



CITY OF CUMMING DEPARTMENT OF UTILITIES

Sanitary Sewer and Pump Station Technical Standards Manual



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TABLE OF CONTENTS

| | | |
|--------------------|--------------------------------------------------------------------------|-----------|
| SECTION 100 | GENERAL | 1 |
| 101 | PURPOSE OF THIS DOCUMENT | 1 |
| 102 | USE OF THIS DOCUMENT | 1 |
| SECTION 200 | SANITARY SEWER PUMP STATIONS | 2 |
| 201 | PUMP STATIONS PROHIBITED | 2 |
| 202 | REGISTERED PROFESSIONAL REQUIRED | 2 |
| 203 | STATE REQUIREMENTS | 2 |
| 204 | PLANNING AND ZONING REQUIREMENTS | 2 |
| 205 | LEGAL DOCUMENTS AND REQUIREMENTS | 3 |
| 206 | PUMP STATION AND WETWELL MATERIALS:..... | 4 |
| 207 | PUMP DESIGN AND MATERIALS | 23 |
| SECTION 300 | FORCE MAINS | 29 |
| 301 | GENERAL | 29 |
| 302 | PIPE AND FITTINGS: | 29 |
| 303 | DIP FORCE MAIN LAYING: | 29 |
| 304 | LOW PRESSURE AIR TESTING | 31 |
| 305 | RESTRAINT AND THRUST BLOCKS: | 32 |
| 306 | SEWAGE AIR RELEASE AND VACUUM RELIEF VALVES | 32 |
| 307 | SURGE RELIEF | 34 |
| 308 | PLUG VALVES | 34 |
| SECTION 400 | GRAVITY SEWER COLLECTION SYSTEM | 35 |
| 401 | OTHER CODE COMPLIANCE | 35 |
| 402 | DESIGN CRITERIA..... | 35 |
| 403 | MATERIALS OF CONSTRUCTION | 40 |
| 404 | EXCAVATION AND CONSTRUCTION | 44 |
| SECTION 500 | STANDARD SEWER & PUMP STATION DETAILS INDEX | 60 |
| SECTION 600 | APPROVED MANUFACTURERS | 62 |
| 601 | SUBMERSIBLE WASTEWATER PUMPS | 62 |
| 602 | SCADA SYSTEM AND VERBATIM AUTO-DIALER..... | 62 |
| 603 | GENERATORS (DIESEL ABOVE 100KW, NATURAL GAS BELOW 100KW) | 62 |
| 604 | BACKFLOW PREVENTION DEVICE RPZ (HEATED COVER)..... | 63 |
| 605 | JIB CRANES AND ELECTRIC HOISTS | 63 |
| 606 | WETWELL AND VALVE BOX HATCH DOORS | 63 |
| 607 | GE LIGHT POLE AND FIXTURE, GE BRACKET, WINCH, LAMP, AND PHOTOCCELL | 63 |

LIST OF ABBREVIATIONS AND TERMS

| | | | |
|---------------|----------------------------------------------------------|-------------------|-----------------------------------------------------------------|
| ABC | Aggregate base course | FCWS | Forsyth County Water System |
| AC | Asphalt cement or concrete | FF | Finished Floor |
| ACB | Asphalt concrete base | FG | Finished Grade |
| ACI | American Concrete Institute | FH, F. Hyd | Fire hydrant |
| ACPA | American Concrete Pipe Association | FPS | Feet per second |
| AISC | American Institute of Steel Construction | GA | Gauge |
| ANSI | American National Standards Institute | GADOT | Georgia Department of Transportation |
| APWA | American Public Works Association | GALV | Galvanized |
| ASCE | American Society of Civil Engineers | GPM | Gallons per minute |
| ASME | American Society of Mechanical Engineers | HORIZ | Horizontal |
| ASTM | American Society for Testing Materials | ID | Inside diameter |
| AWWA | American Water Works Association | IE | Invert Elevation |
| BM | Bench Mark | INV | Invert |
| BOC | Back of Curb | IP, IPS | Iron Pipe Size |
| BST | Bituminous Surface Treatment | JCT | Junction |
| BTB | Bituminous Treated Base | LIN | Linear |
| CB | Catch Basin | MH | Manhole |
| C/C | Center to Center | MH F/C | Manhole frame and cover |
| FOC | Face of Curb | MJ | Mechanical Joint |
| CFS | Cubic Feet per second | MSL | Mean Sea Level |
| CIP | Cast Iron pipe | NIST | National Institute of Standards and Technology |
| CIPP | Cast-in-place concrete pipe | NEC | National Electric Code |
| CL | Centerline | NEMA | National Electrical Manufacturer's Assoc. |
| CLFMI | Chain Link Fence Manufacturers Institute | NFPA | National Fire Protection Association |
| CMP | Corrugated metal pipe | NSC | National Safety Council |
| CO | Clean out | NSF | Public Health and Safety Organization |
| COL | Column | OC | On Center |
| CONC | Concrete | OD | Outside diameter |
| CONSTR | Construction | OHP | Overhead Power |
| CP | Concrete pipe (non-reinforced) | OSHA | Occupational Safety & Health Administration |
| CTB | Cement Treated Base | PI | Point of intersection |
| DI | Drop Inlet | PL | Property line |
| DIP | Ductile Iron Pipe | POC | Point of Curve |
| DIPRA | Ductile Iron Pipe Research Association | PP | Power pole |
| EC | End of curve | PRC | Point of reverse curve |
| EG | Existing Grade | PSI | Pounds per square inch |
| ELEV | Elevation | PSF | Pounds per square foot |
| EVC | End of vertical curve | PT | Point of Tangent |
| EXIST | Existing | PVC | Polyvinyl Chloride |
| | | PVMT | Pavement |
| | | Q | Rate of flow |
| | | R | Radius |

| | | | |
|--------------|---------------------------------------------|--------------|------------------------------------------------------|
| RC | Reinforced concrete | SDL | Saddle |
| RCP | Reinforced concrete pipe | SECT | Section |
| RDWY | Roadway | SJ | Slip Joint |
| REINF | Reinforced / Reinforcing | TH | Test Hole |
| RET | Retaining Wall | TRANS | Transition |
| RPM | Revolutions Per Minute | UL | Underwriters' Laboratories LLC |
| R/W | Right-of-way (City, County, State Roadways) | UPC | Utility Protection Center, (Ga. 811) |
| SAN | Sanitary Sewer | V | Velocity of flow |
| SD | Storm Drain | VC | Vertical curve |
| | | VERT | Vertical |

"Authority" shall mean the City of Cumming Department of Utilities.

"Contractor" shall mean the individual, firm or corporation undertaking the execution of the Work under the terms of the contract and acting through its agents and employees.

"Standards" and/or "Specifications" shall refer to the Sanitary Sewer Technical Standards and Details for Cumming Utilities.

"Work" of the contractor shall include all labor, material, equipment, skills, transportation, tools, machinery, and other equipment and things useful and necessary to complete the contract.

"Owner" shall mean the project owner and/or developer and/or property owner as an individual or a collective.

SECTION 100 GENERAL

101 PURPOSE OF THIS DOCUMENT

1. The City of Cumming Sewer System Technical Standards and Details provide standard design direction and construction standards for improvements within the City of Cumming Service Area. The standards herein govern improvements dedicated to the public and accepted by the City for maintenance and/or operation, and serves as coordinated development of those facilities to be used by and for the protection of the public. This includes certain private works, as well as improvements installed within existing City right-of-way and easements. The City shall interpret and apply these Standards in a manner which achieves their intent, but is not limited strictly to new construction.
2. These Standards shall apply to, regulate, and guide preparation/design of plans for construction of utilities, drainage, sewer system(s), site access, and related public improvements, and shall set guidelines for all private works which involve drainage, grading, trees, and related improvements. The result of these standards shall protect and promote the health, safety, and general welfare of the public as well as conserving and protecting the natural, economic, and scenic resources of the community.

102 USE OF THIS DOCUMENT

1. This document shall be used jointly with the City's Comprehensive plans, including Cumming's Water, Sewer and Storm Water Master Plans which provide utility services to the community such as water supply, sewer conveyance, storm water management and flood control. This document and the related standard details are downloadable in electronic format at www.cummingutilities.com for developers, contractors, and engineers in preparing plans, documents, and construction of public improvements within the City Service Area.
2. This Manual is updated regularly to reflect current minimum and uniform requirements from the City of Cumming adopted Codes and Ordinances. They shall be applied jointly with the latest issue of federal and state regulations. When the provisions of any other statute, ordinance, or regulation are more restrictive than the provisions of this Manual, the provisions of the more restrictive regulation shall apply.
3. The City of Cumming reserves the right to revise/update these standard details and technical standards manual without notice, as well as revise/update specific construction specifications to achieve their intent and compliance with the City's master plans and/or a more stringent or restrictive requirement by another agency having jurisdiction.

SECTION 200 SANITARY SEWER PUMP STATIONS

201 PUMP STATIONS PROHIBITED

Pump stations or grinder pump systems will only be allowed in those areas where gravity sewer is not feasible. The City will determine the feasibility of gravity sewer in each case, independently of costs to the developer/owner.

202 REGISTERED PROFESSIONAL REQUIRED

All reports, plans, and studies that are submitted to the City of Cumming must be approved by and carry the seal of a professional engineer qualified to design sewerage conveyance systems and treatment facilities in the State of Georgia.

203 STATE REQUIREMENTS

1. Georgia EPD Approval

The City holds “delegation of authority” as granted from GAEPD to review and approve all sanitary sewer extensions except for those requiring approval by the Georgia Department of Natural Resources, Environmental Protection Division (EPD), Engineering and Technical Support Program.

2. Sanitary Sewer Extension Submittal Form

Certain sewer system improvements require a Sanitary Sewer Extension Submittal Form that must be submitted to the EPD. The City of Cumming Department of Utilities shall be contacted to obtain this form.

204 PLANNING AND ZONING REQUIREMENTS

1. The developer/owner/contractor holds responsibility for ensuring planning and zoning compliance by contacting the City of Cumming Planning and Zoning Department. Compliance includes but is not limited to any variances, stream/waters of the state set-back requirements, environmental concerns, and right-of-way requirements. The responsibility for additional/specific site requirements as set forth by federal, state, or other local agencies lies expressly with the developer/owner/contractor.

205 LEGAL DOCUMENTS AND REQUIREMENTS

1. Easements

- A. It is the responsibility of the developer/owner to obtain, at no expense to the City of Cumming, all easements and properties associated with a pump station, force main, and gravity collection system. Easement documents are available from The City of Cumming Department of Utilities and online at www.cummingutilities.com.

2. Title Opinion

Current Title Opinion: the developer/property owner's attorney must provide the City of Cumming with a current title opinion before the City will accept any associated deeds or easements.

3. Ownership of Pump Station Properties

- A. Warranty Deed: pump stations constructed by private entities, developers, or individuals shall be conveyed to the City in fee simple and the City shall be supplied with an acceptable Warranty Deed. Pump stations, force mains, and other related infrastructure constructed by the City may be constructed on property which the City owns in fee simple, has an easement, has a license, or leasehold from the land owner including but not limited to the U. S. Army Corps of Engineers.
- B. Quitclaim Deed: all banks and lending institutions that hold a security deed on the property associated with the pump station must provide a Quitclaim Deed to the owner of the property. A copy of the recorded Quitclaim Deed must be provided to the City.

4. Sewer Easements

- A. Sewer Easement: the property owner must provide a minimum 20 ft wide perpetual sewer easement over, under, and through property(ies) containing sewer lines. All Sewer Easements must include Meets and Bounds.
- B. Consent and Subordination: all banks and lending institutions that hold a security deed on the property must provide a document consenting to and becoming subordinate to all Sewer Easements. All Sewer Easements must include Meets and Bounds.

5. Access Easements

- A. Access Easement: the property owner must provide a minimum 20 ft wide perpetual access easement over, under, and through property(ies) containing sewer lines. All Access Easements must include Meets and Bounds.

- B. Consent and Subordination: all banks and lending institutions that hold a security deed on the property must provide a document consenting to and becoming subordinate to all Access Easements. All Access Easements must include Meets and Bounds.

6. Warranty and Performance Bonds

- A. The developer/contractor shall obtain a Performance Bond for a minimum period of one year after the City accepts the Warranty Deed for the Pump Station. The total aggregate penal sum of the Performance Bond shall be at a minimum equal to the total cost of all pumps, control panels, generators, automatic transfer switches, SCADA system, SCADA antenna, and crane.
- B. The developer/contractor shall provide a one-year warranty for the work by contractual agreement with the City of Cumming. Warranty shall guarantee all equipment and workmanship for one year, beginning when the City accepts the Pump Station and Warranty Deed.

206 PUMP STATION AND WETWELL MATERIALS:

1. Pump Station Site Location

- A. Flood Plain Restriction; The pump station, fenced area and access road, as well as all equipment/appurtenances shall be above the 100-year flood elevation and as provided in the contract documents.

2. Precast Concrete Sections:

- A. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
- B. Wall thickness shall be minimum 6-inches or as required by the contract documents.
- C. Joint seals: Joints between precast sections shall be sealed by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.
- D. Non-shrink grout
 - i. All pumps, compressors, motors and other heavy equipment items shall be grouted in place with a nonmetallic, noncorrosive, nongaseous, non-shrink grout requiring no cutback or protective coating. Non-shrink grout shall show zero shrinkage from the placement volume or initial expansion volume

as determined by ASTM C 827, and shall have an initial set time at 70 degrees F of not less than 45 minutes as determined by ASTM C 191. When tested in accordance with ASTM C 109, non-shrink grout shall have a one-day compressive strength of not less than 2,000 psi and a 28-day compressive strength of not less than 9,000 psi at a flow of not less than 100 percent, determined in accordance with the Corps of Engineers Specification CRD-C-621.

- ii. The grout shall contain no corrosive irons, calcium, chloride, oxidizing catalysts, gas-forming agents, harmful aluminums or corrosive chemicals and shall be resistant to oil, water and sewage. The grout shall be premixed and shall require only the addition of water prior to placement. The grout shall be delivered to the job site in unopened, plastic-lined bags and shall have the manufacturer's mixing instructions printed on the back of each bag. Non-shrink grout shall be EUCO N-S Grout as manufactured by the Euclid Chemical Company, Master flow 713 Grout as manufactured by the Master Builders Company, or Upcon High Flow Grout as manufactured by UPCO Division of Emhart Chemical Company.

3. Concrete Placement

- A. Wetwell tops SHALL NOT BE PRECAST but poured on site. Additionally, all other areas around the on-site crane, valve box and connected elements shall be contiguously placed and in one monolithic pour. All concrete shall be smoothed and light broom finished in a professional manner.
- B. Valve Box top slab SHALL NOT BE PRECAST but poured on site. Slab area shall be poured in one single contiguous pour with the wetwell top and crane area, finished area. Concrete shall be light broom finished in a professional manner.
- C. Sidewalks shall be poured separately with contraction joints every 6-8 feet, minimum 4-inch thick, 3000 psi class "B" with 6/6-10/10 Welded Wire Fabric.

4. Wetwell Access

- A. Wet well access hatch shall be a double leaf type, built to withstand 150 pounds per square foot.

- B. The access hatch frame shall be ¼-inch extruded aluminum with built-in neoprene cushion and strap anchors bolted to the exterior. The door leaves shall be ¼-inch aluminum diamond plate reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be equipped with a snap lock and removable handle. Doors shall also be equipped with a hasp and padlock in addition to built-in locking mechanisms. Padlocks for all doors shall be keyed alike and match the standard lock for all other City pump stations. All parts shall be aluminum or stainless steel.
 - C. Access hatch shall be Typed K (single leaf) or KD (double leaf) by Bilco Company or equivalent as approved by the City. Pedestrian rated for 150 psf and lift assistance for easy one-hand operation.
 - D. All access doors and hatches must have the capability of being locked with a pad lock as required by the City. Locks and spare keys must be supplied to the City. Locks should be keyed to match the City's standard pump station lock.
 - E. Wet well access steps shall not be allowed in any wet wells.
 - F. All conduit that enters a wet well must be sealed at the wet well and at the motor control panel.
5. Trash Basket Required
- A trash basket and rail system must be provided for each influent pipe to the wet well. Each trash basket must be easily removed from the wet well for cleaning purposes.
6. Reflective Signage
- Reflective signage denoting pump station address, emergency telephone numbers, and other required information must be provided and attached to the fencing as specified by the superintendent.
7. Lighting
- An outdoor security light, that is capable of automatically switches on at night and off in the day, shall be provided at each pump station site. Each light pole must be equipped with a hinge, pin, and wench system that allow the pole and light to be lowered to the ground for maintenance and bulb changing, and then to be raised back into an upright position. The type of light and location of the pole must be approved by the superintendent and the pole shall be painted dark brown.

8. Maintenance and Equipment Building

- A. An equipment and maintenance building shall be provided and shall be built within 10 ft – 15 ft of the wet well. Guidelines for the design of the building include the following:
- B. The building should be architecturally compatible with nearby structures. In most cases, concrete block buildings are acceptable and must be painted dark brown or a City approved color.
- C. An oversized double-door should be provided at a convenient location for the removal and replacement of equipment. The doors must be heavy duty steel with appropriate hardware and lock.
- D. The building shall house the auxiliary power transfer switch, surge suppressor, SCADA RTU unit, and main power disconnect. The pump control panel shall be hung on the exterior of the building, on the closest side facing the wetwell. There shall be sufficient space for maintenance operations inside. A minimum 8-foot by 10-foot building shall be designed for small pumping stations.
- E. Adequate lighting shall be provided in work areas for night operations, both inside the building and on the exterior.
- F. The building shall have adequate ventilation to prevent buildup of corrosive and potentially dangerous gases. This includes a ventilation fan system.
- G. A thermostatically-controlled heater shall be provided in the building.
- H. The building must be at a minimum constructed of concrete block and painted inside and out with two coats of dark brown paint. The ceiling must be insulated and covered with plywood and painted. The building must be supplied with adequately sized gutters and down-spouts.
- I. The roof structure must be galvalume and shall be dark brown in color.

9. Power Disconnect

A breaker or other device as described by the superintendent, that will completely disconnect the pump station from the power source must be provided on the main power supply line.

10. Potable Water Supply Required

- A. All pump stations must be supplied with a self-draining, non-freezing $\frac{3}{4}$ inch or larger yard hydrant. The water service shall be located as close to the wet well as is practicable.
- B. Back flow prevention:

- i. Potable water supply lines must be equipped with a reduced pressure zone back flow prevention device (RPZ).
- ii. The RPZ must be installed according to the Georgia plumbing code.
- iii. The RPZ must be above grade and covered with a frost proof, insulated, heated cover that is made of a corrosion proof metal such as aluminum. For recommended manufacturers, contact the Water Pollution Control Division.

11. Fencing

- A. Overall height for fencing shall be seven feet including three strands of barbed wire on malleable iron post tops. Posts shall be set at maximum 10-foot centers, and installed up to three feet deep within concrete footings with concrete poured the full size of the excavated hole. Corner posts shall have the necessary strut and tie bracing.
- B. Fence mesh: 9-gauge wire, woven to 2-inch squares, galvanized after weaving, six-foot wide roll. Continuous tension wire shall be provided at the lower edge of the mesh.
- C. Line post: 2-1/2-inch O.D. Galvanized Pipe (3.65 lb. / ft.)
- D. Corner post: 3-inch O.D. Galvanized Pipe (5.79 lb. / ft.).
- E. Gate post: 4-inch O.D. Galvanized Pipe (9.11 lb. / ft.).
- F. Top Rail: 1-5/8-inch O.D. Galvanized Pipe (2.27 lb. / ft.). with extra-long pressed steel sleeves.
- G. Gates shall be supplied with heavy-duty latches, keepers and padlocks with duplicate keys.
- H. Gate frames shall be 2-inch O.D. Galvanized Pipe Frame (2.72 lb. / ft.).
- I. Barbed wire shall consist of three strands of 12-gauge wire, with 4-point pattern barbs, galvanized after weaving.
- J. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Superintendent. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94.
- K. Fence installation shall occur only after final grading is completed, with finished grade elevations established, unless permitted by the Superintendent.

- L. Repair damaged coatings in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.
 - M. Barbed wire shall be installed as three parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fastened securely to each extension arm.
 - N. Top rails shall be run continuously through post caps or extension arms and shall be bent to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.
 - O. Cleaning: Perform cleaning during installation of the work and upon completion of the work. Remove from the site all debris and equipment. Repair any damage resulting from fence system installation.
 - P. Color: All fencing material and posts shall be coated with dark brown vinyl. Privacy slats shall also be dark brown. Slats shall be double walled type from extruded high-density polyethylene (HDPE) with color pigments and ultra violet inhibitors.
 - Q. Access gates must be a minimum 14 feet wide. The location of all gates must be approved by the Superintendent.
 - R. Fencing shall not cross any drainage ditches, swales, or be located on steep grades or in unusual configuration without written approval of the City. Fence and access gate function shall ensure security, ease of use, appearance, maintainability and permanence of the installation.
 - S. Manufacturer standards shall comply with the Chain Link Fence Manufacturers Institute (CLFMI).
 - T. All fencing must be provided as a complete unit produced by a single manufacturer including the required erection accessories, fittings and fasteners.
 - U. For specific residential developments or other locations as specified by the City, a wooden privacy fence shall be used.
12. Access Roads and Pavement
- A. All access roads to pump stations must be 20 feet wide with a 32-foot turning radius.
 - B. All access roads must be paved. Roads must have a 6-inch minimum base of graded aggregate stone, prime coat and either 2-inch minimum asphalt plant mix (type E or F), or 2 1/2-inch base course (type B) plus 1 1/2-inch surface course (type E or F).

- C. A paved area with turn around sufficiently sized for all expected service vehicles inside the pump station fencing shall be constructed to provide service access to the wet well and all other facilities.
- D. All paved areas shall be contiguous with the paved access road.
- E. A pole-gate shall be installed at the access road entrance and shall span the entire width of the drive. The pole-gate shall be positioned at least 30 feet from the main road unless otherwise indicated on the contract documents and shall be constructed of approved materials.

13. Unpaved Areas

All unpaved areas inside the fenced area shall be stabilized with a minimum of 6 inches of #57 stone with finished grade sloped for positive drainage from the pump station site and designed to convey storm water in relation to any surrounding storm water conveyance systems where available.

14. Hoist or Crane

A hoist or crane must be included with each station. Each hoist or crane must be properly sized and placed to facilitate the removal of each pump from the wet well. The hoist system shall be designed so that the pumps can be lifted from the wet well and placed on a platform or maintenance vehicle easily. The hoist shall have the capability of lowering and raising maintenance personnel into and out of the wet well. Special care should be taken to ensure that the proper length and strength of hoist cable is provided. Electric hoists must be provided for each crane and hoist system. Manual hoists are prohibited. All cranes and components shall be painted dark brown.

15. Signage

Reflective signage at the entrance gate of the pump station shall be provided as specified by the superintendent and according to the standard details.

16. Valve Vaults

Pump station check valves and isolation valves must be housed in a below grade, concrete valve vault, separate from but immediately adjacent to the wet well.

- A. The discharge piping from each pump shall be routed through the valve vault with check valves and shutoff valves on horizontal stretches of pipe. Check valves shall be placed upstream of shutoff valves. Connection of the discharge pipes should be accomplished outside and downstream of the valve vault.
- B. A pressure gage with diaphragm mounted seals should be located on the sides of each pipe in the valve vault, upstream of the check valve.

- C. The valve vault should have a reinforced concrete floor and top slab with a hinged aluminum floor door (see wet well floor door requirements above - Section (D)(3)). The vault walls may be precast or cast-in-place reinforced concrete or reinforced masonry. The valve vault should have a maximum depth of 4 feet unless specifically approved by the Superintendent.
- D. The floor of the valve vault should be sloped to a sump to collect water. A drain should be provided in the sump. The drain should be routed to the wet well with a P-trap installed to prevent the release of hazardous gases into the valve vault. A Tide Flex Valve shall be installed in the drain line to prevent flooding of the valve vault by backflow from the wet well.

17. Corrosion Prevention

- A. The first manhole up-stream from the pump station and the first manhole downstream from the pump station, the wet well itself, and all valve boxes must be coated with a two-part epoxy (such as protecto 401 ceramic epoxy or mainstay ds-4 coal tar epoxy mortar) to prevent corrosion from hydrogen sulfide gases.

18. Control Panels

- A. General: The control system shall be designed to operate the required number of pumps specified on the drawing at the power characteristics shown on the plans. The control function shall provide for the operation of the pumps under normal conditions, and shall alternate the pumps on each pump down cycle to equalize the run time. In the event the incoming flow exceeds the capacity of the lead pump, subsequent pumps shall automatically startup to handle the increased flow. As the flow decreases, the pump shall cut off at the elevations as shown on the plans. The control shall function as described below. The equipment listed below is a guide and does not relieve the supplier from supplying a system that will function as required.
- B. Electrical enclosures: All pump station electrical components and controls must be housed in a weatherproof, water tight, 14-gauge, Nema 4X rated enclosure manufactured from 304 stainless steel. The enclosure shall be a wall mounted type with a minimum depth of 12 inches, sized to adequately house all the components. The door gasket shall be rubber composition with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees.

- C. Inner dead front door: A polished, aluminum dead front shall be mounted on a continuous aircraft type hinge. It shall contain cutouts for mounted equipment, and provide protection of personnel from live, internal wiring. Cutouts for breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters, duplex receptacle, and other operational devices shall be mounted on the external surface of the dead front. The dead front shall open a minimum of 150 degrees to allow access to equipment for maintenance. A 3/4-inch break shall be formed around the perimeter of the dead front to provide rigidity.
- D. Back plate: the back plate shall be manufactured of 12-gauge steel and be finished with a primer coat and two (2) coats of baked on, white enamel. All hardware mounted to the subpanel shall be attached with machine thread, tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified.
- E. Power distribution: The panel power distribution shall include necessary components and be completely wired stranded copper conductors rated at 90 degrees C. All conductor terminations shall be as recommended by the device manufacturer. Control power to the panel, including all alarm and telemetry circuits shall be provided by an uninterruptable power supply (UPS).
- F. Circuit breakers: All circuit breakers shall be heavy duty thermal magnetic motor circuit protectors similar and equal to Square D Type FAL. Each motor breaker shall be adequately sized to meet the pump motor operating characteristics and shall have a minimum of 14,000 amps interrupting capacity at 480 VAC. The control circuit shall be controlled by heavy duty breakers. Circuit breakers shall be indicating type, providing “on-off-trip” positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating “trip”. Thermal magnetic breakers shall be quick-make and quick-break on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip. Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable.
- G. Motor starters (across-the-line): motor starters shall be open frame, across-the-line, NEMA rated with individual overload protection in each leg. Motor starter contacts and coil shall be replaceable from the front of the starter without removal from its mounted position. Overload heaters shall be block type, utilizing melting alloy spindles and shall have visual trip indication. Overloads shall be sized for the full load amperage draw of the pumps. Adjustable type overloads, definite purpose contactors, fractional size starters and horsepower rated contactors or relays shall not be acceptable.

- H. Motor starters (reduced voltage autotransformer): motor starters shall be open frame, reduced voltage, autotransformer, NEMA rated with individual overload protection in each phase. Motor starter contacts and coil shall be replaceable from the front of the starter without removal of the starter from its mounted position. Overload heaters shall be blocked type, utilizing melting alloy spindles sized for the full load amperage of the load. Adjustable overload, definite purpose contacts, fractional size starters and horsepower rated contact or relays shall be acceptable. Motor starter resets shall be provided on the front of the dead front.
- I. Motor starters (solid state reduced voltage): Motor starters shall be solid state reduced voltage starters to provide smooth, step-less acceleration through the use of silicon controlled rectifiers. By gradually applying voltage to the motor, a soft start condition will accelerate the motor to full speed. The adjustable current-limit feature: the starters shall limit currents to 25%-70% and starting torque to 6%-49% respectively of full voltage values. Adjustable ramp shall be for 1 – 30 seconds. A ramp down signal may be required and must be available on the starters. Motor protection shall be provided by calculation of temperature rise of the motor and starter and shut the motor down in case of an out of tolerance condition.
- J. VFD Drives; The City shall specify the type and brand of VFD drive and the configuration of the control panel.
- K. Pressure Transducer controller system: The station pumping system shall be controlled by a pressure transducer. See City for brand of transducer and specifications.
- L. Spare pressure transducer required: An extra pressure transducer must be supplied with each pump station.

19. Level Control Systems

- A. Duplex Pump Stations: the control system shall provide for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well. Levels shall be sensed through a measurement device adjusted to the specified levels. The device shall sense the “off”, “lead”, “lag”, and “alarm” levels. As the level in the wet well rises, the lead pump as determined by the alternator, shall start and pump the station to the “off” level. In the event the incoming flow exceeds the capacity of the lead pump, the lag pump shall start and both pumps shall run to the “off” level. If the level continues to rise, alarm functions shall be activated. The control system shall include, but not be limited to, the ancillary equipment listed below.

- B. Triplex Pump Stations: the control system shall provide for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well. Levels shall be sensed through a measurement device adjusted to the specified levels. The device shall sense the “off”, “lead”, “lag”, and “alarm” levels. As the level in the wet well rises, the lead pump as determined by the alternator, shall start and pump the station to the “off” level. In the event the incoming flow exceeds the capacity of the lead pump, the lag pump shall start and both pumps shall run to the “off” level. If the level continues to rise, the second “lag” pump shall start and all three pumps shall run to the “off” level. If the level continues to rise, alarm functions shall be activated. The control system shall include, but not be limited to, the ancillary equipment listed below.

20. Ancillary Equipment

- A. HOA (Hand/Off/Auto) switches: A three-position HOA switch shall be provided for each motor. The switch shall be NEMA 4X rated with 10-amp contacts. A position indicating legend plate shall be provided. The HOA in the hand position shall allow the pump to run and bypass all safety shutdowns except for overloads. In the “Auto” position, the pump controller will control the pumps while monitoring all shutdowns and stop the pump.
- B. Run indicators: A green run pilot indicator shall be mounted on the dead front door.
- C. Elapsed time meter: An elapsed time meter shall be mounted on the dead front door. The meter shall operate on 120V AC, shall indicate in hours (6 digits) and tenths and shall not be resettable.
- D. Moisture and thermal measurement: A plug-in, solid state control and status relay with indicating LEDs shall be provided to measure motor thermal overload and moisture in the pump housing. Any moisture or thermal condition shall signal failure and stop the pump. The failure mode shall also be indicated by an illuminated light on the MT3PC controller.
- E. Heater: An internal 100-watt heater shall be provided to maintain temperature above the dew point. The unit shall be thermostatically controlled.
- F. Trouble light: An internal trouble light shall be installed to illuminate the internal portion of the enclosure.
- G. Alarm system: A visible alarm light shall be installed on the exterior of the control panel and shall be a weatherproof, shatterproof, red light fixture with a 40-watt bulb to indicate alarm conditions. The alarm light shall be turned on by the alarm relay. An audible alarm such as a bell, horn, or buzzer must be installed. The audible alarm shall be turned on by the alarm relay.

- H. Automatic Dialer: An automatic dialer shall be installed and connected to a phone line. The city requires that this device be a Verbatim brand automatic dialer with a minimum of 8 channels. The phone service shall be part of the City's ESSEX phone system.
- I. Gas detector: Gas detection equipment for each pump station is required as specified by the Superintendent. This detector must be connected to the auto-dialer, audible horn and visible alarm light.
- J. Lightning-transient protection: Each complete suppression unit shall be UL listed as a secondary surge arrester and bear CSA certification and meet ANSI/IEEE C62-11-1987; suitable for indoor and outdoor applications; suitable for use in service entrance location; meet requirements of NEC Article 280; rated at 650V phase-to-ground maximum.
- K. Transformers: Control transformers shall be provided to produce the 120V AC and/or 24V AC for control circuits. Transformers shall be fused on the primary and secondary circuits. The secondary circuits shall be grounded.
- L. Phase monitor: A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reverse phase, and loss of phase. Control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
- M. Drawings A final, "as built" drawing encapsulated in mylar shall be attached to the inside of the front door. A list of all legends shall be included.
- N. Panel markings: All component parts in the control panel shall be permanently marked and identified as they are indicated on the drawing. Marking shall be on the back plate adjacent to the component. All control conductors shall be identified with wire markers at each end, as close as practical to the end of the conductor.
- O. Testing: All panels shall be tested to the power requirements as shown on the plans to assure proper operation of all components. Each control function shall be activated to check for proper indication.
- P. Guarantee: All equipment shall be guaranteed for a period of three (3) years from the date of shipment. The guarantee is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement or repair of the defective equipment.
- Q. Manufacturer: The manufacturer shall be a UL listed shop for industrial control systems and shall indicate evidence of such on the control panel enclosure.
- R. Phase convertors: Phase convertors will not be accepted unless specifically approved by the superintendent.

21. Emergency Power Backup Required:

- A. Location: The location of the generator shall be next to the Maintenance and Equipment Building, on the opposite side from the wetwell. The Maintenance and Equipment building shall be in the middle of the wet well and generator set.
- B. Generator brand: The brand of generator accepted by the city is limited to Caterpillar, Cummins-Onan, Caterpillar, Katolite, or Kohler.
- C. Sizing: The engine / generator set shall be sized to accommodate all loads at the pump station.
- D. Hot water jacket: A hot water jacket shall be supplied to keep the engine warm and ready to operate.
- E. Storage battery: A storage battery should be provided with each engine / generator along with a trickle charger fed off commercial power.
- F. Fuel type: All 100 kW (or smaller) generators must be fueled by natural gas. All 101 kW or larger must be fueled by diesel.
- G. Automatic transfer switches: An automatic transfer switch must be installed separately from (not inside) the control panel. Automatic transfer switches should be supplied by the manufacturer of the generator.
 - i. Simultaneous starting of two pumps should be prevented. A reasonable generator run time should be provided before pump start and after primary power returns.
 - ii. A connection should be provided so that the generator can power an external, portable load bank for maintenance purposes.
- H. Generator receptacle: The Superintendent may require the control panel to have a generator receptacle mounted to the side. The receptacle brand must be Crouse Hinds, AR2042 for 230V and DF4404 for 480 V.
- I. Housing: Weatherproof, sound attenuated steel housing with lockable, hinged doors and Critical Grade Exhaust Silencer with mounting hardware. Silencer mounting kit, tail pipe and rain cap. Genset shall be painted dark brown.
- J. Engine Cooling System: Unit Mounted Radiator w / pusher fan
- K. Ambient Low Coolant Level Shutdown
- L. Engine Heating System: Engine Block and Coolant Heater, 120 V, 2500 Watts 40 F Minimum Ambient Temperature.

- M. Automatic exercise cycling: Generators must be set up for automatic exercise cycling.
 - N. Engine Fuel System: Flexible Fuel Lines Subbase Fuel Tank sized for 24 Hours of Continuous Operation at Full Load. Double Wall Construction, Skid Mounted, With Leak Detection Monitoring, U.L. Listed, Fuel Level Gauge, Low Fuel Level Alarm.
 - O. Engine Electrical Equipment: Battery Rack and Cables, Starting Batteries – 2 @ 12 volts, lead acid type, Battery Charging Alternator - 60 Hz DC, 10 Amp Battery Charger, 120 Volts AC, 24 Volt DC Starter
 - P. Governor: Electronic Isochronous Governor
 - Q. Electrical Accessories: Main Line Circuit Breaker, Mounted on Generator, 3 Pole, 600 Amps Per Pole, Voltage Regulator +/- 2% Safeguard Breaker.
 - R. Controller and Alarms: Engine Pre-Alarm Senders to include:
 - S. Pre-high Engine Temperature Alarm, Pre-low Oil Pressure Alarm/Low Engine Temperature Alarm.
 - T. Other Genset Requirements: Skid End Caps, Spring Type Vibration Isolators – External to Skid Base.
 - U. Automatic Transfer Switch Requirements: Application: Utility to Genset, 800 Amp, 3-phase, 3 pole, 277/480 volts, seven day exerciser clock, pilot lights on door to show switch position, pilot light on door to show normal is available, adjustable time delay on engine start, adjustable time delay for cool-down after re-transfer to normal before stopping, test switch on door, plant exerciser with load, in-phase monitor both directions.
 - V. Additional Requirements: 5 – Year Comprehensive Warranty, 2 sets of Operation and Maintenance manuals shall be provided prior to delivery of equipment. Initial start-up to be performed by manufacturer’s representative – includes warranty validation, engine oil and antifreeze must be provided and installed at start up by manufacturer.
 - W. Communications: the generator controller must be capable of Modbus Protocol and be compatible with the City’s SCADA and RTU systems as described below.
22. Monitoring Devices; Remote Terminal Units (RTUs) and Supervisory Control and Data Acquisition (SCADA)
- A. General requirements given under this section are established in the interest of functionality, durability, flexibility, cost effectiveness, and standardization for operations and maintenance.

B. Each Pump Station must be equipped with an RTU that will communicate with the Advanced Water Reclamation Facility’s SCADA system (by **J.K. Duren Company**). All system upgrades to the City’s SCADA system required for the efficient operation of each individual RTU shall be included in the work. This may include but not be limited to “store and forward” upgrades to subsequent RTUs required to convey the signal to the AWRF main computer or upgrades to the AWRF main computer, antenna, radio, or any other related equipment or programming.

C. RTU Requirements

- i. The RTU shall communicate using MODBUS RTU Protocol, be programmable in IEC 61131 suite of logic languages, and provide communication with the existing Master Control Center at the City of Cumming Advanced Water Reclamation Facility
- ii. RTU’s shall be microprocessor based capable of routing or “store and forward” repeating. Capability of serving as an area or process controller and have the ability for executing system control computer (SCC) commands. The RTU’s shall report alarms as they occur.
- iii. RTU’s shall provide monitoring and controlling of site functions and status by processing digital and analog inputs and outputs and be capable of on-board counters for totalization.
- iv. Normal Operation shall be on normal input power 15 Amp /120 volts AC and minimum backup operation during power loss for one hour on a 12V DC battery. Solar power capability shall include the radio.
- v. The RTU shall have a unique group and station digital address
- vi. All SCADA and RTU shall have overvoltage protection on I/O, line and antenna interconnections.
- vii. Enclosure for the RTU shall be sized for all equipment, environment, and meet NEMA-4X standards with a hinged pad-lockable door.

D. Electrical Specification

- i. AC power 120 volts, 60 hertz
- ii. DC power 13.8 volts, 22 amp, the DC power supply in the base station RTU shall be sized to power the indicated analog loops and shall have at least 40% spare capacity for future use.
- iii. Battery shall be sealed lead-acid 12 VDC rated at 5 Amp-hours

E. Input Specification

- i. Analog inputs, 4-20 ma/0-5vdc/1-5vdc
- ii. Digital inputs, on/off, 12vdc, 24vdc, 120vac, dry contacts, isolated
- iii. Counter 16 bit or 32 bit, on/off isolated

F. Output Specification

- i. Analog output, 4-20ma, 0-5vdc
- ii. Digital outputs, on/off, 120vac, dry contacts

G. The RTU I/O requirements are as follows:

Analog Inputs (AI)

- AI-1 Level
- AI-2 Spare

Digital Inputs (DI)

- DI-1 Pump-1 Status
- DI-2 Pump-2 Status
- DI-3 Pump-3 Status
- DI-4 Pump-1 Fail Alarm
- DI-5 Pump-2 Fail Alarm
- DI-6 Pump-3 Fail Alarm
- DI-7 High Wetwell Level Alarm
- DI-8 High Wetwell Float Alarm
- DI-9 Motor Control Panel Power-fail Alarm
- DI-10 Generator Run Status
- DI-11 Generator Major Alarm (Shutdown such as over-temp)
- DI-12 Generator Minor Alarm (Warning such as low fuel)
- DI-13 Transfer Switch in Generator Position
- DI-14 TVSS Fail Alarm
- DI-15 Valve 1 Fail Alarm
- DI-16 Valve 2 Fail Alarm
- DI-17 Valve 3 Fail Alarm
- DI-18 Gas Detector Alarm
- DI-19 RTU Power-fail Alarm

Digital Outputs (DO)

- DO-1 Spare
- DO-2 Spare

H. Radio

- i. General - The telemetry signals shall be transmitted over a radio system operating in a half-duplex mode on a single FM radio frequency. The radio equipment shall have capability for operating on a narrow band splinter frequency in the Power Radio Service. The telemetry system manufacturer shall provide all radio path surveys design the system for a least 99.9% reliability. System manufacturer shall also provide all help necessary to the end user for radio frequency coordination and FCC licensing, all as previously specified.
- ii. Radio Transceiver - The radio transceiver shall be a new current modem FM 2-way radio suitable for transmitting and receiving audio tones at up to 1200 bits per second.

Transmitter

| | |
|------------------------------|-------------------------------------|
| RF Power Output | 20 watts adjustable to 5 watts min. |
| Frequency Range | 150-174 MHz |
| Frequency Stability | +/-0.0005% from -30 to 60 C |
| Modulation..... | 6F9, +/-2.5 KHz for 100% modulation |
| FM Hum and Noise..... | Minus 50 dB |
| Spurious and Harmonics | Minus 80 dB |

Receiver

| | |
|-------------------------------|---------------------------|
| Sensitivity (12 dB SINAD).... | 0.35 uV |
| Selectivity | Minus 80 dB @ +/- 30 KHz |
| Frequency Stability | +/-0.0005% from 30 - 60 C |
| Intermodulation..... | Minus 70 dB |
| Spurious and Image Rejection | Minus 85 dB |

Radio transceivers shall be provided with integral audio feedback to allow audible diagnostics while troubleshooting.

I. Antennas, Cable, Masts, and Poles: The radio telemetry system supplier shall provide the antennas for each site as required to achieve the overall communications and requirements of the system. Antennas shall be directional or omni-directional as required and suitable for outdoor environments. They shall be of all aluminum construction and rated to withstand at least 100 MPH winds with ½ inch radial ice. Adequate lengths of RG213A/U coaxial cable shall be provided for connection of the antenna to the radio transceiver at each site. The transmission line shall be terminated only in connectors rated for the required service. A lightning arrestor shall be placed between the transceiver and coaxial cable. Unless specifically stated, the antennas shall be attached to existing structures, such as tanks or buildings. Attention shall be given to the correct installation of the antennas to give adequate protection from nearby lightning strikes by providing a low resistance DC path to ground. Contractor shall follow the instructions provided by the supplier for installation of these antennas to insure reliable operation. Contractor shall furnish all mounting masts or poles as required to support the antennas at the elevations and orientations required. Masts and poles shall be suitable for outdoor environmental conditions, provide adequate support and protection for transmission lines and be provided complete with all necessary mounting accessories. Minimum acceptable technical and physical specifications of the antenna shall be as follows:

| | |
|----------------------------|------------------------------------------------------|
| Directional Antenna | |
| Type..... | 5 element Yagi, with a forward gain of at least 7 dB |
| Front to back ratio | 20 dB |
| Lightning protection | Direct ground |
| Feed-point method..... | Weather-proof gamma match for coaxial feed line |

J. Modifying Software: The supplier shall be responsible for modifying the software at the Master telemetry unit to include this RTU. The HMI SCADA software shall be modified to add a new screen for this lift station, and include this lift station in all reports, communications, maps, and overview screens. The HMI computer and SCADA software versions shall be upgraded as required to maintain this unit at the most current reliable industrial standard.

23. Spare Parts

- A. Spare pump: The Developer must supply the City with a spare pump for each pump station.
- B. Spare fuses: One of each of the fuses that are used in the electrical control system must be provided to the City.
- C. Spare transducer: an spare transducer must be supplied with each station.

24. Start Up

- A. The developer, the pump manufacturer’s representative, the generator manufacturer’s representative, the design engineer, the superintendent, and any other associated parties must be present at “start-up”.
- B. The pump manufacturer’s representative must inspect each pump for proper rotation, pumping capacity, vibration, and amperage draw.
- C. The generator manufacturer’s representative must test the generator and transfer switch for proper operation at full load.
- D. Each pump must be removed from and reinstalled into the wet well to demonstrate that the pumps can be easily maneuvered for maintenance purposes.
- E. All keys and spare parts must be submitted to the City.
- F. Information submittal required at start up:
 - i. Three sets of as-built drawings.
 - ii. Three sets of detailed drawing schematics.
 - iii. Three sets of manufacturer’s operation and maintenance (O&M) literature for each piece of equipment at the station.
 - iv. Three copies of each pump curve.
 - v. The name, address, and telephone number for the developer, design engineer, contractors, subcontractors, and manufacturers’ representatives.

25. Landscaping

- A. Six (6) ft to eight (8) ft tall Leland Cypresses (or City approved) landscape trees/bushes must be planted around the perimeter of each station.
- B. All native brush and trees shall be removed from the pump station site except where prohibited by the City.
- C. All trees deemed dangerous by the City and/or with the potential to damage the pump station site shall be removed before the station will be approved.
- D. A “soil sterilizer” shall be properly applied to all graveled areas on the pump station site as directed by the City.

207 PUMP DESIGN AND MATERIALS

For maintenance and efficiency, The City requires Flygt pumps and equipment as standard on all pump stations for the city sewer system. Equivalents shall only be allowed as approved by the Water Pollution Control Superintendent. Written approval from the Superintendent is mandatory for any portion of a pump station which relates to the Flygt equipment or is being submitted as an equivalent.

1. Submersible Pumps:

- A. General: Pumps must be submersible, non-clog type and be equipped with a submersible electric motor supplied with adequate submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. All pumps shall operate from three-phase power.
- B. Pump design: The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two 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. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall be directly on the sump floor.
- C. Pump construction: Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces in contact with the pumped media at any time, 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.
- D. Pump seals: sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

- E. Pump cooling system: Each unit shall be provided with an adequately designed cooling system. The water jacket shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. 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 according to their dimensions. 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. Restrictions below this temperature are not acceptable.
- F. Cable Entry Seal: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, planked by washers, all having a closed tolerance fit against the cable outside diameter and compressed by the body containing a strain cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
- G. Motor: The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. 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 motor shall be designed for continuous duty handling pumped media of 40°C (104°F), capable of 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°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. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer O-ring seal.

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. The motor and pump shall be designed and assembled by the same manufacturer.

- H. Pump performance: The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.
- I. Power Cable: The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
- J. Bearings: The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a two-row angular contact type to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.
- K. Mechanical Seals: each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide 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. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.
- a. 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. The following seal types are not acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

- b. 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. 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. The seal lubricant shall be FDA approved and nontoxic.
- L. Pump Shaft: Pump motor and shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Coupling shall not be acceptable. The shaft shall be AISI type 431 stainless steel. The use of stainless steel sleeves will not be considered equal to stainless steel shafts.
- M. Impeller: The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be keyed to the shaft, retained with an allen head bolt and shall have capability of passing any solids that may enter it. All impellers shall be coated with an acrylic-dispersion zinc phosphate primer.
- N. Wear rings: A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet. Each pump must also have a stainless-steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.
- O. Volute: Pump volute(s) shall be single-piece gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet discharge size shall be as specified.
- P. Protection: All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm. A leakage sensor shall be installed to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and remote. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED. The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

- Q. Explosion proof pumps: All pumps must be explosion proof.
 - R. Service Capability: the pump manufacturer shall have an authorized factory service center / stocking facility capability of completely servicing the required pumps within 50 miles of the project site. This facility shall also have the capability of performing field service, including routine inspections and maintenance contracts. No exceptions to this will be accepted.
 - S. Pump control device: The City shall determine the equipment to be used to activate and terminate pump operation and to determine high and low-level conditions. Pump controls shall be equipped with an alternating lead-lag pump option.
 - T. Chains required: all submersible pumps must be provided with stainless steel chains connected to each pump, to aid in the removal of each pump from the wet well for maintenance purposes. Each pump shall be supplied with a mating cast iron discharge connection and be fitted with a Grip-Eye lifting system. The working load of the lifting system shall be 50% greater than the pump unit weight.
 - U. Mix Flush Valve required: One pump shall be fitted with a Mix-Flush valve to automatically agitate the liquid in the wet well using a 90 degree discharge elbow and adjustable flushing period of 20 to 50 seconds.
 - V. Storage and protection: Pumps and accessories shall be stored and protected in accordance with the manufacturer's recommendations. Pumps shall be completely drained prior to shipment. Suction and discharge ports shall be provided with plastic plugs. Each pump shall be secured to a wooden skid to facilitate handling and storage.
2. Piping Considerations
- A. Minimum velocity: All sewage piping shall be sized to maintain a minimum scour velocity of three feet per second. Minimum line size shall be 4 inches in diameter.
 - B. Ductile Iron: All pipe, fittings, and valves shall be ductile iron and shall be pressure rated for the expected operating and surge pressures.
 - C. Avoid air and vacuum release valves: The force main location shall be designed to provide continuous positive grade up to the existing sewer to avoid the need for air and vacuum release valves.
 - D. Force main termination: All force mains shall terminate at a receiving manhole and provided with energy dissipating inlets.

- E. Check valves: Check valves shall be iron body, bronze-mounted, outside lever with flanged ends and conform to AWWA C508.
- F. Shut-off valves: Shutoff valves shall be either plug valves or resilient-seated gate valves. Plug valves shall be eccentric, non-lubricated two-way plug valves with lever operators and flanged ends for installation within a valve box/pit.
- G. Flexible couplings: Flexible couplings shall only be used when allowed by an engineer and only around the valves and at the pump outlet. These couplings allow slight misalignment during construction, are easily disassembled and reassembled, and impede the transmission of damaging forces. “Dresser couplings” shall not be allowed without approval from the City.
- H. Quick-connect emergency bypass: A connection for a quick-connect bypass pump shall be provided as redundancy for station failure. See Drawing at end of this Section.
- I. Water Hammer & Surge: Pump stations shall include analysis for hydraulic transients (water hammer and surge) to provide proper pressure rating for the pipe as well as protection of the pump and line.

SECTION 300 FORCE MAINS

301 GENERAL

All materials used in the construction shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation. Storage of all materials shall be on pallets and/or as directed by the manufacturer/supplier and protected from damage until installed.

302 PIPE AND FITTINGS:

1. Polyvinyl Chloride (PVC) pipe is prohibited for use as a force main.
2. Ductile iron pipe shall meet the requirements AWWA C151 with push-on and mechanical joints meeting AWWA C111 and a standard cement lining. Pipe shall be pressure Class 350 unless indicated otherwise in the contract documents.
3. Fittings shall be measured for payment by unit weight of each fitting (bare barrel weight; excluding weight of cement mortar lining), gland, bolts and gasket. Weights of fittings shall be as listed in AWWA C153. Payment shall be at the Unit Price per ton given in the contract documents.

303 DIP FORCE MAIN LAYING:

1. DIP shall be used for all force mains. PVC pipe is prohibited for use as a sewer force main or in any part of a pump station configuration.
2. Laying conditions for Ductile Iron Pipe:
3. Type 3 Laying Condition: Pipe bedded in 4” minimum native soils from undisturbed trench bottom. Backfill shall be native or select soils to top of pipe and lightly consolidated in lifts not to exceed 8-inches. Native soil shall be those soils as excavated from the trench, free of rocks, foreign materials, and frozen earth.
4. Type 4 Laying Condition: Pipe shall be bedded in sand or crushed stone at a depth of 1/8 of the outer diameter of the pipe, or 4” minimum whichever is greater. Backfill shall be select structural soils and compacted to top of pipe. (Approximately 80% Standard Proctor, AASHTO T-99)
5. Type 5 Laying Condition: Pipe bedded in approved compacted granular material 4” minimum depth under the pipe and brought to the top of pipe.
6. Type 1 and Type 2 Laying Conditions: Pipe shall not be laid directly on the trench bottom with no bedding. Type 1 and 2 shall not be used.

7. Ductile iron pipe laid in rock trenches shall have 6 inches of approved compacted granular material under the pipe and between the pipe and trench limits on all sides. See Standard Construction Drawing S-13.
8. Minimum allowable depth of cover shall be 3-feet, or greater when required by State or County for work within their right-of-way.
9. Pipe, appurtenances, and fittings shall be laid to the line and grade established on the Drawings, or as directed by the Engineer. A minimum cover of 48" shall be maintained over all pipe, unless otherwise indicated. The bed for the pipe shall be shaped either by trimming the bottom of the trench or by placing excavated earth thereon and tamping so that each piece of pipe has uniform bearing. The trench shall be further excavated around each bell or hub, so that it will be entirely clear of the ground and leave ample room for making joints.
10. Inside of bells and outside of the spigots shall be thoroughly clean before being installed. The inside of the pipe shall remain clean and free of obstructions and foreign matter until all work is completed.
11. Where pipe laying ceases at the end of the day, or for any cause, the end of the pipe shall be securely closed to prevent the entrance of water, mud, critters, or any other objectionable matter.
12. The Contractor shall furnish and install copper clad steel wire (12 AWG) or metallic detection tape wrapped a minimum of twice per length of pipe in trenches alongside all PVC mains. All wire shall be joined by a common bond. Payment for furnishing and installing shall be included in the Unit Price bid for the pipe.
13. The Contractor shall furnish and install pipe identification tape with the words "Buried Sewer Line." The tape shall be secured to the pipe and shall be continuous along the entire length of sewage force main. Payment for furnishing and installing tape shall be included in the Unit Price bid for the pipe.
14. In the event the sewage force main crosses a water main, a minimum vertical distance of 18" between the outside of the water main and the outside of the force main shall be maintained. This shall be the case where the water main is either above or below the force main. The crossing shall be arranged so that the force main joints will be equal distant and as far as possible from water main joints. Where a water main crosses under the force main, adequate structural support shall be provided for the force main to prevent damage to the water main.

15. Minimum 10 feet horizontal separation shall be maintained between the force main and water main when laid parallel. When conditions prevent 10-foot horizontal separation, the water main may be laid closer to a sewer line with approval from the City and providing a minimum of 18-inches vertical separation obtained by benching for the waterline and locating it ABOVE the sewer line. Separation shall be measured from the bottom of the water main vertical to the top of the sewer line.
16. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, either the water main or the sewer line shall be cased extending 10-feet on both sides of a perpendicular crossing and/or until such point that the 18-inch vertical or 10-foot horizontal separation has been re-established. Carrier pipe shall be steel with thicknesses and diameters as specified in the Standard Casing Detail-Size Chart.

304 LOW PRESSURE AIR TESTING

All lines shall be air tested in the following manner after backfilling and tamping has been completed:

1. Test Preparation: All wyes, tees or end-of-side sewer stubs shall be plugged with flexible-joint caps, or acceptable alternate and securely fastened to withstand the internal test pressures. Prior to testing for acceptance, the pipe shall be cleaned and televised.
2. Test Procedure: The sewer segment being tested shall be pressurized to 3.5 psi allowing time (2-4 minutes) as required for the pressure to stabilize. The pressure shall not decrease more than 0.5 psi (from the original 3.5 psi) during the time periods shown below:

| Pipe Size (inches) | Time Period |
|--------------------|-------------|
| 4 | 1:53 min |
| 6 | 2:50 min |
| 8 | 3:47 min |
| 10 | 4:43 min |
| 12 | 5:40 min |
| 15 | 7:06 min |
| 18 | 8:30 min |
| 21 | 9:55 min |
| 24 | 11:20 min |
| 27 | 12:45 min |
| 30 | 14:10 min |

3. Test Failure: If the pipe installation fails to meet the infiltration or air test requirements shown above, the Contractor shall determine, at his own expense, the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of these tests and the results of the air test shall be neatly tabulated by the Contractor and submitted to the City of Cumming Inspector.
4. A leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be 2 hours. During the test, the system shall be subjected to a pressure of 150 psi gauge.
5. Testing procedure shall be as specified in AWWA C600 and/or C900 (latest revisions) – Standard Hydrostatic Test Method of Sewer Force Mains- ASTM 1003.
6. Allowable leakage shall not exceed the following gallons per hour per 1,000 feet (0.18, 0.28, 0.37, 0.55, 0.75, 0.90, 1.1), respectively for line size diameters (2", 3", 4", 6", 8", 10", 12").
7. No separate payment will be made for leakage and pressure tests. The cost of these operations shall be included in the Unit Price bid for pipe installation.

305 RESTRAINT AND THRUST BLOCKS:

1. Concrete restraint blocks shall be installed at all bends, valves, plugs, tees, and caps. Concrete shall have a minimum compressive strength of 3000 psi after 28 days.
2. Restraint blocks shall be of mass concrete with minimum dimensions as indicated in the standard details and/or contract drawings. All pipe connections and bolts shall remain exposed are covered so as to prevent removal of fittings or valves.
3. Surge blocks shall be backed against firm, undisturbed earth. Any extra concrete volume required due to over-excavation shall be installed at no additional cost to the City.
4. Surge blocks in place shall be paid for at the Unit Price bid for concrete blocking in the Bid Schedule.

306 SEWAGE AIR RELEASE AND VACUUM RELIEF VALVES

1. Sewage air release valves (when required and approved by the City) shall be Vent-O-Mat Model No. 050RGX1021 with 2-inch inlet size or approved equal.

2. Materials of construction shall be certified according to the following:

| | | |
|---------------------------------------|---------------------------|--------------------------------|
| Body & Cover, Internal Linkage, Stem, | Cast Iron | ASTM A48, Class 30 |
| Concave Float | Stainless Steel | ASTM A240 |
| Needle | Buna-N | Nitrile Rubber |
| Exterior Paint | Phenolic Primer Red Oxide | FDA Approved for Potable Water |
| Exterior Finish Coat | Compatible with Primer | FDA Approved for Potable Water |

3. A combination type valve in one valve body shall be used, which performs the function of both air and vacuum valves as well as pressure air release valves.
4. Vacuum valve material shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in HDPE stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat.
5. The valve shall have an integral "anti-surge" orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to less than 2 x valve rated working pressure. The intake orifice shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice.
6. Large orifice sealing shall be effected by the flat face of the control float searing against a nitrile rubber O-ring housed in a dovetail groove circumferentially surrounding the orifice. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented.
7. Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7 psi to twice the rated working pressure.
8. Air release valve design shall respond to the presence of air/gas within the line by air/gas discharge through a small orifice at any pressure within a specified design range (ie; 7 psi - 150 psi) and shall remain leak tight in the absence of air.
9. Vacuum relief valves shall also react immediately to pipe line drainage or liquid column separation by the full opening of a large orifice to allow unobstructed air intake at the lowest possible negative internal pipe line pressure.

307 SURGE RELIEF

Surge relief and transient pressures such as water hammer shall be accounted for and included in any force main designs to reduce approach velocities to less than 2X the valve rated pressure. Surge relief valves shall automatically discharge air/gas through the anti-surge orifice.

308 PLUG VALVES

Plug valves shall be of the eccentric non-lubricated, manually operated type, and be designed for the use and working pressure intended. Valves shall have flanged ends or mechanical joint end, as shown on the Drawings. Valve body shall be of semi-steel. Seats shall have a welded-in overlay of not less than 90% pure nickel on all surfaces which will contact the plug face. The plug shall be totally encapsulated with Buna-N rubber. Plug stem bushing shall be of stainless steel, and permanently lubricated type. Valves shall have a 2" square operating nut, with worm gear actuator and open LEFT. Valves placed in a valve box shall have a hand-wheel operator. Plug valves shall be as manufactured by DeZurik, Homestead, or approved equal.

SECTION 400 GRAVITY SEWER COLLECTION SYSTEM

401 OTHER CODE COMPLIANCE

In conjunction with these standards and the City of Cumming Sewer Use Ordinances, construction of all sewerage facilities in the City of Cumming shall conform to the following codes:

1. Southern Plumbing Code;
2. Southern Building Code;
3. City of Cumming's Cross-Connection Program;
4. Water Environment Federation (WEF) Manual for Design (MFD) No. 5, latest edition (for sewer design and construction); and

402 DESIGN CRITERIA

1. Separate Sewers are required: Sanitary sewers shall be designed exclusively for sewerage and not designed to transport storm water.
2. Design Period
 - a. Sewer systems should be designed for the estimated ultimate tributary population. Tributary population is defined as all areas upstream of the discharge point of the system being designed within a topographically delineated area or within a defined development. Sewers will be designed and installed to the uppermost and lowermost property lines of the development being served. Consideration should be given to the maximum anticipated capacity of institutions, industrial parks, and other common facilities.
3. Sewer capacity shall include the following parameters during design and sizing of lines:
 - a. Maximum daily sewage flow based on accepted peaking factors, as provided in the Water Environment Federation's Manual of Practice FD-5. If these peaking factors are not used, a peak factor of 6.0 will be used.
 - b. Additional maximum sewage or waste flow from industrial plants.
 - c. Groundwater infiltration rates shall be a minimum of 15 percent unless otherwise approved by the City.
 - d. Topography of the area and depth of excavation.



4. New sewers for residential areas shall be designed on the basis of a daily flow of sewage of not less than 250 gallons per residential unit per day.
5. Flows and Loadings: Design flows and loadings shall be as listed in Table JT-1 as excerpted below from the Rules of the Georgia Department of Human Resources, Public Health, Manual for On Site Sewage Management Systems.

**ADOPTED FROM TABLE JT-1
 GEORGIA DEPARTMENT OF HUMAN RESOURCES**

| <u>FACILITY</u> | <u>GPD*</u> |
|---------------------------------------------------------|--------------------|
| Airport (Also R.R. & Bus Terminal)----- | 5/Passenger |
| No Food Service----- | +10/Employee |
| Assembly Hall (Also Stadium, Racetrack, Ball Park)----- | 5/Seat |
| Bar/Lounge, Tavern (No Food Service)----- | 30/Seat |
| Barber Shop----- | 100/Chair |
| ----- | +20/Employee |
| Bath House for Swimming Pool----- | 10/Swimmer |
| Beauty Salon----- | 150/Chair |
| ----- | +20/Employee |
| Boarding House**----- | 75/Resident |
| Bowing Alley (No Food Service)----- | 75/Lane |
| ----- | +20/Employee |
| Car Wash (Non-Recycling)----- | 75/Car |
| Church (No Kitchen)----- | 5/Sanctuary Seat |
| (With Kitchen)----- | 7/Sanctuary Seat |
| Bath House for Travel Trailer Park, Campground** | |
| (With Independent Sewer Connections)----- | 50/Space |
| (Without Independent Sewer Connections)----- | 100/Space |
| Construction Camp**----- | 60/Person |
| (With Use of Chemical Toilets)----- | 40/Person |
| Cottage/Lodge (Vacation)----- | 50/Bed |
| Country Club (No Food Service)----- | 25/Member |
| Dance Hall (No Food Service)----- | 5/Person |
| Day Camp----- | 20/Person |
| Day Care Center | |
| (No Meals)----- | 15/Person |
| (With Meals)----- | 20/Person |
| Dental Office | |
| (Continuous Water)----- | 250/Chair |
| (Demand Water)----- | 100/Chair |
| ----- | +20/Employee |
| Department Store----- | 40/Employee |
| Dump Station for Travel Trailers----- | 50/Vehicle |
| Fairground (Use Average Attendance)----- | 5/Person |
| Fitness Center/Spa----- | 50/Person |
| †Food Service** ----- | |



| | |
|-------------------------------------------------------------------|-------------------------------------|
| Restaurants, less than 24 hrs/day----- | 50/Seat |
| Restaurants, 24 hrs.----- | 75/Seat |
| Restaurants on Interstates ----- | 100/Seat |
| Drive-In Restaurant----- | 50/Space |
| Carry-out Only; Food Stands ----- | 50/100ft ² Floor Space |
| ----- | +20/Employee |
| Banquet Rooms----- | Add 5/Seat |
| Single-Service Only----- | Subtract 10/Seat |
| Funeral Home----- | 300/Embalming |
| ----- | +100/Staff Member |
| (no kitchen) ----- | +5/Sanctuary Seat |
| (w / kitchen----- | +7/Sanctuary Seat |
| Grocery Store----- | 200/1000ft ² Floor Space |
| Hospital----- | 300/Bed |
| ----- | +100/ Staff Person |
| Hotel/Motel** ----- | 100/Room |
| Motel with Kitchenette ----- | 150/Room |
| †Institution ----- | 100/Bed |
| Laundry, Self-Service----- | 500/Machine |
| Marina (Pumpout Facilities)----- | 30/Slip |
| †Meat Market----- | 50/100ft ² Floor Space |
| Medical Offices ----- | 200/Exam Room |
| Migrant Labor Camp**----- | 50/Bed |
| Nursing Home/Personal Care Home ----- | 50/Bed |
| ----- | +100/Resident Staff |
| Picnic Park----- | 10/Person |
| †Prison/Jail----- | 25/Bed |
| ----- | +20/Employee |
| Resident Camps** | |
| (With Food Service)----- | 60/Person |
| (Without Food Service)----- | 50/Person |
| Residential Units, Apartments, Condos, Town Homes, Houses----- | 250 GPD Per Unit |
| Resort**----- | 75/Person |
| Rest Area----- | Consult with GADOT |
| Retail Stores, Convenience Stores (Freestanding)----- | Larger of 400/restroom |
| or ----- | 100/commode or urinal |
| Rooming House** (No Meals)----- | 60/Bed |
| Schools | |
| (Day, Toilets Only)----- | 12/Person |
| † (Day, Toilets & Cafeteria)----- | 16/Person |
| † (Day, Toilets, Cafeteria, Gym)----- | 20/Person |
| Boarding----- | 100/Person |
| Service Station | |
| Interstate Location----- | 3000 Minimum |
| 24 Hour Operation----- | 325/Commode or Urinal |
| <24 Hour Operation----- | 250/Commode or Urinal |
| Shopping Center/Mall (No Food Service or Laundering Service)----- | 100/1000ft ² Enclosed |
| Space | |
| Theaters | |
| (Indoor)----- | 5/Seat |



| | |
|------------------------------------------------------------------------|--------------|
| (Drive-In)----- | 10/Space |
| Travel Trailer Park** | |
| with Independent Water & Sewage Connections----- | 100/Space |
| Veterinary Office/Animal Hospital**----- | 100/Run |
| ----- | 10/Cage |
| ----- | +20/Employee |
| Warehouse Space----- | 50/1000sqft |
| Warehouse ----- | 100/1000sqft |
| Workers Including Factory, Office, School, Commercial and Construction | |
| Without Showers and Industrial Waste ----- | 25/Person |
| With Showers and No Industrial Waste----- | 35/Person |
| With Kitchen Add----- | +5/Person |

*GPD: means gallons per day

**Add 500/machine if washing machines installed.

†Operations with BOD₅ and TSS greater than 200 mg/L require pretreatment to reduce BOD₅ and TSS to 200 mg/L or below.

6. Line size minimum; No sewer shall be less than 8" in diameter.
7. Minimum Cover; All sewers installed in the street shall be sufficiently deep to provide six (6) feet of cover at the inlet end of all service laterals at the street right-of-way, and over any part of the collector sewer or service lateral within the street right-of-way.
8. Road Crossings: Road crossings (except for interior subdivision streets) shall be steel cased. PVC pipe that is installed underneath pavement shall have a minimum of 6 feet of cover.
9. Minimum slopes shall provide a minimum mean scour velocity of 2.0 feet per second at all flow capacities and at all future phasing. The following minimum slopes or greater shall be provided. Steeper slopes are desirable.

Minimum Slope in Feet for Sewer Lines

| Sewer Line Size (Dia.) | Minimum Slopes Feet per 100 Foot |
|------------------------|----------------------------------|
| 8" | 0.50 |
| 10" | 0.29 |
| 12" | 0.22 |
| 14" | 0.17 |
| 15" | 0.15 |
| 16" | 0.14 |
| 18" | 0.12 |
| 21" | 0.10 |
| 24" | 0.08 |
| 27" | 0.07 |
| 30" | 0.06 |
| 36" | 0.05 |

10. Ductile iron pipe material shall be used under the following conditions:

- a. When the proposed sewer line is under less than 4 feet of cover.
- b. When the proposed sewer line crosses a storm sewer with less than 2 feet of clearance.
- c. When the sewer line location is within one foot laterally of a storm sewer.
- d. When fill over the sewer line is greater than 16 feet.
- e. When sewer lines are located in swampy or unstable soil conditions, DIP shall be required and additional bedding may also be required.
- f. When the sewer slope is greater than 20%.
- g. Casing is required according to the standard details when sewer lines cross creeks with less than 3 feet of original stream bed cover or less than 3 feet cover for any original drainage ditch, or crossings within 18 inches of other utilities.

11. Manholes

- a. Outside drop at the manhole shall be provided wherever the drop is greater than 2 feet and constructed in accordance with the standard details.
- b. Minimum Angle: Minimum angle between influent and effluent sanitary sewer lines at a manhole shall be 90°.
- c. Maximum Distance Between Manholes shall be 400 feet.

12. Easements: A minimum twenty foot (20') permanent sanitary sewer easement shall be used on all lines. All sewer easements shall be grassed. Rip-rap shall be placed where required to control erosion.

13. Sand and Oil/Grease Interceptors

- a. Grease interceptors shall be sized according to the following formulas. But no smaller than 1000 gallons capacity and no larger than 3000 gallons. In certain cases, multiple grease interceptors may be required.

Formula for Restaurants:

$$(S) \times (GS) \times (HR/12) \times (LF) = \text{Grease Interceptor Capacity, in gallons}$$

Where:

S = Numbers of seats in dining area

GS = Gallons of wastewater per seat (use 15 gallons per seat)

HR = Numbers of hours open
 LF = Loading Factor = 2.0 for Interstate freeways, 1.5 for other freeways, 1.25 for recreational areas, 1.0 for other highways.

Formula for Hospitals, Schools, Nursing Homes, Other Types of Commercial Kitchens with Varied Seating Capacities:

$(M) \times (GM) \times (SC) \times (LF) =$ Grease Interceptor Capacity, in gallons

Where:

M = Meals per day

GM = Gallons of Wastewater per meal (Use 5 gallons per meal)

LF = Loading factor – 1.0 with dishwashing or 0.5 without dishwashing

SC = storage capacity factor – 1.0 for Public sewer, 2.5 for on-site septic disposal

14. All sand and oil/grease interceptors used in conjunction with facilities other than eating establishments shall have a capacity that will provide not less than ten (10) minutes nor more than thirty (30) minutes retention time at the peak eight (8) hour flow rate. Flow through velocities shall not exceed one foot per second at the peak eight (8) hour flow rate. At a minimum, interceptors shall be 1000 gallons, concrete, and in-ground.

403 MATERIALS OF CONSTRUCTION

1. Polyvinyl Chloride (PVC) Pipe:

PVC sewer pipe and fittings shall be plastic gravity sewer pipe with integral wall bell and spigot joints for the conveyance of domestic sewage. Pipe and fittings shall meet extra strength minimum of SDR 26 of the requirements of ASTM D3034-73 for 4" through 15" and ASTM F679 for 18" through 27". Minimum wall thickness shall be as follows:

| Pipe Diameter | Minimum Wall Thickness |
|---------------|------------------------|
| 4" | 0.120" |
| 6" | 0.180" |
| 8" | 0.240" |
| 10" | 0.300" |
| 12" | 0.360" |
| 15" | 0.437" |
| 18" | 0.536" |
| 21" | 0.632" |
| 24" | 0.711" |
| 27" | 0.801" |

2. Manufacturer Markings; Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested, and date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture and the classes of pipe with which it can be used.
3. PVC pipe shall NOT be installed above ground.
4. Ductile Iron Pipe (DIP): Ductile iron pipe and fittings shall conform to the requirements of ANSI A21.51 (centrifugally cast in metal or sand lined molds). Pipe shall be thickness Class 50 for 8" diameter pipes and smaller, and Class 51 for 10" diameter pipes and larger. The pipe shall be lined with cement-mortar lining in accordance with ANSI A21.4, or approved equal. The lining shall have a minimum thickness of 1/16 inch. The exterior of the pipe shall be seal coated with an approved bituminous seal coat in accordance with ANSI A21.4.
5. Transition Joints
 - A. Joints Between DIP: Ductile iron pipe shall be of the bell and spigot type with push-on joints, conforming to ANSI Specification A21.11 or mechanical joints.
 - B. Joints Between PVC: PVC pipe shall be joined with a rubber gasket or PVC ring which is designed to prevent inflow and ex-flow. Mechanical compression joints shall be molded plastic or similar material (with or without the use of rubber or elastic plastic compression rings) as described in ASTM C425 for polyvinyl chloride (slip joint). Precast joints or rubber push-type gaskets for compression joint sealing (ASTM D3312 or F477) are all acceptable. (PVC pipe shall not be joined by a solvent cement joint in which the pipe spigot wedges into the tapered socket and the surfaces fuse together.)
 - C. Joints Between Sewer Pipes of Differing Materials: Transition joints between sewer pipes of different materials shall be accomplished by the use of adapters made especially for that purpose. NOTE: *Transition of piping materials between manholes is prohibited without the express consent of the City of Cumming Department of Utilities.*

6. Casings

- A. Steel casing pipe shall be used for all cased piping where the carrier pipe is six inches (6") or greater in size.
- B. Yield Strength: Steel casing pipe shall have a minimum yield strength of 35,000 psi and shall conform to the requirements of ASTM A139. It shall be fully coated on the exterior and interior with a coal tar coating. The casing pipe diameter shall be six to eight inches greater than the "bell" diameter of the carrier pipe. Minimum wall thickness shall be as follows:

| Nominal Diameter (inches) | Nominal Thickness (inches) |
|---------------------------|----------------------------|
| Under 14 | 0.188 |
| 14 | 0.219 |
| 16 | 0.219 |
| 18 | 0.250 |
| 20 | 0.281 |
| 22 | 0.312 |
| 24 | 0.344 |
| 26 | 0.375 |
| 28 | 0.406 |
| 30 | 0.406 |
| 32 | 0.438 |
| 34 | 0.469 |
| 36 | 0.469 |
| 42 | 0.500 |
| 48 | 0.625 |
| 54 | 0.750 |

7. Precast Concrete Manholes

- A. Precast concrete manholes shall consist of precast reinforced concrete sections with eccentric, (or flat slab for shallow manholes) top section and a base section conforming with the typical manhole details as shown on the Standard Construction Drawings S-5, S-7, S-8 and S-9.
- B. Precast manhole sections shall be manufactured, tested, and marked in accordance with the latest provisions of ASTM C478.
- C. Joints of the manhole sections shall be of the tongue-and-groove type. Sections shall be joined using O-ring rubber gaskets, flexible plastic gaskets conforming to the applicable provisions of ASTM C443, latest revision, or an approved bituminous mastic joint material.

- D. Handling: Each section of the precast manhole shall have not more than two holes for the purpose of handling and laying. These holes shall be sealed with cement mortar using one-part Portland cement to two parts clean sand, meeting ASTM C144, latest revision. Holes shall be sealed from the outside prior to backfilling the manhole.
- E. Manhole steps conforming to the applicable provisions of ASTM C478, latest edition, such as aluminum 14967 as manufactured by Alcoa, or Plastic Step manufactured by M.A. Industries, Inc., or equal, shall be factory built into the precast sections.
- F. Holes in precast bases to receive sewer pipe shall be precast at the factory at the required locations and heights. Knocking out of holes in the field will not be permitted. All manholes shall have Kor-N-Seal (or equal) rubber boots for all pipe entries/exits. Stainless steel bands shall be tightened with a torque wrench in accordance with the manufacturer's recommendations.
- G. Manhole bases and inverts shall be constructed of 2500 psi concrete in accordance with details on Standard Construction Drawings S-5, S-7, S-8 and S-9, and inverts shall have the same cross-section as the invert of the sewers which they connect. The manhole base and invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit. Brick used in inverts shall be in accordance with this Manual, Subsection 5 BRICK.
- H. Foundation: The manhole base shall be set upon a 6-inch (minimum thickness) mat of #57 crushed stone.
- I. Mortar for brickwork that is required to complete the precast concrete manhole shall be constructed using 1-part Portland cement to 2 parts clean sand, meeting ASTM C144, thoroughly mixed to a workable plastic mixture. Brickwork shall be constructed in a neat and workmanlike manner. Cement mortar shall be used to grout interior exposed brick joints and faces. Brick used in manholes shall be in accordance with this Manual, Subsection 5 BRICK.
- J. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry. Frames and covers shall be Vulcan VM-3MOD, or equal. (See Standard Construction Drawing S-12.) Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown and grade of the existing adjacent pavement. Manholes on all outfall sewers shall have bolt-down, watertight lids and shall be 18 inches above grade.

- K. All bolt-down sewer manhole access covers shall have at least one manhole locking device as per McGard LLC USA 3875 California Road, Orchard Park, New York 14127-4198. McGard manhole cover locks prevent unauthorized access and protect against vandalism and tampering. The access cover lock must have a codification groove that is milled into the top of the access cover lock, which can therefore only be installed or removed using the corresponding key. The access cover lock must be constructed of special high-quality alloy and hardened to at least 60 Rockwell (HRC).
 - L. Contractors shall ensure that ALL bolts and locking devices are properly installed before a project will be accepted by the City.
 - M. Masonry work shall be allowed to set for a period of not less than 24 hours. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.
8. Brick
- A. Brick for sewer manhole construction shall be hard No. 1 building brick manufactured from clay or shale. Brick shall be uniform standard commercial sizes with straight, parallel edges with square corners burned uniformly through, and uniform color with uniform abrasive resistance. All brick shall conform to the latest version of ASTM C32. Brick for manhole inverts shall be grade SM; brick for manhole construction shall be grade MM.

404 EXCAVATION AND CONSTRUCTION

- 1. Soil Erosion and Sediment Control
 - A. Land disturbance activity shall not commence until the Land Disturbance Permit is issued and phase 1 erosion control measures are in place and the design engineer has signed the certification statement.
 - B. Temporary erosion and sedimentation controls shall meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 (as amended) and local soil erosion and sedimentation control ordinances. The Contractor shall acquire land disturbance permits from the City of Cumming and/or Forsyth County or other appropriate governing authority, and shall pay any associated fees. The Contractor shall be responsible for submitting to the City and/or County sufficient documents such that the City and/or County can acquire approval from the Soil and Water Conservation District. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.

- C. Silt dams, traps, barrier, and appurtenances shall be installed, and shall be maintained DAILY until no longer needed, and then removed. Hay bales that deteriorate, and filter stone which becomes dislodged shall be replaced with new materials. Detention ponds, if constructed, shall be maintained and cleaned out to provide the designed sediment storage. Materials used in temporary erosion and sedimentation control shall meet the following requirements.
 - D. Silt fence shall meet the requirements of Section 171 - Temporary Silt Fence of the Department of Transportation, State of Georgia, Standard Specification, latest edition. Silt fence fabric must be on the Georgia Department of Transportation Qualified Product List.
 - E. Hay bales shall be clean, seed-free cereal hay type.
 - F. Netting shall be 2-inch, galvanized steel, chicken wire mesh. Netting stakes shall be either steel rods not smaller than 2-inch diameter, or shall be fir southern pine or hemlock for type B silt fence.
 - G. Filter stone shall be crushed stone conforming to Georgia Department of Transportation Table 800.01 H, Size Number 3.
 - H. Clean up and grassing operations shall be maintained with 2,000 feet of the pipe-laying operation and shall occur within seven days after pipe has been installed. Clean up and grassing shall be required daily during seasonal rain periods and on all cut & fill slopes and drainage areas. Grassing of cut & fill slopes shall conform to the Georgia Department of Transportation Standard Specification, latest edition.
2. Trench Excavation
- A. OSHA Regulations: Trench excavation shall conform to OSHA regulations, 29 CFR Part 1926, Subpart P, Paragraphs 1926.650 through 1926.653, or the most current OSHA requirement.
 - B. Trenches shall be cut true to the lines and grades shown on the plans. The bottom of the trench shall be cut carefully to the required grade of the pipe except where bedding materials or cradles are shown in which case the excavation shall extend to the bottom of the bedding or cradles as shown on the plans. Minimum pipe cover shall be as shown on the approved plans.
 - C. Bell holes shall be excavated at proper intervals so the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of all joints in the pipe.

- D. Inconvenience to Public: Pipe trenches shall not be excavated more than 100 feet in advance of pipe laying, and all work shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
- E. Barricades and Lights: All excavations shall be adequately guarded with barricades and lights in compliance with all OSHA and Georgia Department of Transportation requirements so as to protect the public from hazard.
- F. Shoring and Bracing: Excavations adjacent to existing or proposed buildings and structures, or in paved streets or alleys shall be sheeted, shored and braced adequately to prevent undermining or subsequent settlement of such structures or pavements. Underpinning of adjacent structures shall be done when necessary to maintain structures in safe condition. The contractor shall also provide bracing and shoring when required to prevent damage to existing utilities, trees, or private property which are specifically required to remain.
- i. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the City it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.
 - ii. Steel Sheet Piling: Continuous lock-joint steel sheet piling may be substituted for timber sheeting when approved by the City. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where directed to be left in place by the City for reasons of safety, will be cut off where directed.
- G. Disturbed Public Property: Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored to as near as original condition as possible in a manner satisfactory to the City.
- H. Wet Conditions: Whenever water is present in the trench, it shall be removed in a manner satisfactory to the City and sufficient backfill placed on the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and relayed later during dry conditions. No pipe shall be laid in wet trench conditions that preclude proper bedding, or on frozen trench bottom, or when, in the opinion of the City, the trench conditions or the weather are unsuitable for proper installation (See Section V.12 below for details on the Dewatering process).

3. Rock Excavation

- A. Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws and regulations governing blasting and the use of explosives. Rock excavation near existing pipelines or other structures shall be conducted with the utmost care to avoid damage. Injury or damage to other structures and properties shall be promptly repaired to the satisfaction of the City and/or property owner.
- B. Excavation of Rock: Rock in trenches shall be excavated over the horizontal limits of excavation and to depths as follows:

| Size of Pipeline | Depth of Excavation Below Bottom of Sewer Pipe (in) |
|------------------|-----------------------------------------------------|
| 4 and less | 4 |
| 4 to 8 | 6 |
| 10 to 18 | 8 |
| 18 to 30 | 10 |
| Over 30 | 12 |

The space below grade for pipe lines shall then be backfilled with #57 and smaller crushed rock, gravel, or other approved bedding material.

4. Backfilling Trenches

- A. General: Backfill material shall consist of fine, loose earth containing sufficient but not excessive moisture content for thorough compaction. Material that is too dry for adequate compaction shall receive a prior admix of sufficient water to secure adequate moisture content. Material having excessive water content shall not be placed at any time. Backfill material shall be free of large clods, stones, vegetable matter, debris and other objectionable material.
- B. Percentage of Maximum Density Requirements: Achieve not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for each layer of soil material-in-place as determined by ASTM D698 (Standard Proctor) test procedures:
 - i. Structures: Under structures and within 10 feet outside of exterior walls, compact top 12 inches of subgrade and each layer of backfill or fill material to 98 percent of maximum density.
 - ii. Building Slabs and Steps: Under and within five feet outside perimeter of slabs and steps, compact top 12 inches of subgrade and each layer of backfill or fill material to 98 percent of maximum density.

- iii. Berms and Liquid Holding Fills: Compact each layer of backfill or fill material to 98 percent of maximum dry density.
- iv. Lawn or Unpaved Areas: Compact each layer of backfill or fill material to 88 percent of maximum dry density.
- v. Walkways: Under and within two feet horizontal distance of paved walks, compact top six inches of subgrade and each layer of backfill or fill material to 98 percent of maximum dry density.
- vi. Pavements: Under and within entire roadbed, compact top 12 inches of subgrade and each layer of backfill or fill material to 98 percent of maximum dry density.
- vii. Spoil Areas: Compact each layer of backfill or fill material to 88 percent of maximum dry density.

C. Dewatering

- i. The Contractor shall provide and maintain: adequate dewatering equipment, including back up equipment, to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during sub-grade preparation and continually thereafter, until the structure to be built or the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
- ii. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12" or more below the bottom of the excavation.
- iii. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.
- iv. The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes of conduits shall be left clean and free of sediment.

5. Installation of Sewer Pipe

- A. Care of Materials: Pipe and accessories shall at all times be handled with care to avoid damage. Whether moved by hand, skidways or hoists, material shall not be dropped or bumped. The interior of all pipe shall be kept free from dirt and foreign matter at all times. Each joint of pipe shall be unloaded opposite or near the place where it is to be laid in the trench.

- B. Damaged or Defective Materials: All such material that is defective in manufacture or has been damaged in transit or after delivery shall be removed from the job site.
- C. Pipe Joints: Sewer pipes shall be joined by "push-on" joints using elastomeric gaskets to affect the pressure seal. The ends of pipe to be jointed and the gaskets shall be cleaned immediately before assembly, and the assembly shall be made as recommended by the pipe manufacturer. Lubricant used must be non-toxic and supplied or approved for use by the pipe manufacturer. Sewer pipes shall be laid in the uphill direction with the bells pointing upgrade. Any variation from this procedure shall require approval from the City.
- D. Plugging Pipe Ends: When pipe laying is not in progress, the open ends of installed pipe shall be plugged by approved means to prevent entrance of trench water into the line.
- E. Ductile Iron Pipe: The following laying rules shall be followed for ductile iron pipe:
 - i. Standard ductile iron pipe laying conditions shall be per ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51.
 - ii. DIP laid in rock trenches shall have 6-inches of granular bedding per the standard bedding details.
 - iii. Pressure class and casing requirements shall be verified with the City when cover exceeds 25 feet for 8-inch lines and larger.
- F. PVC Pipe: The following laying rules shall be followed for PVC pipe:
 - i. Bedding and primary backfill material shall consist of Class I or Class II soil (USCS Soil Classification System) placed in 6" layers. Where Class II soil is used, bedding primary backfill shall be compacted as specified in ASTM D2321.
 - ii. PVC pipe bedded in sand or graded gravel do not require special compaction. However, the sand or gravel minimum depth below the pipe shall be four inches, and brought up to the spring-line of the pipe and the material must be firmly placed under the pipe haunches. Minimum bedding / backfill at pipe sides and haunches shall be 6-inches from the pipe OD to the trench wall.
 - iii. When PVC pipe is laid in a rocked trench, a minimum of 6-inches crushed stone shall be used as bedding under the pipe.

- G. Bell Hole Requirements: Bell holes shall be provided of sufficient size to allow ample room for making the pipe joints properly. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length as shown on the plans. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.
- H. Standing Water in Trench: Water shall not be allowed to run or stand in the trench before the trench has been backfilled. At no time shall the Contractor(s) excavate more trench than their ability to dewater for backfilling.
- I. Trench Widths
- i. Maximum permissible trench widths from bottom of trench to a point 12" above top of pipe shall be equal to the outside diameter of pipe barrel plus 16", except as noted otherwise.
 - ii. If the trench walls collapse, or if the excavated trench width up to a point 12" above the top of sewer pipe is greater than the maximum permissible trench width according to the standard detail, then the Contractor shall, at no additional cost to the City/Owner, lay and backfill the line as specified in ASTM D2321.
- J. Service Laterals and Connection Locations
- i. Sewer Tap Approval and Inspection: No plumber or Contractor will be allowed to make a tap onto City sewerage system without prior approval and without the tap being made in the presence of a City of Cumming Inspector.
 - ii. All service lines extending from collector sewers must utilize a plugged, or capped stub at the termination point according to the standard details. Plug Type shall be an air-tight, removable plastic plug.
 - iii. Location on As-built Plan: The precise location of each stub shall be indicated on the As-Built plans to the nearest foot.
 - iv. A plugged stub shall be provided for every existing or proposed lot or building per City standard details. Wye branches shall be of the same material as the collector sewer and installed on the trunk line at the locations indicated on the contract drawings. A single service stub shall be provided for each residence and shall extend from the wye to the property line or easement of each lot being served and shall include a clean out for each service at the property line or easement.

- v. Service to all lots within a development shall be the responsibility of the developer. On any lot where the service stub cannot be found, the developer shall install or bear the costs for payment of installation of the service stub. Also, unless otherwise noted on the final plat, the service stub shall be low enough to serve the first ground level floor elevation, and where grades permit, it shall be low enough to serve the basement.
- vi. For new construction, the builder shall be responsible for the location of the service line and checking its elevation prior to the pouring of the foundation, driveway, or other appurtenances. The City will not be responsible for any house built too low to be served nor for any service covered by construction.
- vii. Riser connections shall be installed on service lines which are greater than nine feet deep. Driveways, parking pads, paving, and similar shall not be installed over any portion of a sanitary sewer lateral
- viii. Service Stub Requirements: Service stubs shall be laid in compacted or undisturbed soil from the main sewer to the property line. The slope shall be 2.0% or greater. All house or service lines not immediately connected to a service stub shall be located and marked in the same manner as described for plugged stubs, below.

K. Service Laterals with no stub out provided

- i. Wye Branches: Connections to existing sewer lines where no stub exists shall be made by removing a section of the sewer from the existing line and inserting, in the space, a wye branch of proper size, or by the construction of a manhole or other such method as approved by the City of Cumming.
- ii. Coring Manholes: Where no existing manhole stub-outs exist for connection manhole coring shall be made by neatly cutting a hole in the wall of the existing structure with a manhole coring machine made for that purpose at or near its invert, inserting a Kor-N-Seal rubber boot. This work shall be done by a qualified Contractor with equipment approved by the Kor-N-Seal manufacturer.
- iii. All sewer connections for multi-unit development or non-residential structures shall be made by the owner (applicant) at their expense.

L. Highway Construction

- i. State Highways: The Contractor shall be responsible for the coordinating and scheduling of all construction work in the State highway right-of-way with the City of Cumming and/or Georgia Department of Transportation, as appropriate.
- ii. Construction Standards: Work along and across Georgia State highway right-of-way shall conform to Georgia D.O.T. Standard Specifications for Construction of Roads and Bridges.

M. Jack and Bore

- i. General Requirements: Jacks for forcing the casing pipe through the roadbed shall have a jacking head constructed in such a manner as to apply uniform pressure around the ring of the pipe. The pipe to be jacked shall be set on guides, braced together, to properly support the section of the pipe and direct it to the proper line and grade. In general, roadbed material shall be excavated just ahead of the pipe, the excavated material removed through the pipe, and the pipe then forced through the roadbed into the excavated space.
- ii. Impact on Structures: Where pipe is required to be installed under highways, streets or other facilities by jacking or boring methods, construction shall be done in a manner that will not interfere with the operation of the facility, and shall not weaken the roadbed or structure.
- iii. Disposal of Excavated Materials and Use of Water: Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids related to the boring operation will be permitted only to the extent necessary to lubricate cuttings. Jetting will not be permitted.
- iv. Diameter of Excavation: The diameter of the excavation shall conform to the outside diameter and circumference of the casing pipe as closely as practicable. Any voids which develop during the installation operation shall be pressure grouted.
- v. Jacking Requirements: The pipe shall be jacked from the low or downstream end. At each end of the casing pipe, the void between the carrier pipe and casing shall be sealed with brick and mortar. Any pipe damaged in jacking operations shall be removed, and replaced by the Contractor at his expense.

- vi. Installation of Carrier Pipe: After the steel casing pipe has been installed, the carrier pipe shall be installed in the casing pipe. Care shall be exercised at all times to protect the coating and lining of the carrier pipe, maintain tight, full-seated joints in the carrier pipe and ensure it is fully supported and centered with specified spacers. Casing shall be installed and to the standards set forth in the Casing Standard Detail.

N. Clearances with Other Utilities

- i. Minimum of ten feet horizontal distance between sewer and water main shall be maintained for parallel installations.
- ii. Minimum 18-inches vertical distance shall be maintained for water main and sewer line perpendicular crossings. Sewer shall always be placed below water mains.
- iii. Parallel Installations: The City may allow parallel installation of water line closer than ten feet to a sewer, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer.
- iv. Sewer and Water Main Crossings: For sewer and water main crossings, the crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. A minimum 18-inches shall be maintained. Where a water main crosses over a sewer, adequate structural support shall be provided for the sewer. In no instance shall sewer be installed above any water lines without City approval.
- v. The City shall approve any instances when proper clearances are unable to be maintained as stipulated in this section.

O. Pavement Replacement

- i. Contractor shall fully restore and replace all pavement, curbs, gutters, sidewalks and other surface structures removed or disturbed, to a condition that is as near original condition as possible and in accordance with the standard details.
- ii. Pavement cuts shall be made by saw cutting prior to excavation to eliminate uneven and ragged edges.
- iii. Concrete Cap Required: All Georgia D.O.T. and Forsyth County road cuts shall have an eight (8) inch thick concrete cap (3000 psi in 28 days) which shall extend not less than twelve (12) inches beyond the edges of the backfilled ditch per the pavement replacement standard detail.

- iv. Asphalt Patches: Final asphalt patches shall match the existing pavement type, quality and thickness as closely as possible. Special attention shall be given to match existing slopes and grades for a smooth transition.
- v. For sewer lines installed in existing paved streets parallel with the roadway, the streets in which the sewer lines are installed shall receive a full width asphalt repaving in accordance with Georgia D.O.T. specifications.

P. Protection of Existing Utilities

- i. It is the responsibility of the Contractor to locate all underground utilities and to protect same. Utility lines or services damaged by the Contractor shall be repaired by the Contractor at the Contractor's own expense. Contractors must utilize the Utilities Protection Center's "Call Before-U-Dig" hotline at 1-800-282-7411.

Q. Clean-Up

- i. Construction Site: Prior to requesting the "completion of sewer construction" inspection, the Contractor shall remove and dispose in an acceptable manner all shipping timbers, shipping bands, spacers, excess materials, broken material, crates, boxes and any other material brought to the job site.
- ii. Repair/Replace Damaged Items: Any work, trees, lawns, shrubs, fences, flower beds, drainage culverts or other property damaged by the sewer construction, shall be repaired or replaced.
- iii. All shoulders, ditches, culverts and other areas impacted by the sewer construction shall be at the proper grades and smooth in appearance.
- iv. All manhole covers shall be brought to grade.
- v. Grassing: A uniform stand of grass is required prior to acceptance of the sewer by the City of Cumming.

6. Testing and Acceptance

All gravity sewer lines shall be cleaned and televised prior to testing

- A. Infiltration Testing: Infiltration of groundwater into sewer lines shall not exceed 25 gallons per inch of diameter, per 24-hour day, per mile of sewer.
- B. Low Pressure Air Testing: All lines shall be air tested in the following manner after backfilling and tamping has been completed:

- i. Test Preparation: All wyes, tees or end-of-side sewer stubs shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Prior to testing for acceptance, the pipe should be cleaned.
- ii. Test Procedure: The sewer segment being tested shall be pressurized to 3.5 psi. A short period of time (2-4 minutes) may be required to allow the pressure to stabilize. The pressure shall not decrease more than 0.5 psi (from 3.5 to 3.0 psi) during the time periods shown below

| Pipe Size (inches) | Time Period |
|--------------------|-------------|
| 4 | 1:53 min |
| 6 | 2:50 min |
| 8 | 3:47 min |
| 10 | 4:43 min |
| 12 | 5:40 min |
| 15 | 7:06 min |
| 18 | 8:30 min |
| 21 | 9:55 min |
| 24 | 11:20 min |
| 27 | 12:45 min |
| 30 | 14:10 min |

v. Test Failure: If the pipe installation fails to meet the infiltration or air test requirements shown above, the Contractor shall determine, at his own expense, the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of these tests and the results of the air test shall be neatly tabulated by the Contractor and submitted to the City of Cumming Inspector.

C. Mandrel Testing

All PVC pipe must pass a 5.0% deflection test as follows: Not before 30 days after pipe is laid and backfill placed, the Contractor shall, in the presence of the City Inspector, test the pipe for deflection.

- i. A mandrel, sized to permit up to 5.0% deflection, shall be used.
- ii. Flush Line: Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel
- iii. Float Rope: During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line.

- iv. Connect Mandrel: After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
- v. Connect a retrieval rope to the back of the mandrel to pull it back, if necessary.
- vi. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe where the mandrel will exit, determining the location of the mandrel in the line.
- vii. Draw mandrel through the sewer line.
- viii. If a section with excessive deflection is found, locate it; dig down and uncover the pipe; inspect the pipe, if any damaged pipe is found, replace it; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.

D. Vacuum Testing of Manholes

Each manhole shall be tested immediately after assembly and prior to backfilling. Test shall be in accordance with ASTM C1244-94.

- i. No grout will be placed in the horizontal joints before testing.
- ii. Pipes Entering Manhole: All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
- iii. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation.
- iv. Vacuum Requirements: A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches of mercury shall be recorded.
- v. Leakage: Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to nine inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

| Manhole Depth | Minimum Elapsed Time for a Pressure Change of 1-inch Hg |
|-------------------|---------------------------------------------------------------|
| 10 ft or less | 60 seconds |
| >10 ft but < 15ft | 75 seconds |
| >15 ft but < 25ft | 90 seconds |

Note: For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes.

- vi. Test Failure: If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
- vii. Test Equipment: Vacuum test equipment shall be equal to that of P.A. Galzier, Inc., Worcester, MA.

7. As-Built Drawings

- A. The owner, developer (or the developer's engineer), or Contractor are responsible for furnishing As-Built drawings to the City of Cumming as soon as all work has been completed and all inspection items approved such that no subsequent structures are changed. The developer's engineer (when applicable) holds responsibility to ensure that the necessary information is received from the Contractor to complete the As-Built drawings.
- B. As-built drawings shall be submitted to the City of Cumming for every project governed by this manual. The City of Cumming will not permit the issuance of any certificate of occupancy or the approval of any final plat until appropriate as-built drawings are received.
- C. As-Built guidelines
 - i. Sewer As-Built should be on a separate plan sheet from other utilities.
 - ii. As-Built shall contain the name of the development.
 - iii. Location of all sewer lines, manholes, stream crossings, road crossings and all other appurtenances shall be shown.
 - iv. Land lots and districts shall be shown and all lots numbered.
 - v. Road names shall be included.
 - vi. The words "As-Built" shall be stamped in large clear print on the plans.
 - vii. "As-Built" drawing size shall be 24" x 36" whether submitted electronically and/or hard copy.
 - viii. Minimum scale 1" = 20'. Maximum scale 1" = 100'.
 - ix. For phased subdivisions as a phase is completed, a key "map" location sketch showing the entire subdivision with said phase outlined shall be included.

- x. As-Built drawings must be sharp, clear, clean and legible, suitable for filming as permanent record. Contour lines when shown shall be faded in contrast and not conflict with clarity and legibility of the drawing details.
- xi. Outlots shall be labeled (Outlots are those parcels not designated as a lot, public street, or public dedication. Includes private roads, areas for future development or any other non-buildable parcel retained by the developer.)
- xii. Contractor's name, address and phone number shall be included.
- xiii. “As-Built” sewer plans shall show by appropriate dimensions the location of all plugged stubs to the nearest foot.
- xiv. No hand-drawn or “marked-up” (red-lined) construction plans will be accepted as As-Built or record drawings.
- xv. Site plan and plan and profile sheets shall be included.
- xvi. Electronic copies of all as-built drawings, plans, and related documents/files must be submitted to the City of Cumming. Electronic files must be submitted on a high-quality data CD and in AutoCAD format in a version compatible with the City’s version.

8. Construction within State Highways, County Roads, and City Streets.

- A. All storage of materials, excavation, backfilling, pavement removal and replacement, clean up and grassing shall be in strict accordance with the applicable State, County, or City regulations. It shall be the Contractor's responsibility to determine the exact requirements of the authority having jurisdictions over the right-of-way and no extra compensation will be allowed the Contractor for meeting such requirements. No highway, road, or street shall be closed to traffic without authorization from the proper authority. The Contractor shall provide suitable lights, signs, barricades, and flagmen to insure the safety of pedestrians, vehicle traffic, and workers and to protect the work.
- B. The Contractor shall coordinate the closing of any street at least 72 hours in advance with the Department of Utilities at 770-781-2020.

Prior agency approval is required when working within the following permitted or maintained right-of-way

| | |
|---------------------------------------------------------------------------------------------------|--------------|
| City of Cumming Street Department. | 770-781-2010 |
| City of Cumming Police Dept. | 770-781-2000 |
| Department of Utilities Construction Inspection | 770-781-2020 |
| Forsyth County Engineer | 770-781-2165 |
| State of Georgia DOT – Gainesville Office | 770-532-5500 |
| http://www.dot.ga.gov/AboutGDOT/Districts | |

- C. The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; shall provide qualified flagmen where necessary to direct traffic; shall take all necessary precautions for the protection of the work and the safety of the public.
- D. Construction traffic control devices and their installation shall be in accordance with the current Georgia "Manual of Uniform Traffic Control Devices for Streets and Highways."
- E. Placement and removal of construction traffic control devices shall be coordinated with the Georgia Department of Transportation, Forsyth County, and/or the City of Cumming a minimum of 48 hours in advance.
- F. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed. When working within State Highway right-of-way, provide trained and certified flag people who have completed a training program approved by the State of Georgia.
- G. The City shall obtain a permit from the Georgia DOT for all work performed in Georgia DOT ROW. The contractor shall maintain a copy of the permit at all times on the work site and shall comply with all provisions of the document. The contractor shall contact the DOT prior to start of construction.

SECTION 500 STANDARD SEWER & PUMP STATION DETAILS INDEX

Sanitary Sewer Details

| | |
|-------|---------------------------------------------------------|
| S-1 | Utility Locations Within the Right-Of-Way - Subdivision |
| S-2 | Sewer Service Lateral |
| S-3 | Service Line Termination |
| S-4 | Dry Service Line Instillation |
| S-5 | Manhole Plan |
| S-6 | Outside Vertical Drop |
| S-7 | Manhole in Pavement |
| S-8 | Manhole in Outfall |
| S-9 | Shallow Manhole |
| S-10 | Manhole Steps |
| S-11 | Vented Manhole |
| S-12 | Manhole Frame and Cover Traffic Rated |
| S-13 | Manhole Frame and Rotating Cover Non-Traffic Rated |
| S-14 | Sewer Bedding detail |
| S-15 | Sewer Casing Detail |
| S-16A | Concrete Encasement Detail |
| S-16B | Allowable Trench Width Chart |
| S-17 | Thrust Restraint Horizontal Thrust |
| S-18A | Thrust Restraint Upward Thrust |
| S-18B | Thrust Restraint Size Chart Upward Thrust |
| S-19 | Thrust Restraint Downward Thrust |
| S-20 | Thrust Restraint Concrete Collar |
| S-21 | Pavement Cut Repairs Type A, B, and C |
| S-22 | Stream Crossing |
| S-23 | Oil and Grease Interceptor |
| S-24 | Low Pressure Connection Detail |
| S-25 | Grinder Pump Simplex Operation |
| S-26 | Grinder Pump Duplex Operation |
| S-27 | Marker Ball Detail |
| S-28A | Dumpster Enclosure Site |
| S-28B | Dumpster Enclosure Details |
| S-29 | Air/Vacuum Valve Detail |
| S-30 | Line Transition Detail |
| S-31 | Maximum Slope for Gravity Sewer Lines |

Sanitary Sewer Pump Station Details

| | |
|-------|-----------------------------------------------------------------|
| PS-1 | Electrical Building Layout |
| PS-2 | Waste Water Pumping Station Elevation View |
| PS-3 | Pump Station Site Layout |
| PS-4 | Wet Well Access Hatch |
| PS-5 | Valve Vault for Duplex Station with Eccentric Plug Check Valves |
| PS-6 | Electrical Building Typical Wall Section |
| PS-7 | Electrical Building Gable Framing Detail |
| PS-8 | Electrical Building Structural Detail |
| PS-9 | Typical Yard Hydrant |
| PS-10 | Asphalt Paving Detail |
| PS-11 | Sidewalk Detail |
| PS-12 | Buried Valve Detail |
| PS-13 | RPZ Backflow Preventer and Hot Box |
| PS-14 | Chain Link Fence Detail |
| PS-15 | Emergency Bypass Piping Detail |
| PS-16 | Triplex Station with Emergency Bypass |
| PS-17 | Wet well Vent Detail |
| PS-18 | Wet well Configuration Example Only |

SECTION 600 APPROVED MANUFACTURERS

601 SUBMERSIBLE WASTEWATER PUMPS

Flygt Pumps

90 Horizon Drive
Suwanee, Georgia 30024
(770) 932-4320 Ext. 19 FAX (770) 932-4321
<http://www.flygtus.com/115107.asp>

602 SCADA SYSTEM AND VERBATIM AUTO-DIALER

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5125 Highway 85
Atlanta, Georgia 30349
(404) 765-5138 FAX (404) 763-0711
<http://www.south.cummins.com>

Nixon Power Services / Kohler

3121 Oakcliff Industrial Street
Atlanta, Georgia 30340
(770) 452-7695 FAX (770) 452-7696
www.kohlergenerators.com

Reagan Equipment / Katolite

995 Marietta Industrial Drive
Marietta, Georgia 30062
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www.katolight.com

604 BACKFLOW PREVENTION DEVICE RPZ (HEATED COVER)

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