

ARTICLE 28

GRAVITY SANITARY SEWERS

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This ARTICLE shall govern the design and construction of gravity sewer mains, service laterals, manholes, stoppers, and other appurtenances.

Pipe used in gravity sewer construction shall be polyvinyl chloride (PVC) or ductile iron pipe with an approved interior coating/lining (DIP). Alternate pipe material use may be allowed if prior approval is obtained from the City Engineer. Where reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision.

The Contractor shall be responsible for all materials furnished and storage of same until the date of substantial completion. At the Contractor's expense, all materials found to be defective or damaged in handling or storage shall be replaced. The Contractor shall, if requested by the City, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated Specifications.

Section	28.02	<u>DESIGN CRITERIA</u>
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- A) Design Flow: Sewers of 15" in diameter and less shall be designed to not exceed $\frac{1}{2}$ pipe depth full at peak design flow. Sewers greater than 15" shall be designed to not exceed $\frac{3}{4}$ pipe depth full at peak design flow.
- B) Minimum diameter
 - 1) Main Sewer - 8 inches.
 - 2) Single lateral - 6 inches.
 - 3) Commercial user lateral - 6 inches.
 - 4) Multi-Family user lateral - 6 inches.

- C) Velocity in pipes
 - 1) Minimum - 2 feet per second. (At the design flow)
 - 2) Maximum - 7 feet per second.

D) Minimum Cover

The minimum cover over gravity sewers shall be no less than 3 feet, calculated from the finished grade. Exceptions to this requirement may be made for a short length of pipe where structural considerations are incorporated in the design.

- E) Roughness Coefficient: For Manning's formula use an “n” value of 0.012 for PVC and 0.013 for other pipe materials.

F) Minimum Slope versus Pipe Diameter

<u>Table 28-1</u>		
<u>Minimum Slope in Foot Per 100 Feet</u>		
<u>Sewer Size</u>	<u>PVC</u>	<u>Other Material</u>
8"	0.30	0.33
10"	0.21	0.25
12"	0.17	0.19
15"	0.12	0.15
18"	0.10	0.11
21"	0.08	0.09
24"	0.07	0.08
27"	0.06	0.07
30"	0.05	0.06
36"	0.04	0.04

Slopes slightly less than those required for the velocity of 2.0 feet per second may be permitted under special conditions, when pipe is flowing full, if detailed justifiable reasons are given. Such decreased slopes shall only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the Developer's Engineer must furnish computations of the depths of flow in such pipes at minimum, average, and peak rates of flow.

Sewers shall be laid with uniform slope between manholes.

G) Size and Alignments

Size conversion between manholes shall not be allowed. All sewers shall be laid with straight alignments between manholes.

H) Additional Requirements

Main drain and back wash systems for pools, spas and storm drain systems shall not connect to the gravity sewer system.

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

- A) Total sewer extension length shall be limited to 50 feet.
- B) Sewer extension location at the initiating manhole shall be plugged to the satisfaction of the City.
- C) Such sewer extensions shall not be a part of the accepted sewer facilities. This shall be clearly delineated on the plans.
- D) All such sewer extensions shall be inspected and accepted as part of the future construction phase.

Section 28.03 MATERIALS

28.03.01 PVC Gravity Sewer Pipe

PVC Gravity Sewer Pipe (4" to 15"), ASTM D-3034, SDR 35. Uniform minimum "pipe stiffness" at 5% deflection shall be 46 psi. When the average depth of cover of the gravity sewer pipe is 12' or greater, SDR 26 PVC pipe shall be installed. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM F-477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4.

PVC Gravity Sewer Pipe (18" to 27"), ASTM F-679, SDR 35. Uniform minimum "pipe stiffness" at 5% deflection shall be 46 psi. When the average depth of cover of the gravity sewer pipe is 12' or greater, SDR 26 PVC pipe shall be installed. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM F-477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.

All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be 13 feet.

28.03.02 DIP Gravity Sewer Pipe

The use of Ductile Iron Pipe (DIP) shall be limited to specific uses and shall be approved by the City Engineer. DIP shall conform to ANSI/AWWA A-21.51/C-151, class thickness designed per ANSI/AWWA A-21.50/C-150, with mechanical or push-on joints. An interior protective lining of Protecto 401 shall be provided with a minimum dry thickness of 40 mils or equivalent. DIP gravity sewers, where called for by the City, shall be wrapped with polyethylene film, AWWA C-105. (See approved Manufacturer's List attached as part of this Manual.) The minimum standard length of pipe shall be 18 feet.

28.03.03 Coatings and Linings (Iron Pipe)

All ductile iron pipe and fittings shall have an interior protective coating of Protecto 401 in accordance with the manufacturers recommendations. Interior coating shall be holiday free and holiday tested in accordance with ASTM G-62 and ASTM D5162.

Polyethylene Encasement, where required, shall be per ANSI A-21.5 (AWWA C-105). If Exterior polyethylene encasement is not required, the pipe exterior shall be bituminous coated.

28.03.04 Non-Shrink Mortar

All holes in manholes and wet wells shall be thoroughly plugged with an approved non-shrinking mortar, applied and cured in strict conformance with the manufacturer's recommendations. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole and wet well wall surfaces. When mortar is set coat with an approved coating material. For manholes and wet wells with sprayed on liners, treatment of exposed mortar shall follow manufacturer's recommendations.

28.03.05 Sanitary Manholes

Sanitary manholes shall be in accordance with ARTICLES 17 and 27 of this Manual.

Section 28.04 INSTALLATION

28.04.01 General

Trench excavating and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be performed in such a manner as to promote the safe and expedient execution of the work and in all cases shall conform to the requirements of OSHA CFR 1926 Subpart P for trench safety.

28.04.02 Pipeline Trenching

- A) Excavation of trenches shall not advance more than 50 feet ahead of completed pipe installation, except as approved by the City Engineer or his Designee.
- B) Excavation in close proximity to existing utilities shall be performed in a manner to prevent damage. Representatives of utilities shall be contacted for assistance in locating buried lines.
- C) All excavations should be made by open cut **unless otherwise indicated in this Manual**. See the Typical City Details attached as part of this Manual.

28.04.03 Sheeting, Shoring, and Bracing

Furnish, install, and maintain sheeting, bracing, and shoring support required to keep excavations within the easement or right-of-way, to support the sides of the excavation, and to prevent any movement which may damage adjacent pavements or structures, damage or delay the work, or endanger life and health. Voids outside the supports shall be immediately filled and compacted. Sheeting, bracing, and shoring to be used shall be designed by a Florida Registered Professional Engineer.

28.04.04 Dewatering and Drainage

At all times during construction keep excavations free from standing water. Sumps, if required, shall be located outside of load bearing areas so the bearing surfaces will not be disturbed. Water pumped from the excavation shall be discharged to prevent re-entry into the soil strata being dewatered. Water containing material such as silt in suspension or solids shall not be pumped into sewer lines or adjacent streams. The method of disposing of water pumped from the excavation shall be approved by the City Engineer or his Designee prior to actual disposal. Dewatering discharges shall comply with all Regulatory Agency Requirements.

28.04.05 Stabilization

If portions of the bottom of trenches or excavations consist of material unstable to such a degree that, in the opinion of the City Engineer, it cannot adequately support the pipe or structure, the bottom of the trench or excavation shall be over-excavated and stabilized with approved coarse granular stabilization material. Depth of stabilization shall be sufficient to provide unyielding Surface or a min thickness of 6 as directed by the City Engineer or his Designee.

28.04.06 Bedding of Piping

A) General

- 1) Haunching is defined as the shaped and tamped granular material which extends from the pipe bedding to the spring line of the pipe. Cover is defined as the compacted material which protects and covers piping, and which extends from the top of haunching material to a point 1' above the top of the pipe. Backfill, as specified hereafter, is defined as the material extending above the top of pipe cover to topsoil, paving subgrade, or foundation level.
- 2) All buried piping shall be continuously bedded and covered, except where concrete encasement, concrete cradles, or jack and bore are indicated.

B) Pipe Bedding

Any part of the trench bottom that is excavated below the pipe grade shall be backfilled to grade with a minimum of 6 inches of granular material and compacted as required in Section 26.04.07. Bedding materials shall be limited to Class I or Class II materials.

C) Pipe Cover

All cover materials shall be clean fill with no debris and carefully deposited to avoid damage to the pipe and shall be compacted as specified hereafter.

28.04.07 Trench Backfilling

Backfill shall be granular material or suitable previously excavated pipe trench material approved for use by the City Engineer. The granular backfill shall be carefully deposited in uniform lifts as specified below and each lift shall be wetted adequately as needed to obtain the required compaction density with vibratory compactors, as specified hereafter.

Unless otherwise indicated or approved by the City Engineer or his Designee, fills shall be placed in the loose lift thicknesses indicated hereafter and compact to a dry density, not less than the following percentage of maximum dry density, determined by the Modified Proctor Test, ASTM D-1557, unless otherwise noted.

28.04.08 Pipe Laying and Jointing

Gravity sewers shall be laid in the dry to the elevations and slopes shown on the approved construction drawings. Laser equipment shall be used to provide line and grade. Surveying equipment shall be used to set the laser. The laser equipment shall have a slope indicator to facilitate checking by both the pipe-laying foreman and the City Engineer. Since most gravity sewers are laid with extremely flat slopes, zero tolerance for errors in line and grade will be allowed. Upon completion of the work, the lines shall be cleaned, with all debris removed at downstream manhole. Each section of pipe shall be TV inspected to indicate any pipe defects such as bellies or other deformities, and, if necessary, shall be taken up and re-laid to provide the correct line and grade. Special attention shall be given to the requirement that the pipe be laid in a dry trench with properly compacted bedding and backfill. The pipe shall be laid with the spigot ends pointing in the direction of flow, starting at the lowest point. Joint contact surfaces shall be cleaned immediately prior to jointing. Lubricants, primers, or adhesives shall be used as recommended by the joint manufacturer. The minimum allowable cover for gravity sewers shall be 3 feet from the top of the pipe to the finished grade. However, should this depth not be feasible, where grade depressions along the alignment are unavoidable, ductile iron pipe shall be provided within the limits of the lesser cover. In no case shall the pipe cover be less than 18 inches, and any deviations from 3 feet of cover shall be approved in writing by the City Engineer. Pipes shall be installed to the alignment and grade as shown on the approved plans.

28.04.09 Branches

Wye branches are to be installed in conjunction with the laying of sewer pipe. Wyes to serve all existing and future dwelling units shall be installed. The longitudinal barrel of branch fittings shall conform to the line and grade, diameter, and quality of the sewer main. All service laterals shall be perpendicular to the longitudinal axis of the pipe.

28.04.10 Laterals

Laterals shall be extended to and located between 3 and 4 feet below the right-of-way line's finished grade, with a 6" clean out as near to right-of-way line as permitted. No double service laterals allowed for single or duplex homes. Laterals shall run in the most direct route and perpendicular to the sewer main at a minimum grade of 1% from the main to the right-of-way line. A wye branch fitting for each service line shall be provided. Double wyes are not acceptable. All laterals and service wyes at the last joint shall be plugged and securely sealed to withstand the internal pressure of leakage or air pressure testing. The plug shall be capable of removal without injury to the socket. An S shall be saw cut and painted green in the top of the curb directly over the lateral location. If curbing is not part of the work, a 4" x 4" x 3' wooden stake shall be painted green and installed at the end of the connection. Clean-out caps shall be of the inverted hex-nut type. If required by the City Engineer or his Designee, the terminal ends of laterals shall be marked by electronic location devices that are compatible with City owned equipment. Cleanouts shall not be permitted in driveways.

28.04.11 Protection of Water System Crossings

1. Separation of Water Mains and Sewers:
 - A. Separation of potable water, reclaimed water, storm and sewer systems shall comply with FDEP regulations and STANDARD DRAWINGS
 - B. Water pipes shall not pass through any part of a storm sewer or manhole. A three-foot minimum separation from storm water structures shall be maintained to facilitate maintenance and operation.
2. Compliance with F.A.C.Rule 62-555.314 shall be met as a minimum.
3. If required by the City Engineer, cathodic protection shall be provided.

28.04.12 Downstream Protection

Dirt and debris collected in the pipe during construction shall not be flushed downstream. The open end of pipe shall be closed daily to prevent foreign matter from entering.

Section 28.05 CONNECTIONS

28.05.01 Transition Connections

Where pipes of alternate materials (VC to CI, etc.) are to be connected between manholes, suitable approved transition couplings shall be installed. Specially designed units may be submitted for approval. Concrete collars are not acceptable.

28.05.02 Connections to Existing Lines

A collar wye saddle for 4 inch and 6 inch diameter connections to existing sewer lines shall be used. The existing line shall be cut using a template to accomplish a true and clean opening for the saddle. Gasketed saddles with stainless steel straps shall be used, where available from the manufacturer. The sewer main shall be protected and cleaned of debris.

28.05.03 Tall Riser Connections

Connections shall be provided, as specified in the Typical City Details attached as part of this Manual, where the depth of the sewer main invert exceeds 10 feet below the finished grade of the street, unless otherwise required by the City Engineer or his Designee. Lateral connections shall be made by individual single wyes. Double wyes for connection are not permitted. One tall riser connection may service no more than 2 connections, 1 to each side.

28.05.04 Connections to Manholes

Connections shall be as specified in the Typical City Details attached as part of this Manual. Connections shall be made with a Kor-N-Seal/**A-Lock** type or equal wall penetration boot. Space between boot and pipe OD shall be filled with appropriately sized cavity O-ring. Clay pipe shall have a short nipple (18 inch or 24 inch) between the manhole fitting and the first full length of pipe. All openings for pipes into existing structures shall be made by cutting with a power driven circular coring machine.

28.05.05 Connections to Wet Wells

One joint (18-20 feet) of ductile iron pipe shall extend outward from the structure. Perform connections as for manholes.

28.05.06 Conflicting Structures and Protection of Sanitary Sewer at Utility Crossing

Where it becomes necessary to extend sewers through structures, such as conflicting manholes, junction boxes, etc., the pipe shall be ductile iron within a casing pipe with no joints inside the conflicting structure. Where the vertical separation between sanitary sewer and storm sewer is less than 18 inches, the sanitary sewer shall be installed as polyethylene lined ductile iron pipe.

Section 28.06 TESTING

28.06.01 PVC Ring Deflection

Maximum diameter ring deflection shall not exceed 5% of the internal pipe diameter throughout the warranty period when tested by a mandrel. The mandrel shall be a GO-NO-GO type with an unequal number of runners, minimum of 9, and a maximum distance between the runners of 2 inches. A gauging ring certified for each size of pipe inside diameter and the mandrel size shall be as follows:

<u>Pipe Size</u>	<u>Mandrel Diameter</u>
8"	7.37
10"	9.22
12"	10.98
15"	13.43

Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, and all other items necessary to conduct the required testing and perform the necessary system repairs required to comply with the specified test. On pipes determined to have excessive deflection, the length in question shall be relayed or replaced.

28.06.02 Infiltration/Exfiltration

There shall be no detectable level of infiltration or exfiltration from the system at the time of inspection. Any evidence of exceeding the limits of 28.07.02 must be corrected prior to acceptance by the City. This includes both line and manholes.

Section 28.07 CCTV INSPECTION STANDARDS

28.07.01 PART 1 – GENERAL

28.07.01.01 Scope of Work

- A) These specifications cover the testing and inspection for acceptance of wastewater and storm-water collection and transmission systems.
- B) Requests for testing and acceptance of wastewater and storm-water collection and transmission systems shall be executed in accordance with Article 26 and Article 32.
- C) Gravity Mains:
Shall be inspected with CCTV for alignment, grade variations, separated pipes, leaks, deflection, cracked, broken or otherwise defective pipe to ensure overall pipe integrity. The CCTV inspection contractor shall perform the CCTV inspection(s) and submit the electronic files and report(s) to the City Engineer as required.

28.07.02 PART 2 - PRODUCTS

28.07.02.01 CCTV Inspection Equipment

- A) Closed Circuit Television Camera:
The television camera used for the inspection shall be color and one that is specifically designed and constructed for sanitary sewer inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 percent humidity/submerged conditions. The CCTV camera equipment will provide a view of the pipe ahead of the equipment and of features to the side of the equipment through turning and rotation of the lens. The camera shall be capable of tilting at right angles along the axis of the pipe while panning the camera lens through a full circle about the circumference of the pipe.
- B) Lateral Video Camera
Lateral cameras may be push type or launched from the sewer main line. Lateral cameras shall be color, shall be self leveling, and equipped with a footage counter to provide on screen display of footage measurement.

C) Video Capture System:

The video recordings of the sewer inspections shall be made using digital video equipment. The digital recording equipment shall capture sewer inspection on DVD disks or hard drive, with each sewer reach inspection recorded as an individual movie file (.MPEG, .MPG, or .WMV) or approved equal.

1. The video file names will be referenced in the inspection database and in an inspection report generated in PDF format. The pipeline collection and real time video capture and data acquisition systems shall be provided.
2. The system shall use the most current PACP compliant application software and shall be fully object oriented or approved equal. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
3. The imaging capture system shall store digitized color picture images and be saved in digital format on a DVD, hard drive or approved equal. Also, this system shall have the capability to supply the City of Ocoee with inspection data reports for each line segment.
4. The contractor shall have the ability to store the compressed video files in industry standard and approved the City of Ocoee format and be transferable with the PACP compliant inspection database.
5. The contractor's equipment shall have the ability to "Link". "Linking" is defined as storing the video time frame code with each observation or defect with the ability to navigate from/to any previously recorded observation or defect instantaneously.
6. The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes in accordance with PACP naming conventions
7. The data-sorting program shall be capable of sorting all data stored using generic sort key and user defined sort fields.
8. Camera footage, date & manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.
9. Depth gage: The camera shall have a depth gage or approved method to measure deflection in the pipe and joint separation approved by the City of Ocoee.

28.07.02.02 Gravity Main Inspection CCTV Data

- A) CCTV data shall be recorded and saved in MPEG format or Windows Media video format.
- B) CCTV inspections shall use unique identification numbers established and provided by the City of Ocoee in pipe segment reference, upstream manhole number and the downstream manhole number fields.
- C) The video files will be named in accordance with the City of Ocoee file naming convention:
Upstream MH ID _ Downstream MH ID _ Inspection Date (year_month_day).wmv.
Example: 39540008_39540007_2009_08_05.wmv
- D) Reports shall be submitted in an electronic version (.pdf) generated by the computer software and shall be consistent with PACP requirements, observation report with still images; and CCTV inspection results.
 - 1. PACP export pipe inspection database (.mdb) saved on CD-R's, DVD, or portable hard drives
 - 2. Inspection digital photographs in JPEG format saved on CD-Rs, DVD or portable hard drives
- E) The video file names will be referenced in the inspection database and in an inspection report generated in PDF format. The pipeline collection and real time video capture and data acquisition systems shall be provided
- F) The system shall use the most current PACP compliant application software and shall be fully object oriented or approved equal. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
- G) The imaging capture system shall store digitized color picture images and be saved in digital format on a DVD, hard drive or approved equal. Also, this system shall have the capability to supply the City of Ocoee with inspection data reports for each line segment.
- H) The CONTRACTOR shall have the ability to store the compressed video files in industry standard and approved the City of Ocoee format and be transferable with the PACP compliant inspection database.
- I) The CONTRACTOR'S equipment shall have the ability to "Link". "Linking" is defined as storing the video time frame code with each observation or defect with the ability to navigate from/to any previously recorded observation or defect instantaneously.

- J) The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes in accordance with PACP naming conventions
- K) The data-sorting program shall be capable of sorting all data stored using generic sort key and user defined sort fields.
- L) Camera footage, date and manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.

28.07.03 PART 3 – EXECUTION

28.07.03.01 Gravity Main Requirements Before CCTV Inspection

- A) All manhole flow channels and benching per specifications shall be constructed and coated (if applicable) prior to CCTV inspection.
- B) CCTV inspections shall be received, reviewed and approved by the City of Ocoee prior to installation of pavement.
- C) The CONTRACTOR shall clean gravity mains to remove debris and stains from the pipe prior to televising. Flushing water or debris will not be allowed to enter pump station wet wells. Water will be pumped from the sewer system during flushing to an acceptable discharge location. A visual inspection shall be made and all obstructions removed.
- D) Gravity Mains/Pipes that are dirty (dirty walls and/or debris in the inverts) shall be re-flushed and cleaned before rescheduling a CCTV inspection. If necessary, swabbing may be required of specific sections of pipe.
- E) The CONTRACTOR shall pass a mandrel through the PVC pipe to confirm if ring deflection is in excess of five percent (5%). The base inside diameter shall be used to determine mandrel size as per ASTM D 3034 and/or ARTICLE 28.
- F) Dewatering systems shall not be operated within 48 hours prior to CCTV inspection.
- G) Backfill from the gravity main to the subgrade shall be compacted and stabilized for inspection and cleaning vehicle access prior to CCTV.

28.07.03.02 Notification

- A) Contractor shall notify the City of Ocoee a minimum of 48 hours prior to performing any CCTV gravity main inspection work.

28.07.03.03 Televising of Gravity Mains

- A) Wherever possible, gravity mains shall be televised in the downstream direction.
- B) Sufficient water shall be run through each section of main until water runs through each downstream manhole no more than 24 hours prior to televising. Lines that are dry or that enough water has not run through to reach the downstream manhole shall not be televised.
- C) Gravity mains shall be televised from manhole to manhole utilizing a 360-degree pan and tilt color camera driven through at a moderate rate of speed not more than 30 feet per min. The camera shall 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, three inches.
- D) Begin video recording at the top of the manhole to see the condition of the manhole and any pipe that is connected to the manhole. Record going down into the manhole all the way to the preset footage with continuous recording until the down stream manhole.
- E) Lighting should be set to allow for clear visibility without excessive reflection and should allow realistic colors to be visible.
- F) The iris of the camera should be adjusted to allow for a sharp focused image and the lens should be kept clean and free of obstructions.
- G) The operator should follow the manufacturer's instructions to achieve the proper color correction.
- H) All notes or coded references shall have footages recorded with them
- I) The camera should be centered within the pipe.
- J) The distance between manhole centers shall be accurate within 0.5 percent.
- K) The camera shall be stopped at all laterals adjusted for a clear picture and an orbital scan of the lateral taken pausing at the invert at the service lateral to detect dirt or infiltration.
- L) All laterals shall be televised when reaching the lateral if a launch type camera is utilized.
- M) The camera shall also be stopped at any suspected or confirmed defects, the focus properly adjusted and a clear digital video taken.
- N) Areas suspected of leaking shall be paused long enough to determine if a leak exists currently or if deposits have occurred.

- O) A digital photo shall be taken of all areas noted on the report including laterals and any confirmed or suspected defects.
- P) Manholes upstream and downstream shall be measured from rim to invert and the depth recorded on the inspection header in feet and inches.
- Q) Manhole material and defects shall be noted.
- R) Manholes that have laterals tied into them shall have sufficient water run through them and then a CCTV inspection to the property line will be conducted.

28.07.03.04 CCTV QA/QC Inspection Procedures and Causes for Rejection of CCTV Work

- A) The CONTRACTOR shall submit their Quality Assurance Plan and Quality Control procedures to the City of Ocoee. The CONTRACTOR shall ensure data quality and submit the results of the internal quality control checks performed on submitted data.

28.07.03.05 Gravity Main Inspection CCTV Report

- A) The CONTRACTOR will be required to submit the following deliverables on a weekly basis.

1. Inspection Reports are to include:

- a) Inspection session header information (see required fields in Section 2.02 above)
 - b) Defect log report including photo captures from CCTV video
 - c) Schematic drawing of pipe showing defects
 - d) Format: Adobe Acrobat PDF files – 1 report PDF per pipe with the following
 - e) File name format: <upstream MH ID>_<downstream MH ID>_<Date
 - f) (year_mo_day format)>.PDF
 - g) Example: 30060002_30060001_2010_02_16.pdf
- B) The CONTRACTOR shall submit quality control forms that include a hard copy print out of the inspection reports checked with errors and omissions clearly marked
 - C) Inspection video files on DVD or portable hard drive, labeled as follows: DVD/Hard drive Labels - Typed labels shall be attached to the face of each DVD. The typed index labels shall include the following information:
 - 1. Content (CCTV)
 - 2. Contractor name

3. Purpose of Survey
4. Tributary Pump station number
5. Reaches included (from Manhole Number ## to Manhole Number ##)
6. Date of survey
7. Contract Number / Delivery Order Number (if applicable)
 - a) Electronic Inspection Data stored and exported in a NASSCO Pipeline
 - b) Assessment and Certification Program (PACP) compliant Microsoft Access
 - c) database (.MDB) version 4.4 delivered on DVD or portable hard drive.
 - d) Inspection photograph digital files (jpeg) indexed to NASSCO PACP
 - e) compliant database.

28.07.03.06 Causes for Rejection of Gravity Mains

- A) The CONTRACTOR shall be required to replace the pipeline if the CCTV inspection reveals cracked, broken or defective pipe, and/or in the case of PVC pipe if a ring deflection is in excess of five percent (5%).
- B) Joint separation shall be no greater than one inch between the spigot and bell of the pipe or as required by the pipe manufacture.
- C) No evidence of leakage will be acceptable for private gravity mains connecting to the City of Ocoee's collection system.
- D) Misalignment resulting in vertical sags in excess of $\frac{3}{4}$ " will require replacement of the gravity main.
- E) The following NASSCO PACP codes or notes shall be cause for rejection of gravity sewer systems
 1. PACP coding of "Line" (L) shall be accompanied by a measurement of the line, grade or angular deviation. Variance of established line and grade at any point along the length of the pipe shall not be greater than 1 inch, provided such variation does not result in a level or reverse sloping invert. An approved method shall be used to determine this deviation. A PACP coding of MWLS with a percentage of pipe greater than 12.5% on 8-inch sewer, 15% on 10-inch sewer etc. will be corrected by excavation and repair.
 2. PACP coding of "Infiltration" (I) for pipe joints shall be replaced or the pipe joint shall be reseated at the joint. Grouting shall not be considered a method of repair and will not be accepted. Replace the leaking gravity main segment if there is visible infiltration at any point other than the pipe joint.
 3. Any PACP coding in the category of "Structural Family".

4. PVC pipe having ID tears will be rejected.
5. PACP condition grading of “OB” (obstruction) in pipe shall be rejected, the obstruction shall be removed and the line cleaned and re-televised.

28.07.03.07 Acceptance

- A) Successful passage of both the leakage test and CCTV inspection is required before acceptance by the City of Ocoee.
- B) Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to the City of Ocoee for approval. Pressure grouting of pipe or manholes shall not be considered as an acceptable method of repair.

Section 28.08 TESTING PRIOR TO SURFACING

28.08.01 General

All tests shall be completed and accepted by the City Engineer before any trench or pavement is asphalted. Contractor shall provide all testing equipment and material. Lines shall be televised to determine if they were acceptably constructed. Lines to be dedicated to the City and private lines shall be televised by a reputable company experienced in sewer examination. The Contractor shall be present to note required corrections, if any, and schedule remedial action prior to acceptance by the City. In all cases, a stabilized driving surface shall be prepared to allow access to all manholes by TV inspection trucks. The cost of the TV inspections shall be borne by the Contractor installing the line.

28.08.02 Test Procedure

- A) All gravity sanitary sewer collection lines and manholes, public and private, which are directly connected to the City collection system shall be tested to insure the minimal exfiltration of wastewater and infiltration of groundwater and stormwater. Lines and manholes shall be tested by either exfiltration and/or infiltration. In the event the exfiltration and/or infiltration test cannot be taken or is inconclusive, the City Engineer at his sole discretion may require a low pressure air test of all or portions of the gravity sewer to be put in service.
- B) Line and manholes must be cleaned of all material and meet all other conditions as described by this ARTICLE before proceeding with a test.
- C) Exfiltration Test: Where groundwater at the time of testing is near the lowest invert of gravity system to be tested, a passing exfiltration test is required. Exfiltration loss shall not exceed 100 gallons per inch of diameter of pipe per mile tested after a two (2) hour duration.

- D) Infiltration Test: Test sewer system when piping is submerged in groundwater above crown of pipes. Infiltration loss shall not exceed 100 gallons per inch diameter of pipe per mile tested after two (2) hours duration.
- E) Measured Loss: Exfiltration or infiltration loss shall be measured by summing the volumes lost in all test sections of the manholes and pipe.
- F) The low pressure air test method shall be in accordance with ASTM F1417-90 (most current version). Line must be slowly pressurized to four (4) psig (10 psig relief valve required) and hold for two (2) minutes and then slowly release to obtain a pressure to 3.5 psig. Line pressure must not experience a pressure drop greater than 1 psi during the specified testing interval per the following table.

Pipe Diameter (In.)	Minimum Test Interval Minutes	Length for Minimal Time (Feet)	Time for Longer Lengths (Feet)
8	7:34	298	1.520 x Length
10	9:26	239	2.374 x Length
12	11:20	199	3.418 x Length
15	14:10	159	5.342 x Length
16	15:10	149	6.282 x Length
18	17:00	133	7.692 x Length

In the event no pressure loss is experienced within half the test interval specified, the test can be discontinued.

- G) Test Sections: Test sections shall be divided to ensure proper testing method. In test sections where groundwater influence cannot be determined, the City Engineer may require both exfiltration and infiltration tests.

Section 28.09 FINAL INSPECTION

After all manholes are raised to grade and paving operations are completed, a final visual inspection shall be made by the City Engineer or his Designee. All manholes shall be examined for proper grade and water tightness. The Contractor shall assist the City Engineer or his Designee by providing all labor as required. The Contractor shall make note of any corrections required and shall perform all remedial actions prior to the acceptance by the City.

Section 28.10 GREASE INTERCEPTORS

The City of Ocoee has a pretreatment program that requires all new sewer usages to comply with all applicable requirements and regulations.

Section 28.11 IDENTIFICATION

For connections of gravity sewer smaller than 12” to pipes larger than 12”, the connecting shall be made using a manhole. The crown elevation of the smaller pipe will be required to match the crown elevation of the larger pipe.