the drawings. Four hundred eighty volt (480V), three-phase stations shall be equipped with octal base mount units with two form “C” contacts. Phase monitors shall be manufactured by Diversified Products.

7.21.19. Control wire shall be minimum 14 AWG THHN, UL 1015. All control wire shall be routed through plastic wireway with snap-on covers and be neatly bundled and tie wrapped to form a neat assembly.

7.21.20. Three (3) engraved nameplates, made from black PVC with white letters, shall be supplied on the front door of the control panel. The first label shall be seven (7) inches wide and eight (8) inches tall and will state City of Titusville, L/S #___, name of station, and emergency phone number. The labels shall be attached with a 5 mil thick, 3-M type adhesive. No foam tape will be acceptable. The labels shall be uniform in size with ¾” minimum letter size. The second label shall be one (1) inch by seven (7) inches and will show emergency phone number only. For private lift stations the emergency phone number shall be the contracted maintenance provider of the lift station. The third label shall be one (1) inch by seven (7) inches and will list the site address of the lift station.

7.21.21. Generator receptacle shall be Crouse Hinds #AR2042. The completed control panel shall be UL approved and labeled.


7.22. TELEMETRY UNIT

7.22.1. GENERAL: A one-time fee will be charged to the contractor for the purchase of the telemetry unit. This unit shall be designed and installed by the City of Titusville.
7.23. WET WELL REQUIREMENTS

7.23.1. Wet wells shall be constructed of concrete and have a wall thickness of at least eight (8) inches. Steel reinforcement shall be applied according to industry standards. The wet well floor shall have a thickness of at least twelve (12) inches. Wet well lids shall be at least five (5) inches thick and be sealed to the wet well with ram-neck.

7.23.2. Wet wells shall meet the requirements of ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections. Cement shall meet the requirements of ASTM C150-74, Specification for Portland Cement, Type II. Concrete shall meet the minimum requirement for 4,000 psi concrete. Reinforcement shall be grade 40 unless otherwise specified. The required minimum strength of concrete shall be confirmed by making and testing three standard cylinders at seven days. Rings shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Base riser section shall be integrally cast with the base slab. Reinforcement of the base slab shall be welded, or continuous with wall reinforcement.

7.23.3. All interior services of the wet well shall be coated with one of the following: GSE StudLiner® as manufactured by Gundle/SLT Environmental, Inc., Houston, TX, Agru Sure Grip® Concrete Protective Liner as manufactured by Agru America, Inc., Georgetown, SC, or City approved equal.

7.23.4. Wet wells shall be a minimum of eight (8) feet in diameter and shall have a minimum depth of seven (7) feet below the lowest influent for stations over 10,000 GPD, and a minimum of six (6) feet in diameter and a minimum depth of five (5) feet for single family residential of twenty-five (25) lots or less. Additional depth shall be provided based on station design and cycle time. The wet well shall have only one (1) influent line.

7.23.5. Exteriors of the wet well are to be coated with two coats ConSeal CS-55 as manufactured by Concrete Sealants, Inc., Tipp City, OH, or City approved equal. Each coat shall have a dry film thickness of 3.8 millimeters.

7.23.6. Pumping levels shall be set to provide a minimum cycle time of ten (10) minutes at peak flows.

7.23.7. Pump-off water levels shall provide adequate submergence to preclude pump inlet vortexing, or air binding. Operational maximum water levels shall not exceed the invert elevation of the influent pipe.

7.23.8. The wet well floor shall have a minimum slope of 1:1 to the hopper bottom.

7.23.9. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and operations of the pumps.

7.23.10. No interior ladders shall be permitted in the wet well.

7.24. HATCH AND SAFETY GRATE
7.24.1. Each pump station shall include an aluminum access hatch in the wet well to allow for installation and removal of the pumps. The access hatch shall be manufactured by Syracuse Casting, Cicero, NY. Hatch shall be the single or double door type based on the size of the pump.

7.24.2. The hatch is to be constructed of aluminum with a load rating of 300 pounds per square feet.

7.24.3. Access hatches will be sized in accordance with pump manufacturer’s recommendations and shall include an automatic hold open arm with red vinyl grip.

7.24.4. Hinges shall be Type 316 stainless steel with tamper proof bolts.

7.24.5. A recessed stable for padlock is required that will house a size four (4) Master padlock.

7.24.6. A ¼” extruded angle section with integral seat and continuous anchor flange will be provided so that the hatch can be cast in the concrete wet well lid.

7.24.7. Each access hatch shall include an aluminum safety grate designed for sewer applications. The grate is to be two-piece and hinged for access to pumps.

7.25. PIPING

7.25.1. All above ground piping shall be ductile iron with Protecto 401® interior coating as manufactured by Induron Protective Coatings, Birmingham, AL. All above ground fittings shall be flange to flange with Epoxy or Protecto 401® interior coating. All fastening hardware shall be Stainless Steel Type 316. A minimum of four (4) inch diameter pipe is required. Force mains shall be AWWA Standard C900 or AWWA Standard C905 PVC. No PVC may be exposed. All fittings and pipe in the wet well or valving arrangements shall be flange to flange.

7.26. VALVES

7.26.1. All valves shall be plug type, DeZURIK or City approved equal. Check valves shall be DeZURIK or City approved equal. All checks shall have a brass or bronze seat and flapper with external lever and spring. Valves shall be installed twenty four (24) inches above ground elevation to the center line.

7.27. PUMP STATION WATER SYSTEM

7.27.1. All public and private wastewater pump stations shall be provided with a potable water system and shall be separated from the potable water supply by means of a reduced pressure type backflow preventer, per City of Titusville specifications. A hose bib for connection of a garden hose shall be provided and shall be located at least five (5) feet from the control panel. The water system shall be complete and include the installation of the water meter per current City of Titusville specifications.
7.28. SITE SIZING AND EASEMENT REQUIREMENTS

7.28.1. Pump station sites shall be a minimum of forty (40) feet by forty (40) feet as shown on City of Titusville detail. The Developer shall dedicate the pump station site by warranty deed to the City. Dedicated easements shall also be required around the site as required to provide proper access. In general, the site for the paved access road shall also be dedicated to the City. An exception to this requirement may be allowed on a case-by-case basis in the form of an ingress/egress easement for the access road supplying ample room for proper cleaning and maintenance of the lift station. This includes access for a vacuum tank truck for wet well cleaning.

7.29. ACCESSIBILITY

7.29.1. The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the pumping station shall be paved. The facility shall not be located in road rights-of-way. In a phased development, a stabilized access road may be accepted during the initial phase with paving to be accomplished in the later phase. A performance bond may be required for paving.

7.30. SITE FENCING

7.30.1. All pump station site perimeters shall be fenced. The fence shall be of the metal chain link type, six (6) feet tall with one (1), forty three (43) inch wide, personnel gate. One (1) drive through double gate at least twelve (12) feet wide for access to the wet well shall be provided. The inside of the fenced area shall have a geotextile ground cloth to prevent grass and weeds from growing. The surface is to be covered with FDOT #57 stone to a consistent depth of four (4) inches.

7.31. FLOW METER

7.31.1. Indicating, totalizing and recording flow measurements shall be provided at pumping stations designed to handle peak flows of 1,000 GPM or more, or at a station that is deemed critical or at a remote location. Bypass piping around the meter shall be provided for all stations with flow meters to facilitate meter maintenance.

7.32. ODOR CONTROL

7.32.1. On regional stations or stations that would cause a nuisance odor problem, odor control will be required. This will be addressed on a case-by-case basis at the time of the construction permit request.

7.33. EMERGENCY OPERATIONS

7.33.1. All pump stations shall be provided with emergency power receptacles as specified in the control panel schematics (Crouse Hinds model AR2042). Stand-by emergency generators shall be provided at all wastewater pumping stations which are at critical points in the sewer system or which have a peak design capacity of 1,000 GPM or more. Such stand-by generator facilities shall be sized
on case-by-case status. All such generators shall be rated and designed to operate the pump station under design conditions. Fuel tanks must be of sufficient size to operate the station for a minimum of twenty four (24) hours.

7.34. START-UP

7.34.1. The City will perform a confined space entry inspection of the wet well and all equipment prior to any liquid being introduced to the wet well.

7.34.2. A competent factory trained representative shall perform the initial start-up and shall be available for not less than one (1) day for each station being placed into operation.

7.34.3. In addition to the start-up, the representative shall instruct the owner’s personnel in the operation, maintenance, and adjustments of the equipment.

7.34.4. A complete set of repair manuals shall be provided, including rebuild specifications, part numbers, and general maintenance procedures at the time the pump test is performed.
8.0 RECLAIMED SPECIFIC PLAN PREPARATION, DESIGN, AND CONSTRUCTION STANDARDS

8.1. OWNERSHIP: The City of Titusville shall own and maintain all portions of the reclaimed water system up to and including the individual curb stop, service box and/or meter.

8.2. Rights-of-way: Reclaimed water mains shall maintain a consistent alignment with respect to the centerline of the road. In residential developments, mains should be installed as illustrated on the City’s “Utility Placement Within a 50’ Public Road Right-of-Way” detail WRE-#060945. Exceptions will be made on a case-by-case basis. In all cases, mains shall be installed along one side of the road, with crossings kept to a minimum.

8.3. RECLAIMED WATER SERVICES

8.3.1. All installations shall be installed in accordance with City of Titusville Specification details. All reclaimed water service lines shall be constructed of Pantone Purple 522C polyethylene (PE) pipe conforming to the requirements of AWWA Standard C901, utilizing copper tube sizes (CTS) and compression adapters.

8.3.2. Reclaimed water service lines greater than ten (10) feet in length from the corporation stop to the curb stop shall have one (1) strand of a suitable conductive location wire installed with the reclaimed water service. The wire shall be 14 gauge single-conductor copper with purple insulation color. Only purple color is acceptable. The wire shall be continuous between fittings.

8.3.3. Location: All service lines will be located in the right-of-way. Service lines shall not be terminated in the sidewalk or within two (2) feet adjacent to driveways. Location of service lines in single family and townhouse developments shall be at alternating lot lines. Multiple service line installations shall be located in common areas, and curb stops spaced no more than 18-20 inches apart in single file. Curb stops shall be mounted in a horizontal position at a depth of no greater than ten (10) inches from finished grade.

8.3.4. Meter boxes must be installed at the time of service line installation, prior to final inspection. Refer to Paragraph 8.4.5.

8.3.5. Service saddles: Service saddles shall be used for all connections to PVC pipe. Saddle body for C900 pipe shall be nylon/epoxy coated ductile iron and tapped for AWWA/CC threads. Body and bands must be factory pre-sized for C900 or C905 pipe diameter. Bands shall be stainless steel, minimum two (2) inches wide. Brass saddles are acceptable. See Appendix A for approved vendor list for acceptable materials.

8.3.6. Curbs shall be etched with the letter “X”, three (3) inches in height, to designate the location of the reclaimed water service.
8.3.7. Reclaimed water service lines crossing paved roadways shall be installed by directional bore method. The Contractor shall furnish all material, equipment, transportation, tools and labor, and shall comply with all regulations of the governing authority to install the service lines.

8.4. TAPPING- RECLAIMED WATER

8.4.1. Service saddle placement on main shall be at least 45 degrees off vertical and not to exceed horizontal positioning. No vertical tapping will be allowed except at temporary jumper connections.

8.4.2. Corporation stops shall be CC thread to CTS. Corporation stops will be used only for one (1) inch taps. See Appendix A for approved vendor list for acceptable materials.

8.4.3. Curb stops shall be CTS to meter swivel nut for one (1) inch. No H pattern or roundway type will be permitted. Curb stops will be used only for one (1) inch service lines. See Appendix A for approved vendor list for acceptable materials.

8.4.4. All service lines greater than one (1) inch in diameter shall meet the requirements of the specifications for one and one half (1-1/2) inch and two (2) inch meters (refer to City standard details for meter installations).

8.4.5. Meter protection boxes shall be according to size of service line. Meter boxes are to be provided with a cast iron reader lid with “RECLAIMED WATER” and the words in English and Spanish, “DO NOT DRINK, NO BEBER”, together with the international symbol equivalent imprinted on meter box top. When new service lines are installed, meter boxes shall be placed over curb stops with sufficient space for future installation of a reclaimed water meter by the City. The top of the meter box shall be adjusted to grade and shall be in undamaged condition. If it is necessary to locate meter boxes near concrete or paved areas, steel meter box covers with reader lids shall be required.

8.5. RECLAIMED WATER: All pipe and fittings for reclaimed water distribution shall be ductile iron or polyvinyl chloride (PVC) pipe. Refer to Sections 3.21 and 3.22. High Density Polyethylene (HDPE) pipe can be used for directional boring purposes only. Refer to Section 3.23.

8.6. CROSS CONNECTION CONTROL

8.6.1. GENERAL: Backflow prevention is required in accordance with PL 93-623, the Federal Safe Drinking Water Act, and Florida Administrative Code (FAC) 62-555.360 for the protection of the potable water system. The COT has established a Cross-Connection Control Program to meet the above requirements and to monitor and review the reclaimed water system and additions or extensions thereto.

8.6.2. At all locations where reclaimed water service is provided, the public potable water supply shall be protected by installation of a backflow prevention device as required by the City of Titusville Water Resources Department Cross-Connection Control Program Manual.
8.6.3. No cross connection between the reclaimed water system and the potable water system shall be allowed.

8.6.4. Prior to receiving reclaimed water service, the Contractor shall install a dual check valve (a backflow prevention device) or the backflow prevention device as required by the Cross-Connection Control Program Manual on each residential customer’s potable water meter in order to protect the potable water system.

8.6.5. Dual check valves shall be capable of being removed in line and shall be the Ford Retrosetter Style B or C, or COT approved equal.

8.6.6. Reclaimed services shall be locked off using a HIGHFIELD mfg Mini lock seal assembly until inspection and approval for service by the City Utility Inspector.

8.7. VALVE LOCATION MARKING: Curbs shall be etched with the letter “V”, three (3) inches in height, with the point of the “V” facing the valve, to designate the location of valves.

8.8. PUBLIC NOTIFICATION

8.8.1. The public shall be notified of use of reclaimed water by posting advisory signs designating the nature of the reuse project area where reuse is practiced.

8.8.2. Signage shall be placed, as appropriate, at entrances to residential neighborhoods where reclaimed water is used for landscape irrigation and at prominent locations at all commercial sites, including multi-family developments, office parks, schools, churches, condominiums, residential common areas, recreational developments, and golf courses. A notification method for golf courses, for example, would be to post an advisory sign at the entrance to a golf course and at the first and tenth tees as well as notes on scorecards.

8.8.3. Advisory signs shall be color-coded Pantone Purple 522C and include the following text, “RECLAIMED WATER” and bearing the words in English and Spanish, “DO NOT DRINK, NO BEBER”, together with the equivalent standard international symbol.

8.8.4. Advisory signs shall be posted adjacent to lakes or ponds used to store reclaimed water and at decorative water features that use reclaimed water. Advisory signs at storage ponds or decorative water features shall include the following text, “RECLAIMED WATER” and bearing the words in English and Spanish, “DO NOT DRINK, NO BEBER” and “DO NOT SWIM, NO NADIR”, together with the equivalent international symbols.
9.0 PERVIOUS CONCRETE CONSTRUCTION STANDARDS

9.1. INSPECTION

9.1.1. Inspect the pervious pavement for staining, ponding, deposited sediments, leaves or debris. This should be performed during or after a rain event. If a rain event has not predicted a garden hose can be placed at several locations of the pavement and allowed to run for a minute or so, at each location.

9.1.2. INITIAL INSPECTION

9.1.2.1. Period between post-construction and pre-opening to traffic for service. Visually inspect the entire pervious concrete pavement for sediment deposit from possible sources such as, but not limited to, construction activities, installation of irrigation system and landscaping, etc. Proper maintenance technique shall be implemented to correct any deficiencies. See Maintenance section below for vacuuming & water pressure washing techniques.

9.1.2.2. Visually inspect the entire pervious concrete pavement for surface defects such as spalling, cracking and/or raveling. Document all surface defects and use industry recommendation for corrective measures.

9.1.2.3. Prior to opening to traffic, it is recommended that an initial in-place infiltration rate be tested and the results are used as benchmark for future inspection. See Determining Frequency of Maintenance subsection below for more details on ASTM C 1701 Test Method. Select test location, preferably in high traffic area, one per 2500 SF. Properly document the selected test location(s) for future inspection & testing. Document all initial results for each test location. These will be used as “established benchmark” against future results. Any initial result that is below 100 in./hr. shall be retested and replacement may be required. Future testing location can be performed within 5 ft radius of the original selected test location.

9.1.3. POST INSPECTION

9.1.3.1. Period after opening to traffic. Annually inspect the entire pervious concrete pavement for signs of clogging due to heavy deposit of sediments from adjacent unpaved areas, landscapes, trees, runoff from impervious surfaces, etc. during or immediately after a rain event. Clogging is defined as standing water above the pavement surface in excess of 24 hrs after the last rain event. Implement proper maintenance procedure to correct the deficiency.

9.1.3.2. In-lieu of a rain event, perform an in-place infiltration test using the pre-selected test location(s) above to compare any potential changes in water infiltration rate. When a result is below 50% of the “established benchmark” rate or less than 100 in./hr., initiate maintenance
procedure(s) to rejuvenate the pervious concrete pavement. Retest. If the result continues to remain below 50% of the “established benchmark” rate or less than 100 in./hr., pressure wash the pavement, then vacuum or use alternative cleaning method. A full-depth slab replacement may be necessary if rejuvenation attempts are unsuccessful.

9.1.3.3. When stormwater is visible above the pavement surface and recess within the 24-hr period, vacuum or use alternative cleaning method is recommended within 6 months of the inspection date. When an in-place infiltration test result is between 25% and 50% of the “established benchmark” rate, vacuum or use alternative cleaning method is recommended within 6 months of the inspection date. No retesting is required.

9.1.3.4. Visually inspect the entire pervious concrete pavement for surface defects such as spalling, cracking and/or raveling. Document all surface defects and use industry recommendation for corrective measures.

9.1.3.5. Inspect the structural integrity of the pervious pavement for spalling, cracking or raveling.

9.1.3.6. Inspect contributing impervious areas for sediment buildup and damage. Sediment should be removed.

9.1.3.7. Inspect adjacent and contributing landscaped and green areas for sources of sediment buildup or areas that may require better stabilization with erosion control.

9.2. CLEANING

9.2.1. Cover any grease or oil spots with kitty litter or sweeping compound. Allow the substances one (1) hour to soak up the grease and oil from the porous concrete. Remove the kitty litter or compound by sweeping with a broom or pressure washer if necessary. Properly dispose of any residual product.

9.2.2. Spray a biodegradable degreaser over any remaining stains on the concrete. Let the degreasers work on the stains for 30 minutes.

9.2.3. A Wet the concrete with a water hose. Apply 3 to 4 teaspoons of liquid laundry mild detergent. Scrub the soap into the concrete with a shop broom.

9.2.4. Starting at one end of the concrete, rinse the soap from the surface with a water hose using a jet nozzle. Use back and forth sweeping motions to move the soap suds across the concrete till it dissipates. Inspect the stains after removing the soap. Reapply the degreaser, if necessary.

9.3. MAINTENANCE

9.3.1. Sweeping (dry sweeping) should be performed routinely to remove any surface debris before it can infiltrate the pervious concrete. Smaller walk-behind leaf vacuums or leaf blowers can be used for smaller parking lots. Walk behind
sweepers, riding sweepers or truck mounted units can be used for larger parking lots. Sweeping should be performed over the entire parking lot not just the pervious concrete.

9.3.2. FREQUENCY OF MAINTENANCE

9.3.3. The required frequency of maintaining a pervious concrete system is different for every pavement. The variables are, but not limited to the followings;

9.3.3.1. Trees & type of vegetation,

9.3.3.2. Mounted landscaping,

9.3.3.3. Runoff from impervious surfaces,

9.3.3.4. Unpaved areas surround pervious system,

9.3.3.5. Volume of traffic, etc.

9.3.4. There are 2 methods that can used to determine the fluctuation of the pavement infiltration rate; The Embedded Ring Infiltrometer Kit (ERIK) device, which was developed by the UCF’s Stormwater Academy or the ASTM C 1701 “Standard Test Method for Infiltration Rate of In-Place Pervious Concrete”. The ERIK device is installed during construction and remained in place the entire service life of the pavement. The ASTM Method is used any time after construction and can be used over any test location. For more information on the ERIK device, contact the UCF’s Stormwater Academy. For determining the in-place infiltration rate, the ASTM Method is preferred.

9.3.5. DETERMINING FREQUENCY OF MAINTENANCE

9.3.5.1. Determine an in-place infiltration rate of the pervious concrete pavement using ASTM C 1701 Test Method and use the results to establish a benchmark for future inspection & frequency of maintenance. Select test location, preferably in high traffic area, one per 2500 SF. Properly document the selected test location(s) for future inspection & testing. Future testing location can be performed within 5 ft radius of the original selected test location.

9.3.5.2. Document all testing results and compare against “established benchmark” rate. When a result is below 50% of the “established benchmark” rate or less than 100 in./hr., initiate maintenance procedure(s) to rejuvenate the pervious concrete pavement. Retest.

9.3.5.3. When an in-place infiltration test result is less than 25% of the “established benchmark” rate over 2 consecutive inspection cycles, the next inspection shall be 2 years from the previous date. When the result is between 25% and 50% of the “established benchmark” rate, vacuum or use alternative cleaning method is recommended within 6 months of the inspection date. No further testing is required until a year from the previous date.
9.3.6. VACUUMING

9.3.6.1. When pervious concrete pavement is maintained annually, surface vacuuming is the most effective method in collecting sediments, leaves, debris, etc. deposited on pavement surface due to normal use. Vacuuming shall be done while the pavement is dry or fully saturated. Do not use sprayers to moisten the surface during vacuuming. Standard street sweeper types with capability of vacuuming are most effective. Maintenance procedures shall be performed 50’ in both side of the test location in the direction of traffic and at a minimum of 12’ wide or 1000 SF with test location at center. Retest location. If the result remains below 50% of “established benchmark” level or 100 in./hr., the owner may seek and implement an alternative maintenance method, then retest or replace the clogged section at full-depth with similar pervious concrete mixture. See Full-Depth Replacement section below.

9.3.6.2. Pressure washing should be performed when routine maintenance has been neglected. The goal for power washing is to dislodge particles in the top portions of the pervious concrete and flush them off the pavement.

9.3.7. WATER PRESSURE WASHING

9.3.7.1. Water pressure washing of the pervious concrete pavement is normally considered when the pavement exhibits near zero infiltration from performing the ASTM C 1701 Test Method due to lack of maintenance over a period of 5 or more years in service. Pressure washing shall be done over the affected areas with a minimum of two (2) passes, then vacuum over the washed areas with a minimum of two (2) passes. Follow the Vacuuming procedures above.

9.3.7.2. Annual maintenance should be performed using a street sweeper that uses water in conjunction with brushes and vacuum to clean the surface.

9.3.8. REPAIR

9.3.8.1. Replacement of a section of pervious concrete is to be done by cutting the pavement at an existing control or construction joint. The section should be cut full depth, removed and replaced with pervious concrete per City of Titusville Specifications.

9.3.8.2. Full-Depth Replacement

9.3.8.3. Prior to full-depth replacement due to clogging, the owner is allowed to retest using ASTM C1701 method within 5 ft radius of the clogged location. If the result is above the 50% level of the “established benchmark”, no replacement is required. If the result is below, replace the entire panel at full-depth. A panel is defined by four sides, which made up of either a construction, isolation and/or contraction joints.
9.3.8.4. Slab replacement due to spalling, cracking and/or raveling shall be determined based on the severity of the case. Currently there is no specific direction on how to quantify the degree of the problem that would trigger a full-depth replacement of the slab. Some loose gravel on the surface is an acceptable condition and vacuum or use alternative cleaning method is recommended to correct the condition. When spalling, cracking and/or raveling become a safety issue for pedestrians, a full-depth slab replacement shall be completed within 90 days from the date the problem was identified and documented.
10.0 STORMWATER CONVEYANCE SYSTEMS CONSTRUCTION STANDARDS

10.1. HYDRAULIC DESIGN CRITERIA

10.1.1. This section of the City of Titusville’s Stormwater Design Criteria Manual shall be utilized in the design of the collection and conveyance portion of any stormwater management facility to be constructed and to be maintained by the City and shall be designed per City of Titusville Specifications.

10.2. GENERAL ROAD/PAVEMENT DRAINAGE DESIGN

10.2.1. Good pavement drainage design consists of the proper selection of grades, cross slopes, curb types, inlet locations, etc., to remove the design storm rainfall from the pavement in a cost-effective manner while preserving the safety, traffic capacity and integrity of the highway and street system. Additionally, protection of the convenience of pedestrian traffic is essential. These factors are generally considered to be satisfied when undue spreads of water are removed from the vehicular and pedestrian traveled ways and siltation at pavement low points is not allowed to occur. The guidelines included herein will accomplish these objectives.

10.3. MINIMUM GROUNDWATER AND HIGH WATER CLEARANCES

10.3.1. All arterial streets shall be designed to provide a minimum of two feet (2’) between the bottom of the base and the sustained ground water table. A sustained ground water table is defined as that which is prevalent during the wettest portion of the year. The clearance required for residential and collector streets under the same conditions shall be one foot (1’).

10.4. RUNOFF DETERMINATION

10.4.1. The peak rates of runoff for which the pavement drainage system must be designed may be determined by the Rational Method. The coefficients of runoff to be used are those shown in Table 5.

### TABLE 5

<table>
<thead>
<tr>
<th>Roughness Coefficients</th>
<th>Manning's “n” for Street Gutters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Gutter troweled finish</td>
<td>0.012</td>
</tr>
<tr>
<td>Asphalt Pavement</td>
<td></td>
</tr>
<tr>
<td>(1) Smooth texture</td>
<td>0.013</td>
</tr>
<tr>
<td>(2) Rough texture</td>
<td>0.016</td>
</tr>
<tr>
<td>Concrete gutter with asphalt pavement</td>
<td></td>
</tr>
<tr>
<td>(1) Smooth texture</td>
<td>0.013</td>
</tr>
<tr>
<td>(2) Rough</td>
<td>0.015</td>
</tr>
<tr>
<td>Concrete Pavement</td>
<td></td>
</tr>
<tr>
<td>(1) Float finish</td>
<td>0.014</td>
</tr>
<tr>
<td>(2) Broom finish</td>
<td>0.016</td>
</tr>
</tbody>
</table>
10.5. STORMWATER SPREAD INTO TRAVELED LANE

10.5.1. Inlets shall be spaced at all low points and along continuous grades so as to prevent the spread of water from exceeding tolerable limits. The acceptable tolerable limits within the City are approximately one-half of the travel lane width for two-lane roadways and one full lane width of the outside travel lane for roads consisting of three or more lanes. For two-lane roadways with twenty four feet (24') of pavement, a six-foot (6') spread measured from the face of curb is considered acceptable. For multilane facilities with no paved shoulders, a twelve-foot (12') spread is also considered the maximum spread. For roadways with parking lanes or paved shoulders, the maximum spread shall be measured from the face of curb to the centerline of the outermost lane. However, the depth of flow at the gutter shall be such that one inch (1") of clearance is maintained between the top of curb and design water surface. Spread of water shall be calculated by making use of the roughness coefficients shown in Table 35-1.

10.6. ALLOWABLE LENGTH OF GUTTER FLOW TO FIRST INLET

10.6.1. A maximum distance of four hundred feet (400’) shall be allowed for flow in a curb and gutter section to the first point of removal from the pavement by an inlet. A lesser distance may be dictated by the water spread criteria included above.

10.7. INLET TYPES

10.7.1. The inlet types to be used in the City shall be the latest version of the Florida Department of Transportation (FDOT) inlet types 1, 2, 3, and 4. Complete details can be found in FDOT Roadway and Traffic Design Standards.

10.8. INLET CAPACITY

10.8.1. Inlet capacities and intake rates for varying cross slopes and longitudinal grades shall be determined from approved FDOT standards.

10.9. LOW POINT INLETS

10.9.1. All inlets at low points (sumps) shall be designed to intercept 100% of the design flow without exceeding the allowable spread of water into the traveled lanes as defined above. On arterial and collector roadways, in order to prevent siltation and to provide for a safety factor against clogging of a single inlet in a sump location, the applicant shall construct multiple inlets at all sump locations. Preferably three inlets should be constructed on each side of the roadway, one at the low point and one to each side at a point 0.2 feet higher than the low point. This multiple inlet sump design is also desirable but not mandatory on minor streets.

10.10. MISCELLANEOUS INLET PLACEMENT
10.10.1. For maintenance purposes, no curb inlets shall be placed on radii of curb returns, and the applicant must demonstrate adequate protection of inlets from damage. All stormwater shall be removed prior to pedestrian crossing or bicycle facilities. Inlets shall be placed at all points where the cross slope on a roadway reverses from a negative to a positive to prevent stormwater from crossing the roadway.

10.11. STORM SYSTEM DESIGN

10.11.1. The purpose of this section is to outline in general the criteria governing the design of all storm sewer systems constructed within the City of Titusville. These criteria are intended to govern not only new systems being constructed by governmental agencies and private developers, but also for the analysis and/or redesign of existing systems.

10.12. MINIMUM PIPE SIZE

10.12.1. The minimum size of pipe to be used in storm sewer systems is fifteen (15) inches. Designs shall be based upon six inch increments in sizes above eighteen (18) inches.

10.12.2. MAXIMUM AND MINIMUM PIPE SLOPES: All storm sewers shall be designed and constructed to produce a minimum mean velocity of 2.0 fps. No storm sewer system or portion thereof will be designed to produce velocities in excess of 10.0 fps. All pipes shall be constructed of reinforced concrete (RCP) or corrugated aluminum (CAP).

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Minimum Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RCP</td>
</tr>
<tr>
<td>15&quot;</td>
<td>0.4%</td>
</tr>
<tr>
<td>18&quot;</td>
<td>0.3%</td>
</tr>
<tr>
<td>24&quot;</td>
<td>0.2%</td>
</tr>
<tr>
<td>30&quot;</td>
<td>0.15%</td>
</tr>
<tr>
<td>36&quot;</td>
<td>0.10%</td>
</tr>
<tr>
<td>42&quot;</td>
<td>0.08%</td>
</tr>
<tr>
<td>48&quot;</td>
<td>0.07%</td>
</tr>
<tr>
<td>54&quot; &amp; larger</td>
<td>0.05%</td>
</tr>
</tbody>
</table>

10.12.3. MAXIMUM PIPE LENGTH: The following maximum runs of pipe shall be used when spacing access structures of any type.

<table>
<thead>
<tr>
<th>Pipe Diameter (or minimum dimension of elliptical pipe or box culvert)</th>
<th>Absolute Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 24&quot;</td>
<td>300 feet</td>
</tr>
<tr>
<td>24&quot; or larger</td>
<td>400 feet</td>
</tr>
</tbody>
</table>

10.12.4. PIPE MATERIAL: All storm pipe is to be constructed of reinforced concrete pipe (RCP) or corrugated aluminum pipe (CAP) or corrugated HDPE. CAP and corrugated HDPE is not allowed under pavement.

10.13. MINIMUM PIPE COVER
10.13.1. The minimum pipe cover shall be two feet (2.0’). Special considerations may be considered if located under parking areas or roads if the pipe is upgraded to Class IV RCP.

10.14. HYDRAULIC GRADE LINE

10.14.1. The hydraulic grade line of the stormwater conveyance system shall be a minimum of six inches (6”) below the flow line of the inlet.

10.15. DESIGN TAILWATER

10.15.1. All storm sewer systems shall be designed taking into consideration the tailwater of the receiving facility or body of water for the 10-year/24-hour storm event. Generally, the tailwater must be determined by calculations based upon the design criteria and frequencies contained in this section.

10.16. TIME OF CONCENTRATION

10.16.1. A minimum time of concentration to be utilized in storm sewer computations shall be fifteen (15) minutes for single family and duplex residential projects, and ten (10) minutes for all other developments.
APPENDIX A
Approved Vendor List
<table>
<thead>
<tr>
<th>Category</th>
<th>Manufacturer</th>
<th>Water (Model #, Comments)</th>
<th>Reclaim (Model #, Comments)</th>
<th>Wastewater (Model #, Comments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Release Valves</td>
<td>ARI</td>
<td>ARI D-040 2” only</td>
<td>ARI D-040 2” only</td>
<td>ARI D-025 2” only</td>
</tr>
<tr>
<td></td>
<td>Apco</td>
<td>200 2” only</td>
<td>200 2” only</td>
<td>ASV-401 2” only</td>
</tr>
<tr>
<td></td>
<td>Val-Matic</td>
<td>VM-45 2” only</td>
<td>VM-45 2” only</td>
<td>VM-801A 2” only</td>
</tr>
<tr>
<td>ARV Enclosures</td>
<td>Water Plus</td>
<td>No. 30131632 (LG) Blue</td>
<td>No. 30131632 (LG) Pantone</td>
<td>No. 30131632 (LG) Green</td>
</tr>
<tr>
<td></td>
<td>Water Plus</td>
<td>No. 40171730 (SM) Blue</td>
<td>No. 40171730 (SM) Pantone</td>
<td>No. 40171730 (SM) Green</td>
</tr>
<tr>
<td>Gate Valves</td>
<td>AVK</td>
<td>Series 25</td>
<td>Series 25</td>
<td>Series 25</td>
</tr>
<tr>
<td></td>
<td>AFC</td>
<td>Series 2500</td>
<td>Series 2500</td>
<td>Series 2500</td>
</tr>
<tr>
<td></td>
<td>Mueller</td>
<td>Series A 2360</td>
<td>Series A 2360</td>
<td>Series A 2360</td>
</tr>
<tr>
<td></td>
<td>Clow</td>
<td>F6100</td>
<td>F6100</td>
<td>F6100</td>
</tr>
<tr>
<td>Larger than 12”</td>
<td>AVK</td>
<td>Series 25</td>
<td>Series 25</td>
<td>Series 25</td>
</tr>
<tr>
<td></td>
<td>AFC</td>
<td>Series 2500</td>
<td>Series 2500</td>
<td>Series 2500</td>
</tr>
<tr>
<td></td>
<td>Mueller</td>
<td>Series A 2361</td>
<td>Series A 2361</td>
<td>Series A 2361</td>
</tr>
<tr>
<td></td>
<td>Clow</td>
<td>F6100</td>
<td>F6100</td>
<td>F6100</td>
</tr>
<tr>
<td>Gate Valves</td>
<td>AVK</td>
<td>Series 25</td>
<td>Series 25</td>
<td>Series 25</td>
</tr>
<tr>
<td></td>
<td>AFC</td>
<td>Series 2500</td>
<td>Series 2500</td>
<td>Series 2500</td>
</tr>
<tr>
<td></td>
<td>Mueller</td>
<td>Series A 2361</td>
<td>Series A 2361</td>
<td>Series A 2361</td>
</tr>
<tr>
<td></td>
<td>Clow</td>
<td>F6100</td>
<td>F6100</td>
<td>F6100</td>
</tr>
<tr>
<td>Valves and Accessories</td>
<td>Tapping</td>
<td>AVK</td>
<td>Series 25</td>
<td>Series 25</td>
</tr>
<tr>
<td></td>
<td>Tapping</td>
<td>AFC</td>
<td>Series 2500</td>
<td>Series 2500</td>
</tr>
<tr>
<td></td>
<td>Tapping</td>
<td>Mueller</td>
<td>Series A 2361</td>
<td>Series A 2361</td>
</tr>
<tr>
<td></td>
<td>Tapping</td>
<td>Clow</td>
<td>F6114</td>
<td>F6114</td>
</tr>
<tr>
<td>Valve Boxes</td>
<td>Russco</td>
<td>VB262</td>
<td>VB262-RECL LID</td>
<td>VB262-SEWER LID</td>
</tr>
<tr>
<td></td>
<td>Tyler</td>
<td>Series 6850</td>
<td>Series 6850-RECL LID</td>
<td>Series 6850-SEWER LID</td>
</tr>
<tr>
<td></td>
<td>Star</td>
<td>V8562S</td>
<td>V8562S-RECL LID</td>
<td>V8562S-SEWER LID</td>
</tr>
<tr>
<td>Valve Ext.</td>
<td>Custom Fab</td>
<td></td>
<td>w/ctr. ring &amp; set screws</td>
<td>w/ctr. ring &amp; set screws</td>
</tr>
<tr>
<td></td>
<td>Geneco</td>
<td></td>
<td>w/ctr. ring &amp; set screws</td>
<td>w/ctr. ring &amp; set screws</td>
</tr>
<tr>
<td></td>
<td>Approved Equal</td>
<td></td>
<td>w/ctr. ring &amp; set screws</td>
<td>w/ctr. ring &amp; set screws</td>
</tr>
<tr>
<td>Valve Box Alignment Rings</td>
<td>BOXLOX</td>
<td>#1</td>
<td>#1</td>
<td>#1</td>
</tr>
<tr>
<td></td>
<td>BOXLOX</td>
<td>#2</td>
<td>#2</td>
<td>#2</td>
</tr>
<tr>
<td>Category</td>
<td>Product Description</td>
<td>Water Model</td>
<td>Water Comments</td>
<td>Reclaim Model</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Corporation Stops</td>
<td>Ball type 1&quot; with AWWA Taper CC Threads/CTS</td>
<td>Ford</td>
<td>FB1000-4-NL</td>
<td>F1000-4-NL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>P15008/H15008</td>
<td>P15008/H15008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>4701-22</td>
<td>4701-22</td>
</tr>
<tr>
<td>Corporation Stops</td>
<td>Ball Type 2&quot; with MIP x CTS</td>
<td>Ford</td>
<td>FB1700-7-NL</td>
<td>FB1700-7-NL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>B-20046</td>
<td>B-20046</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>73149B</td>
<td>73149B</td>
</tr>
<tr>
<td>Corporation Stops (Jumper)</td>
<td>Ball Type 2&quot; with MIP x CTS</td>
<td>Ford</td>
<td>FB1100-7-NL</td>
<td>FB1100-7-NL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>P=25028N</td>
<td>P=25028N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>74704B-22</td>
<td>74704B-22</td>
</tr>
<tr>
<td>Corporation Stops (Services)</td>
<td>Ball Type 2&quot; with MIP x CTS</td>
<td>Ford</td>
<td>B-43-342W</td>
<td>B-43-342W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>P24350/B24350</td>
<td>P24350/B24350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>6100MW-22</td>
<td>6100MW-22</td>
</tr>
<tr>
<td>Curb Stops</td>
<td>Straight Valves- Ball Type-Full Port compression by meter CTS OD X 5/8 X 3/4 meter</td>
<td>Ford</td>
<td>BF43-777W-G/</td>
<td>BF43-777W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>B24335/P24335</td>
<td>B24335/P24335</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>6100MW-22</td>
<td>6100MW-22</td>
</tr>
<tr>
<td>Curb Stops</td>
<td>Straight Valves- Ball Type-Full Port compression by meter flange CTS OD X 2&quot; flange</td>
<td>Ford</td>
<td>BA-33-342W</td>
<td>BARW-33-342W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>P24258/B24258</td>
<td>P24258/B24258</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>4642B-22</td>
<td>4642B-22</td>
</tr>
<tr>
<td>Angle Stops (Below grade)</td>
<td>Ball type 1&quot; CTS OD, by 5/8 X 3/4 meter</td>
<td>Ford</td>
<td>BA-33-342W</td>
<td>BARW-33-342W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>P24258/B24258</td>
<td>P24258/B24258</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>4642B-22</td>
<td>4642B-22</td>
</tr>
<tr>
<td>Angle Stops (Above Grade)</td>
<td>Ball type 1&quot; FIP OD, by 5/8 X 3/4 meter</td>
<td>Ford</td>
<td>BA-13-342W-NL</td>
<td>BARW-13-342W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>B24265N</td>
<td>B24265N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>4642BT</td>
<td>4642BT-RWT</td>
</tr>
<tr>
<td>Angle Stops (Above grade)</td>
<td>Ball Type 2&quot; FIP OD by meter flange</td>
<td>Ford</td>
<td>BFA13-777W-NL</td>
<td>BFARW13-777W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>B24286N</td>
<td>B24286N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald</td>
<td>4604BT</td>
<td>4604BT-RWT</td>
</tr>
<tr>
<td>Service Saddles</td>
<td>Epoxy coated DIP, type 304 straps, 1&quot; CC threads, single strap 2&quot; through 8&quot;, double strap 10&quot; and larger</td>
<td>Romac</td>
<td>R101N</td>
<td>R101N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>DR15</td>
<td>DR15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JCM</td>
<td>405S</td>
<td>405S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ford</td>
<td>Series FC101</td>
<td>Series FC101</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smith Blair</td>
<td>31S</td>
<td>31S</td>
</tr>
<tr>
<td>Category</td>
<td>Product Description</td>
<td>Manufacturer</td>
<td>Water</td>
<td>Reclaim</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>Epoxy coated DIP, type 304 straps, 2&quot; IPT, single strap 2&quot; through 8&quot;, double strap 10&quot; and larger</td>
<td>Romac R202N</td>
<td>R202N</td>
<td>R202N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller DR25</td>
<td>DR25</td>
<td>DR25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICM 406D</td>
<td>406D</td>
<td>406D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ford Series FC202</td>
<td>Series FC202</td>
<td>Series FC202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smith Blair 317</td>
<td>317</td>
<td>317</td>
</tr>
<tr>
<td>Service Saddle</td>
<td>Assemblies with Angle ball valves 1&quot; CTS x 3/4 x 7-1/2&quot;</td>
<td>Ford UV843-42W</td>
<td>UV8RW43-42W</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller P15363-05</td>
<td>P15363-05-20</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McDonald 09U2BW</td>
<td>09U2BW</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>4&quot; to 12&quot; to be Class 350; 16&quot; to 24&quot; to be Class 250</td>
<td>American Cement Lined</td>
<td>Cement Lined</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cloe Cement Lined</td>
<td>Cement Lined</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McWane Cement Lined</td>
<td>Cement Lined</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US Pipe Cement Lined</td>
<td>Cement Lined</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td>Ductile Iron Pipe</td>
<td>4&quot; to 12&quot; AWWA C-900; DR-18</td>
<td>Diamond Plastic C-900</td>
<td>Blue</td>
<td>C-900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Freedom Plastic C-900</td>
<td>Blue</td>
<td>C-900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JM Manufacturing C-900</td>
<td>Blue</td>
<td>C-900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>National Pipe C-900</td>
<td>Blue</td>
<td>C-900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NAPCO C-900</td>
<td>Blue</td>
<td>C-900</td>
</tr>
<tr>
<td></td>
<td>HDPE Pipe DR11 AWWA 906 shall be ductile iron pipe size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901 or AWWA C906. Pipe joints shall be butt fusion or electro-fusion with MJ flange adaptor. All HDPE shall be color coded to the utility.</td>
<td>JM Eagle DR 11 Blue</td>
<td>DR 11 Pantone</td>
<td>DR 11 Green</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approved equal DR 11 Blue</td>
<td>DR 11 Pantone</td>
<td>DR 11 Green</td>
</tr>
<tr>
<td></td>
<td>Polyethylene Tubing</td>
<td>Endot- Yardley 2&quot; only Blue</td>
<td>1&quot;, 1-1/2&quot;, 2&quot; Pantone SDR 9 EndoTrace Green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C153 SSB/ C110 FLG-Cement or fusion bonded epoxy lined; DOMESTIC ONLY</td>
<td>American Permafuse or Cement</td>
<td>Permafuse or Cement</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tyler/Union Permafuse or Cement</td>
<td>Permafuse or Cement</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US Pipe Permafuse or Cement</td>
<td>Permafuse or Cement</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Star Permafuse or Cement</td>
<td>Permafuse or Cement</td>
<td>401 Protecto lined</td>
</tr>
<tr>
<td></td>
<td>Ductile Iron Pipe; DOMESTIC ONLY</td>
<td>EBAA Iron Inc Series 1500/1600-TD</td>
<td>Series 1500/1600-TD</td>
<td>Series 1500/1600-TD</td>
</tr>
<tr>
<td></td>
<td>Bell Restraints</td>
<td>Ford UniFlange Series 1390-C</td>
<td>UniFlange Series 1390-C</td>
<td>UniFlange Series 1390-C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sigma PV-Lok PWP Bell Restraint</td>
<td>PV-Lok PWP Bell Restraint</td>
<td>PV-Lok PWP Bell Restraint</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tyler/Union Tufgrip Series 300C</td>
<td>Tufgrip Series 300C</td>
<td>Tufgrip Series 300C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Star Series 1100C</td>
<td>Series 1100C</td>
<td>Series 1100C</td>
</tr>
</tbody>
</table>
# City of Titusville
## Water Resources Department

## Table of Pipe and Hydrant Information

<table>
<thead>
<tr>
<th>Category</th>
<th>Product</th>
<th>Manufacturer</th>
<th>Water</th>
<th>Reclaim</th>
<th>Wastewater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Model #</td>
<td>Comments</td>
<td>Model #</td>
</tr>
<tr>
<td>Bell Restraints</td>
<td>Ductile Iron Pipe; DOMESTIC ONLY</td>
<td>EBAA Iron Inc</td>
<td>Mega-lug Series 1100</td>
<td>Mega-lug Series 1100</td>
<td>Mega-lug Series 1100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ford</td>
<td>UFR-1400u</td>
<td>UFR-1400u</td>
<td>UFR-1400u</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sigma</td>
<td>One-Lok</td>
<td>One-Lok</td>
<td>One-Lok</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tyler/Union</td>
<td>Tufgrip Series 1000</td>
<td>Tufgrip Series 1000</td>
<td>Tufgrip Series 1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Star</td>
<td>Series 3000</td>
<td>Series 3000</td>
<td>Series 3000</td>
</tr>
<tr>
<td>Restrained Gaskets</td>
<td>Ductile Iron Pipe</td>
<td>American</td>
<td>Fast Grip Gasket</td>
<td>Fast Grip Gasket</td>
<td>Fast Grip Gasket</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US Pipe</td>
<td>Field-Loc Gasket</td>
<td>Field-Loc Gasket</td>
<td>Field-Loc Gasket</td>
</tr>
<tr>
<td>Pipe Fittings</td>
<td>PVC Pipe</td>
<td>EBAA Iron Inc</td>
<td>Series 1500/1600</td>
<td>Series 1500/1600</td>
<td>Series 1500/1600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ford</td>
<td>Uni-flange Series 1390-C</td>
<td>Uni-flange Series 1390-C</td>
<td>Uni-flange Series 1390-C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sigma</td>
<td>Sigma PV-Lok PWP</td>
<td>Sigma PV-Lok PWP</td>
<td>Sigma PV-Lok PWP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tyler/Union</td>
<td>Tufgrip Series 300 C</td>
<td>Tufgrip Series 300 C</td>
<td>Tufgrip Series 300 C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Star</td>
<td>Series 1100C</td>
<td>Series 1100C</td>
<td>Series 1100C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ford</td>
<td>UFR-1500u</td>
<td>UFR-1500u</td>
<td>UFR-1500u</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sigma</td>
<td>One-Lok</td>
<td>One-Lok</td>
<td>One-Lok</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Star</td>
<td>Series 4000</td>
<td>Series 4000</td>
<td>Series 4000</td>
</tr>
<tr>
<td>Tapping Sleeves</td>
<td>For all taps. 18-8 type 304 body, flange, and bolts. Flange to accept standard tapping valves</td>
<td>Ford</td>
<td>Series FTSS</td>
<td>Series FTSS</td>
<td>Series FTSS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JCM</td>
<td>Model 432</td>
<td>Model 432</td>
<td>Model 432</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smith Blair</td>
<td>Series 663</td>
<td>Series 663</td>
<td>Series 663</td>
</tr>
<tr>
<td>Hydrants</td>
<td>Meet City of Titusville Specifications; Stainless Steel shaft and bolting, both upper and lower. Hydrant to be epoxy coated in the color of Safety Yellow. To be barrel size 5-1/4&quot;</td>
<td>AVK</td>
<td>Series 2700</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mueller</td>
<td>Super Centurion 250</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>American Flow</td>
<td>B-84-B</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Claw</td>
<td>Medallion</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Misc</td>
<td>Polyethylene Encasement</td>
<td>Mult. Manufacturers</td>
<td>AWWA C105 Blue/Black</td>
<td>AWWA C105 Pantone/Black</td>
<td>AWWA C105 Green/Black</td>
</tr>
</tbody>
</table>
## City of Titusville
### Water Resources Department

### Model # Comments Model # Comments Model # Comments

### Category | Product | Manufacturer |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Casing Spacers</td>
<td>All sizes to be stainless steel with vinyl runners</td>
<td></td>
</tr>
<tr>
<td>Casing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Seal</td>
<td>Model 4810</td>
<td>Series CCS/CCPS/AZ</td>
</tr>
<tr>
<td>PSI</td>
<td>Series S-G-2</td>
<td>Series S-G-2</td>
</tr>
<tr>
<td>CCI</td>
<td>Model CSS</td>
<td>Model CSS</td>
</tr>
<tr>
<td>Casing End Seals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Seal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracer Wire</td>
<td>Multiple Manu.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 Guage Blue</td>
<td>14 Guage Pantone</td>
</tr>
<tr>
<td></td>
<td>10 Guage (Directional only) Blue</td>
<td>10 Guage (Directional only) Pantone</td>
</tr>
<tr>
<td>Meter Boxes</td>
<td>Rhino</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MB-17 Single Black</td>
<td>MB-17 Single Pantone</td>
</tr>
<tr>
<td></td>
<td>MB-18 Double Black</td>
<td>MB-18 Double Pantone</td>
</tr>
<tr>
<td>DFW Plastics Inc</td>
<td>1200 Series Black</td>
<td>1200 Series Pantone</td>
</tr>
<tr>
<td>DFW Plastics Inc</td>
<td>1500 Series Double Black</td>
<td>1500 Series Double Pantone</td>
</tr>
<tr>
<td>Locators</td>
<td>3M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Liners</td>
<td>AGRU America</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>N/A Agru Sure Grip</td>
</tr>
<tr>
<td></td>
<td>Gundie/SLT Environ.</td>
<td>N/A</td>
</tr>
<tr>
<td>PVC Gravity Fittings</td>
<td>Harco</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Multi Fitting</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>GPK</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Plastic Trend</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Manhole Joint</td>
<td>Canusa-CPS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Selant Tape</td>
<td></td>
</tr>
<tr>
<td>Manhole Coatings</td>
<td>Raven</td>
<td></td>
</tr>
<tr>
<td>Backflow Devices</td>
<td>Watts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Watkins</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibit #</td>
<td>WRE #</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>-----------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>C1</td>
<td>930106</td>
<td>Typical Trench Detail</td>
</tr>
<tr>
<td>C2</td>
<td>930112</td>
<td>Typical Storm Drain &amp; Ditch Crossing</td>
</tr>
<tr>
<td>C3</td>
<td>951243</td>
<td>Typical M.J. Thrust Restraint for Vertical or Lateral Offset</td>
</tr>
<tr>
<td>C4</td>
<td>090416</td>
<td>Typical Gate Valve Installation</td>
</tr>
<tr>
<td>C5</td>
<td>060945</td>
<td>Utility Placement Within a 50’ Public Road Right-Of-Way</td>
</tr>
<tr>
<td>C6</td>
<td>080736</td>
<td>Above Ground Air Release Valve Detail</td>
</tr>
<tr>
<td>C7</td>
<td>090835</td>
<td>Typical Directional Bore Conflict Resolution (1 of 2)</td>
</tr>
</tbody>
</table>

DEP Pipe Conflict Table
TRENCH WIDTH

"SECOND LIFT"
LAYERS NOT MORE THAN 9 INCHES DEEP

"FIRST LIFT"
LAYERS NOT MORE THAN 6 INCHES DEEP

PIPE BELL

DETECTION WIRE

PREPARED BED

0.6D

NOTES:
1. MAXIMUM W = D+2 FEET
2. MINIMUM W = D+16 INCHES
3. DEPTH OF COVER = 30 INCHES MINIMUM
4. COMPACT FILL AND BACKFILL IN ACCORDANCE WITH ASSHTO T-180 AND THE FOLLOWING CRITERIA:
   LOCATION AT OPTIMUM MOISTURE
   UNDER PAVED AREAS
   UPPER 12 INCHES 100
   BELOW 12 INCHES 98
   OTHER PAVED SURFACE 95

BACKFILL REQUIREMENTS

"FIRST LIFT"

PIPE MATERIAL
PLASTIC 1/2 INCH
IRON, CONC. 3 INCHES
"SECOND LIFT"
ALL MATERIALS 6 INCHES

TYPICAL TRENCH DETAIL

DEPARTMENT OF WATER RESOURCES
DATE 09/15
EXHIBIT NO. C1
SCALE N.T.S.
SHEET 1 OF 1

CITY OF TITUSVILLE, FLORIDA
NOTES:
1. WARNING SIGNS REQUIRED ON BOTH SIDES OF DITCH.
2. ALL PIPE SHALL BE CLASS 52 DUCTILE IRON. RESTRAINED JOINTS SHALL BE INSTALLED AS REQUIRED TO DEVELOP THRUST RESTRAINT.

DITCH/CANAL CROSSING DETAIL

ONE FULL LENGTH OF PIPE, CENTERED

30” MIN. COVER

6” MIN.

STORM DRAIN

12” MIN.

ONE FULL LENGTH OF PIPE, CENTERED

NOTE: PVC WATER MAIN MAY BE USED IF THERE IS A MIN. OF 18” CLEARANCE FROM THE INVERT OF THE WATER MAIN TO THE CROWN OF THE STORM DRAIN.

STORM DRAIN CROSSING
### Polyvinyl Chloride (PVC) & Poly-Wrapped Ductile Iron (DIP) Pipe

#### Restrained Joint Length (FT)

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>Tee Branch Size on Size</th>
<th>22 1/2° Bend</th>
<th>45° Bend</th>
<th>90° Bend</th>
<th>Dead End</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>54</td>
<td>4</td>
<td>8</td>
<td>20</td>
<td>58</td>
</tr>
<tr>
<td>6</td>
<td>85</td>
<td>6</td>
<td>12</td>
<td>27</td>
<td>82</td>
</tr>
<tr>
<td>8</td>
<td>118</td>
<td>7</td>
<td>15</td>
<td>35</td>
<td>107</td>
</tr>
<tr>
<td>10</td>
<td>146</td>
<td>9</td>
<td>18</td>
<td>42</td>
<td>128</td>
</tr>
<tr>
<td>12</td>
<td>176</td>
<td>10</td>
<td>21</td>
<td>49</td>
<td>151</td>
</tr>
<tr>
<td>14</td>
<td>203</td>
<td>11</td>
<td>23</td>
<td>55</td>
<td>171</td>
</tr>
<tr>
<td>16</td>
<td>231</td>
<td>13</td>
<td>26</td>
<td>62</td>
<td>193</td>
</tr>
<tr>
<td>18</td>
<td>258</td>
<td>14</td>
<td>28</td>
<td>67</td>
<td>213</td>
</tr>
<tr>
<td>20</td>
<td>285</td>
<td>15</td>
<td>31</td>
<td>73</td>
<td>234</td>
</tr>
</tbody>
</table>

#### Notes:
1. The table indicates minimum lengths of restrained joints on each side of fittings and changes in direction. Where practical, full lengths of restrained pipe shall be laid to achieve the required minimum restraint.
2. Where combinations of fittings are used, the piping between the fittings shall be restrained. The minimum restrained length of pipe required upstream and downstream of the combination of fittings shall be determined on the basis of one equivalent fitting (i.e., two 45° bends will be considered as though a 90° bend were located midway between the two 45° bends.)
3. 1 1/4" bends shall be restrained the same as that shown for 22 1/2" bends.
4. Restrained joint lengths noted are based on the test pressure, silty sands (SM), 3-feet depth, laying condition No. 5 & tee size on size.
5. In-line valves: If the straight run of pipe on both sides of the valve exceeds the length required for "dead ends", then no restrained joints are necessary.

---

**TYPICAL HORIZONTAL MECHANICAL THRUST RESTRAINT**

**City of Titusville, Florida**

---

**Department of Water Resources**

**Exhibit No.**

**Date:** 09/15

**Scale:** N.T.S.

**Sheet:** T of 1
NOTE:
INSTALL TRACER WIRE ABOVE ALL PVC MAINS. TRACER WIRE SHALL BE 14UF, WITH ONE TURN AROUND BARREL OF EACH FIRE HYDRANT AT FINISHED GRADE AND WITH 4 FEET EXCESS IN EACH VALVE BOX. CONNECT TO CONTINUOUS WIRE WITH WIRE NUTS AND ELECTRICIAN’S TAPE.
1. "R" IS TO BE BASED ON 125% OF MANUFACTURER'S RECOMMENDED RADIUS.

2. ON A CASE-BY-CASE BASIS AN MJ REDUCER WITH INTERNAL STAINLESS STEEL PIPE STIFFENER MAY BE USED IN LIEU OF FUSED MJ ADAPTORS.
## LOCATION OF PUBLIC WATER SYSTEM MAINS IN ACCORDANCE WITH F.A.C. RULE 62-555.314

<table>
<thead>
<tr>
<th>Other Pipe</th>
<th>Horizontal Separation</th>
<th>Crossings (1)</th>
<th>Joint Spacing @ Crossings (Full Joint Centered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Sewer, Stormwater Force Main, Reclaimed Water (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Main</td>
<td></td>
<td>3 ft. minimum</td>
<td></td>
</tr>
<tr>
<td>12 inches is the minimum, except for storm sewer, then 6 inches is the minimum and 12 inches is preferred</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate 3 ft. minimum</td>
<td>Water Main</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum Sanitary Sewer</td>
<td></td>
<td>10 ft. preferred</td>
<td></td>
</tr>
<tr>
<td>3 ft. minimum</td>
<td></td>
<td>6 inches minimum</td>
<td></td>
</tr>
<tr>
<td>12 inches preferred</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate 3 ft. minimum</td>
<td>WATER MAIN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravity or Pressure Sanitary Sewer, Sanitary Sewer Force Main, Reclaimed Water (4)</td>
<td></td>
<td>10 ft. preferred</td>
<td></td>
</tr>
<tr>
<td>Water Main</td>
<td></td>
<td>6 ft. minimum (3)</td>
<td></td>
</tr>
<tr>
<td>12 inches is the minimum, except for gravity sewer, then 6 inches is the minimum and 12 inches is preferred</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate 6 ft. minimum</td>
<td>WATER MAIN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Site Sewage Treatment &amp; Disposal System</td>
<td></td>
<td>10 ft. minimum</td>
<td></td>
</tr>
<tr>
<td>12 inches is the minimum, except for gravity sewer, then 6 inches is the minimum and 12 inches is preferred</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate 6 ft. minimum</td>
<td>WATER MAIN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Water main should cross above other pipe. When water main must be below other pipe, the minimum separation is 12 inches.
(2) Reclaimed water regulated under Part III of Chapter 62-610, F.A.C.
(3) 3 ft. for gravity sanitary sewer where the bottom of the water main is laid at least 6 inches above the top of the gravity sanitary sewer.
(4) Reclaimed water not regulated under Part III of Chapter 62-610, F.A.C.

Disclaimer – This document is provided for your convenience only. Please refer to F.A.C. Rule 62-555.314 for additional construction requirements.
APPENDIX C
Potable Water Details
## POTABLE WATER DETAIL DRAWINGS

<table>
<thead>
<tr>
<th>Exhibit #</th>
<th>WRE #</th>
<th>DESCRIPTION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>930103</td>
<td>Water Distribution As-Built Sample</td>
<td>05-14</td>
</tr>
<tr>
<td>W2</td>
<td>951134</td>
<td>Typical Fire Hydrant &amp; Gate Valve Installation</td>
<td>05-14</td>
</tr>
<tr>
<td>W3</td>
<td>951135</td>
<td>Alternate Fire Hydrant Installation</td>
<td>05-14</td>
</tr>
<tr>
<td>W4</td>
<td>951137</td>
<td>Temporary Jumper Connection Detail</td>
<td>05-14</td>
</tr>
<tr>
<td>W5</td>
<td>000102</td>
<td>Fire Line Backflow Preventer (1 of 2)</td>
<td>05-14</td>
</tr>
<tr>
<td>W6</td>
<td>000102</td>
<td>Fire Line Backflow Preventer (2 of 2)</td>
<td>05-14</td>
</tr>
<tr>
<td>W7</td>
<td>050420</td>
<td>3&quot; or Larger Meter Installation</td>
<td>05-14</td>
</tr>
<tr>
<td>W8</td>
<td>050524</td>
<td>Typical Water Meter Installation</td>
<td>05-14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On A Single Service Line</td>
<td></td>
</tr>
<tr>
<td>W9</td>
<td>050525</td>
<td>Typical Residential Service Connections</td>
<td>05-14</td>
</tr>
<tr>
<td>W10</td>
<td>050526B</td>
<td>Typical 1&quot; Backflow Installation</td>
<td>05-14</td>
</tr>
<tr>
<td>W11</td>
<td>050526C</td>
<td>Typical 2&quot; Backflow Installation</td>
<td>05-14</td>
</tr>
<tr>
<td>W12</td>
<td>060104</td>
<td>Typical 2&quot; Blowoff Details</td>
<td>05-14</td>
</tr>
<tr>
<td>W13</td>
<td>110931</td>
<td>Fire Hydrant and Fire Protection Appliances Clear Area</td>
<td>05-14</td>
</tr>
</tbody>
</table>
NOTES:
1. INSTALL TRACER WIRE ABOVE ALL PVC MAINS. TRACER WIRE SHALL BE 14UF, WITH ONE TURN AROUND BARREL OF EACH FIRE HYDRANT AT FINISHED GRADE AND WITH 4 FEET EXCESS IN EACH VALVE BOX. CONNECT TO CONTINUOUS WIRE WITH WIRE NUTS AND ELECTRICIAN’S TAPE.
2. HYDRANT TO BE PLACED WITH NOZZLES FACING STREET.
3. HYDRANT TO BE TRAFFIC MODEL.
4. MECHANICAL JOINT RESTRAINERS SHALL BE THRUST RESTRAINT.
5. CONTRACTOR SHALL INCLUDE ALL ITEMS SHOWN IN ASSEMBLY DETAIL IN THE UNIT PRICE, INCLUDING HYDRANT, VALVE, VALVE BOX AND TEE.
NOTE:
IN CLOSE QUARTERS WHEN ORDINARY HYDRANT INSTALLATION IS NOT POSSIBLE
AN ELBOW MAY BE INSTALLED BETWEEN
THE VALVE AND TEE IN ORDER TO ALLOW
THE FIRE HYDRANT TO BE CLOSE TO THE
WATER MAIN.
ELEVATION VIEW

*SEE SHEET 2 FOR POST PROTECTION PLAN.

LEGEND:
1. MECHANICAL JOINT TEE OR TAPPING SLEEVE/TEE
2. GATE VALVE
3. ROADWAY VALVE BOX WITH LID LABELED "FIRE"
4. 90° BEND - MECHANICAL JOINT TO FLANGE
5. DOUBLE CHECK DETECTOR ASSEMBLY
   a. OSY FLANGED VALVE
   b. 5/8"x3/4" METER W/ COUPLINGS
   c. 3/4" BACKFLOW PREVENTER
   d. 3/4" BALL VALVE

NOTES:
1. LOCATION OF DEVICE MUST BE APPROVED BY FIRE MARSHAL AND WATER RESOURCES.
2. DEVICE TO BE PROTECTED FROM FREEZING, VEHICULAR TRAFFIC AND TAMPERING. FIRE MARSHAL SHALL APPROVE METHODS OF PROTECTION.
3. PROVIDE FIRE DEPARTMENT CONNECTION WITHIN 10 FEET OF FIRE HYDRANT.
4. VALVE BOX COVER SHALL BE LABELED "FIRE".
MINIMUM OF 2 DIAMETERS DOWNSTREAM OF METER

IF METER DOES NOT HAVE A TEST PORT, THEN A TAPPING SADDLE WITH A PLUGGED 2” FULL PORT BALL VALVE MUST BE INSTALLED.

NOTE #1

SEE NOTE #1

SEE DETAIL “A”

B.F.P.

SEE DETAIL “A”

SEE NOTE #3

SEE NOTE #2

SEE NOTE #4

FOR 3” TO 4” METER, USE FULL PORT BALL VALVE CURB STOP W/ LOCKWING (FORD No. B-11-777-W)

NOTES:
1. ALL VALVES ARE OSY N.R.S. UNLESS OTHERWISE NOTED.
2. ONE PIPE SUPPORT SHALL BE PLACED AT THE INLET FLANGE OF THE OUTLET METER VALVE FOR METERS UP TO 4”.
3. FOR METERS 6” AND LARGER, TWO PIPE SUPPORTS WILL BE USED: ONE AT THE OUTLET FLANGE ON THE INLET METER VALVE AND ONE AT THE INLET SIDE OF THE OUTLET METER VALVE.
4. 3” TO 4” METERS WILL USE A 2” BRASS-THREADED BYPASS LINE. 6” AND LARGER METERS WILL USE A 4” D.I.P. BYPASS LINE. A 2” BYPASS CAN BE USED ON A 6” METER AS LONG AS IT IS A TURBINE METER.
5. USE TAP SADDLE (OR OPTIONAL TEE) FOR 2” BYPASS LINES. USE TEE FOR 4” BYPASS LINES.
A) PLASTIC METER BOX W/ CAST IRON METER LID
B) CURB STOP – BRASS LOCK WING BALL VALVE
C) WATER METER (COT FURNISHED)
D) METER DUAL CHECK (COT FURNISHED)

NOTE:
1. CONTRACTOR SHALL INSTALL CURB STOP, METER BOX AND SET TO FINISHED GRADE.
TYP. 3/4" & 1" BACKFLOW INSTALLATION
CITY OF TITUSVILLE, FLORIDA

DEPARTMENT OF WATER RESOURCES
DATE: 09/15
EXHIBIT NO.: N.T.S.
SCALE: T OF 1
TYPICAL TRAFFIC BEARING BOX DETAIL
FOR BLOWOFF OUTSIDE OF PAVEMENT

TEMPORARY AND PERMANENT BLOW OFF DETAIL

TYPICAL TRAFFIC BEARING BOX DETAIL
FOR BLOWOFF IN THE ROAD/PAVING

TYPICAL 2" BLOWOFF DETAILS
CITY OF TITUSVILLE, FLORIDA
IN ACCORDANCE WITH THE FLORIDA FIRE PREVENTION CODE (FFPC) AND THE NATIONAL FIRE PROTECTION ASSOCIATION NFPA 1, UNIFORM FIRE CODE:

1. NO PERSON SHALL PLACE OR KEEP ANY POST, FENCE, VEHICLE, GROWTH, VEGETATION, TRASH OR STORAGE OF OTHER MATERIALS THAT WOULD OBSTRUCT A FIRE HYDRANT OR FIRE PROTECTION APPLIANCE AND HINDER OR PREVENT ITS IMMEDIATE USE BY FIRE DEPARTMENT PERSONNEL.

2. CLEARANCE REQUIREMENTS FOR FIRE HYDRANTS SHALL BE SEVEN AND ONE HALF FEET (7’-6”) IN FRONT OF AND TO THE SIDES OF THE FIRE HYDRANT, WITH A FOUR FEET (4’) CLEARANCE TO THE REAR OF THE HYDRANT.

3. CLEARANCE REQUIREMENTS FOR FIRE PROTECTION APPLIANCES SHALL BE SEVEN AND ONE HALF FEET (7’-6”) IN FRONT OF AND TO THE SIDES OF THE APPLIANCES.
<table>
<thead>
<tr>
<th>Exhibit #</th>
<th>WRE #</th>
<th>DESCRIPTION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>910910</td>
<td>Standard Precast Manhole</td>
<td>05-14</td>
</tr>
<tr>
<td>S2</td>
<td>911137</td>
<td>Sanitary Sewer As-Built Sample</td>
<td>05-14</td>
</tr>
<tr>
<td>S3</td>
<td>010418</td>
<td>Typical Section Through Grease Interceptor</td>
<td>05-14</td>
</tr>
<tr>
<td>S4</td>
<td>050315</td>
<td>Typical Drop Manhole Detail</td>
<td>05-14</td>
</tr>
<tr>
<td>S5</td>
<td>050629</td>
<td>Typical Traffic Bearing Cleanout</td>
<td>05-14</td>
</tr>
<tr>
<td>S6</td>
<td>061051</td>
<td>Sanitary Sewer Manhole Frame (Ring) &amp; Cover Detail</td>
<td>05-14</td>
</tr>
<tr>
<td>S7</td>
<td>061254</td>
<td>Non-Traffic Bearing Cleanout</td>
<td>05-14</td>
</tr>
<tr>
<td>S8</td>
<td>080102</td>
<td>Typical Sewer Service Connection</td>
<td>05-14</td>
</tr>
</tbody>
</table>
FUND 1867

ADIR, ELV, VSUIT

NOTES:

1. FOR RESIDENTIAL SEWAGE ALL INTERIOR SURFACES OF THE MANHOLE TO BE COATED WITH 2 COATS RED-GREY ACRYLIC EPOXY CORNUCOPIA PAINT. EACH COAT SHALL HAVE A DRY THICKNESS OF 8 MILS FOR A TOTAL OF 16 MILS DRY.

2. FOR COMMERCIAL OR INDUSTRIAL SEWAGE, FIBERGLASS-LINED MANHOLES SHALL BE USED.

3. EXTERIORS OF THE MANHOLE ARE TO BE COATED WITH 2 COATS CONSEAL CS55 OR CITY APPROVED EQUAL. EACH COAT SHALL HAVE A DRY THICKNESS OF 3.8 MILS.

4. PRECAST MANHOLE SECTIONS TO CONFORM TO ASTM C 478 AND C 76 WITH 4000 LB. CONCRETE TYPE II CEMENT.

5. BASE SECTION OF PRECAST MANHOLE SHALL BE PLACED ON BEDDING ROCK OF 9" MINIMUM DEPTH. BEDDING ROCK EXTEND A MINIMUM OF 9" PER SIDE BEYOND THE DIAMETER OF THE MANHOLE BASE. THE FILTER FABRIC IS TO BE PLACED IN SUCH A FASHION AS TO PREVENT EARTH FROM SATURATING THE BEDDING ROCK OVER A PERIOD OF TIME.

6. WRAPID SEAL MUST BE USED ON ALL JOINTS, CASTINGS AND RISER RINGS. ON ALL JOINTS ON AIR RELEASES, MANHOLES, GREASE/WATER, OIL/WATER SEPARATORS, AND WETWELLs.

7. WRAPID SEAL MUST BE USED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

8. RAM-NEK PREMOLDED PLASTIC JOINT SEALER IS TO BE USED BETWEEN ALL MANHOLE SECTIONS.

STANDARD PRECAST MANHOLE
CITY OF TITUSVILLE, FLORIDA

DEPARTMENT OF WATER RESOURCES
DATE: 09/15
EXHIBIT NO.: 51
SCALE: N.T.S.
SHEET: 1 OF 1
HEAVY DUTY CAST IRON FRAME AND COVER
U.S. FOUNDRY NO. 225–AS–DRS OR EQUAL.
"GREASE INTERCEPTOR" TO BE STAMPED ON COVER. BRICKED TO GRADE BY CONTRACTOR

THE CITY OF TITUSVILLE REQUIRES GREASE TRAPS FOR RESTAURANTS, CAFETERIAS, COMMERCIAL KITCHENS AND SIMILAR INSTITUTIONS (TO BE MIN. 750 GALLON CAPACITY).
PRECAST SECTIONS TO CONFORM TO ASTM C427
AND 076 W/4000 PSI CONCRETE, TYPE II CEMENT
THE STRUCTURE CAN BE MADE OF PRECAST CONCRETE, WITH NO LESS THAN 4" WALLS IN NON–TRAFFIC AREA, IN TRAFFIC AREAS WAALS AND SIDES TO BE 8" TO 10" THICK AND/ OR MEET H20 TRUCK LOADING FACTOR @ 50% IMPACT PER ANSI–H–3, AND MUST BE APPROVED BY THE CITY OF TITUSVILLE PLUMBING OFFICIAL.
ALL THE ABOVE IS BASED ON FLORIDA PLUMBING CODE SECTION: 1003.5 AND THE CITY OF TITUSVILLE CODE OF ORDINANCES SECTION 21–240

NOTES:
1. INTERIOR AND EXTERIOR OF MANHOLE TO BE SMOOTHED OVER WITH CONCRETE AND BE GIVEN TWO COATS, KOPPERS HUMMATIC 500–M COAL TAR EPOXY OR EQUAL (18–22 MILS, DRY FILM THICKNESS).
2. BRICK ADJUSTMENTS TO FINISHED GRADE AS REQUIRED. 2 ROWS MIN./5 ROWS MAX. BRICKS ARE TO BE CEMENTED AND ARE TO BE LAAED SHORT END TOWARDS MANHOLE OPENING TO PROVIDE AN 8 WIDE BASE FOR MANHOLE RING.
3. PREFABRICATED PLASTIC JOINT SEALANT "RAM-NECK" OR EQUAL, TO BE PLACED BETWEEN BRICK ADJUSTMENTS AND MANHOLE RING FRAME.
4. Baffle wall shall be ram-needled or grooved.
5. PIPE OPENING IN Baffle wall shall be the same size (MIN.) AS INLET AND OUTLET PIPES TO GREASE TRAP.
6. MAXIMUM GREASE TRAP SHALL BE 2000 GALLONS UNLESS APPROVED BY THE CITY OF TITUSVILLE PRE–TREATMENT COORDINATOR.

TYPICAL SECTION THROUGH GREASE INTERCEPTOR
CITY OF TITUSVILLE, FLORIDA

DEPARTMENT OF WATER RESOURCES
DATE: 09/15
EXHIBIT NO.: S3
SCALE: N.T.S.
SHEET: 1 OF 1
TYPICAL DROP MANHOLE

Alternate method is the drop tube can be formed with a minimum 6" cover around pipe and poured with 2,500 p.s.i. (@ 28 days) concrete.

Precast concrete "U" blocks (as necessary) blocks to be keyed together & into manhole footer.

#4 @ 12" O.C. E.W.
FOR SITE TEE/INSPECTION TEE CLEANOUT IN PAVEMENT

USF 7610 HANDHOLE RING AND FC COVER MARKED WITH AN "S"

FINISHED GRADE

BASE LIME ROCK MATERIAL

(4) #4 REBAR E.W.
3" COVER (TYP.)

TWO LAYERS OF BUILDING PAPER BETWEEN PIPE AND CONCRETE

CONCRETE PAD
8" THK. x 24" SQ.
3,000 P.S.I.

REMOVABLE P.V.C. THREADED PLUG

6" P.V.C. SDR 35

NOTE: SEE CITY OF TITUSVILLE SPECIFICATIONS FOR MIN./MAX. DEPTH OF GRAVITY MAIN.

4"X4"X8' PRESSURE TREATED LANDSCAPE TIMBER W/ TOP 12" PAINTED GREEN TO MARK END POINT OF SERVICE CONNECTION.

3M EMS1258 ELECTRONIC MARKER

SITE TEE/INSPECTION TEE CLEANOUT

6" WATERTIGHT CAP

45° BEND

1% MINIMUM SLOPE

6" P.V.C. SDR 35

6"x6"x6" TEE

LENGTH VARIES

SIDEWALK

EDGE OF RIGHT-OF-WAY

12"

FINISHED GRADE

PAVEMENT

6" BRASS THREADED PLUG

SEE NOTE

6" P.V.C. SDR 35

NOTE: SEE CITY OF TITUSVILLE SPECIFICATIONS FOR MIN./MAX. DEPTH OF GRAVITY MAIN.

TYPICAL SEWER SERVICE CONNECTION

CITY OF TITUSVILLE, FLORIDA

DEPARTMENT OF WATER RESOURCES

DATE: 09/15
EXHIBIT NO.: 56
SCALE: N.T.S.
SHEET: 1 OF 1
<table>
<thead>
<tr>
<th>Exhibit #</th>
<th>WRE #</th>
<th>DESCRIPTION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>020316D1</td>
<td>Typical City Standard Wastewater Pump Station Details (1 of 2)</td>
<td>05-14</td>
<td></td>
</tr>
<tr>
<td>020316D2</td>
<td>Typical City Standard Wastewater Pump Station Details (2 of 2)</td>
<td>05-14</td>
<td></td>
</tr>
<tr>
<td>030526</td>
<td>Typical City Standard Wastewater Pump Station Details Lift Station Site Plan</td>
<td>05-14</td>
<td></td>
</tr>
</tbody>
</table>
LIFT STATION DETAILS AND SPECIFICATIONS

No.

Revision

Date

WATER RESOURCES
September 2015

N.T.S.

TYPICAL CITY STANDARD
WASTEWATER PUMP STATION DETAILS

TYPICAL CITY STANDARD
WASTE WATER PUMP STATION DETAILS

LS1
and the minimum motor chamber wastewater.

Agru American

"Typical portion of the pump shall bear directly on the sump floor. under twenty five (25) HP, the shaft shall be Stainless Steel AISI Type 420. Department

1,000 station be capable of passing a minimum three-inch (3") sphere without clogging. The

equipped for pumping force the all

be be

inches capability wet

The

or

being

all

shall

shall

a

available

be

service

Fuel

EMERGENCY OPERATIONS

provider

(1)

be

3.14.2.

published

3-M

L/S

for

The

monitoring

and

indicators, showing

of

the

removing

the

be

the

removing

of

be

available

be

fuel

be

being

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be

be
<table>
<thead>
<tr>
<th>Exhibt #</th>
<th>WRE #</th>
<th>DESCRIPTION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>030207A</td>
<td>Removable Hose Bibb &amp; Box for Reclaimed Water Service (1 of 3)</td>
<td>05-14</td>
</tr>
<tr>
<td>R2</td>
<td>030207A</td>
<td>Quick Disconnect Hose Bibb for Reclaimed Water Service (2 of 3)</td>
<td>05-14</td>
</tr>
<tr>
<td>R3</td>
<td>030633</td>
<td>Typical Non-Residential 2” Reclaimed Service Connection</td>
<td>05-14</td>
</tr>
<tr>
<td>R4</td>
<td>040834</td>
<td>Typical 3” and Larger Reuse Meter Installation</td>
<td>05-14</td>
</tr>
<tr>
<td>R5</td>
<td>070829</td>
<td>Typical Reclaimed Water Sign Detail (1 of 4)</td>
<td>05-14</td>
</tr>
<tr>
<td>R6</td>
<td>070829</td>
<td>Typical Reclaimed Water Sign Detail (2 of 4)</td>
<td>05-14</td>
</tr>
<tr>
<td>R7</td>
<td>070829</td>
<td>Typical Reclaimed Water Sign Detail (3 of 4)</td>
<td>05-14</td>
</tr>
<tr>
<td>R8</td>
<td>070829</td>
<td>Typical Reclaimed Water Sign Detail (4 of 4)</td>
<td>05-14</td>
</tr>
<tr>
<td>R9</td>
<td>090413</td>
<td>Typical Residential Reclaimed Service Connections (1 of 2)</td>
<td>05-14</td>
</tr>
</tbody>
</table>
RAINBIRD - MODFL 33DRC QUICK COUPLER BRASS VALVE
WITH A #33DK QUICK KEY - AVAILABLE AT LOCAL IRRIGATION & PUMP SUPPLY BUSINESSES OR AT www.rainbird.com

REMOVABLE HOSE BIBB & BOX FOR RECLAIMED WATER SERVICE
CITY OF TITUSVILLE, FLORIDA
**Copper & Brass Installation**

**Notes:**
1. Install purple 14UF tracer wire above pipe between valves.

**Typical Non-Residential 2” Reclaimed Service Connection**

City of Titusville, Florida
NOTES:

1. ALL VALVES ARE RESILIENT SEAT GATE VALVES BELOW GROUND N.R.S. UNLESS OTHERWISE NOTED.
2. ALL ABOVE GROUND FITTINGS SHALL BE FLANGED.
3. ALL ABOVE GROUND PIPING TO BE PAINTED PANTONE PURPLE 522C.
4. PIPING ON THE SUPPLY SIDE OF THE METER IS TO BE EVEN SIZED (2", 4", 6" ETC.).
NOTES:
1. SIGN SHALL BE 0.080 GAUGE ALUMINUM WITH WHITE BACKGROUND AND MAGENTA TEXT.
2. ADVISORY SIGNS ARE REQUIRED IN ALL AREAS SERVED BY REUSE. THE LOCATION OF THE SIGNS SHALL BE SHOWN ON THE APPROVED SITE PLAN OR REUSE IRRIGATION PLAN.
3. SIGN TO BE MOUNTED ON POST WITH 5/16" S.S. NUTS AND BOLTS.

USE 5/16" S.S. BOLTS, LOCK WASHER & NUTS TO FASTEN 1/8" THICK HOT DIPPED GALVANIZED STEEL STABILIZER PLATE

FOR SIGN POST ANCHORING SEE DETAIL RIGHT (OTHER ANCHORING DETAILS PERMITTED SUBJECT TO APPROVAL BY CITY ENGINEERING)
NOTES:
1. SIGN SHALL BE 0.080 GAUGE ALUMINUM WITH WHITE BACKGROUND AND MAGENTA TEXT.
2. ADVISORY SIGNS ARE REQUIRED IN ALL AREAS SERVED BY REUSE. THE LOCATION OF THE SIGNS SHALL BE SHOWN ON THE APPROVED SITE PLAN OR REUSE IRRIGATION PLAN.
3. SIGN TO BE MOUNTED ON POST WITH 5/16" S.S. NUTS AND BOLTS.

USE 5/16" S.S. BOLTS, LOCK WASHER & NUTS TO FASTEN 1/8" THICK HOT DIPPED GALVANIZED STEEL STABILIZER PLATE

FOR SIGN POST ANCHORING SEE DETAIL RIGHT (OTHER ANCHORING DETAILS PERMITTED SUBJECT TO APPROVAL BY CITY ENGINEERING)
CITY OF TITUSVILLE
WATER CONSERVATION PROGRAM

THIS AREA IRRIGATED WITH RECLAIMED WATER

DO NOT DRINK

NO BEBER

1/4" (MAGENTA)

WHITE BACKGROUND

0.4" LETTERS

0.5" LETTERS

0.75" LETTERS

0.45" LETTERS

1" RADIUS TYPICAL

NOTE: SIGN SHALL BE 0.080 GAUGE ALUMINUM WITH WHITE BACKGROUND AND MAGENTA TEXT.
NOTE: SIGN SHALL BE 0.080 GAUGE ALUMINUM WITH WHITE BACKGROUND AND MAGENTA TEXT.

CITY OF TITUSVILLE
WATER CONSERVATION PROGRAM

THIS AREA IRRIGATED WITH
RECLAIMED WATER

DO NOT DRINK
NO SWIMMING

NO BEBER
NO NADAR

1/4" (MAGENTA)

0.4" LETTERS

0.5" LETTERS

0.75" LETTERS

0.45" LETTERS

1" RADIUS
TYPICAL
<table>
<thead>
<tr>
<th>Exhibit #</th>
<th>WRE #</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1</td>
<td>070103</td>
<td>Typical Pervious Concrete Pavement Sign Detail (1 of 2)</td>
<td>05-14</td>
</tr>
<tr>
<td>PC2</td>
<td>070103</td>
<td>Typical Pervious Concrete Pavement Sign Detail (2 of 2)</td>
<td>05-14</td>
</tr>
<tr>
<td>PC3</td>
<td>090519</td>
<td>Typical Pervious Concrete Parking Lot Design Details – Notes</td>
<td>05-14</td>
</tr>
<tr>
<td>PC4</td>
<td>090520</td>
<td>Typical Pervious Concrete Parking Lot Design Sections</td>
<td>05-14</td>
</tr>
<tr>
<td>PC5</td>
<td>090521</td>
<td>Typical Pervious Concrete Parking Lot Design Joint Layouts (1 of 2)</td>
<td>05-14</td>
</tr>
<tr>
<td>PC6</td>
<td>090521</td>
<td>Typical Pervious Concrete Parking Lot Design Joint Layouts (2 of 2)</td>
<td>05-14</td>
</tr>
<tr>
<td>PC7</td>
<td>090522</td>
<td>Typical Pervious Concrete Parking Lot Design – Joints at Manholes (1 of 3)</td>
<td>05-14</td>
</tr>
<tr>
<td>PC8</td>
<td>090522</td>
<td>Typical Pervious Concrete Parking Lot Design – Joints at Manholes (2 of 3)</td>
<td>05-14</td>
</tr>
<tr>
<td>PC9</td>
<td>090522</td>
<td>Typical Pervious Concrete Parking Lot Design – Joints at Manholes (3 of 3)</td>
<td>05-14</td>
</tr>
</tbody>
</table>
CITY OF TITUSVILLE
WATER CONSERVATION & STORMWATER
MANAGEMENT PROGRAM

THIS AREA PAVED WITH
PERVIOUS
CONCRETE

WATER DRAINS TO SOIL

1/8" RADIUS
TYPICAL

3/8" (WHITE)
25" LETTERS
4 LETTERS
6 LETTERS
5 LETTERS

USE 5/16" S.S. BOLTS, LOCK WASHER &
NUTS TO FASTEN 1/8" THICK HOT-DIPPED
GALVANIZED STEEL STABILIZER PLATE

8'-0" X 2"
HOT DIPPED GALV.
SQUARE-CHANNEL POST

FOR SIGN POST ANCHORING SEE
DETAIL, RIGHT OTHER ANCHORING
DETAILS PERMITTED SUBJECT TO
APPROVAL BY CITY ENGINEERING

NOTES:
1. SIGN SHALL BE 0.080 GAUGE
ALUMINUM, PANTONE 359 FOR GREEN
BACKGROUND AND PANTONE 300 FOR
BLUE ARROWS.
2. THIS SIGN SHALL BE POSTED AT
PRE-DETERMINED LOCATIONS PER THE
APPROVED SITE PLAN.
3. SIGN TO BE MOUNTED ON POST WITH
5/16" S.S. NUTS AND BOLTS.
This area paved with pervious concrete. Water drains to soil.
GENERAL NOTES:

1. USE NRMCA CERTIFIED "CRAFTSMEN" FOR ALL FIELD SUPERVISION.

2. PREPARE THE BASE AND SUBGRADE IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER’S RECOMMENDATIONS FOR RIGID PAVEMENTS. SUBGRADE SOIL DENSITY TESTING MUST BE COMPLETED AND VERIFIED BY THE GEOTECHNICAL ENGINEER PRIOR TO PERVIOUS CONCRETE PLACEMENT.

3. IMPORTED SOIL USED FOR BACKFILL SHOULD BE FREE OF HEAVY CLAY, SILTS, STONES, PLANT ROOT OR OTHER FOREIGN MATERIAL GREATER THAN 1–1/2” IN DIAMETER IN ORDER TO ACHIEVE ADEQUATE COMPACTION AROUND ANY FIXED OBJECT IN GROUND.

4. KEEP ALL JOINTS CONTINUOUS.

5. CONTROL JOINTS SHALL BE FORMED WITHIN 12 HOURS FROM TIME OF PLACEMENT.

6. CURE CONCRETE IMMEDIATELY AFTER FINISHING OPERATION IS COMPLETED BY COVERING WITH A POLYETHYLENE SHEET (VISQUEEN).

CURBS:

1. ALL CURBING SHALL BE CONSTRUCTED OF CONCRETE THAT WILL OBTAIN A MINIMUM COMPRESSIVE STRENGTH OF 2,500 PSI AT 28 DAYS.

2. ALL CONCRETE CURBS SHALL BE SPACED WITH A FULL-DEPTH, 1/2” WIDE MATERIAL PRIOR TO PLACEMENT OF ADJACENT CONCRETE PAVEMENT.

3. THERE SHALL BE CONTROL JOINTS, EITHER TOOL OR SAW–CUT, TO MATCH PAVEMENT JOINTS, UNLESS OTHERWISE SPECIFIED; JOINTS SHALL BE FORMED WITHIN 12 HOURS OF PLACEMENT.
TYPICAL PARKING AREA JOINT LAYOUT

TYPE JOINT DETAILS

A  DOWELED OR UNDOWELED
B  TIED
C  CONSTRUCTION WITH KEYWAY
C-1  BUTT
D  ISOLATION
D-1  ISOLATION WITH DOWEL

LOCAL JURISDICTION MAY REQUIRE
AN ISOLATION JOINT INSTEAD OF A
CONTRACTION JOINT AT PROPERTY LINE

TYPICAL PARKING AREA JOINT LAYOUT

N.T.S.

PERVIOUS CONCRETE PARKING LOT DESIGN JOINT LAYOUTS

CITY OF TITUSVILLE, FLORIDA
JOINTS AT MANHOLES

1/2" ISOLATION JOINT
WITH SEALANT

1' MIN.

LONGITUDINAL JOINT

TRANSVERSE JOINT

N.T.S.
JOINTS AT MANHOLES

TRANSVERSE JOINT

LONGITUDINAL JOINT

1/2" ISOLATION JOINT

WITH SEALANT

1/2" ISOLATION JOINT

WITH SEALANT

LONGITUDINAL JOINT

N.T.S.