SPECIFICATION 333001: GRAVITY WASTEWATER SEWERS AND APPURTENANCES

PART 1.0 GENERAL

1.1 DESCRIPTION

1.1.1 The following specification covers the design, installation, inspection, testing, and acceptance of gravity wastewater systems. Construction consists of furnishing all labor, equipment, tools, appliances, and materials for performing all operations necessary for the construction and installation of gravity wastewater sewers and service lines, including all manholes, laterals, and appurtenances, complete and ready for operation as shown on the construction drawings and described herein. All requirements of the Florida Department of Environmental Protection must be complied with in addition to the criteria contained within.

1.1.2 The Developer/Contractor must furnish to the County a two-year warranty on the materials, fabrication, and workmanship of all installed pipe and fittings furnished and installed. Warranty periods typically commence upon written acceptance of the component or appurtenance by the County for ownership and operation. Section 1.6.4 of the Hillsborough County Public Utilities Water Resources Department (WRD) Technical Manual describes the requirements and duration of a Warranty Bond for all contributed assets.

1.1.3 All Construction plans, project submittals and record drawings must comply with the requirements of Section 1 and Section 2 of the Hillsborough County Public Utilities Water Resources Department (WRD) Technical Manual.

1.2 REFERENCE DOCUMENTS

- American Association of State Highway & Transportation Officials (AASHTO).
- American Concrete Institute (ACI)
- American National Standard Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Society of Sanitary Engineers (ASSE)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)
- Florida Department of Transportation (FDOT)
- Florida Plumbing Code
- Portland Cement Association (PCA)
- Uni-Bell Plastic Pipe Association

1.3 SHOP DRAWINGS AND SUBMITTALS

1.3.1 For County projects, shop drawings and related manufacturer's product certifications must be made in accordance with the General and Special Conditions of the Contract for approval prior to purchase or fabrication of the material by the manufacturer. Additional shop drawings may be required by the Contract, but the following items that will require shop drawings are brought to the Contractor's attention:

1.3.1.1 Detail Drawings of all classes of pipe, joints, and fittings.

1.3.1.2 Pipeline laying schedule tabulated and referenced to construction line and grade controls shown on plans, with station, offset, and elevations. References must be provided for pipe fittings and other important features of the pipeline.
1.3.1.3 Service Connections.
1.3.1.4 Manholes.
1.3.1.5 Manhole frames and covers.
1.3.1.6 All appurtenant items.
1.3.1.7 Contractor's cleaning and testing plans for all gravity system piping and manholes.

1.3.2 Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied must be performed and furnished by the pipe manufacturer in accordance with the latest standards of the industry as referenced in Part 1.2 herein.

1.3.3 Shop drawing submittals for items listed in Appendix B, the Pre-Approved Products List, do not require material certification.

1.3.4 Submit a copy of any design exception prior to installation. Design exceptions are issued by the Utility Design Section Manager. Any deviation from the specifications requires a design exception.

1.4 RELATED WORK

- All Specifications of Division 03
- All Specifications of Division 33
- Hillsborough County Public Utilities Technical Manual
- Hillsborough County Utility Accommodation Guide (UAG).

PART 2.0 DESIGN

2.1 FLOW CRITERIA

2.1.1 Flow estimates for design must be calculated based on full or projected ultimate development. The average daily flow (ADF) for single-family or master-metered residences must be the per unit demand factors contained in the most current Hillsborough County Utility Rate Resolution. Industrial and commercial design flows for sanitary wastewater must be in accordance with Table 1 of the County's Utility Rate Resolution.

2.1.2 Wastewater gravity collection systems, lift stations, and force mains must be designed for average daily flow times the appropriate peaking factor. Refer to Section 4 of the Public Utilities Technical Manual for flow criteria and peaking factors.

2.2 MINIMUM LINE SIZE

2.2.1 Gravity Mains: Gravity mains must be sized to accommodate peak flow (refer to Part 2.1) when flowing one-half full. No gravity sewer main must be less than eight inches in diameter.

2.2.2 Laterals: Minimum diameter must be four inches for residential service, and six inches for commercial service.

2.3 ALIGNMENT

2.3.1 All gravity mains must be laid with straight alignment between manholes.

2.3.2 Wastewater collection systems are to be constructed within County right-of-way.

2.3.3 Where inverted crown roads are installed the wastewater system must be **private**.

2.4 DEPTH OF COVER

2.4.1 The depth of cover over all mains, within County right-of-way or easement, must be not less than 52 inches (except for some segments of laterals).

2.4.2 The depth of the lateral at the property line (measured from the crown of pipe) must be no less than 36 inches and no greater than 48 inches below design grade.

2.5 SLOPE

2.5.1 Gravity mains must be designed with the following minimum grades:

Gravity Main	Minimum Grade
8”	0.40%
10”	0.28%
12”	0.22%

2.5.2 Mains with diameters greater than 12 inches must be designed to have mean velocities of not less than 2.0 feet per second, when flowing one-half full. For velocity determinations, Manning's Formula "N" value must be 0.013 for PVC pipe.

2.6 HORIZONTAL SEPARATION

2.6.1 Wastewater gravity sewers must be laid at least 10 feet horizontally from any existing or proposed potable water main.

2.6.2 A three-foot horizontal separation must be maintained between a wastewater gravity main and all other underground utilities, except potable water mains (UAG Section 5.4). The distance must be measured face to face.

2.6.3 For service lines, a minimum of five feet must be maintained between a potable water service line and a gravity lateral. For locations where this separation cannot be maintained, refer to the latest edition of the Florida Plumbing Code.

2.7 CROSSINGS

2.7.1 Vertical separation between wastewater gravity sewers crossing potable water mains, and other pipelines/utility lines must be a minimum vertical distance of 18 inches between the outside of the other utility line(s) and the outside of the gravity sewers. This must be the case where the other pipeline is either above or below the gravity sewer.

2.7.2 Potable water main crossings below the gravity sewer should be avoided whenever possible. If the potable water main must cross under a gravity sewer, the crossing must have a vertical clearance

of 18 inches (minimum) and be arranged so that the gravity sewer joints will be equidistant and as far as possible from the potable water main joints. The potable water joints may be required to be restrained.

2.7.3 See Specification 333006, Exhibits S-1A for details on intersecting gravity and storm mains.

2.8 GRAVITY LATERALS

2.8.1 Each lateral must be supplied with a WYE fitting and bend (22-1/2° or 1/8 bend) at the main to ensure proper alignment. The lateral must be laid at a minimum slope of 1/8-inch per foot until one foot past the right-of-way line, where a clean-out will be installed in accordance with Specification 333006, Exhibits S-2A and S-2B.

2.8.2 Lateral clean-outs must not be installed in concrete/hardscape (driveways or sidewalks).

2.8.3 Residential double-service laterals are allowed, but the lateral size must be six inches.

2.8.4 Where the use of double-service laterals may be problematic, the engineer must use single-service laterals.

2.8.5 The Builder needs to be aware that where double-service laterals are already installed, driveways on adjacent lots may require additional spacing between the driveways to keep the clean-outs out of the driveway. When this situation is anticipated, the Builder needs correct the location of the clean-outs.

2.8.6 Water service lines and building sewer laterals must maintain a five-foot separation per the Florida Plumbing Code. For locations where this separation cannot be maintained, refer to the latest edition of the Florida Plumbing Code for possible mitigation methods.

2.8.7 Laterals must run straight (no horizontal bends) between the clean-out and the WYE fitting at the main, and between the clean-out and the connection at a terminal manhole.

2.8.8 Laterals that connect into terminal manholes must be considered a “secondary” line and must be designed as such. See Specification 333006 Exhibit S-3B.

2.8.9 Laterals must be marked in the field per Part 4.9.

2.8.10 Laterals must not exceed 71 feet in length or contain more than 2 vertical bends.

2.9 WASTEWATER MANHOLES

2.9.1 Manholes must be installed at the end of each line, at all changes in grade, size or alignment, and at all gravity main collection intersections.

2.9.1.1 The distance between manholes must not be greater than 400 feet.

2.9.1.2 Manholes within roadway pavement are to be installed in the centerline of the road. The County recognizes there may be instances when manholes are required to be in a travel lane. Under this circumstance, approval by the County is required and only given during the design stage of a project and the location of the manhole must be verified by the EOR prior to pavement installation.

2.9.1.3 Cleanouts may be used only for special conditions and must not be substituted for manholes.

2.9.2 Manholes must be minimum 48 inches inside diameter with a minimum access diameter of 24 inches. The access diameter minimum includes the manhole ring opening and the finished face of the riser section. A 60-inch manhole is required when any of the following conditions are met:

Conditions that trigger a 60-inch diameter manhole	
1	Gravity line is 16 inches or more in diameter
2	Manhole is greater than 15 feet deep (rim to lowest invert)
3	Manhole changes the direction of flow by more than 45 degrees and is fed by more than 75 wastewater ERCs
4	Lift Station king manhole

2.9.3 The minimum manhole depth is five feet from the top of the manhole cover to the lowest invert.

2.9.4 Materials of construction and installation must be in accordance with the applicable provisions of Parts 3 and 4, and Specification 333006, Exhibits S-3A through S-3E, and Exhibit S-4.

2.9.5 Manholes must consist of a base with a monolithically cast bottom barrel section, vertical pipe barrel sections, concentric cone top section, adjustment section or grade ring(s), and a frame and cover.

2.9.6 The manhole adjustment section (grade rings) must be a minimum of three inches and must in no cases exceed 18 inches in height. The adjustment section for new construction must not exceed 12 inches in height.

2.9.7 All manholes must be concentric in design. Eccentric manholes are not allowed.

2.9.8 Minimum wall thickness must be five inches.

2.9.9 All manholes must have a manhole lid insert installed (water infiltration "dish").

2.9.10 An outside drop manhole connection must be provided for any gravity mains entering at a vertical distance of 2.0 feet or more above the outgoing channel invert.

2.9.10.1 In cases where the vertical distance is less than two feet, a drop pipe is not required, but a channel must be constructed to guide the flow into the outgoing channel.

2.9.10.2 The bottom drop section must be monolithically cast with the bottom manhole section.

2.9.10.3 Riser blocks for an outside drop, are acceptable for use when provided by the manhole supplier. If riser blocks are not available from the supplier, the outside drop must be formed and cast around the PVC drop pipe in the field.

2.9.10.4 The distance between the cores of the drop assembly must be a minimum of 24-inches.

2.9.10.5 See Specification 333006, Exhibit S-4.

2.10 MANHOLE FRAMES AND COVERS

2.10.1 Manhole frames and covers, for structures and for manholes, must be heavy duty frames and covers designed for traffic loads. Frames embedded in top slabs of structures or frames for structures with riser stacks must be pressure-tight base flange type. The minimum inside access diameter must be 24 inches. See Specification 333006, Exhibit S-3E.

2.10.2 Manhole frame and cover must be designed to withstand an HS20-44 loading defined in the

AASHTO Specifications.

2.11 WATERPROOF AND PROTECTIVE COATINGS

2.11.1 Any manhole that is field cored must be coated with an internal protective coating. Interior linings of manholes must be as approved in Appendix B.

2.11.2 Protective coating(s) must be applied to all interior surfaces (including covers) of manholes when specified by Hillsborough County Water Resources Department (WRD).

PART 3.0 PRODUCTS

3.1 MATERIAL

3.1.1 Wastewater Gravity Pipe and Fittings: The following table lists the allowable pipe and fitting material for the various size wastewater gravity mains and laterals:

Diameter	Material	General Specifications
4" to 15"	PVC	ASTM D3034, SDR 26
8" or greater	PVC	C900, DR 25 (Lift Stations)

3.1.2 All pipe, fittings and appurtenances must be supplied in accordance with the approved material list in Appendix B.

3.1.3 Alternative materials may be submitted to Hillsborough County for review by and approval from the Public Utilities Department Product Review Committee (with proper testing documentation, performed by recognized industry authorities) prior to commencement of design. Refer to Section 1 of the Public Utilities Technical Manual for submittal procedures. Tests on alternative materials should be at least as rigorous as testing conducted by ASTM, AWWA and ANSI. A letter of variance must be issued by WRD prior to commencement of installation of any alternative material.

3.1.4 Pipe material manufacturer change only allowed at manholes and fittings for all pipe material types. Manhole to manhole and fitting to fitting pipe material shall be the same type and manufacturer.

3.2 PVC PIPE AND FITTINGS

3.2.1 PVC pipe and fittings, including laterals, must be made of PVC material having a minimum cell classification of 12454 B, 12454 C or 13354 B as defined in ASTM D1784.

3.2.1.1 SDR 26 PVC pipe and fittings must be used in the gravity sewer system and must meet requirements of ASTM D3034.

3.2.1.2 PVC fittings (wyes, bends, etc.) must be gasketed and injection molded.

3.2.1.3 Gravity lines 16-inch and greater require approval of pipe material by Hillsborough County Utility Design.

3.2.1.4 The last run of PVC gravity line from the receiving manhole to the lift station must be C900 DR 25.

3.2.2 Provisions must be made for contraction and expansion at each joint with an elastomeric gasket.

3.2.3 The bell must consist of an integral wall section with solid cross-section elastomeric gasket ring, factory assembled and securely locked in place to prevent displacement and meeting requirements of ASTM D3212.

3.2.4 Gaskets: All pipe gaskets must conform to AWWA C111, and be made of Viton, EPDM, or SBR depending upon the service/soil conditions.

3.2.5 Standard minimum laying lengths must be 20.0 feet one inch. Pipe must be tested in accordance with ASTM D3212.

3.2.6 Each length of PVC pipe must be marked with the following information: size, manufacturer, PVC sewer pipe, ASTM designation, manufacturer's code, and cell classification that will remain legible during normal handling, storage, and installation. Pipe color must be green for wastewater mains.

3.2.7 Where PVC enters a manhole, a suitable flexible manhole connector designed to produce a positive watertight connection must be installed in the wall section of the manhole.

3.3 MANHOLES

3.3.1 Manhole base, barrel sections, and concentric top section must conform to the design requirements of ASTM C478, "Specification for Pre-cast Reinforced Concrete Manhole Sections", except as modified herein. Steps and ladders must not be installed. See Specification 333006, Exhibits S-3A through S-3D for details for standard manholes.

3.3.2 Cement must meet the requirements of ASTM C150, Specification for Portland cement, Type II. When approved by the County, as an alternative, polymer concrete and reinforcing meeting the requirements of ASTM D6783 may be used.

3.3.3 Vertical barrel sections must be custom-made with openings to meet indicated pipe alignment conditions and invert elevations. Pipe penetrations must not be closer than 12 inches to a barrel section joint.

3.3.4 The base of the manhole must be cast monolithically with the bottom manhole section.

3.3.5 Joint contact surfaces must be formed with mechanical castings; they must be parallel with two degrees slope, single offset, and nominal 1/16-inch clearance. Gaskets must conform to ASTM C-443, "Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gasket."

3.3.5.1 Joint contact surfaces must be sealed using a rubber gasket per the manufacturer’s recommendations. Butyl and mastic sealants are not acceptable.

3.3.5.2 An alternate joint contact seal may be used when the joint surface is manufactured with the tongue equipped with a proper recess (confined groove) for the installation of an "O"-ring, conforming to ASTM C443.

3.3.6 Flexible manhole connectors (boots) must be used to join pipes to manhole barrel. The connector components must be flexible connectors and consist of an elastomeric connector compound meeting the requirements of ASTM C923 "Resilient Connectors between Concrete Manhole Structures and Pipes." This includes flexible connectors for laterals entering the manhole.

3.3.7 Grade rings must be cast iron, concrete, HDPE, or Expanded Polypropylene (EPP). If polymer concrete manholes are used, the grade rings must be HDPE or EPP per the manufacturer’s recommendation and a product approved in Appendix B.

3.3.7.1 The final inner diameter of the riser grade rings, including any coating, must be 24 inches (minimum).

3.3.7.2 When grade rings are concrete, the interior of the grade rings must be coated with an acid resistant epoxy mortar.

3.3.8 Manhole lid inserts must comply with the following:

3.3.8.1 Inserts must be stainless steel for installation within manholes located in roads. They must be supplied with a stainless handle and hardware and a closed cell neoprene or elastomeric gasket. Inserts may have a one-way pressure release to prevent the build-up of gas in the manhole.

3.3.8.2 HDPE inserts may be used in non-traffic off road locations. The inserts must have a woven nylon or a stainless handle, attached with stainless steel hardware, structural ribbing, and a closed cell neoprene or elastomeric gasket. Inserts may have a one-way pressure release to prevent the build-up of gas in the manhole.

3.3.8.3 Inserts must be supplied in accordance with Appendix B.

3.3.9 Flow channel(s) in the manhole base must be formed of 4,000 psi concrete, Type II Portland cement, unless a polymer concrete manhole is used. Then the bench and flow channel must be the same material as the manhole.

3.3.9.1 The first manhole in each line must have the flow channel extended full width of the manhole to accommodate a TV camera.

3.3.9.2 Cut off pipes at inside face of the manhole within two inches of the manhole sidewall and construct flow channel(s) to invert of the pipe entering the manholes.

3.3.9.3 Changes in direction of the gravity main and entering branch(es) must be laid out in smooth curves of the longest possible radius which is tangent to the centerlines of adjoining pipelines.

3.4 MANHOLE FRAMES AND COVERS

3.4.1 Manhole frames and covers, for structures and for manholes, must be heavy-duty cast iron frames and covers designed for traffic loads.

3.4.2 Frames for manholes must be pressure-tight base flange type.

3.4.3 The cover and frame castings must meet the requirements of ASTM A48, Specifications for Gray Iron Castings, Class No. 35, or Grade 65-45-12 ductile iron meeting the requirements of ASTM A536, "Standard Specification for Ductile Iron Castings."

3.4.3.1 Manhole frame and cover must be designed to withstand an HS20-44 loading defined in the AASHTO Specifications.

3.4.3.2 Frames and covers must be machined or ground at touching surfaces so as to seat firmly and prevent rocking. Any set not matching perfectly must be removed and replaced.

3.4.4 "SANITARY" must be embossed in the cover. See Exhibit S-3E for Hillsborough County approved ring and covers.

3.4.5 Adjusting rings for adjusting existing manhole covers to new grade (road resurfacing) must be heavy-duty cast iron manhole adjusting rings for two-inch or greater adjustment, and for one-inch adjustment must be steel adjusting rings. Adjusting rings must be coated with an acid resistant coating as specified in Appendix B.

3.5 WATERPROOF AND PROTECTIVE COATINGS

3.5.1 Protective coating must be applied to all interior surfaces of manholes when specified by the County. The waterproofing materials must be applied in accordance with the instructions of the manufacturer by a manufacturer certified Contractor. Time must be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat. Special precaution must be taken not to coat joint contact surfaces.

3.5.2 Interior linings of manholes must be as approved in Appendix B. Cementitious linings must be applied after installation of manholes.

3.5.3 Manholes frames and covers, must be lined with POR-15 on the interior/underside where the metal is exposed to the interior of the manhole atmosphere.

PART 4.0 CONSTRUCTION

4.1 WORK AT HIGHWAY OR RAILROAD CROSSINGS

Construction work to be performed at any County/FDOT highway or railroad crossing must not commence until all right-of-way permits for the pipeline occupancy have been obtained.

4.2 PRECONSTRUCTION PIPE INSPECTION/CERTIFICATION

4.2.1 The Contractor must obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe and fittings supplied for the project have been inspected at the plant and that they meet the requirements of these specifications.

4.2.1.1 For County Contracted projects, the Contractor must submit these certificates to the Project Manager prior to installation of the pipe materials.

4.2.1.2 For developer projects, the Contractor must submit these certificates to the WRD Inspector prior to the installation of the pipe materials.

4.2.2 Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.

4.2.3 The entire product of any plant may be rejected when, in the opinion of the County, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

4.2.4 For County Contracted projects all pipe and fittings must be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.

4.2.5 Hillsborough County requires a television inspection of the interior of the installed pipe prior to final acceptance. This inspection will be performed by the Contractor. All televising inspections must be monitored by the County inspector and the original video must be signed by the inspector. Television reports and tapes must be supplied to the WRD Inspector.

4.3 INSTALLATION

4.3.1 The provisions set forth herein must be applicable to all underground wastewater piping installations.

4.3.2 All connections to pipe, fittings, or apparatus must be made plumb, so to ensure no negative pressure is placed or potential placed against the joint, or connection, thereby causing a malfunction or failure of the mechanical joint, or connection.

4.3.3 All pipe must be color coded green.

4.3.4 PVC fittings (wyes, bends, etc.) must be gasketed and injection molded.

4.3.5 It must be the Contractor's and Developer's responsibility to verify all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where conflicts exist, SUE work must be coordinated with the facility owner and performed so as to cause minimum interference with the service rendered by the facility disturbed.

4.3.6 Facilities or structures damaged must be repaired and/or replaced immediately at the Contractor's and/or developer's expense, in conformance with current standard industry practices, according to the direction of the owner of such facility and approved by the County.

4.3.7 See Specification 333006, Exhibit S-5 for Jack and Bore details and Exhibit S-6 for Ditch Crossing details.

4.3.8 No pipe must be laid when the trench conditions or the weather is unsuitable for such work.

4.3.9 Polyvinyl chloride pipe may be damaged by prolonged exposure to direct sunlight. The Contractor must take necessary precautions during storage and installation to avoid this damage. Pipe must be stored under cover and sufficient backfill must be placed to shield it from the sun as the pipe is installed.

4.3.10 Excavation, trenching and backfilling must be in accordance with the requirements of the applicable portions of these specifications. Pipe installation must conform to Uni-Bell Plastic Pipe Association Standard Uni-B-5 and ASTM D2321.

4.3.11 Pipe material manufacturer change only allowed at manholes and fittings for all pipe material types. Manhole to manhole and fitting to fitting pipe material shall be the same type and manufacturer.

4.4 TRENCH EXCAVATION

4.4.1 All excavations must be open cut, with banks of trenches kept as nearly vertical as possible and wide enough to allow approximately eight inches of clearance on each side of the pipe.

4.4.2 The trench floor must provide a uniform bearing for each full length of pipe section. Excavate bell holes after trench has been graded. See Specification 333006 Exhibit S-15.

4.4.3 Perform all excavations, of whatever substance is encountered, to the depths shown or indicated on plans.

4.4.4 In the event unsuitable or unstable soil is encountered, remove it to a depth of 6 inches (minimum) below the bottom elevation of the pipe (12 inches if rock or boulders are encountered) and replace with material meeting AASHTO Soil Classification A-1, A-2, or A-3, as approved by the Project Manager or Engineer. Reference FDOT Standard Specifications for Road and Bridge Construction Section 125-4.

4.4.5 Dewatering: Remove all water from excavations and maintain the excavations free of water while construction therein is in progress. Provide dewatering equipment as necessary to conform to this requirement. Dewatering procedure must meet all regulatory requirements.

4.4.6 Protection of Trees: Trenching must not take place within the root zone of trees with a trunk diameter six inches or larger. The root zone must be defined as the greater of one) the drip line of the tree or two) a circular zone extending outward from the base of the tree a distance equivalent to 1/2-foot for every inch of trunk diameter as measured 4-1/2 feet above natural grade (see Specification 333006 Exhibit S-7). Exotic nuisance species, such as Brazilian Pepper and Melaleuca, are exempt from this protection.

4.5 HANDLING AND CUTTING PIPE

4.5.1 Every care must be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching, or marring machined surfaces, and abrasion of the pipe coating.

4.5.2 Any fitting showing a crack, and any fitting or pipe which has received a severe blow that may have caused an incipient fracture (even though no such fracture can be seen) must be marked as rejected and removed at once from the work.

4.5.3 In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if approved by WRD, may be cut off before the pipe is laid. The cut must be made in the sound barrel at a point of at least 12 inches from the visible limits of the crack. All cutting must be done with a machine adapted to the purpose. All cut ends must be examined for possible cracks caused by cutting.

4.5.4 Cutting Pipe: The Contractor must cut pipe by means of an approved mechanical cutter. The cut must be perpendicular to the longitudinal axis of the pipe and rough ends or spurs will be satisfactorily removed prior to installation and seating.

4.6 PIPE LAYING

4.6.1 Pipe must be constructed of the materials specified and as shown on the drawings.

4.6.2 Cradle: Upon satisfactory excavation of the pipe trench and completion of the pipe bedding, a trough recess for the pipe bells and joints (or couplings) must be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel must receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

4.6.3 Cleanliness: The interior of the pipes must be thoroughly cleaned of all foreign matter before being gently lowered into the trench and must be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper must be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

4.6.4 Gradient

4.6.4.1 Lines must be laid straight, and depth of cover must be maintained uniform with respect to finish grade, whether final grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Construction Drawings, means must be used by the Contractor to assure conformance to required grade.

4.6.4.2 Any pipe which has its grade or joint disturbed after lying must be taken up and re-laid.

4.6.5 Pipe/Joint Deflection: Whenever it is desirable to deflect PVC pipe/joints, the amount of deflection must not exceed 75% of the maximum limit as specified in C605, or the manufacturer's recommendations, whichever is less.

4.6.6 Rejects: Any pipe found defective due to interior or exterior damage must be immediately removed and replaced with sound pipe at the Contractor's expense.

4.6.7 Any section of pipe already laid which is found to be defective or damaged must be replaced with new pipe without additional cost to the County.

4.6.8 Installation of PVC pipe and fittings must be in accordance with the installation requirements established by the manufacturer and ASTM D2321.

4.7 INSTALLING JOINTS

4.7.1 The joints of all pipelines must be assembled in straight alignment and made tight. The joint used must comply with the requirements of Part 3.2. For County contracted projects, the joint used must be reviewed and approved by the Engineer prior to installation.

4.7.2 Push-On Joints: Push-on joints must be made in strict compliance with the manufacturer's recommendations.

4.7.2.1 Lubricant must be an inert, non-toxic, water-soluble compound.

4.7.2.2 Insert the spigot end into the bell so that it is in uniform contact with the gasket. Push the spigot until the reference mark on the spigot end is flush with the end of the bell. If the reference mark is not visible after assembly, the joint is to be cut out.

4.7.3 Joint Compounds: Sulfur based joint compounds must not be used.

4.8 INSTALLING MANHOLES

4.8.1 The base section must be set in the leveling course of crushed stone, with the sub-base compacted to not less than 98% of maximum dry density as determined by the Modified Proctor Test ASTM D1557. See Part 4.10 for backfill and compaction requirements.

4.8.2 Joints must be sealed using a rubber gasket per the manufacturer's recommendations. Butyl and mastic sealants are not acceptable.

4.8.3 Manhole Riser/Barrel Sections

4.8.3.1 Sewer manhole risers must be watertight.

4.8.3.2 Construct cone section of manhole as detailed on the Construction Drawings. Make watertight connection between the cone section and the riser sections.

4.8.3.3 Riser grade rings must be a minimum of three inches to a maximum of 12-inches in height.

4.8.3.4 The interior of the grade rings must be coated with an acid resistant epoxy mortar when grade rings are concrete.

4.8.3.5 The final interior diameter of the grade rings must be 24 inches minimum. Refer to Specification 333006 Exhibit S-3A through S-3D.

4.8.3.6 Bench and flow channels must be sloped ½ inch per foot. Coat the bench and flow channel with an acid resistant epoxy mortar.

4.8.4 Manhole Frames and Covers

4.8.4.1 Install a cast iron frame and cover with POR-15 coating for each manhole and adjust the frame and cover to proper grade. All castings must be set flush in paved areas and flush with finished grade in unpaved areas unless shown otherwise on plans. Frames and steel adjusting rings must be neatly-set with non-shrink acid resistant epoxy mortar.

4.8.4.2 Frames on manhole cones must be set concentric with the masonry and in a full bed of acid resistant epoxy mortar so that the space between the top of the manhole masonry and the bottom flanges of the frame must be completely filled and made watertight.

4.8.4.3 A ring of mortar at least one-inch thick and pitched to shed water away from the frame must be placed around the outside of the bottom flange. Mortar must extend up to the outer edge of the masonry and must be finished smooth and flush with the top of the flange.

4.9 GRAVITY LATERALS

4.9.1 Open ends of laterals must be securely sealed with appropriate stoppers as recommended by the pipe manufacturer.

4.9.2 Lateral cleanouts must not be installed in concrete or hardscape/pavers (ex: sidewalk or driveways).

4.9.3 Water service lines and building sewer laterals must maintain a five (5) foot separation per the Florida Plumbing Code. For locations where this separation cannot be maintained, refer to the latest edition of the Florida Plumbing Code.

4.9.4 Each lateral/cleanout location must be marked with an “S” saw cut into the top of curb.

4.9.5 The cleanout(s) must be extended 30–40 inches above design grade and must be attached to a green painted wood two-inch by four-inch stake, per Specification 333006 Exhibit S-2A. On both single and double service cleanouts the final grade must be marked on each cleanout two (2) inches from the top of the cleanout.

4.9.6 After connection to the building, the lateral cleanout must be cut down to design grade and a cast iron valve box cover installed as shown in Specification 333006 Exhibit S-2B.

4.9.7 Laterals entering a gravity line must be installed at a 45° angle above the spring line. Laterals must not be surcharged when the gravity line is half full. Refer to Specification 333006, Exhibit S-2A.

4.10 BACKFILL/COMPACTION

4.10.1 Backfilling and compaction must be conducted in a manner as to preclude subsequent settlement and provide adequate support for the surface treatment, pavement, pipelines, or structures to be placed thereon. Structures within the wastewater system include manholes, wet wells, and ARV’s. All trenches must be prepared per the requirements of Part 4.4. Also refer to Specification 333006, Exhibit S-15.

4.10.2 Backfill and bedding material must be common fill material free from organic matter, muck or marl, and rock exceeding 1-1/2 inches in diameter, and must not contain broken concrete, masonry, rubble, or other similar materials. When unstable or unsuitable material is encountered replace with AASHTO soil classification A-1, A-2, A-3, or A-2-4.

4.10.3 Method of Compaction: The Contractor must adopt compaction methods which will produce the degree of compaction specified herein without damage to the new or existing facilities. The degree of compaction specified in the following must be considered the minimum allowable.

4.10.4 Backfilling Procedures: The backfilling procedures outlined in the following must be for wastewater mains, at all point of connection, and related structures.

4.10.4.1 Wastewater Mains

a) First stage - the Contractor must provide adequate compacted fill beneath the haunches of the pipe, using mechanical tampers suitable for this purpose. This compaction applies to the material placed beneath the haunches of the pipe and above any bedding material. Fill compacted by mechanical compactors must be placed in six-inch layers and thoroughly tamped over the entire surface.

b) Second stage - the Contractor must obtain a well-compacted bed and fill along the sides of the pipe and to a point of at least one foot above the top of the pipe. The width of backfill and compaction to be done under this second stage must be the width of the portion of the trench having vertical sides; or, when no portion of the trench has vertical sides, it must be to a width at least equal to three times the outside diameter of the pipe. Material to be placed in six-inch layers (loose thickness).

c) Third stage - the remainder of the trench must be backfilled with suitable material in layers not to exceed 12-inch loose thickness and compacted.

4.10.4.2 Manholes

a) The Contractor must provide well-compacted sub-base under the manhole per Part 4.8.1.

b) From the bedding up to grade the Contractor must backfill around the manhole in lifts not to exceed 12-inch layers (loose thickness). The width of the backfill and compaction must be the width of the excavation, or to a width equal to three times the manhole diameter whichever is less.

4.10.5 Compaction Density: The excavation backfill density for all stages must be provided as follows:

4.10.5.1 From right-of-way line to right-of-way line and including all structures and railroad crossings: Compaction must be 98% of the maximum density as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor) with no tolerance.

4.10.5.2 For outside of the right-of-way (but within maintenance easements): Compaction must be 95% of the maximum density as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor) with no tolerance.

4.10.6 Compaction Test Requirements

4.10.6.1 Compaction test results must be submitted for all work.

4.10.6.2 Results of compaction tests must meet minimum requirements prior to proceeding with the next stage of the work.

4.10.6.3 For developer projects, one complete set of all test reports must be submitted with the as-built package to the Site Plan and Subdivision Review Section and the WRD Inspector upon project completion.

4.10.6.4 For County run projects, one complete set of all test reports must be submitted with the as-built package to the Project Manager upon project completion.

4.10.6.5 The Contractor must employ an independent testing laboratory, acceptable to the County and pay for all required tests.

4.10.6.6 The laboratory must submit one copy of the certified test reports, after testing in each phase, to the Construction Services Section in the Development Services Department and the WRD Inspector; or the County Project Manager (as applicable), for approval.

4.10.6.7 In the second and third stage of backfilling, density tests must be made every one foot vertically, staggered every 200 feet (minimum) horizontally. There must be a minimum of one test (per vertical foot) between structures, and a minimum of one test per day.

4.10.6.8 For structures, density tests must be every two feet vertically, staggered spirally around

the manhole, and a minimum of one test per day.

4.10.6.9 Compaction testing at the **Point of connection** to existing infrastructure is required to be taken at the point of connection within the width of the portion of the trench having vertical sides; or when no portion of the trench has vertical sides, tests must be within a width equal to three times the width of the pipeline or structure.

4.11 CONNECTIONS TO GRAVITY SYSTEMS

4.11.1 Connections to the existing sanitary sewer system must be made as shown the Construction Drawings. Coordination between the County and the Contractor must be required in order to accomplish this task. The Contractor must supply a connection schedule to the County two weeks prior to the proposed connections. Connections 6" and less must be made through a lateral connection into the existing gravity line. Connections 8" and greater must connect into an existing manhole.

4.11.2 After approval of the schedule, the County will be responsible for shutting down any County owned lift stations or valves as applicable. The Contractor will then make the required connection as quickly as possible. The Contractor must be responsible for the coordination of all the existing private lift stations shutdown. The Contractor is responsible to coordinate and provide any and all pumping, bypass pumping and/or removal of effluent at connection points to existing mains and at affected lift stations (County owned and private) during wastewater connection operations. Contractor is also responsible for any trucking of effluent and the proper disposal of wastewater, and any other work required to maintain existing services until and during transfer to the new service.

4.11.3 Connections to an existing manhole must be made after complete flushing of the new system and **must** be made under the direction of Hillsborough County WRD.

4.11.4 The Contractor must cut suitable openings into the existing manholes or remove the existing pipe to accommodate the pipelines as indicated on the Construction Drawings and as herein specified. The portion of each existing structure removed for new installation must be confined to the smallest opening possible, consistent with the work to be done.

4.11.5 The existing manhole must be properly prepared to receive the connection by carefully core drilling the wall of the existing manhole using mechanical drilling equipment. The perimeter of the penetration must not be closer than 12 inches to a barrel section joint. Any manhole which is core drilled must be lined with a protective coating as listed in Appendix B.

4.11.6 A flexible resilient watertight connector must be installed prior to pipe insertion into the manhole.

4.11.7 Any penetration to a manhole liner, or coating, must be properly sealed to restore the integrity of the liner/coating.

4.11.8 After the pipe is installed, the Contractor must carefully repair the existing manhole invert in accordance with manufacturer recommendations and in a manner satisfactory to Hillsborough County WRD Project Manager, or Inspector, as applicable. Manhole inverts/benching must be reshaped as required by the new connection to provide a smooth flowing channel of the exact shape of the gravity main to which it connects. Refer to Specification 333006 Exhibit S-3B.

4.12 TAKING EXISTING WASTEWATER SYSTEMS OUT OF SERVICE

4.12.1 Existing wastewater gravity pipelines must be taken out of service when indicated on the Construction Drawings. When lines are taken out of service, backfill the line with flowable fill (FDOT Standard Specifications for Road and Bridge Construction Section 121) or grout if the line is not removed.

4.12.2 Existing wastewater systems to be taken out of service must be plugged after the relief interceptor and appurtenances downstream have been constructed, successfully tested, and approved by the Engineer, and after the County permits the existing wastewater system to be taken out of service.

4.12.3 The upper portion of manholes to be taken out of service must be removed to not less than 36 inches below the proposed finish grade. The remaining portion of the structure must be filled with sand or an approved granular fill material. The material used to fill the abandoned structure must be clean, granular, well graded and free of any organic matter or deleterious material. Before filling, the bottom must be punctured with a hole of 6-inch (minimum) diameter.

4.13 INSPECTION AND TESTING

4.13.1 General

4.13.1.1 All construction within existing or proposed public right-of-way or within an easement dedicated to the County must be inspected by a representative of WRD for compliance with approved construction plans and requirements of the Public Utilities Technical Specifications. The level of inspection will be based on the size and complexity of the project.

4.13.1.2 The County Project Manager or WRD Inspector must designate the locations of tests, the extent of the system to be tested, approve the methods of testing, and the requirements for recording test results. The groundwater level at the time of testing must be listed on all test reports. All manholes, manhole risers and gravity lines, including laterals, must at a minimum be tested for water tightness upon completion of installation. It is highly recommended that pavement, sidewalks, and curbs over newly installed WRD utilities not be constructed until the WRD utilities have been tested and have passed inspection.

4.13.1.3 Prior to acceptance of developer-projects, the developer must have all testing performed, repairs (as required) completed, and must supply to the WRD Inspector a report Certified by the Engineer of Record that the construction, test, and inspection results comply with County and State standards. At the discretion of the County, any system that is not accepted and not in service within nine months of being inspected must be re-inspected and re-Certified before project acceptance and subsequent release of performance bonds.

4.13.1.4 For County-run projects and prior to Substantial Completion, it is the responsibility of the Contractor to perform all testing, repair all defects, and submit a report to the Project Manager certifying completion and compliance with County and State standards. The report must include all test and inspection results.

4.13.1.5 The Contractor must at their expense supply all materials and equipment necessary to perform the required inspections and tests. All tests must be witnessed by the Engineer of Record, or someone under their responsible charge. Contractor must notify the Engineer of Record a minimum of seven days in advance of all tests.

4.13.1.6 All testing equipment must be calibrated annually by an independent testing agency. Upon request, a copy of the calibration report must be submitted to the County Project Manager or WRD Inspector

4.13.1.7 All equipment used in testing must be suitable to the application and must be subject to

the approval of Hillsborough County WRD.

4.13.1.8 Piping must be properly backfilled and compacted before testing.

4.13.1.9 Prior to tests, all gravity lines must be cleaned and flushed with an appropriately sized cleaning ball. Pre-cleaning by high velocity jet or other methods may also be necessary.

4.13.1.10 Adequately brace and support all piping during testing so that no movement, displacement, or damage must result from the application of test procedures.

4.13.1.11 All associated strength-specified concrete must be tested, and results submitted to the Engineer of Record and WRD Inspector for acceptance.

4.13.1.12 If any manhole or section of the sewer fails to pass the tests, the Contractor must perform an inspection of the faulty section, locate the defects, and repair or replace all defective materials, or correct workmanship issues, at their own expense.

a) Repairs must be made using new materials.
b) No caulking of threaded joints, cracks, or holes will be accepted.
c) Where it becomes necessary to replace pieces of pipe, the replacement must be the same material and thickness as the defective piece.
d) The Contractor must obtain approval in advance for all materials and methods used for repairs from either the County Project Manager or the WRD Utility Design Section Manager. Tests or inspections after correction of defects must be repeated until the work is completed to the satisfaction of the County Project Manager or Engineer of Record, and the WRD Inspector.

4.13.2 Inspection of Wastewater Systems

4.13.2.1 Wastewater gravity mains and laterals must be televised prior to final acceptance to verify proper construction, accuracy of alignment, and freedom from debris and obstruction. The full diameter and length of the pipe must be visible. The method of inspection will be closed circuit television.

4.13.2.2 Anomalies detected or suspected as a result of the visual inspection may prompt additional testing requirements.

4.13.2.3 All televised inspections that are performed for final acceptance must be witnessed by the County Project Manager or WRD Inspector. Reports and recordings must be supplied to the County by the responsible party. The original video media must be signed by the Project Manager or WRD Inspector that witnessed the testing.

4.13.2.4 For developer projects, the televised inspection will be performed by and is the responsibility of the developer who must coordinate the television inspection with the WRD Inspector. For County projects, the televised inspection will be performed by and is the responsibility of the Contractor who must coordinate the television inspection with the County Project Manager.

4.13.2.5 Additional and detailed televising procedures are given in Part 5 of this specification.

4.13.3 Testing of Wastewater Systems

4.13.3.1 Hillsborough County requires wastewater systems be tested prior to final acceptance for water tightness and to ensure that any irregularities in the completed pipe are not going to be transferred to the County for ownership and maintenance. All testing will be performed by and is the responsibility of the developer for developer-run projects, and the responsibility of the Contractor for all County-run projects.

4.13.3.2 Low-Pressure Air Testing of Gravity Mains and Laterals

a) The Contractor may desire to make an air test prior to backfill for their own purposes, but the line acceptance test must be conducted after backfilling has been completed in accordance with other portions of these specifications.
b) All wyes, tees, or ends of lateral stubs must be suitably capped to withstand the

internal test pressures. Such caps must be easily removed for future lateral connections or extensions.

c) After a manhole-to-manhole section of line has been backfilled and cleaned, it must be plugged at each manhole with pneumatic plugs inflated to 30 psig (pounds per square inch gauge) internal pressure. The design of the pneumatic plugs must be such that they will hold against the line test pressure without requiring external blocking or bracing, although blocking and bracing is recommended for personal safety.

d) Low pressure air testing must comply with the requirements of ASTM F1417.

e) There must be three hose connections to the pneumatic plug. One hose must be used only for inflating the pneumatic plug. The second hose must be used for continuously reading the air pressure rise in the sealed line. The third hose must be used only for introducing low pressure air into the sealed line.

f) Low pressure air must be introduced into the sealed line until the internal air pressure reaches four psig greater than the average back pressure of any groundwater pressure that may be over the pipe, but no greater than 9 psig. At least two minutes must be allowed for the air pressure to stabilize. After the stabilization period, the internal air pressure must be pressurized to the final test pressure, and the third hose must be disconnected.

g) The portion of line being tested will be accepted as being water-tight if the portion under testing does not lose pressure greater than 1 psi for the specified time required when tested at an average pressure of 3.5 psi greater than any back pressure exerted by groundwater that may be over the pipe at the time of the test.

h) The previous requirements must be demonstrated by performing the test as follows:
   1) The time requirement for the pressure to decrease from 3.5 to 2.5 psi (greater than the average backpressure of any groundwater that may be over the pipe) must not be less than the time indicated in ASTM F1417.
   2) In areas where groundwater is known to exist, the Contractor must:
      a. Immediately prior to the performance of the water tightness test, the groundwater level must be determined, and compared to the average depth of the line being tested. Determine the height in feet the groundwater level is over the pipe.
      b. The height in feet must be divided by 2.31 to establish the pounds of pressure that will be added to all readings.

i) If any section of the wastewater system fails to meet this requirement, the Contractor must perform an inspection of the faulty section and repair or replace, at their own expense, all defective materials or workmanship. The test procedure must be repeated until the results are acceptable.

j) Test gauges for air tests must have the following characteristics:
   1) Range - 0 to 30 psi, maximum
   2) Minor Gradation - 0.1 psi, maximum
   3) Accuracy - plus or minus 0.5 percent of range

4.13.3.3 Water Infiltration Testing of Gravity Mains and Laterals

a) Where the groundwater elevation is 12.75 feet or higher than the crown of the pipeline throughout the section being tested the Contractor must test the wastewater system for infiltration rather than air testing.

b) The allowable rate of infiltration must be zero for the entire section being tested. No visible leakage will be allowed.

c) If any section of the wastewater system fails to meet this requirement, the Contractor must perform an inspection of the faulty section and repair or replace at their own

expense all defective materials or workmanship. The test procedure must be repeated until the results are acceptable.

4.13.3.4 Water Exfiltration Testing

a) Wastewater Manholes and Risers
   1) Low pressure air testing is not acceptable for use on Manhole Risers.
   2) All wastewater manhole risers must be tested for leakage/water tightness by plugging pipelines and filling the manhole with water to the top of the manhole.
   3) The test period must be for 24 hours and during the test period, the water level must not drop.
   4) The WRD Inspector is required to sign off all manhole leakage tests.

b) Gravity mains and Laterals
   1) Where the groundwater elevation is less than four feet above the crown of the pipeline, the Contractor may test the wastewater system for exfiltration rather than air testing.
   2) Plug the pipeline to be tested at the downstream manhole and fill the line with water. The test must run for 24-hours minimum. The water level inside the manhole must be two feet higher than the top of the pipe or two feet higher than ground water level, whichever is greater. The maximum internal pipe pressure at the lowest end should not exceed 25 feet of water or 10.8 psi.
   3) The allowable rate of exfiltration must be zero for the entire section being tested.
   4) If any section of the wastewater system fails to meet this requirement, the Contractor must repair or replace at their own expense all defective materials or workmanship. The test procedure must be repeated until the results are acceptable.

4.13.4 Deflection Tests: PVC Pipe

4.13.4.1 Maximum allowable pipe deflection (reduction in vertical inside diameter) must not exceed 5%. Deflection testing shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system.

4.13.4.2 The Project Manager, or WRD Inspector (as applicable), may determine that deflection testing is unnecessary when using proper construction practices and inspection during pipe installation and when using embedment material which has been properly selected, placed and compacted. However, random deflection testing of pipe may be required at locations where construction encountered unstable trench walls or bottoms, heavy rainfall, high ground water levels, deep lines, difficulty in obtaining compaction, or where other problems are indicated.

4.13.4.3 Locations with excessive deflection must be excavated and repaired by re-bedding or by replacing pipe. Optional devices for testing include a deflecto-meter, a properly sized "go, no go" mandrel or sewer ball. Diameter of the mandrel or sewer ball must not be less than 95 percent of the base inside diameter of the pipe.

4.13.4.4 For deflection measurements, the base inside pipe diameter without deflection is provided in the following table.

a) The maximum allowable deflection should be applied to the base inside diameters in determining the minimum permissible diameter.
b) To ensure accurate testing, the lines must be thoroughly cleaned.

Base Inside Diameter for Deflection Measurements of ASTM D3034 DR26 PVC Sewer Pipe

Size	Avg. O.D.	t	1.06t or t'	Avg. I.D.	Base I.D.	5 % Deflection I. D.
4"	4.215	0.162	0.171	3.872	*	3.68”
6"	6.275	0.241	0.256	5.764	5.612	5.33”
8"	8.400	0.323	0.342	7.715	7.488	7.11”
10"	10.500	0.404	0.428	9.644	9.342	8.87”
12"	12.500	0.481	0.510	11.480	11.102	10.55”
15"	15.300	0.588	0.623	14.053	13.575	12.90”

* 4” ID pipe use Average ID

4.13.4.5 If the Contractor performs the deflection testing rather than employing an approved test lab, the Contractor must furnish the mandrel or sewer ball, labor, materials, and equipment necessary to perform the tests as approved by the Project Manager, or WRD Inspector (as applicable).

a) Mandrels or sewer balls may be pulled through by hand in the presence of the Project Manager, or WRD Inspector. No mechanical pulling devices may be used.
b) Prior to performing the deflection tests, the Contractor must submit certification that the test equipment is set as previously stated.
c) Each mandrel must be engraved with the following:
    1) Serial Number
    2) Nominal pipe diameter
    3) "ASTM D 3034" and either "SDR-26"
    4) % deflection as previously stated

4.13.4.6 If the mandrel or sewer ball fails to pass any section of pipe, the Contractor must excavate to the point of excess deflection and carefully compact around the point where excess deflection was found or replace the section. After the permanent pavement base has been compacted and resealed, the line must be retested. If the mandrel or sewer ball fails to pass a second time, the section must be replaced. Re-rounding is not permitted.

PART 5.0 TELEVISING OF LINES

5.1 PROCEDURES FOR TELEVISING SANITARY SEWER MAINS

5.1.1 The following procedures must be followed on all sanitary sewer mains which are to be accepted by the County.

5.1.2 All sanitary sewer mains will be televised utilizing a 360-degree pan and tilt color camera. The camera must be of the self-propelled tractor type, with a measuring device mounted to the front capable of being read as the tractor moves and capable of accurately measuring depth of standing water up to and including one inch. A pull type camera may be used only as a system backup.

5.1.3 All sanitary sewer mains with less than eight-foot of compacted backfill above the main must require the base to be placed and compacted prior to televising. All mains not filled to subgrade will have at least 10-foot of compacted backfill.

5.1.4 All sanitary sewer mains must be televised in an upstream direction unless previously approved by WRD Inspection.

5.1.5 Inverts will be constructed in manholes prior to televising.

5.1.6 Televising for the Contractor's own use may be done at any time; however, the County inspector must be present during all televising for acceptance and the procedures listed herein must be followed.

5.1.7 Mains and laterals must be flushed and cleaned prior to televising.

5.1.8 At least 24 hours prior to, and no more than 48 hours prior to televising, sufficient water must be run through each section of main until water runs through each downstream manhole. No lines must be televised which are dry or that enough water has not run through to reach the end of each section.

5.1.9 Laterals shall be flushed.

5.1.10 Mains which are dirty (dirty walls and/or debris in the inverts) must be re-flushed and cleaned before rescheduling another televising with the County inspector. The County inspector may require pigging of specific sections, as necessary.

5.1.11 There must be no dips in the mains. Any dips which are found must be reviewed and a decision made by the County Inspection Section as to whether to accept the main as is or to have the dip removed. Decisions will be made on a case-by-case basis; however, normally any dip 1/2 inch or greater will be required to be removed.

5.1.12 Laterals entering a gravity line must be installed at a 45° angle above the spring line. Laterals must not be surcharged when the gravity line is half full. Refer to Specification 333006, Exhibit S-2A.

5.1.13 The Contractor is entitled to a second inspection on lines requiring repairs. Second inspections for dirty lines and additional inspections for repairs after the second free inspection may be billed by the County for each section of main televised.

5.1.14 The County inspector will initial each video utilized in televising and that video will be submitted to the County for its records. Copies of the original video will not be accepted. The original video and the televised reports must be submitted to the County prior to the inspector signing-off on the project.

5.1.15 Video for laterals and gravity mains must contain the following information on the screen: Project Name, Date of Inspection, Lot Number, Block, Recording Distance, Sewer Ball Size, Pipe Information including size and material. Water must be in the pipe during the video.