



# SOUTH GRANVILLE WATER AND SEWER AUTHORITY

# STANDARD SEWER SPECIFICATIONS

Adopted by the  
South Granville Water and Sewer Authority

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## **INTRODUCTION**

This document has been developed by the South Granville Water and Sewer Authority's Utility Department to outline the Authority's policies, standards, and specifications as they pertain to Water and Sewer. This Document is not intended to replace or override any accepted Industry Standard; Local, State, or Federal Laws; or any "Best Engineering Practices". **Any discrepancies or deviations from this document must be approved in writing by the Authority's Utility Director prior to any construction. The contents of this document are subject to change at anytime without notice.**

### **Water and Sewer Allocations**

Water and Sewer allocations shall be made in accordance with the Authority's Allocation Policy. For a copy of the application and policy, contact the SGWASA main office.

### **Line Extensions within the Authority or Extensions to the Authority's System**

If an extension of the Authority's water or sewer system is proposed, the extension will be approved by the SGWASA Board. No extension shall result in cost being borne by the authority unless the extension is initiated by the Authority to improve efficiency or reduce costs. To initiate such an extension request, please submit a letter of request to the South Granville Water and Sewer Authority, Attn: Utility Director, 415 Central Avenue, Suite B, Butner, NC 27509. Questions concerning such an extension can be directed to the South Granville Water and Sewer Authority's Utility Director at (919) 575-3367.

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PART ONE

GENERAL PROVISIONS

All water and sewer main extensions and service connections to the Authority's utility system must be approved, prior to construction, by the Utility Department. All sewer and water services in public right-of-way are to be installed by Authority forces or by a licensed utility contractor. Sewer taps in dedicated easements will either be made by Authority Forces, licensed utility contractors or licensed plumber. All water and sewer connections in new subdivisions are responsibility of the developer. All sewer services will be metered through a dedicated sewer meter, water meter serving the facility at 1:1, or another method approved by the Utility Director. The meter will be located at the right-of-way or in a 2 foot dedicated utility easement adjacent to the right-of-way.

**During installation of any water or sewer system that is to be connected to the South Granville Water and Sewer Authority, if the procedures outlined in this document are not strictly adhered to, the Authority reserves the right to**

- 1 require the installation to be uncovered for visual inspection;**
- 2 reinstallation or retesting of the installation in question;**
- 3 refusal of acceptance of the installation;**
- 4 and/or refusal of acceptance of the entire project.**

**The authority shall be held harmless to any and all costs associated with any deviation from the procedures outlined in this document.**

**Testing and Inspections**

**It is the responsibility of the Engineer of Record to have a representative present during construction and testing. This representative must be present at least 25% of the time during construction and 100% of the time during all testing procedures. The cost associated with inspections will be paid for by the developer.**

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A. Septic Tank Policy

Septic Tanks inside the Authority will require a permit from the County Health Department. If a septic tank is installed, there shall be no connection to the Authority's water system.

B. Flood Policy

New and replacement water and sewer systems shall be designed and constructed to be flood resistant in flood prone areas as indicated on FEMA Flood Maps. If the manholes are not watertight, they shall be built one foot above the anticipated 100-year flood elevation as determined by the U.S. Army Corps of Engineers.

C. Sewage Backflow Policy

The North Carolina Plumbing Code deals with fixtures and drains subject to backflow. This Code states that the traps shall be installed with an elevation at least one foot higher than the manhole top upstream from the property. If not, the property must have a back water valve on the sewer service to protect against backflow. No claims shall be made against the Authority for failure in the Authority's water or sewer system.

D. Service Connections in Sewer Easements

Sewer service connections in existing sewer main easements shall be conducted only by South Granville Water and Sewer Authority and no services connections shall be made to trunk or interceptor sewers 15-inches in diameter and larger without the specific approval of the Utility Director. Services on 15-inch and larger mains will require connection at an existing manhole or the installation of a manhole.

E. Sewer Main/Easement Relocation Policy

The Utility Department shall only consider requests for relocation of sewer mains and easements proposed as a remedial action to resolve conflicts such as encroachment of existing buildings, houses, and other such permanent structures. The total cost of relocation of sewer mains and dedication of new easements shall be at the expense of the property owner, such as engineering cost, survey cost, recordation of maps, surplus property procedure, etc.

F. Connection of Pools and Fountains to Sanitary Sewer

When any swimming pool or ornamental fountain is connected to the sanitary sewer system for the purpose of draining or flushing the pool/fountain or backwashing the filters, the drainage system shall be equipped with a pump or flow restrictor so that the discharge rate to the sanitary sewer does not exceed 100 gallons per minute.

G. Construction Water

All water used from the South Granville Water and Sewer Authority Public Utilities system must be metered.

H. Fire System Billing

Any Fire System that uses water for routine testing of pumps and/or appurtenances shall have an appropriate sized meter put into place and shall be billed in accordance with the SGWASA Rate Schedule. If the test water is returned to the SGWASA sewer system, appropriate sewer charges shall be applied.

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PART TWO

PUBLIC SEWER EXTENSION POLICIES

The minimum sanitary sewer main shall be eight inches and may be larger as required by the Authority/County/Municipal long range plans.

PART THREE

USE OF THE SANITARY SEWER SYSTEM

The Authority's Sewer Use Ordinance fully describes the use of the sanitary sewer system in the South Granville Water and Sewer Authority. In this section, the terms that relate to the sewage treatment system are defined.

In summary, this article makes it unlawful to destroy or interfere in any way with any part of Authority's water or sewer system or to deposit any solid or liquid substances directly into any manhole. Also, it sets a limit on certain amounts of biological and toxic wastes that can be discharged into the sewage system. Failure to comply with either of these can result in a civil penalty of not more than \$25,000 per incident. If an incident lasts for more than one day, civil penalties may be assessed up to \$25,000.00 per day. These limits are necessary so that the biological treatment process can be maintained at acceptable levels. A procedure is listed so that the persons generating waste over the prescribed limits may pre-treat it, apply to the Utility Director for permission to regulate the rate of discharge so that it is at an acceptable level, or apply to the Utility Director for permission to discharge certain wastes, but to pay a surcharge equal to the extra treatment cost.

In addition to the surcharges, the South Granville Water and Sewer Authority has an Industrial Pretreatment Program. Discharges exceeding the defined waste limits are to submit an industrial pretreatment application. The application must be approved by the Utility Director prior to connection and discharge into the public sewer system.

PART FOUR

SEWER DESIGN STANDARDS (Public and Private Systems)

Described in this section are the general design standards which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the South Granville Water and Sewer Authority. These design standards will ensure that the citizens of the Authority will continue to have good water and sewer facilities. Private systems located within the SGWASA Utility Service Area shall be constructed to these standards minus the exceptions listed under Private Systems, Section V.

All engineering plans for public and private water systems must meet State and Authority minimum design standards as indicated in the most recent amended Rules Governing Public Water Supplies and Public Wastewater Collection Systems by the N.C. Dept. of Environment and Natural Resources and/or the South Granville Water and Sewer Authority Standard Specifications, whichever is the most stringent. All projects must be certified by an engineer of record.

Plan and profile drawings shall be prepared by a registered professional engineer signed, sealed and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch=200 feet. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. The water and sewer drawings may be on the same sheets. All utility engineering drawings shall be on paper 24 inches by 36 inches. All sewer drawings will show all structures which shall include but not be limited to drainage ditches, storm drains, streams, ponds, lakes, buildings, streets, driveways and other existing utilities.

No plans will be approved for construction until all off-site easements have been obtained. All plans shall show the existing utilities and their size with the existing easements. Off-site drainage shall be indicated on the plans along with the proposed utilities. These plans shall include the service stubs for the individual lots to be served.

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Once installed, "as built" plans in paper form and digital form shall be provided to the Authority showing the utilities. **The digital form will be specified by the Utility Director.** "As built" drawings for the utilities shall be submitted to the Utility Department at the time of acceptance of the project by the Authority. All service stubs shall be shown on the "as built" plans and shall be referenced to the property lines. Prior to construction approval of sewers for public maintenance, recorded sewer easement plats must be submitted to the Utility Department along with all associated material and information as specified within this document and specifically but not limited to Part 7 – Construction Specifications for Sewer mains, Section II Sewer Mains and related Accessories (J) As built plans and Information.

I. SEWER DESIGN

A. Location

1.0 All public sanitary sewer mains shall be installed within dedicated street rights-of way or dedicated sanitary sewer easements. When sanitary sewer mains are installed in street rights-of way, they shall be located in the center of the pavement or right-of-way where practical or in the south or west side of the pavement.

2.0 Minimum widths of permanent and construction sanitary sewer easements, for public sewer mains, are:

Permanent/Construction	
8" & 10" main	- 20 feet wide/20 feet wide
12" & 15" main	- 30 feet wide/30 feet wide
18" & 24" main	- 40 feet wide/40 feet wide

Larger size easements are to be determined by the Utility Department if depths exceed eight feet. Sewer special conditions, temporary construction easements may be required upon approval of the Utility Department. All sewer easement boundaries must be field staked and flagged by developer's surveyor and at his expense.

3.0 The minimum combination easement width for sanitary sewer and water line is 30 feet. There must be a separation of 10 feet between outside diameters of pipes and 10 feet from the center line of the sanitary sewer to the easement line. Such easements are to be recorded as "South Granville Water and Sewer Authority Sanitary Sewer and Water Line Easement".

4.0 All off-site easements shall be acquired by the developer. These off-site easements shall be recorded by map and by deed of easement. The easements shall be dedicated to the South Granville Water and Sewer Authority and entitled "South Granville Water and Sewer Authority Sanitary Sewer Easement". The dedication of these easements shall be recorded and recorded plats must be submitted to the Utility Department prior to construction approval of the plans.

5.0 No permanent structure or impoundment shall be constructed on sanitary sewer easement or mains.

6.0 Unless specified by the Utility Director in writing prior to construction, all contiguous sewer line easements shall be constructed in a fashion so that maintenance equipment and vehicles can travel from one end to the other without having to turn around or enter from a different point. Access to any easement shall not have to be made using a private owners driveway or property. This may require driveway pipe to be installed at creek crossings. If driveway pipe are required, they shall be placed the entire width of the easement.

B. All elevations shall be shown or described on the plans. Spot elevations on 100' stations, 75' from the centerline on both sides, shall be shown on the plan, or cross-sections supplied to ensure that the sewer can adequately serve the property. The plans shall show the manhole number, top elevation, station, depth along with invert elevations, length of sewer reach, pipe material used, and slope (in percent).

C. Proposed sewers paralleling a creek shall be designed to a proper depth to allow lateral connections, such that all creek crossings will be below the stream bottom elevation. The top of the sewer pipe should be at least 1 foot below the stream bed elevation and be of ductile iron. The center line of a main paralleling a creek shall be a minimum of 25 feet from the top of the closet creek bank or in accordance with the minimum set by NCDENR for that river basin. Manholes along these sewers must be protected against the 100-year flood by raising top elevation one (1) foot above

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or by providing sealed manholes (see S-24). All sealed manholes must be vented every 1,000 feet along the sewer line as per details S-24.

D. Size

1.0 All gravity sewer mains shall be designed and sized to serve the total natural drainage basin or in accordance with the South Granville Water and Sewer Authority's Sewer Study, whichever is greater. Total off-site drainage area in acres must be shown on the plans and calculations should be submitted to the Utility Department upon request to justify pipe sizing. An 8-inch main shall be the minimum size permitted.

2.0 Sewer size design shall be based on an average daily flow of 100 gpcd and a peak/average ratio of 2.5. This ratio includes an allowance for infiltration.

Sewer size design shall be to half full or 50% capacity for the maximum depth of flow for all grades.

3.0 Grades for sanitary sewers must be such that a minimum flow velocity of 2 fps is maintained. The maximum grade for sanitary sewers is 10% and the minimum grades for gravity sewers are as follows:

Pipe Diameter (in.)	Minimum Slope(%)
8	0.4
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.1
24	0.08
27	0.07
30	0.06
36	0.05

4.0 Any grades which exceed the maximum of 10% must be approved by the Utility Director and must be accompanied with details of a high velocity manhole S-23. Any time the grade is greater than 15%, ductile iron pipe shall be used with high velocity blocking (anchoring) provides as per detail S-6.

5.0 Pipe diameter changes shall occur in a manhole with the pipe crowns matched provided a minimum drop of approximately 0.20 feet is maintained between inverts.

E. Gravity Flow and Pump Stations

1.0 It is the policy of the Utility Department to utilize gravity flowing sewers unless it has been determined to be physically impossible by the Utility Director to provide sewer service to a particular area.

2.0 In situations where the gravity sewer is not available, the Authority may consider the installation of a privately owned and maintained pump station and force main provided the pump station serves a single parcel of land. The engineer for the project must address these factors:

(a) Evaluate the capacity of the receiving sewer main at the point of discharge and downstream to determine that the line can handle the transferred sewer flow.

(b) Perform a cost analysis of the pump system and gravity system. The gravity must be at least 2.5 times more expensive for the Authority to consider a pump station.

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- (c) The pump station must be sized to accommodate the total basin area that could gravity flow into it.

In some circumstances, the Utility Department may choose to accept for permanent ownership and maintenance pump stations designed in accordance with the Authority Standards. Those stations suitable for acceptance by the Utility Department must meet the following criteria:

- (a) Be determined by the Utility Director to be in the "best interest" of the Authority.
- (b) Be necessary due to limitations imposed by existing Authority facilities.

3.0 The evaluation of the use of a pump station (public or private) must be completed and submitted for review by the Utility Department prior to subdivision submittal to the Planning Board for consideration.

4.0 Pump stations will have 100% reserve peak pumping capacity (dual pumps) and shall be either the wet well-dry well type, the flooded suction type, or the above ground positive prime type unless specific approval is granted by the Utility Director for use of other type pumps. Permitted confined space conditions shall be avoided unless written justification is approved by the Utility Director. Detailed engineering plans will need to be approved by the Utility Director prior to any permitting, bidding, or construction activities take place. The public stations shall include a telemetry monitoring unit compatible with the Authority's existing system and audible and visual alarms. All pump stations accepted by the Authority for permanent ownership must be provided with on-site standby power and an appropriately sized suction and discharge stand piping system for auxiliary pumping that is compatible with the Authority's existing system. The last gravity manhole(s) prior to discharging into the pump station shall be located within 50 feet of the wet well without any creeks, roads or other obstacles between the pump station and the manhole. Wetwells shall be tested in accordance with II SEWER MAINS AND RELATED ACCESSORIES F. 5.0

5.0 All force mains shall be of South Granville Water and Sewer Authority water main materials and installed under the same construction specifications as water mains. Force mains shall include a gate valve ten feet outside of the station with gate valves every 2000 feet with a minimum of one in-line gate valve excluding the one ten feet from the station. Air release valves shall be installed at all high points. The engineer shall do a water hammer calculation to determine if a surge valve is needed.

6.0 Public pump stations must be provided with a dedicated 20' public access with a 15' wide gravel roadway. The gravel roadway shall have a minimum of 6" crush and run with slope not to exceed 10%.

7.0 On-site generators with auto-transfer switch are required for all permanent public pump station sites. Generators will be fully fueled and serviced prior to acceptance.

8.0 Private pump stations shall be equipped with a sign indicating a 24-hour on call service number.

9.0 All Pump Stations shall be equipped with Odor Control in accordance with this section:

9.1 - GENERAL

9.1.01 SCOPE

- A. Work under this section includes a complete Bioxide<sup>®</sup> chemical feed system for the control of hydrogen sulfide. The system shall consist of a feed system composed of chemical feed pumps, feed controls, liquid storage tanks, and all piping and appurtenances required to feed Bioxide<sup>®</sup> into the wastewater system, and one full load of Bioxide<sup>®</sup> product to facilitate start-up and system optimization. All materials shall be provided in accordance with these specifications.
- B. All components of the system shall be compatible with the conditions and chemicals to which they are subjected to during the normal operation of the system. Compounds with which the materials must be compatible include, but are not limited to:
1. Hydrogen Sulfide
  2. Bioxide<sup>®</sup> solution

9.1.02 PROCESS DESCRIPTION

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The system shall provide for bulk storage of Bioxide<sup>®</sup> and metering of the Bioxide<sup>®</sup> from the bulk storage tank to the wastewater collection system. The system shall contain controls as necessary to facilitate variation in feed rates over a 24-hr period. A calibration cylinder shall be permanently installed to facilitate calibration of feed pumps.

The Bioxide<sup>®</sup> material shall utilize the inherent ability of the facultative bacteria normally present in wastewater to metabolize hydrogen sulfide and other odor-causing, reduced sulfur containing compounds. The material shall provide nitrate-oxygen to the wastewater to support this biochemical mechanism. This nitrate-oxygen shall be applied via nitrate salts. The material shall be chemically stable, allowing continuous removal of sulfide contributed by side streams downstream of the application point. As a result of the biochemical process, the material shall provide the additional benefit of biochemical oxygen demand (BOD) reduction in the wastewater.

This process is described and protected by United States Patent Number Re #36,651 and Re #37,181.

The purchase of Bioxide<sup>®</sup> from Siemens Water Technologies constitutes an implied license to practice the process of "Removal of Dissolved Hydrogen Sulfide and Reduction of Sewage BOD in Sewers and Other Waste Systems", as described in United States Patent #Re. 36,651 Re #37,181.

9.1.03 MANUFACTURER

- A. All components of the feed system shall be provided by a single manufacturer who shall have sole-source responsibility for the system.
- B. The manufacturer of this equipment shall be one recognized and established in the design, production, and operation of chemical feed injection systems for the specific purpose of liquid phase odor control. The manufacturer shall provide, with the submittal data, a list of 10 systems in operation using Bioxide<sup>®</sup> for the control of hydrogen sulfide and other odor causing components associated with municipal wastewater. These systems must have been in operation at least five years. The list shall include correct names, phone numbers, length of service and design criteria.
- C. The manufacturer shall maintain regular production facilities at their place of business. These facilities shall be open for inspection by a representative of the Owner or Engineer at any time during construction and testing of this equipment.
- D. The manufacturer of the feed system shall be an Underwriters Laboratories listed manufacturer of Enclosed Industrial Control Panels.
- E. The system shall be provided by Siemens Water Technologies of Sarasota, Florida.

9.1.04 SUBMITTAL

- A. The manufacturer shall submit complete shop drawings and engineering data to the Owner or Engineer, upon request. These submittals shall include, at a minimum:
  - 1. Drawings showing plan and elevation views of the feed system
  - 2. Control system layout drawing
  - 3. Control systems electrical diagram
  - 4. Manufacture's catalogue information on major system components including, but not limited to:
    - a. Chemical Feed Pumps
    - b. Bioxide<sup>®</sup> Feed Controls
    - c. Liquid Storage Tanks
  - 5. Statement of design conditions and performance guarantee
  - 6. Statement of warranty
  - 7. Reference list as described in section 1.03, B above
- B. The manufacturer shall submit complete Operation and Maintenance manuals to the Owner. These manuals shall include at a minimum:
  - 1. Information in hazards associated with the system and the appropriate safety precautions
  - 2. Material Safety Data Sheet- Bioxide<sup>®</sup>
  - 3. Equipment installation instructions
  - 4. Equipment startup instructions
  - 5. Equipment maintenance procedures

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6. Troubleshooting guide
7. Individual operation and maintenance information on major system components, including but not limited to:
  - a. Chemical Feed Pumps
  - b. Bioxide<sup>®</sup> Feed Controls
  - c. Liquid Storage Tanks

9.1.05 SUBSTITUTIONS

Any substitutions or deviations in equipment or arrangement from that shown on the drawings specified herein shall be the responsibility of the Manufacturer or Contractor. Any deviations must be accompanied by detailed structural, mechanical, electrical drawings and data for review by the Engineer. All costs associated with review of the substitutions or deviations and costs associated with project drawing changes as a result of approval shall be borne by the Manufacturer or Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

9.2 - PROCESS

9.2.01 BIOXIDE<sup>®</sup> PRODUCT INFORMATION

A. Technical Requirements

1. The material supplied shall be an aqueous solution of calcium nitrate containing a minimum of 3.5 pounds of nitrate-oxygen per gallon.
2. The material shall be capable of reducing the dissolved hydrogen sulfide concentration in wastewater to less than 0.1 mg/l.
3. The material shall be free of any objectionable odor-producing compounds.
4. The pH of the material shall not be less than 4.0 or greater than 7.5.
5. The material shall have a freezing point less than  $-10^{\circ}\text{F}$ .

B. Safety Requirements

1. The material shall contain no hazardous substances as defined by both the Federal EPA's and State CERCLA lists.
2. The material shall be exempt from Federal DOT placard requirements.
3. Recommended handling procedures for the material shall require protective gloves and safety glasses only. Any material recommending more sophisticated equipment (i.e., face shield, body suit, etc.) during routine handling shall not be considered.

9.2.02 CHEMICAL STORAGE TANKS - (GENERAL)

The chemical storage tank shall be constructed of Rotationally Molded High-Density Crosslinked Polyethylene (HDXLPE). No other material of construction shall be acceptable.

- A. High density crosslinked polyethylene tanks shall be manufactured by the rotational molding process in accordance with ASTM D 1998-93 Standard Specification for Polyethylene Upright Storage Tanks, Type 1 only. Rotational Molding shall be defined as a three-stage process consisting of loading the mold with powdered resin, fusing the resin by heating while rotating the mold about more than one axis, and cooling and removing the molded article.
- B. Plastics. The molding powder used shall be Marlex CL-250 or CL-200 as manufactured by Phillips 66, or powders of equal physical and chemical properties.
  1. The polyethylene shall preferably be virgin material. Any use of regrind, recycled, or reprocessed materials or combinations of such materials shall not rely upon the performance data of their original constituents, but must meet the requirements of this standard in its own right.
  2. The polyethylene shall have a stress-cracking resistance of 500 h minimum F50 in accordance with Test Method D 1693, Condition A, full-strength stress-cracking agent. The test specimens may be compression molded or rotationally molded. If compression molded, Procedure C of Practice D 1928 shall be followed for both types of polyethylene with a minimum platen

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temperature of 350 °F (177 °C). If it is crosslinkable polyethylene the temperature shall be 390 °F (197 °C) and the platen shall be kept closed under full pressure for 5 minutes at the specified temperature in order to bring about the crosslinking reaction. If the test specimens are rotationally molded, the conditions for rotational molding shall be similar to the conditions used for molding a vessel from this polyethylene.

C. Fillers and Pigments. The plastic shall contain no fillers. All plastic shall contain an ultraviolet stabilizer at a level adequate to give protection for the intended service life of the vessel, minimum of 0.25%. This stabilizer shall be compounded in the polyethylene. Pigments must be compounded at the same time of resin manufacture.

D. Vessel Construction

1. Mechanical properties. The nominal value for the properties of the materials shall be based on the molded parts:

Property	ASTM	Value	Units
Density	D105	59(0.937-0.944)	Lb/ft <sup>3</sup> (S.G.)
ESCR spec. thickness 0.125"	D1693	900-1000	Hrs.
Tensile Strength Ultimate 2"/min.	D638 Type IV	2600	PSI
Elongation at Break 2"/min.	D638 Type IV	450	%
Vicat Softening Temp.	D1525	255	°F
Brittleness Temp.	D746	-180	°F
Flexural Modulus	D790	100,000-110,000	PSI

2. Design Parameters.

a. Hoop Stress. The vessels shall be designed with a hoop stress value no greater than 600 psi at 100 °F with a safety factor of no less than 2, using the Barlow Formula for calculating wall thickness.

b. Wall Thickness. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the Barlow Formula. The wall thickness shall be based on the maximum temperature of the service.

3. Cut edges. All edges where openings are cut into the vessel shall be trimmed smooth.

4. Appearance. Type 1 finished vessel walls shall be free, as commercially practicable of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking, and delaminations that will impair the serviceability of the vessel.

5. Dimensions and Tolerance. The vessel diameter shall be measured externally. The tolerances on the outside diameter, including out of roundness, shall be plus or minus 1 percent. Measurement shall be taken in a vertical position.

E. Fittings

1. All fittings with the exception of the overflow protection site glass, shall be located on the tank top or dome. No penetration of the tank side-wall shall be made.

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2. Plastic Fittings. Plastic fittings shall be "bulk-head" or "two-flange" style and shall be constructed of PVC. There shall be 4 bolts on any bolted flanges up to and including 3 inch, 8 bolts on fittings 4 inch - 8 inch diameter, and 12 bolts on 10 inch - 12 inch fittings. All bolts shall be all thread design with heads completely encapsulated in polyethylene. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4" of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material: (Green-316 grade S.S., Red-Hastelloy "C", Blue-Monel, Black-Titanium). Each bolt shall have a gasket, which is on the inside of the vessel.
3. Openings that are cut in vessel to install fittings shall not have sharp corners. Holes shall have minimum clearance to insure best performance of fittings.
4. For all flanged connectors, the flange drilling and bolting shall be in accordance with ANSI/ASME B-16.5 for 150-psi pressure class straddling the principle centerline of the vessel.

**F. Tank Manway Covers**

- 1 Manway covers shall be 16 inches diameter.
2. Manway covers shall have either a threaded or bolted cover or gasket

**9.2.03 CHEMICAL STORAGE TANK - SPECIFICATIONS**

The chemical storage tank shall be double-wall and shall have the following capacity and approximate dimensions (+/- 5%)

Tank Options:

Parameter	Chemical Tanks
Nominal Capacity	1,550 U.S. gal
Diameter	6'
Height	10'3"
Empty Weight	900 lb.
Specific Gravity	1.65

Parameter	Chemical Tanks
Nominal Capacity	3,050 U.S. gal
Diameter	8'
Height	11'6"
Empty Weight	2,000 lb.
Specific Gravity	1.65

Parameter	Chemical Tanks
Nominal Capacity	4,050 U.S. gal
Diameter	8'
Height	14'8"

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Empty Weight	2,580 lb.
Specific Gravity	1.65

**9.2.04 BIOXIDE® FEED CONTROLS**

- A. General. The operation of the Chemical Feed System shall be controlled from a Control Panel. All equipment control switches, pilot lights, controllers, etc. and the chemical feed pumps shall be housed in this panel. The control system shall be UL Approved and shall bear the UL Listed Enclosed Industrial Control Panel Label.
- B. Enclosure. The control panel enclosure shall be constructed of 316 stainless steel and shall be rated NEMA 3R. It shall be equipped with a door with a continuous hinge. The hinged door shall have two latches and shall be capable of locking via a padlock. The enclosure shall be mounted on the control stand, which shall contain the calibration stand.
- C. Components. The Control Box Shall Contain the following:
  - 2- 24 Hour Time Clocks
  - 1- 15 Amp Circuit Breaker, 115 volt
  - 1- Ground Fault Receptacle
  - 5- On/Off Switches with LED Indicator Lights
  - 2- Chemical Feed Pumps
  - 1- Cooling Fan
  - 2- Dry Contact to Receive Signal From Remote Source
- D. Controls Layout. All manually operated controls (control switches, pilot lights, etc.) shall be located on a panel behind the enclosure door. The panel shall be outfitted with a main power disconnect located in the Control Stand.
- E. Standards. All control system design, fabrication, and wiring shall conform to the standards of Underwriter's Laboratories, National Electrical Code, and any other applicable federal, state, or local codes.
- F. System Operation. Chemical Feed Pumps. The bellows pump shall be controlled by a three-position HAND/OFF/AUTO switch. When in the AUTO position the pump shall be controlled by a timer. The timer shall turn the pump on and off based upon preset time intervals. When in the HAND position the pump shall run, regardless of the preset time interval. Either one or both chemical feed pumps may turn on or off at preset speeds and preset times.
- G. Control Stand. Pump control box shall be mounted on a 316 stainless steel pedestal.
  - 1. Calibration Cylinder. The stand shall be used to house a calibration cylinder used to measure the chemical being injected into the system. A 3 way valve shall be located at the top and bottom of the calibration tube to facilitate flow measurement. Access inside this pedestal shall be accomplished through a door located on the front of the pedestal. Instructions for use of this cylinder shall be permanently affixed to the interior of the enclosure.
  - 2. Disconnect Switch. A main power disconnect shall be located in the control stand.

**9.2.05 CHEMICAL FEED PUMPS**

- 1. General. Provide Siemens Water Technologies Process Bellows Pump(s) as shown on the following table. Each pump shall include motor, base, sealed bearings, flexible coupling and check valve filters.

Pump Options:

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2. Performance. Pump rates and maximum discharge pressures shall be in accordance with the table above.
- a. The pumps shall be self-priming capable of suction lifts, when dry, up to seven (7) feet, and with bellows full, they will prime up to twenty (20) feet.
  - b. Flow rate of each pump shall be adjustable by (a) diameter of bellows, and (b) adjustment of stroke length. A calibration cylinder and valves will be installed to calibrate the pump feed rates.
  - c. Pump suction and discharge shall be 3/8" ID polypropylene barbed connection for "T" tubing. A 1-1/2" wye strainer will be installed.

3. Construction.

<u>Material Reference</u>	<u>Material</u>
Bellows	Polypropylene
Poppet valves	EPT®
O-rings	EPT®
Springs	Hastelloy C

4. Motors. Motor shall be totally enclosed 115 volt, 60 Hz, 0.034 HP, single-phase and shall be rated for continuous duty.

9.2.06

Quantity	Model No.	Bellows Diameter	Adjustable Flow Rate Range (mL/min)	Max Discharge Pressure (psi)
2	15907-002	1.0"	12-120	40
2	15907-002	1.5"	25-250	20
2	15908-001	1.0"	30-300	40
2	15908-001	1.5"	63-630	20

**PIPING & APPURTENANCES**

- A. All suction and discharge piping shall be standard 1/2" or 3/4, Schedule 80 PVC. All valves, fittings, and connectors shall be Schedule 80 PVC.
- B. All fill line piping shall be 2" Schedule 80 PVC. All fill line valves, fittings, and connectors shall be Schedule 80 PVC.
- C. Fill line shall have a 2" stainless steel male camlock with a 2" plastic female camlock cap.
- D. All chemical feed seals shall be compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the feed system.
- E. All fittings shall be solvent-welded or threaded.
- F. Contractor must install chemical feed discharge lines so that the product is injecting directly into the waste streams and not onto structures or equipment.

9.2.07 LEVEL INDICATION

Provide one mechanical tank level indicator. The level gauge shall operate utilizing a mechanical float and pulley system within the tank. The level gauge shall indicate the liquid level in feet and inches by a stainless steel tape and indicator finger through an observation window.

9.3 - EXECUTION

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9.3.01 SITE AND UTILITIES

The feed system, Bioxide<sup>®</sup> tanks, and other appurtenances shall be located on a foundation as shown in drawing. The following utilities shall be provided at the feed system site and located as shown on the drawing. Site preparation, utility service, and installation are not provided by the Manufacturer under these specifications.

- A. Electrical. One 120 VAC, 60 Hz, 15 amp single-phase electrical service shall be required.
- B. Drain - A minimum 2-inch P.V.C. gravity pad drain to sewer is recommended.

9.3.02 EQUIPMENT SHOP TESTING

Before shipping the equipment, the Manufacturer shall perform shop tests. These tests shall include at a minimum:

- A. Visual inspection of all equipment.
- B. Complete assembly, start-up, and "wet-test" of feed pumps and calibration piping.

9.3.03 INSTALLATION

The system shall be installed in accordance with the manufacturer's instructions. All installation personnel shall be trained and qualified in the areas of plumbing, electrical work, and instrumentation as required to complete the installation.

9.3.04 FIELD TESTS AND OPTIMIZATION

- A. The performance of the system shall be demonstrated to reduce dissolved hydrogen sulfide concentration in the wastewater to less than 0.1 mg/l. The manufacturer shall use an industry approved field testing method to demonstrate the results.
- B. If required, Manufacturer shall make any changes to the system, at his own expense, that may be necessary to assure satisfactory and efficient operation of this system.

9.4 - WARRANTY

The Manufacturer shall guarantee that the Chemical Feed & Storage system will perform as described in these Specifications. The Manufacturer shall warrant the system, complete, to be free from defects in materials or workmanship for a period twelve (12) months from acceptance or eighteen (18) months from shipment, whichever occurs first. The Manufacturer shall repair or provide replacement for any defective components under this warranty. In addition, the chemical storage tanks shall be warranted for a period of five (5) years from warranty start date.

F. Manholes

- 1.0 Manholes shall be spaced a maximum distance of 450 feet apart and shall be installed at each deflection of line and/or grade.
- 2.0 On 8" and larger mains when there is an elevation difference between the inverts greater than 2.5 feet, an outside drop manhole shall be used. On 6-inch services, an outside drop manhole will be required when there is an invert elevation difference greater than 10 feet. This outside drop manhole is shown in Standard Detail S-24A.
- 3.0 See Standard Details S-20 throughs-29 for manhole standards. Manholes will be supplied with rubber water stops for connecting the sewer pipes with the barrel section.
- 4.0 Eccentric or concentric cones may be used on 8 through 12-inch mains. On 15-inch and larger mains, concentric cones must be used.

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5.0 The following minimum diameter manholes shall be used dependent upon the size mains and depth of installation. The larger manhole sizes will be required if either the main size or the depth warrants as follows:

Diameter Manhole	Depth of Main Size or	Installation
4'- 0"	8" to 12"	0'-12'
5'- 0"	15" to 30"	12' to 20'
6'- 0"	36" to 54"	20' and greater

Extended manhole bases may be used to minimize manhole diameter when larger manhole is required because of the depth, main size will dictate manhole diameter.

Variance from these requirements must be approved by the Utility Department prior to construction. Each manhole must be of consistent diameter throughout its height. No transition rings will be permitted unless approved by the Utility Director based upon extenuating circumstances.

**G. Installation**

1.0 All installations shall be in accordance with established Authority standards for utility mains.

2.0 The depth of sewer mains shall be great enough to serve adjoining property, allowing for sufficient grade on the service line. Lateral connections are to be into manhole barrels (not the cone section) or into the top quarter of sewer mains. Taps made into manholes shall be made with a concrete core with rubber water stops (boots) installed.

3.0 All 4" sewer laterals may be tapped directly into 8, 10, 12, and 15-inch mains or manholes in accordance with Standard Details S-30 through S-32. All sanitary sewer connections 6 inches and larger shall be made into manholes only. If a new manhole is required, it shall be included in the cost of the service line. Service connections are allowed only at manholes on mains larger than 15 inches. Service clean-outs shall be located at the right-of-way line or the easement boundary line.

4.0 All sewer mains shall have a minimum of over of 3'(measured from top of finished grade) in traffic areas to the pipe crown unless ductile iron pipe is provided in Class I bedding where minimum cover shall be three (3) feet. Sewers shall be no deeper than 12' unless approved by the Utility Director. If a deeper cut is allowed, PVC pipe may be used only if the appropriate bedding is used and if the loading calculations are presented to the Utility Director for review. If a special bedding is not used, ductile iron shall be installed for extra depth cuts. Non-traffic areas shall have a minimum cover of 3'(measured from top of finished grade) to the pipe crown. Service laterals shall be of cast iron soil pipe, PVC, or ductile iron when installed in a public right-of-way. If the sewer lateral goes into a manhole within an easement, it may be construction of PVC material. A clean-out is required at the easement or right-of-way line and must be constructed out of cast iron pipe, ductile iron pipe or, if constructed of PVC, must be equipped with a bronze clean-out plug to facilitate location if buried. All clean-outs shall have a two foot by two foot by 6 inches deep poured in place concrete pad with the top of the cleanout flush and centered in the pad.

5.0 Private collector systems installed outside of public easements and rights-of-way will be built to the applicable State Plumbing Code and Department of Environment and Natural Resources Standards and must meet the requirements of the Utility Department's Private Sewer System Standards.

**H. Limits of Installation**

Extensions of sanitary sewer mains are to be to the farthest property line of the tract, where necessary to serve adjoining property with gravity sewer. In all instances, plans shall show the total area in acres draining to the uppermost bounds of the tract on any established watercourse.

**II. GENERAL INSTALLATION STANDARDS**

**A. Horizontal Relation of Water Mains to Sewers**

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Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation in which case:

The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

\*Note: All distances measured from outside diameter to outside diameter.

B. Vertical Relation of Water Mains to Sewers

Crossing a Water Main Over a Sewer. Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18-inch vertical separation in which case both the water main and sewer shall be constructed of ductile iron and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

Crossing a Water Main Under a Sewer. Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ( ferrous ) ductile iron and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing and maintain a minimum of 18" vertical separation. Both lines shall have a section of the main pipe centered at the point of crossing. (no joints within 10 feet of the crossing on either line)

\*Note: All distances measured from outside diameter to outside diameter.

C. Vertical Relation of Sanitary Sewer Mains & Water Mains to Storm Sewer

When a sanitary sewer or water main is crossing over or under a storm sewer, a vertical separation of 18 inches shall be maintained unless both lines are of ductile iron. Distance measured outside diameter to outside diameter.

D. General Vertical Clearance

When other underground utilities are encountered 12 inches of separation should be maintained.

II. PRIVATE SYSTEMS

Private sewer System

1.0 Private sewer collection lines shall not be required to be located in public road right-of-way or publicly dedicated easements.

2.0 Change of direction or slope for private 4 or 6 inch sewers does not require manholes but does require clean-outs.

3.0 Clean-outs shall be not be used for connection of private collections systems to public mains. Manholes are required.

4.0 Private sewers shall not be sized to handle any off-site sewerage flows.

5.0 Ductile Iron or PVC may be used for 4-inch lines and 6-inch lines.

6.0 Profile drawings will not be required for 4 and 6 inch lines however, equivalent information must be provided on detail engineering plans such as minimum depth of cover, culvert elevations, slope, length of reach between manholes/clean-outs, pipe material, vertical separation of sewer from conflicting water main or storm drainage, etc. Profile drawings will be required for main sizes of 8 inch and larger. The minimum slope for 4" and 6" lines are 1.04% and 0.5% respectively. Flow will be based on a half full pipe.

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PART FIVE

PERMITS & APPROVALS

During the course of designing and prior to constructing a utility project, various permits and approvals from the Authority and State Government must be secured. Below is a brief description of some of the major permits that may be required on these projects. First will be discussed the South Granville Water and Sewer Authority permits and approvals followed by a brief discussions of the necessary State permits.

South Granville Water and Sewer Authority Permits and Approvals

1.0 Allocation of Water and Sewer from South Granville Water and Sewer Authority

Any request for allocation from SGWASA must be submitted in writing to the Executive Director, 415 Central Avenue, Suite B, Butner, NC 27509. All allocations will administered in accordance to the SGWASA Allocation Policy.

2.0 Line construction and extensions

Any request for extension of the South Granville Water and Sewer Authority's Water or Sewerage Systems must be made in written form to the Utility Director, South Granville Water and Sewer Authority, 415 Central Avenue, Suite B, Butner, NC 27509. This written request must include a preliminary plan of the proposed extension and a schedule setting forth the proposed beginning and completion for all phases of the project.

Requests for extensions within the South Granville Water and Sewer Authority's Authority will be evaluated by the Utility Department and presented to the Authority Board for approval.

3.0 All applicable submittals and approvals/permits shall be acquired prior to any utility construction.

Wetland Permit

It is the responsibility of the developer/engineer to verify if wetlands exist on a project. The regulatory agency that controls wetlands is the US Army Corp of Engineers and or NC Department of Environment and Natural Resources. If wetlands are present it is developers/engineers responsibility to obtain necessary permits and see that they are strictly adhered to.

NCDOT Encroachment Permit

If a project involves a State maintained road or highway, the engineer or contractor must submit the necessary highway encroachment forms to the North Carolina Division of Highways. The encroachment agreement must first be submitted for execution by the South Granville Water and Sewer Authority through the Utility Department. The engineer/developer will pick-up executed forms from the Utility Department then deliver to NCDOT.

All applicable Erosion and Sedimentation Programs, Buffer Ordinances, Storm water Ordinances, and any other local/state/federal laws, ordinances, and policies must be obeyed.

PART SIX

MATERIAL SPECIFICATIONS FOR SANITARY SEWER LINES

I. GENERAL MATERIAL REQUIREMENTS

Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), American Association of State Highway and Transportation Officials (AASHTO), Ductile Iron Pipe Research Association (DIPRA), and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications, and all material used shall conform fully to these current specifications or be removed from the job at the direction of the Utility Director or his

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assistant. Failure of the Utility Director to condemn materials on preliminary inspection shall not be grounds for acceptance if future defects are found.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Utility Director may direct or as specified herein.

Rejection of pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

These specifications are not be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

II. PIPE MATERIALS (Mains Only)

A. Ductile Iron Pipe

Ductile iron pipe used for sanitary sewers shall be manufactured in accordance with AWWA Standard C-150 latest revision. The minimum class pipe shall be a Class 50 and shall be designed for an 8-foot minimum cover and a Class I (Part Ten Section ii, N-1c) laying condition. Ductile iron may be used for any sewer main 8-inch and larger. Pipe joints shall be the "Push-on" type manufactured in accordance with AWWA Standards C-111.

B. AWWA C-900 PVC Pipe (See Water System Materials)

When a sewer main is being installed within 100 feet of a well, the AWWA C-900 PVC Class 200 pipe may be used for 8-inch sewer mains providing they are serving residential or office and institutional land uses in that basin. In this case, the C-900 PVC pipe will have water tight joints. All material in this case shall meet the requirements of AWWA Standard C-900 latest revision. The pipe shall be supplied with compression bell ends.

C. PVC Gravity Sanitary Sewer Pipe

PVC gravity sanitary sewer pipe and related fittings shall be manufactured in accordance with all the requirements of ASTM D-3034 latest revision SDR 35, Type PSM polyvinyl chloride sewer pipe and fitting. PVC gravity sewer pipe shall be used for 8, 10, 12 and or 15 inch mains and shall be supplied in 12.5 to 20 foot lengths with bell-and-spigot joints. ASTM F-679 latest revision shall establish the requirements for 18, 21, 24 and 27 inch diameter PVC, SDR 35 gravity sewer pipe. The length of joints shall be at least 11 feet for the larger PVC pipe, unless approved differently by the Utility Director. All fittings shall use rubber gaskets which conform to the requirements of ASTM F477 latest revision.

D. Steel Pipe

1.0 Steel pipe for aerial creek crossings or boring installations (without encasement and carrier pipe) shall be high strength steel, spiral welded or smooth-wall seamless manufactured in accordance with ASTM A139 and A283 latest revisions and consisting of grade "B" steel with a minimum yield strength of 35,000 psi. On 8 and 10 inch pipe, the minimum wall thickness shall be 0.375 inches.

The outside of the pipe shall be coated with 2 coats of a compatible black epoxy with a total dry film thickness of 8 – 10 mils per coat. Epoxy coating shall be Tnemec Hi-Build Tnemec-Tar Series 46H-413, or approved equal.

Pipe ends shall be right-angled and shall be compatible to receive a "dresser style 62" - Type I or approved equal mechanical transition coupler.

2.0 Steel encasement pipe shall be longitudinally welded or smooth-wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and manufactured in accordance with ASTM A139 and A283.

The pipe thickness shall be as specified on the encroachment agreement or plans but in no case be less than 0.375 inches and the ends shall be beveled and prepared for field welding at the circumferential joints. Thicker encasement pipe may be required by the North Carolina Department of Transportation, railroads, or other agencies.

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The pipe shall be coated inside and outside, in accordance with AWWA C203, ASTM 3034-12454 B latest revisions and any additional requirements of the N.C. Department of Transportation or the American Railway Engineering Associations' specifications. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

If the encasement pipe is used to carry a sewer main larger than 8-inch in diameter, then a vent pipe shall be installed. The vent pipe shall be made from ASTM A139 and A283, grade "B" steel, with a minimum yield strength of 35,000 psi and coated as described above. The vent pipe location shall be approved by the appropriate agency prior to installation.

All carrier piping shall be slip joint ductile iron (SDR 35 PVC may be used for gravity sewer) and the minimum inside diameter casing shall be eight inches greater than the inside dimension of the carrier pipe as follows:

Carrier Pipe Inside Diameter	Steel Casing Pipe Minimum Inside Diameter
4 inch	12 inch
6 inch	14 inch
8 inch	16 inch
12 inch	20 inch
16 inch	24 inch

Both ends of the casing shall be mortared. In all casing greater than 50' in length or with carrier pipe greater than 12-inch or where necessary to insure proper grade in sewer pipe, metal "spider" devices shall be installed with a minimum of two spider per pipe joint one fourth of the pipe length in from the bell and spigot ends. (See Detail S-18)

III. MANHOLES AND RELATED MATERIALS (See Part Seven, Sec. II, Item F for Manhole Construction)

Manholes will be precast reinforced concrete. Eccentric or concentric cones may be used on 8 through 12 inch mains. Concentric cones will be used on all 15 inch and larger mains. These different type manholes shall conform to these specifications and the South Granville Water and Sewer Authority Standard Detail Drawings. All manholes located outside public road right-of-way must be protected from the 100-year flood by either being sealed or being raised to provide the top elevation set 1.0 foot above the U.S. Army Corp of Engineers established flood elevation. Sealed manholes must be vented as per Detail S-24. All manholes shall be adequately waterproofed and manholes serving outfall sewers (24-inch and greater) and all sealed manholes shall be coated with a bituminous lining as manufactured by Koppers Company or approved equal.

A. Precast Reinforced Concrete Manholes

The concentric and eccentric manholes shall be designed and manufactured in accordance with ASTM C-478-97. Manhole diameters shall be 4, 5, or 6 feet in diameter as determined by the table for main size or depth in Part Six, II, D, 5. The walls shall be a minimum of 5 inches thick and have a 6-inch minimum base. The standard joint shall be sealed with cementitious grout meeting all federal specifications. An o-ring or "ram neck" joint seal may be used. The "o" ring joint shall conform to the requirements of ASTM, C-443-98. A rubber water stop shall be supplied with the manholes to tie the pipe to the barrel section. These gaskets and clamps shall meet the requirements of ASTM C-923-98. (See Standard Detail U-37 for more details on this manhole.) All internal joints and openings 60 shall be grouted with hydraulic cement. All external joints will be wrapped with a six inch wide bituminous material with the wrap centered on the joint.

The manufacturer shall submit drawings showing the reinforcing, pipe openings and other details for approval by the Utility Director. Also, the manufacturer shall provide certified test reports indicating that the materials comply with the requirements of ASTM C-478. "Extended base" precast sections must comply with Detail S-21 dimensions and equivalent reinforcing.

B. Related Materials

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1.0 Manhole rings and covers shall be built to the dimensions shown on the South Granville Water and Sewer Authority Standard Detail S-25 through S-29 and shall be made from Class 30 gray iron, meeting the requirements of ASTM A-48 latest revision.

2.0 Manhole steps shall be made from reinforcing steel which is rubber coated to provide for safer footing. These steps shall be furnished in accordance with the South Granville Water and Sewer Authority Standard Detail S-28 and the applicable OSHA regulations. Steps shall also be provided on outside or raised manholes when top elevation is greater than three (3) feet above existing ground elevation.

3.0 Cement used in masonry or reinforced concrete units shall be Type I, CSA normal, meeting ASTM C-150-99, unless otherwise approved by the Utility Director.

4.0 Concrete shall be only plant-mixed or transit mixed concrete conforming to ASTM C-33 as to aggregate and to ASTM C-94 for Ready-Mixed Concrete.

Concrete shall be of three types as based on 28-day compressive strength:

Type AA	4500 psi
Type A	3000 psi
Type B	2500 psi

Concrete shall be air-entrained, unless specified otherwise, with 4 to 6% air. Retarders and accelerators shall be used only as directed by the engineer.

Concrete used for structures such as sewage lift stations and other reinforced concrete structures shall meet all applicable provisions of the NCDOT specifications regarding manufactures, delivery and placement.

5.0 Steel reinforcing for concrete structures shall meet all applicable provisions of the NCDOT specifications as to manufacture, fabrication and placement.

6.0 Mortar used for sewer structures shall conform to ASTM specification C-144-99 as to aggregate and strength. Mortar shall be prepared from cement in perfect condition and shall be prepared in boxes for that purpose. No mortar that has stood beyond forth-five minutes shall be used. Proportion by volume for different kinds of work shall be:

Brick Masonry	1 part cement to 2 parts sand
Pointing	1 part cement to 1 part sand

#### IV. MISCELLANEOUS MATERIALS

##### A. Transition Couplings

All transition connections between different sewer line materials shall be the Authority's Standard manhole installation unless approved in writing by the Utility Director.

If such a transition is due to a repair and/or approved it shall be done in the following manner:

Material transitions in sewer mains from vitrified clay pipe to ductile iron, ABS composite, reinforced concrete, PVC gravity sewer or PVC AWWA C-900 pipes, may be made providing there is no change in the nominal inside diameter and made with an approved elastomeric PVC compression seal adapter conforming to ASTM A-167. All seals once installed shall be watertight.

A rubber sleeve mechanical coupler, meeting the requirements of ASTM A-167, may be used when joining the plain ends of different type sewer pipes. The couplers shall have three parts:

1.0 A circular synthetic rubber sleeve meetings the physical, chemical and bacteriological requirements.

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2.0 Two stainless steel impression bands with stainless steel nut and bolt.

3.0 A stainless steel shear band shall wrap around the joint a minimum of 380 deg.

All stainless steel bands and tightening devices shall be corrosion resistant. The rubber sleeve shall be chemically resistant. When in place, the coupler shall provide a watertight and gas tight seal.

Only one such transition shall be allowed between man-holes; therefore, the same material must be installed from the transition point to the next downstream manhole. Transitions between manholes can only be material not size.

B. PVC Sewer Service Pipe

PVC Sewer Service pipe used for sewer services shall be scheduled 40 PVC including the clean-out stack provided that a bronze clean-out slotted flush plug for location purposes.

C. PVC Sewer Pipe and Saddles

PVC sewer pipe, saddles and adapters shall conform to the requirements of ASTM D-3034-98. The saddle shall be installed in accordance with Standard Details S-30 through S-32.

D. Sewer Service in Easements

Sewer service material in easements shall comply with the N.C. Plumbing Code.

E. Sewer Services Crossing Creeks or Streams

Sewer services crossing streams or creeks as defined by the NC Department of Environment and Natural Resources shall comply with the North Carolina Administrative Code.

PART Seven

CONSTRUCTION SPECIFICATIONS FOR SEWER MAINS

I. GENERAL REQUIREMENTS

The requirements contained in this section shall apply to sanitary sewer main installations and to projects constructed specifically for the Utility Department or for private developers who may or may not dedicate the sewer improvements to the Authority. All necessary construction permits must be obtained before construction may begin.

A. Scope of Work

1.0 The contractor shall furnish all materials, equipment, and labor for excavation, installation, backfilling or water and/or sewer mains and related appurtenances as shown on the plans.

The Utility Department shall conduct all Authority inspections on main extension projects.

2.0 It shall be the contractor's responsibility to notify the Utility Department at least twenty-four hours and not more than 72 hours in advance of beginning any construction work on any project connecting to or impacting the Authority's water/sewer system. Call the Utility Department at (919) 575-3367 and give the location, project name, individuals name and company name, indicate if it involves water or sewer extension and state the start date.

3.0 Once construction has begun, the contractor shall contact the Utility Department at (919) 575-3367 if there is any interruption of work for more than 48 hours or if there is to be a resumption of work after a 48 hour halt. Any work requiring inspectors observation outside of the normal work day, Monday-Friday, 7:30 to 4:15 shall be charged current inspector hourly rate.

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4.0 If a developer, engineer or contractor proceeds with the main installation prior to the construction authorization, by signatures on the plans, the Authority may require the work to be reinstalled and the developer, engineer or contractor shall be fully liable for all actions and costs, including prosecution by the Authority or the State for proceeding with installation prior to issuance of appropriate permits (s).

5.0 "Field changes" are not considered approved by the Utility Department unless revised plans have been submitted to the Utility Department, reviewed and approved. Therefore, the contractor that proceeds with construction prior to this approval, is at their own risk.

**B. General Testing Requirements**

1.0 The Authority shall perform, or may requires the contractor to perform, such destructive and nondestructive testing, as it deems necessary in order to inspect the materials and workmanship. These tests shall be in accordance with the procedures established by ASTM and AASTHO. The Authority shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-core method and/or nuclear testing gauges.

2.0 The contractor may at any time employ an approved independent testing agency to check the results of the tests made by the Authority. Should such tests change the Authority results from failure to acceptance, the recheck cost shall be borne by the Authority. If the results do not change the Authority's findings, the cost of the tests shall be paid by the contractor.

3.0 All new sanitary sewer mains must be satisfactorily cleaned by jetting or balling prior to final inspection and acceptance by the Authority.

4.0 Prior to final inspection all sanitary sewer mains shall be t.v.'d

**C. Sewer Construction Plugs**

1.0 Mechanical plugs (non-pneumatic) must be installed throughout the time of construction of any sanitary sewer extension. Plugs are to be installed on the downstream end of the new main at the first manhole from the existing tie-in, until final acceptance.

2.0 All plugs must be securely tied off with steel cable within the manhole and must have a secure marking attached to the plug indicating the utility contractor to whom the plug belongs.

3.0 All plugs must be monitored during construction to insure the plug is functioning as required.

4.0 Prior to removing the plug, the contractor must sign a plug removal form verifying that the sewer facilities are sufficient and functionally complete. All plugs must be removed by the contractor upon acceptance that the sewer facilities are sufficiently functionally complete so to accept flow and PRIOR to the mains above the plug location being placed into service and/or accepting any flow of sewerage

**D. Handling and Storage of Materials**

1.0 The contractor shall be responsible for the shipping and storing of sewer materials. Any material which is damaged or defective shall be replaced by the contractor at the contractors' own expense.

2.0 The loading and unloading of all pipe, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.

3.0 The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent, from owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site, it must be delivered to and removed from

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job site each day. In extenuating circumstances when the inspector authorizes pipe to remain on the project from one day to the next, the ends of the pipe must be sealed.

- 4.0 All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations. All PVC pipe sewer pipe shall be protected from the sun's ultra violet rays if stored on the job site longer than twenty days. The type of protective cover for all plastic pipe material shall be approved by the Utility Director prior to installation.
- 5.0 All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for sewer mains shall be repaired in a manner approved by the Utility Director. Machined manhole frames and covers shall remain intact until construction is complete.
- 6.0 The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until the project is complete.

E. Barricades, Signs and Street Provisions

- 1.0 Signs, barricades, warning lights, guard rails and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the Authority harmless for any damages or injuries caused under the construction of the sewer mains and associated activities.
- 2.0 Detours shall be set up and maintained by the contractor under the direction of the North Carolina Department of Transportation or the South Granville Water and Sewer Authority's Utility Department. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights and other safety devices to protect his construction. The contractor is in no way relieved of liability for providing this protection because the detour is approved by others.
- 3.0 Construction work zone signs and signing procedures shall conform to the MUTCD and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the Authority's Public Services, Planning and Zoning, Police, and Fire Departments for all work to be performed in the public rights-of-way.

F. Property Protection

Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the **owner's satisfaction**.

G. General Construction Safety

- 1.0 The contractor and any subcontractors shall be responsible for the total compliance to all federal, state and local ordinances, laws and regulations as it relates to safe construction practices and to protecting the employees and the public's general health.
- 2.0 The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- 3.0 The Authority shall not be responsible for making the contractor adhere to these OSHA regulations and standards. However, the Authority may report known violations or unsafe practices to the appropriate enforcement agency.
- 4.0 The contractor shall furnish safety equipment necessary to inspect the work including, but not limited to ladders, gas detectors/oxygen sensors, blowers, etc.

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H. Encroachment Contracts and Permits

- 1.0 Prior to actual construction, the contractor shall acquire the necessary encroachments from NCDOT when working inside the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- 2.0 The contractor shall be responsible for securing all other local and state permits required for the utility construction. The Contractor must have an approved set of construction plans on site at all times.

I. Pavement Removal and Replacement

All pavement to be removed shall be cut along straight lines with the appropriate equipment. The removal and replacement of the pavement shall conform to the information shown in Standard Details S-1 through S-4; trench bottom width as shown in Standard Detail S-4 , plus six inches in either side. Where the contractor elects to cut pavement wider than this specification without authorization from the inspector, the cost of replacing this pavement shall be at the contractor's expense.

J. Construction Water

The South Granville Water and Sewer Authority Utility Department does not provide free or otherwise unmetered water for any construction project. Hydrant meters may be only moved with the express written permission of the Utility Department. In residential areas hydrant meters may not be used for the filling of swimming pools unless prior approval of the Utility Department. Contractors are responsible for adequate construction water for their job sites in one of the following manners:

- 1.0 Apply for a permanent water service connection at the Finance Department, 415 Central Avenue, Suite B, Butner, NC 27509. Sufficient lead-time (6-weeks) should be provided for all new service taps and all fees must be paid in full prior to the work being authorized.
  - 2.0 Apply to the Utility (Department (919) 575-3367 for the availability of a hydrant meter. There are a limited number of these meters and they are reserved in advance. All appropriate billing information must be provided and fees paid prior to the meter being issued. Customers are responsible for notifying the Water Plant if the meter is not registering usage. If a hydrant meter is available the following information is required:
    - a. Meter location;
    - b. Billing address, telephone number, and responsible party name;
    - c. Location of hydrant;
    - d. Water to be used for;
    - e. Duration of use and frequency of meter reading;
    - f. Meters must be brought to the Billing Clerk Office for monthly readings.
  - 3.0 Purchase bulk water from the SGWASA Water Plant.
- c. Hydrant meters accounts are billed monthly. Failure to report usage in timely manner for billing or accounts that are not paid in full will result in the loss of water service and the closing of the account with the Authority.
  - d. Hydrant meters will only be set when the temperature is over 35 degrees. Damage to meters from the cold weather or abuse will be charged to the customers.
  - e. It is a violation of the Authority Code to establish a direct connection to a fire hydrant to fill a tank or tank vehicle. It is also illegal to use a RP or Double detector check valve on a domestic or fireline service for temporary water service. Violations of the Authority Code will result in loss of service, fines, and other measures as specified by the Code.

Note: Those individuals caught using water unmetered and/or unauthorized may be prosecuted to the fullest extent of the law.

K. Excavation

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- 1.0 Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Utility Department, the contractor should contact the Utility Department at (919) 575-3367.
- 2.0 Open cut shall be used for excavation of all water and sewer mains and services unless written permission of the Utility Director or Engineer is given, or as specified by the encroachment agreement with the N.C. Department of Transportation.
- 3.0 Trench width shall be a minimum of six inches plus outside diameter of pipe and a maximum of twenty four inches plus outside diameter of pipe, unless approval to the contrary is given by the engineer. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in standard Detail S-4.
- 4.0 Trench bottom conformation, where no special bedding is required, may be that referred to herein as Flat Bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly tamped.
- 5.0 The maximum length of open trench shall be no more than three-hundred feet unless approval is obtained from the Utility Director.
- 6.0 The contractor shall, at the contractor's own expense, keep all trenches free from water during the excavation for construction of foundations, masonry, water and sewer mains. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property or the work in progress. Erosion control measures shall be taken during this pumping.
- 7.0 In trenches where water is present or dewatering is required, the trench shall be stabilized with a #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector, Utility Director or Engineer, that is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe laying operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.
- 8.0 Stockpiling of stone for trench stabilization may be done at the option of the contractor, but the inspector will authorize payment for only that portion of the stone used in authorized places. Correction for abnormal waste will be made in the calculation of stone quantities for payment.
- 9.0 Safety and convenience of the public demand that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the NC DOT or the Utility Director provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.
- 10.0 Sheeting of bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASTHO and OSHA safety standards. The decision of the Utility Director or Engineer relative to bracing for the protection of property of the Authority shall be binding upon the contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls.

L. Rock Excavation

- 1.0 Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Utility Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding 1 cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made six inches lower than the outer bottom of the pipe, and this six inches shall be refilled with six inches of #67 stone and thoroughly compacted to the sub-grade level. No soft or disintegrated rock which in the opinion of the Utility Director or Engineer that can be removed with hand picks or power operated shovels, no previously blasted rock or broken rock, and no rock outside the minimum limits of the trench shall be measured or paid for as rock. Manholes shall be excavated to nine inches outside the exterior masonry footing and to a depth as shown

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on the plans or standards, and only that excavation actually done within these limits shall be measured for payment. All trenches for purpose of rock measurement shall be assumed as having vertical walls. Payment for rock shall not necessarily be made because the contractor blasts the material. In order to assure payment for rock, the overburden must be cleared first, and the rock ascertained and profiled in lengths as specified by the Utility Director or Engineer. If the contractor drills and blasts before the over burden is taken off, and the Utility Director or Engineer, after inspection of the material, decides that the material could have been taken out by power driven shovels, no payment shall be made for rock excavation. All blasting shall be done under the supervision of the Utility Director or Engineer and subject to all applicable regulations. The Authority reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock shall be paid for at the unit price bid per cubic yard for the amount removed measured in place. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor. No additional compensation shall be made for disposing of the rock. Rock removed shall be paid for as per the accepted bid for the unit price. The contractor shall reimburse the amount for rock not excavated. Otherwise, when rock excavation exceeds the bid quantity, the unit price in the bid shall be paid for the rock in excess.

2.0 Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the County's Fire Marshall's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshall may fix the hours of blasting if he deems it necessary. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or over burden. The contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to keep a blasting log containing the following information for each and every shot.

- a. Date of shot
- b. Time of shot
- c. Crew Supervisor
- d. Number and depth of holes
- e. Approximate depth of overburden
- f. Amount and type of explosive used in each hole
- g. Type of caps used (instant or delay)
- h. The weather
- i. Seismograph instrument and readings

3.0 This blasting log shall be made available to the Utility Director or Engineer upon request and shall be kept in an orderly manner. The contractor shall comply with these specifications relative to blasting operations. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to save the South Granville Water and Sewer Authority harmless from any claims.

M. Surface Restoration

1.0 All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut.

2.0 Unless approved by the Utility Department for rip-rap or other specified material, all easements will be seeded with grass and left so they can be mowed by conventional mowers. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be liable under a one-year warranty on materials and workmanship.

N. Erosion Control

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Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission and South Granville Water and Sewer Authority Utility Department, and as per the erosion control plan portion of the construction drawings and these specifications. The sedimentation and erosion control plan and permit shall remain on site at all times. The contractor shall not allow mud and debris to accumulate in the streets. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All measures must be taken so that stormwater runoff does not go to the pipes or manholes of the utility system. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

1. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
2. Temporary erosion control measures shall include but not be limited to swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.
3. Permanent erosion control measures shall include but not be limited to swaled easements, rip rap and seeding of disturbed areas.
4. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

O. Maintaining Service

When replacing or extending water and/or sewer mains, the contractor shall maintain existing service to all property being served.

P. Guarantee

The contractor shall guarantee all material, equipment and workmanship for a period of at least one year after final acceptance by the Authority. Repairs occurring under the warrant period ~~will~~ may restart the full one year warrant.

Q. Wetland

Conditions of 401/404 shall be strictly followed to the satisfaction of Corp of Engineers. All Neuse Riparian Buffers shall be maintained as required by the North Carolina Division of Water Quality.

II SEWER MAINS AND RELATED ACCESSORIES

A. Trench Preparation:

- 1.0 Trench excavation shall conform to the line and depth shown on the plans or as directed by the Utility Director. The trench shall be properly braced and shored so that workmen may work safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. See erosion control section for appropriate siltation prevention measures prior to pumping.
- 2.0 The width and type of trench may vary with the depth of cut, and the trench shall be constructed in accordance with the dimensions and other information shown on Standard Details S-1 through S-5.

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- 3.0 Pipe Clearance in rock shall be a minimum of six inches in each side and bottom for mains fifteen inches in diameter and less. For larger size mains, the minimum clearance shall be nine inches on the sides and bottom.
- 4.0 If unstable conditions are encountered, the trench shall conform to the requirements of Section I. J. 7. of this part.

B. Laying PVC Gravity Sewer Pipe

The foundation for PVC gravity sewer pipes shall be a firm flat bottom trench of 4 inches of Class I material as defined in ASTM D-2321 compacted with bell holes (see Standard Detail U-4.) Class II material may be used if contractor can verify that this type of soil is native to the site by having soil tests taken on 200 feet intervals and to a depth equal to or greater than the trench bottom shown on the plans. The results must be approved by the Utility Director prior to pipe installation.

C. Laying Ductile Iron or C-900 Sewer Pipe

The foundation and backfill requirements for ductile iron and C-900 PVC pipe are the same as those described for water mains (see Section II.)

D. Pipe Installation

1.0 The pipe material listed above shall be installed in accordance with the manufacturer's recommendations and the requirements of these specifications.

2.0 All sewer mains and manholes shall be laid to the line and grade shown on plans.

3.0 No deviations from line and grade shall be made, unless they have been approved by the Utility Department or Engineer and identified on the "as-builts".

4.0 The sewer pipe installation shall start at the outlet end and proceed upstream to the termination of the project as shown on the plans. The bell ends shall point upstream. Exceptions to this provision will be considered on a case by case basis, when requested in writing by the owner of the development at the time engineering construction plans are submitted to the Authority for review and approval. The developer/owner must agree to hold the Authority harmless. He must accept full responsibility for compliance with state and federal regulations of the Clean Water Act, including any associated penalties which could reach \$25,000.00 per day, for the release of wastewater from sanitary sewer to the environment, which are not connected to existing sewer due to the granting of an exception to the pipe laying sequence required in this document. The development owner must further agree to not request building permits, if an exception is granted for that portion of the development, until connecting sewer is constructed and accepted by the Authority.

5.0 While working on any part of an existing sewer main, the contractor shall maintain the existing sewage flow. No discharge to the storm waters will be allowed. Water for flushing of new sanitary sewer mains must be obtained through a fire hydrant meter and must be pumped out and may not be discharged into the sanitary sewer system. Construction requiring existing sewer flow to be pumped from existing manholes shall be the responsibility of the contractor and must be approved prior to proceeding by the Utility Director or engineer. Existing sewer that is replaced must be ductile iron under the pump around scenario described above.

6.0 After the trench foundation has been properly graded with bell holes, the pipe shall be carefully lowered into the trench with approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe shall be properly repaired or replaced at the contractor's expense.

7.0 The pipe interior shall be kept clean before and after laying by means approved by the Utility Director or Engineer. Pipe ends shall be plugged at the end of each work day or when work is temporarily stopped. The plugs shall be water tight so the water and debris will be kept out.

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8.0 When a sewer main passes over or under a storm sewer pipe, and the vertical separation is less than 18 inches, then a concrete pad shall be poured between the two to prevent future settlement. All distances are measured from the outside diameter to outside diameter.

9.0 When installing a sewer main, the horizontal separation from any water main shall be ten feet. If this separation cannot be maintained due to existing conditions, the variation allowed is the water main in a separate trench with the elevation of the water main at least 18 inches above the top of the sewer and must be approved by the Utility Director. All distances are measured from the outside diameter to outside diameter.

10.0 When a water main crosses over a sewer main, there must be eighteen inches of vertical separation. If the water main must go under the sewer main, then both these lines must be of ferrous material for a distance of ten feet on either side of the crossing with a 18-inch separation. The crossing of other underground pipe requires a minimum of twelve inches of vertical separation. Any changes in these clearances must be approved by the Utility Director. All crossings within these vertical clearance shall be filled with #67 stone, unless otherwise specified by the utility that is being crossed (i.e. NCPS GAS requires sand to be placed around their gas lines at any crossing – rock is not to be used.). All distances are measured from the outside diameter to outside diameter.

11.0 Railroad crossings shall be made following all precautionary construction measures required by the railroad officials, and no extra compensation will be allowed by the Utility Department or Engineer, unless otherwise provided in the Special Provisions.

12.0 All sewer crossings under state system roads shall be made in accordance with the requirements of Division of Highways as defined in their encroachment permits.

13.0 Where conditions are, in the option of the Utility Department or Engineer, unsuitable for laying pipe because of weather or trench conditions, the Contractor shall be required to cease work until permission is given by the Utility Director of Engineer for work to commence again, providing such conditions have been corrected.

#### E. Sewer Laterals

1.0 Pipe for sewer laterals shall be a minimum of four-inch PVC, ductile iron (D./I.), or C. I. soil pipe. Where installation by boring is specified, four-inch C.I. soil pipe or ductile iron pipe shall be used. A minimum grade of .6% shall be maintained with six-inch C.I./D.I. pipe. Four-inch C.I./D.I. soil pipe shall be laid with a minimum allowable grade of 1.04%. Each lateral shall be sealed at the end with an approved watertight plug. Lateral installation for four-inch services shall conform to Standard detail U-63. All laterals shall be left exposed until the inspectors can verify the installation of each plug.

2.0 Each sewer lateral shall be installed from the main to the street right-of-way line where a combination wye and cleanout stack will be installed. The wyes on the laterals shall be sealed at the property line with a permanent plug.

3.0 Trench support, bedding and backfill for laterals shall conform to the same specifications as those for sewer mains. The contractor shall properly backfill under all WYE and lateral connections at the main. The lateral connection at the main shall be backfilled with #67 stone.

4.0 Where laterals are bored, the entire sewer service from main to property line shall be C.I./D.I. soil pipe. The face of the bore cut shall be a distance of five feet from the edge of the pavement on either side. Unless approval to the contrary is given by the inspector.

5.0 Sewer laterals four inches in diameter shall be connected to the main by means of an in-line wye or a tap and saddle, installed over a hole cut in the top quadrant of the main at an angle of forty-five degrees, with respect to direction of flow. The hole shall be cut with a mechanical circle type saw cutter designed for the particular use and rendering a smooth, uniform cut with no damage to the main and which retrieves the coupon. The cost for such cut-ins shall be included in the cost of the lateral. The cast iron, ductile iron, and PVC saddle installations are shown on Standard Details S-30 through s-32.

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6.0 Sewer laterals six inches and larger will be connected to the main by means of a manhole of size and structure herein described and shown in Standard Detail S-33. The cost of such manhole will be included in the cost of the service, unless specified otherwise in Special Provisions.

F. Manholes (See Part Six, Sec. III, for Manhole Materials)

1.0 Manholes dimensions shall conform to those shown on the Standard Details S-20 through S-29 contained herein. Manholes on all lines twelve inches in diameter or smaller shall have an inside diameter of four feet. On lines from fifteen inches to thirty inches in diameter, manholes shall have an inside diameter of five feet, unless specified otherwise in the Special Provisions or approved to the contrary by the Utility Director.

2.0 Invert shall be constructed with a width equal to that of the effluent pipe, height to the springline and invert "shelves" from that point upward at 60 deg. to manholes walls, it shall be so brushed and troweled that a minimum energy loss occurs in the manholes from invert roughness.

3.0 Foundation for manholes shall be in accordance with Standard Detail S-20, unless approval to the contrary is given by the Utility Director.

4.0 All manholes in the road right-of-ways will be flush with grade not withstanding 100 year flood requirements. In easements, manholes will be a minimum of 12 inches above ground.

5.0 All new manholes and wetwells must be vacuum tested in accordance with the following procedure:

- 1) The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum testing
- 2) All lifting holes shall be plugged with an approved non-shrink grout
- 3) All pipes entering the manhole shall be plugged. The contractor shall securely brace the plugs to keep them from being drawn into the manhole. All service connections tied to the manholes shall also be vacuum tested with the manholes.
- 4) The test head shall be placed inside the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.
- 5) The vacuum testing equipment shall be manhole vacuum tester as manufactured by Cherne Manhole Testing or approved equal. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. Inflate the compressor band to effect a seal between the vacuum pump base and the manhole cone section. Connect the vacuum pump to the outlet port with the valve open. With the valves closed, the time for the vacuum to drop to 9-inches of mercury shall not be less than that shown in the following table:

Manhole Depth	Diameter of Manhole		
	48" Dia	60" Dia.	72" Dia
10 Ft. or less	60 sec.	75 sec.	90 sec.
>10 Ft. But < 15 Ft.	75 sec.	90 sec.	105sec.
>15 Ft.	90 sec.	105 sec.	120 sec.

(Times shown are minimum elapsed times for a drop in vacuum of 1-inch mercury)

- 6) If the manhole fails the initial test, necessary repairs shall be made with an approved non-shrink grout while the vacuum is still being drawn. Retesting shall proceed and continue until a satisfactory test is accomplished.

6.0 All manhole rings on manholes shall be bolted to the cone section and sealed with asphaltic cement or "Ram-Neck". See details.

7.0 All Manhole joints must be waterproofed with asphaltic cement and felt or "Ram-Neck".

8.0 All Main and service pipe connections into manholes must be cored with a concrete coring machine and the pipe connection must be made with a flexible watertight coupling or boot.

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G. Test and Inspection

1.0 Sewer lines shall be visually inspected from every manholes by use of mirrors, television cameras or other devices for visual inspections, and the lines shall exhibit a fully circular pattern when viewed from one manhole to the next. Lines which do not exhibit a true line and grade or have structural defects shall be corrected to meet these specifications.

2.0 Sewer lines will be tested by using the water test or the low pressure air test. If sewer laterals are installed prior to the test then laterals will be tested along with main. It is imperative that proper plugs be installed on the laterals at the cleanout stack. All plugs should be properly installed to withstand the test pressure.

On water exfiltration tests, the main laterals shall be plugged and filled with water in such a manner that the maximum hydrostatic head at any one point in the line shall not exceed ten feet of water. All manholes shall be tested. The exfiltration from the line under test shall not exceed 100 gallons per inch of minimal pipe diameter per mile of pipe per twenty-four hours. The amount of exfiltration shall be measured by the inspector using methods specified by the Utility Director for the particular situation.

The low pressure air test in accordance with ASTM C 828 will be used on the main and laterals. Prior to testing, the main shall be clean of debris and flushed with water. In doing the air test, it is necessary that plugs be secured properly and braced. In doing the air test, nobody will be allowed in the main while it is pressurized.

The line is to be pressurized to 5 psi initially and stabilized.

After stabilization, the pressure will be decreased to 3.5 psi, and the inspector will determine how long the line it takes for the pressure to drop to 2.5 psi.

To simplify the ASTM procedure, use the following table to determine the test time. If there are multiple sizes, add the various times together.

Normal Pipe Size (inches)	Time (t) Minutes/100 ft.
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.5
30	4.8
33	5.4
36	6.0
42	7.3

If the pressure stays between 3.5 and 2.5 psi for the test time length, the pipe is acceptable. If not, the section is not properly installed. Correct and retest.

3.0 Where ground water is encountered during construction, all pipe joints for the sewer line shall be of such quality that there shall be no perceptible infiltration of ground water into the sewer from any single pipe joint. The contractor shall furnish labor, equipment and materials, including pumps, and shall assist the Utility Director in making infiltration tests of the completed sewer section before it can be placed in service or connected to any other lines. The contractor will furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the Utility Director. The total infiltration shall in no case exceed 100 gallons per inch of

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diameter, per mile of pipe per day. The test period shall be twenty-four hours, and if the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be relaid if necessary or other remedial construction shall be performed by and at the expense of the contractor. The section of sewer shall then be retested after repairs are completed to determine compliance with the specifications.

4.0 All tests shall be made in the presence of the contractor or his representative and the Utility Director or Authority Inspector and Engineer of record or his representative. The costs for these tests shall be included in the unit price bid for installing the pipe.

5.0 When sanitary sewer services are installed as a part of the same approval of the sanitary sewer mains, such as in new subdivisions, the air test of the sewer mains shall be performed with the services and clean-outs in place.

6.0 Materials and construction methods called for in these specifications are of such nature as to insure maximum protection for the sewer from infiltration. The contractor shall be responsible for the sewer conforming to the above limits for a period of one year from the date of final acceptance.

H. Back filling

1.0 The back filling of the trench after the pipe installation and testing shall be in accordance with Standard Details S-1 through S-5 for the various pipe materials.

a. RC pipes shall be back filled with suitable native material. No rocks, boulder sand stones larger than four inches shall be included in the backfill for at least two feet above the top of the pipe and no rocks larger than 12 inches in the rest of the backfill.

b. The haunching for PVC pipes shall be with #57 stone (Class I material) material 4 inches below and up to the springline of the pipe. Care shall be taken to work the haunching well under the bottom of the pipe. The initial and final backfill shall be with suitable native material. No rocks, boulders or stones four inches or larger shall be included in the backfill. The haunching shall be tamped to 95% standard Proctor density in six-inch lifts.

c. For PVC sewer installations, Class II material may be allowed for the bedding, housing and initial backfill if the contractor can verify that this type of soil is native to the site by having soil tests made by a soil testing agency. Soil samples borings shall be taken as directed by the Authority Inspector to a depth equal to or greater than the trench bottom elevation shown on the plans or in the specs. The results must be approved by the Utility Director prior to pipe installation. The bedding and backfilling shall be in conformance with ASTM D-2371 and the various soil classes are defined below:

(1) Class I - Angular, 6 to 40mm (1/4 to 1 1/2 inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone and crushed shells.

(2) Class II - Coarse sands and gravels with maximum particle size of 40mm (1 1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. (GW - well graded gravel, GP - Poorly graded gravel, SW - Well graded sand, SP - Poorly graded sand.)

(3) Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class. (GM - silty gravel, GC- clayey gravel, SM - silty sand, SC - clayey sand.)

(4) Class IV - Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials are not recommended for bedding, haunching or initial backfill on PVC pipes. (MH -silty soil with high liquid limit, ML- silty soil with low liquid limit, CH - clayey soil with high liquid limit, CL - clayey soil with low liquid limit.)

2.0 All backfill shall be compacted in six-inch layers measured from the foundation to one foot above the top of the pipe and then in twelve-inch layers to the top of the trench when in easements. Sewer mains in street rights-of-way shall be compacted in six-inch layers all the way to the top of the trench.

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3.0 Material for backfilling shall be approved by the inspector. In areas where settlement of bearing capacity are not a major consideration, the engineer may give permission for a low grade of material to be backfilled from a point two foot above the top of the pipe, but in no event will excavated rock larger than four inches at any point be used for backfill material.

4.0 Where backfill material is unsuitable, in the opinion of the Utility Director or Engineer, the contractor may be directed to dispose of the unsuitable material and provide material suitable to the Utility Director or Engineer.

5.0 Backfill shall be compacted to at least 95% of maximum soil density in those areas where in the opinion of the Utility Department or Engineer, the supporting capacity of the soil is of prime consideration. Generally, these trenches will be confined to those which must support traffic wheel loads whether directly or through a pavement structure. Laboratory determination of maximum soil density will follow the procedure of AASTHO T99-86 Method A. Field determination of the density of soil in place shall follow the procedure of AASHO T191-86 or T204-86.. The result of any one test may be a minimum for the 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted by qualified technicians at the direction of the Utility Director or Engineer and the cost of such tests will be borne by the contractor.

I. Deflection Testing for PVC Sewer Pipes

No sooner than thirty days after final backfill installation, a deflection test shall be executed on the sewer line. The maximum allowable deflection shall be five percent for PVC sewer pipes. The test shall use a minimum of nine pronged mandrel pulled through the pipe. The mandrel size shall be calculated by  $(1 - \text{allowable deflection percent}) \times (\text{Base Inside Diameter})$ . The base inside diameter is the diameter as identified in shop drawing or advertised pipe literature. It shall not include any additional reduction pipe diameter due to manufacturing tolerances.

The contact length of the mandrel shall be at least twenty four inches.

Any lines not meeting this test shall be corrected by the contractor and the test repeated.

J. As Built Plans and Information

"As built" plans and profiles shall be furnished to the Utility Department by the engineer upon completion and acceptance of the public main by the Authority and at completion of private systems. The "as built" plans shall show top and invert elevations, grades, manhole locations, type of material, bench marks, and horizontal deflections. "As built" plans of installed utilities shall be furnished to the Authority prior to issuance of the letter of acceptance. All sewer stubs shall be shown and located with respect to the property lines for each lot on the "as built" plans. "As-Built" of utilities needs to show the overall water and sewer system layout along with the property or subdivision boundaries and connecting manhole. The "as built" plans shall be supplied to the Utility Department at the issuance of the letter of acceptance. "As built" plans and profiles shall be in the form of permanent hardcopy and electronic form as specified by the Utility Director.

GENERAL ACCEPTANCE

The developer or his representative must notify the Utility Departments' Engineering Inspector, in writing, before installation and for scheduling inspection. Once the project is complete a punch list and inspection is scheduled noting any deficient items. Once the deficient items are repaired and/or replaced to meet Authority standards and specifications the developer or his/her representative shall submit the following items to the Authority's Utility Department.

- a. A professional engineer's certified statement of the cost of the public utilities installed.
- b. "As-Built" plans and profile shall be furnished by the engineer upon completion and acceptance by the Authority as stated above.
- c. The developer is responsible for ensuring a one-year written warranty to the Authority prior to issuance of the letter of acceptance.
- d. The developer and/or engineer shall provide a recorded map to the Authority showing all public rights-of-way and easements.
- e. Graphical Information System Data (GIS) shall be provided in accordance with the following:

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**GIS Requirements Section 1 – Overview**

The Contractor will be required to conduct a field survey and collect specific attribute information for all water and sewer system features relevant to the current project. This information will be used by SGWASA to update the existing water and sewer system GIS Database. The Contractor will be provided with an electronic template dataset containing the framework and attribute details for each data layer within SGWASA’s utility database. The dataset can be provided to the Contractor in multiple formats so that Contractors of various technical capabilities can collect and submit project data to SGWASA. The following list briefly describes the approved formats and provides a link to each of the file locations:

- ESRI GIS database (Preferred) [Geodatabase Files](#). \* ArcGIS Standard License Level Required
- ESRI shapefiles [Shapefile Templates](#). \* Minimum of ArcGIS Basic License Level Required to edit shapefiles.
- Excel spreadsheet template [Excel Templates](#). \* Note – Excel files will be sufficient to fulfil Contractor’s requirements on point features. Contractors will need to export line features to shapefiles format and/or provide an AutoCAD drawing file to provide the location of line features.

\* See section 3 BELOW for the full address of the documents. The electronic documents are available from SGWASA upon request.

The Contractor will return the completed database, shapefiles, or spreadsheet to SGWASA after data collection. All data collected by the Contractor will ultimately be formatted by SGWASA for use in the ESRI GIS database. Feature collection will be required for the following water and sewer data layers:

**WATER**

LAYER NAME	DESCRIPTION
ARV	Air Release Valve
Fittings	Various types
Hydrant	Fire Hydrant
Meter	Water meter
Tank	Water tank
Valve	Water valve
Main	Water main
Service	Water service connection

**SEWER**

LAYER NAME	DESCRIPTION
PS	Pump station
SWR_ARV	Sewer air release valve
SWR_CO	Sewer cleanout
SWR_FITTINGS	Sewer fittings, various types
SWR_MH	Sewer manhole
WWTP	Wastewater treatment plant
SWR_FM	Force main
SWR_Gravity	Sewer gravity main
SWR_SERVICE	Sewer service connection

Specific data collection and formatting requirements for each feature layer listed is contained within Appendix A located with the online files, as PDF documents. Refer to GIS Requirements Section 2 for technical details on the field survey GPS and Accuracy requirements.

**GIS Requirements Section 2 – GPS and Accuracy Requirements**

The Contractor is required to conduct a field survey and collect specific attribute information for all water and sewer system features relevant to the current project. This information will be used by SGWASA (Owner) to update the existing water and sewer system databases. The Contractor will be provided with an electronic template dataset containing the framework and attribute details for each data layer within SGWASA’s utility database. The dataset provided to the Contractor will be in the format of an ESRI GIS database, ESRI shapefiles, or an Excel spreadsheet template, depending on the Contractor’s technical capabilities.

The Contractor is required to collect field survey information for the following system features:

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**WATER DISTRIBUTION DATA**

LAYER NAME	DESCRIPTION	Collection Method
ARV	Air Release Valve	GPS
Fittings	Various types	Various, GPS not required
Hydrant	Fire Hydrant	GPS
Meter	Water meter	GPS
Tank	Water tank	GPS
Valve	Water valve	GPS
Main	Water main	N/A (Record Drawing)
Service	Water service connection	N/A (Record Drawing)

**SEWER COLLECTION DATA**

LAYER NAME	DESCRIPTION	Collection Method
PS	Pump station	GPS
SWR_ARV	Sewer air release valve	GPS
SWR_CO	Sewer cleanout	GPS
SWR_FITTINGS	Sewer fittings, various types	Various, GPS not required
SWR_MH	Sewer manhole	GPS
WWTP	Wastewater treatment plant	GPS
SWR_FM	Force main	N/A (Record Drawing)
SWR_Gravity	Sewer gravity main	N/A (Record Drawing)
SWR_SERVICE	Sewer service connection	N/A (Record Drawing)

The field survey will utilize GPS survey methods for the collection of detailed locational attribute data, as applicable. The locational data for all POINT features must be collected to the following specifications:

1. Survey grade accuracy
2. Referenced to the North Carolina State Plane Grid, US Survey Foot, Zone 3200
3. Referenced to horizontal datum NAD83; vertical data to NAVD88
4. All GPS points must be taken at the center of the feature.
5. Sewer Manhole (SWR\_MH) requires elevation data of the manhole rim and each pipe invert. Pipe invert elevations should either directly surveyed or supplied by grade rod measurement from the manhole rim to the pipe invert measured to the nearest 0.1 (one-tenth) of a foot.
6. Specific attribute information is required for each feature type and must be collected and documented as a component of the field survey. A reference sheet (PDF) containing the list of specific attribute requirements for each layer is provided in Appendix A.
7. LINEAR features (Water Main, Water Service, Sewer Gravity, Sewer Service, Force Main) will be added to the Owner's database by logical connections determined through the collection of GPS POINT features.

All features data points must be collected as specified in Items 1 – 7 above unless otherwise specifically agreed upon by SGWASA.

**GIS Requirements Section 3 – Attribute Requirements**

Appendix A provides a detailed explanation of attributes the Contractor is required to complete for each feature specified in the Water and Sewer database. Any attribute with "Engineer/Contractor" in the "Populated By" column should be completed and any attribute with a choice list ("Select" column) specified in the document will be limited to those values. In addition to Appendix A, these detailed attribute descriptions are contained within the links to each approved submittal format.

Full Address to template files.

Geodatabase - <https://www.dropbox.com/sh/5an0x2sveosiv1g/AACep7cRAGAgC8JDWI2u2xJna?dl=0>

Shapefiles - [https://www.dropbox.com/sh/6luds4fi4sam6uj/AABBqDvgimaKGSsHiqmsD\\_R6a?dl=0](https://www.dropbox.com/sh/6luds4fi4sam6uj/AABBqDvgimaKGSsHiqmsD_R6a?dl=0)

Excel Sheet Templates - [https://www.dropbox.com/sh/zzjd00a9z5kmc3t/AACoGeru\\_Px5wBBgF3BK7A87a?dl=0](https://www.dropbox.com/sh/zzjd00a9z5kmc3t/AACoGeru_Px5wBBgF3BK7A87a?dl=0)