# SECTION 10

# SANITARY SEWER CLEANING
# &
# CCTV INSPECTION

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## SANITARY SEWER CLEANING AND CLOSED-CIRCUIT TV INSPECTIONS

### 10.1 General

A. Description

Under this Item, the Contractor is required to furnish all materials, labor, equipment, power, etc. to implement sewer cleaning and closed-circuit television (CCTV) pre-cleaning and post-cleaning inspections. The City shall review the CCTV videos prior to any CIPP installation.

B. Scope

Work under this section includes preparing the sewers for relining and performing closed-circuit television (CCTV) inspection. It is anticipated all sewer lines will require heavy cleaning. Heavy cleaning shall be defined as cleaning requiring more than three passes through the sewer line and the use of mechanical cleaning equipment (roots, rocks, debris, gaskets, protruding taps, etc.). Protruding taps that cannot be removed by mechanical methods will be clearly noted on log report and video and Contractor shall immediately notify the City in writing.

Regardless which activity occurs last, manhole rehabilitation or sewer main CIPP, all sewers and manholes within project shall be cleaned of any construction debris.

The work covered within this specification shall be for internal CCTV inspection of sanitary sewer pipes regardless if performing a pre-CCTV or post-CCTV video. The Contractor shall perform sewer televising work as necessary to thoroughly document the condition of all sewers and service laterals connections. The sanitary sewer and service laterals shall be carefully inspected to determine alignment, grade variations, separated joints, location and extent of any deterioration, breaks, obstacles, obstructions, debris, quantities of infiltration/inflow, and the locations of service connections.

Each lateral shall be fully visible in a window view at a fully stopped position before immediately proceeding with a closer, full perimeter pan-view of the lateral reinstatement. Condition of each lateral must be established through video.

### 10.2 Quality Assurance

Contractor shall be responsible for implementing quality assurance/quality control procedures necessary to ensure that all CCTV inspection video and observation data meet the requirements of the specification. The City will compare the work products submitted as the Five (5) Percent Submittal against the specification requirements contained herein. Necessary quality improvement requirements will be returned to the Contractor within three working days after the City receives the submittal. Thereafter, the City will conduct a quality review of the submittal and notify the Contractor of any deficiencies or rejected work products. The Contractor shall be responsible for correcting or re-televising any rejected segments identified by Engineer. No sewer pipe segment (manhole to manhole

run) shall undergo CIPP lining until Engineer has reviewed and approved the respective pipe segment. Contractor shall be responsible for review of CCTV videos for accuracy, clear to view and completeness before submitting to Engineer for review and approval. Incomplete and/or inaccurate CCTV videos will be returned to Contractor for resubmittal. Contractor shall resubmit videos to Engineer for review and approval that are accurate and complete and at no additional cost to City. No CIPP installation will occur until accurate and complete CCTV videos are submitted, reviewed and approved by Engineer. Both log and video screen data shall be complete, clear to view and accurate.

A. Requirements

1. The Contractor shall inspect the sewer interior using a color CCTV camera and document the inspection on a digital recorder. All inspection video shall be captured in either MPED or Windows Media Video (WMV) file format and saved to DVD for submittal. Each inspected sewer segment, referenced manhole to manhole, should have an associated MPEG or WMV file. Digital photographs (JPG files), inspection reports (PDF files) and any handwritten inspection logs or field maps shall accompany the video inspections for each sewer segment (manhole-to-manhole).

2. The quality of all work specified in this specification shall meet or exceed the requirements of the National Association of Sewer Service Companies (NASSCO) Recommended Specifications for Sewer Collection System Rehabilitation (latest edition), except as described in this specification. Applicable portions of this specification that inadvertently fall below those standards shall be corrected and maintained at the NASSCO standards as a minimum requirement, at no additional cost to the City.

3. Contractor shall provide inspection video, data, and reports in accordance with the requirements specified herein. Contractor shall provide all video on DVD as specified. All work shall conform to current NASSCO Pipeline Assessment Certification Program (PACP) coding conventions and all software used by the Contractor shall be PACP compliant.

4. Contractor shall notify Engineer in writing of any buried structures observed during CCTV activities and shall note such on respective video and log.

B. Major Problems and Emergency Situations

1. The Contractor shall notify the City immediately of any major problems or emergency situations encountered in the field, including collapsed or severely broken pipe, sewer overflows or significant surcharge, sewer blockages, equipment stuck in pipe that cannot be removed, or injury to Contractor personnel or members of the public during Contractor's operations.

2. The Contractor shall provide a twenty-four (24) hour-a-day contact with required available resources to travel to the site within sixty (60) minutes of notification of a problem.

C. Damage

The Contractor will be held responsible for any damage that occurs as a result of the Contractor's work. Any repair of such damage shall be approved by the City prior to its execution. All costs associated with such repairs are solely the responsibility of the Contractor.

D. List of Submittals

1. Contractor shall submit example of log that will be used during project for Engineer's review and approval.

2. Five Percent Submittal (all work products)

   The Contractor shall submit a completed work product (CCTV inspection logs, CCTV inspection database, digital photographs, and digital CCTV inspection recording) at the five (5) percent mark [five (5) percent of total CCTV inspection footage] to the City for formal quality review as described above.

3. Final Sewer Cleaning Field Logs

   The Contractor shall record data about the cleaning operation on field logs provided to the City. The data will include date of cleaning, type of nozzle used, maximum water pressure used, and a qualitative description of the nature of the material removed by the cleaning, using the same types of observations as those used for the CCTV inspection (e.g., heavy grease, light roots, etc.).

4. Final CCTV Inspection Logs

5. Final CCTV Inspection Database

   Final Digital CCTV Inspection Recordings on DVD (analog to digital conversion is allowed as long as requirements regarding "CCTV Equipment" are met)

## 10.3 National Association of Sewer Companies Certification

Contractor's personnel operating CCTV camera and other equipment required to develop the end product shall hold current certification by the National Association of Sewer Companies (NASSCO) Pipeline Assessment Certification Program (PACP).

- NASSCO Certification number shall be present for each certified operator on all submitted CCTV logs to the City Engineer.

## 10.4 Equipment

A. Sewer Cleaning Equipment

1. High-Velocity Jet (Hydrocleaning) Equipment: All high velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two (2) or more nozzles. The nozzles shall be capable of producing a scouring action from fifteen (15) to forty-five (45) degrees in all size lines designated to be cleaned. The equipment will have a minimum working pressure of two thousand (2,000) psi at a sixty (60) gpm rate. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry a nominal eight hundred (800) gallon minimum water tank, auxiliary engines, pumps, and a minimum of six hundred fifty (650) feet of high-pressure hose on a hose reel.

2. Mechanically Powered Equipment: Bucket machines shall be used when the High-Velocity Jet (Hydrocleaning) Equipment is inadequate. Machines shall be belt operated or have an overload device. Machines with direct drive that cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of seven hundred fifty (750) feet of rod. The rod shall be specifically heat-treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

B. Closed-Circuit TV Equipment

The Contractor shall provide the necessary equipment to perform closed circuit television inspection of the designated sewer pipes. The equipment will meet the following specifications:

1. A studio containing the controls for the inspection equipment will be large enough for two (2) people to view a television monitor of the inspection procedure. The studio will be insulated from outside noises that could be inadvertently recorded on the audio channel.

2. A color television monitor will be available to view live camera action and recorded playback. The displayed picture must be capable of providing a clear, stable image free of electrical interference. The television monitor will measure at least fifteen (15) inches across diagonally.

3. The camera used for sewer pipeline inspections will be one specifically made for the purpose. The camera will operate in one hundred (100) percent humidity, be waterproof and able to withstand long periods of submergence in wastewater. The camera will be able to pan, tilt and rotate three hundred sixty (360) degrees. The tilt arc should not be less than two hundred twenty-five (225) degrees. A variable intensity control of the camera lights and remote-control adjustments for focus and iris shall be located at the monitoring station. The remote control of focus and iris will

range from one (1) inch to infinity. The camera and monitor shall be able to produce a minimum of four hundred sixty (460) lines of horizontal resolution and four hundred (400) lines of vertical resolution and capture images in full color. The image pick-up device shall contain in excess of three hundred seventy-nine thousand (379,000) picture elements (pixel). Geometrical distortion of the image shall not exceed one (1) percent Contractor shall present on DVD a continuous image of not less than ninety (90) percent of the internal pipe circumference at all times.

4. Lighting. Illumination shall be adjustable and even around the sewer perimeter without loss of contrast, flare out of picture or shadowing. Lighting and camera quality shall be suitable to allow a clear in-focus picture of a minimum of ten lineal feet of the entire periphery of the sewer pipe. The lighting for the camera shall minimize glare. Lighting sensitivity shall be three (3) lux or less.

5. Transporters. The camera should be mounted on skids or a tractor suitably sized for the pipe to be televised that will position the camera lens above the liquid flow line, near the center axis of the pipe. Any motorized transporters should have adjustable speed control. The televising may also be accomplished using camera equipment mounted on a raft or floating pontoon, if the required pipe condition information cannot be obtained by tracked camera equipment within the maximum allowable flow depths.

6. Cable and Footage Counter. A minimum one thousand five hundred (1,500) feet of TV cable on the spool reel shall be provided. The TV cable will be supported by an equal length tag line for removal of the equipment from the pipeline.

7. Computer System. The computer system shall be capable of recording, indexing, and processing inspection data; printing CCTV inspection logs; and recording, storing, and playing video and images of pipe observations as required for the data documentation requirements of these specifications.

8. Software. Inspection software shall be PACP compliant versions of CUES Granite XP, WinCam, Flexidata, or approved equal.

## 10.5 Execution

A. Safety

The Contractor shall adhere to all local, state, and federal health and safety standards.

B. Sewer Cleaning

1. The intent of sewer line cleaning is to remove all sludge, dirt, sand, rocks, grease, and other solids or semisolid material from the pipe so that the sewer lines are ready for relining.

2. Sewer cleaning shall be performed with hydraulically propelled high velocity jet designed for cleaning sewers. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. As a minimum, jetting of lines must be performed by pulling the high velocity spray nozzle in the direction opposite to the force created by the water pressure.

3. During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. Precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. Whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole reach involved.

4. The Contractor shall be responsible for obtaining water at locations designated by the City. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

5. It is anticipated heavy cleaning will be needed. If hydrocleaning is ineffective in removing debris and roots, mechanically powered equipment shall be used to clean the pipe. No additional payment to Contractor will be made for cleaning of sewer pipes.

6. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. The cost of additional manhole set-ups shall be borne by the Contractor. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the City shall be notified as soon as possible.

7. All sludge, dirt, sand, rocks, grease and other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the reach being cleaned. Passing material from manhole reach to manhole reach which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment shall not be permitted. Material removed with heavy cleaning shall be disposed of offsite at permitted facilities to handle such wastes. All materials shall be removed from the site at a minimum of the end of each workday. Under NO circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers acceptable to the City.

C. Sewer Flow Control

The Contractor is allowed to provide bypass pumping and flow control, and these costs shall be included in the unit cost per linear feet for CCTV inspection. If flows are too high for CCTV inspection (greater than twenty (20) percent of the pipe diameter for ten (10) inch and smaller pipe, greater than twenty-five (25) percent for twelve (12) to twenty-four (24) inch pipe, and greater than thirty (30) percent for twenty-seven (27) inch and larger pipe, the Contractor shall evaluate if flows are low enough at a different time of day or night to complete the inspection. The Contractor shall notify the City in advance when performance of the inspection at night is required. If flow levels do not drop below the maximum flow depths noted above, the Contractor shall provide alternate means of flow control.

D. Closed-Circuit TV Inspection

1. After cleaning, the pipe sections shall be visually inspected by means of closed-circuit television. The inspection shall be done one (1) manhole-to-manhole pipe section at a time if possible, and the flow in the section being inspected shall be suitably controlled as specified. Each series of runs shall be recorded on a separate DVD.

2. The camera shall travel in the direction of flow unless access to the upstream manhole is not possible or the camera cannot pass through the pipe from end-to-end in the direction of flow, in which case a reverse setup shall be allowed.

3. If severe defects such as collapses, severe offset joints, or severe sags are encountered that preclude the inspection being completed in one direction, the Contractor shall attempt a reverse setup. If the entire segment cannot be inspected, Contractor shall notify the City immediately.

4. If a buried manhole is encountered during the course of the CCTV inspection, the Contractor shall attempt to CCTV through the buried manhole or conduct the inspection in the reverse direction if possible. The Contractor shall notify the City of the buried manhole and/or if the manhole needs to be exposed in order to complete the inspection.

5. If, during a run, the camera lens becomes soiled or fogged, the camera should be shut down and the lens cleaned, even if this requires removing the camera from the line. If the camera is removed from the line for lens cleaning or for cleaning the line of fog, the camera shall be returned to the point where acceptable footage was obtained. Footage of the camera being pulled out of the line for lens cleaning should not be included in the video. If fog is encountered during a run, the Contractor shall stop the camera and ventilate the line to remove the fog.

   Unclear footage shall not be accepted by the City.

6. The camera shall be moved through the line at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition.

When a defect or other feature is encountered, the progress of camera should be slowed and stopped for a minimum of fifteen (15) seconds or as needed so that the observation can be panned with the camera, the data recorded, narration made, and still picture captured if required. In no case shall the television camera be pulled at a speed greater than thirty (30) feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices not obstructing the camera view or interfering with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire segment, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire segment, the inspection shall be considered complete and no additional inspection work will be required. The contractor shall only be paid for the linear feet that were televised if a large section of pipe is inaccessible. Double payment is not permitted!

7. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two (2) manholes of the segment being inspected to insure good communications between members of the crew.

8. The "zero" (0) point of the inspection shall be the centerline of the manhole where the camera is inserted. The footage counter shall be set accordingly by adding the footage from the centerline of the manhole to the edge of the manhole plus the camera length (or the camera length plus the camera focal length). The importance of accurate distance measurement is emphasized. During any inspection procedure, the television cable shall only be removed from the reel by a motorized system. At no time during the inspection is cable to be removed manually, by hand. The television cable between the counter and the camera shall be taught at all times.

9. The Contractor shall allow the City to observe CCTV inspection work for purposes of verifying that all required CCTV inspection procedures are being followed and CCTV inspection observations are being properly coded. The Contractor shall provide comfortable viewing access to the video monitor during the video inspection recording to allow the City to compile a log of the inspection. The City may make both scheduled and unannounced visits to CCTV inspection operations while work is in progress. Notwithstanding any such observations of the CCTV inspection work by the City, the Contractor shall be responsible for the quality of video and documented observations.

E. Documentation

1. CCTV Inspection Logs

Printed location records shall be kept by the Contractor for each inspected pipe segment. The logs shall indicate, at a minimum, the pipe location, including the street name, addresses if applicable, starting and ending

manholes, date and time of inspection, direction of inspection, pipe diameter, material, and joint length, and final inspected length. The logs shall clearly show the distance from the centerline of the starting manhole of each observation and other points of significance such as locations of building sewers or other connections, broken or cracked pipe, separated or offset joints, vertical misalignment (sags), presence of roots, scale, corrosion, grease, sediment, debris, or infiltration, and other discernible features or unusual conditions, using standard NASSCO PACP codes. Comments shall be noted to document atypical conditions not otherwise described by the observation codes. A copy of each CCTV inspection log will be supplied to the City in hard copy and PDF format on standard DVD.

2. CCTV Inspection Database

The data obtained for all inspections shall be provided in digital format compatible to Microsoft Excel. The database shall contain two tables: one containing a single record or row for each inspection (Site Data Table) and one containing a single record or row for each observation (Observation Data Table). At a minimum, the database tables shall contain the following fields or columns:

a. Site Data Table

1) Site ID – Contractor's unique ID number for inspected segment, cross-referenced to Observation Data Table
2) Project – Contractor's project ID
3) Starting Manhole ID
4) Ending Manhole ID
5) Camera Direction – downstream (Dwn) or reverse (Rev)
6) Street name/location where the inspection is occurring
7) Easement – yes or no
8) Date of Inspection
9) Video disc (DVD) number
10) Inspection complete? – yes or no
11) Inspection abandoned due to prohibiting fault? – yes or no
12) Inspected pipe length (to nearest 0.1 foot)
13) Pipe diameter
14) Pipe material
15) Pipe joint length
16) Video file name
17) Television inspection log file name
18) Comments

19) PACP Certification Number

b. Observation Data Table

1) Site ID – cross reference to inspected pipe segment in Site Data Table

2) Observation ID – Contractor's unique ID number for observation

3) Footage position of observation (to nearest 0.1 foot)

4) Observation code (using NASSCO codes)

5) Clock position of observation (if applicable) – one (1) through twelve (12)

6) JPEG file name for observation photograph (if applicable)

7) Comments (if applicable)

3. Digital Photographs

Digital format JPEG on standard DVD photographs of all problems, severe defects or atypical observations shall be taken by the Contractor.

4. Digital CCTV Inspection Recording

The purpose of digital CCTV inspection recording shall be to supply a visual and audio record of the sewer condition. Format is DVD with 352 X 240 resolution, thirty (30) frames per second, and 1.5 Mbits per second data rate. Other resolution, frame and data rates are acceptable as long as similar or better image quality and acceptable file size are obtained.

Each individual pipe segment must be included in a single file, except if a reverse set up is required due to an obstruction, in which case the reverse inspection shall be contained in a separate file.

a. The following information must be provided as screen text on the video recording:

1) Upstream and downstream node numbers

2) Direction of camera travel

3) Purpose of CCTV

4) Location

5) Date and time of day

6) Job number and/or project name

7) CCTV company

8) Operator's name

b. The text should be clearly displayed on a contrasting background (e.g., white text on dark background or black text on white background). This text should be displayed for approximately 15 seconds or for the duration of the start-up narration, whichever is longer. If an inspection is being performed on consecutive pipe segments with the same setup, this information must be provided at the start of each pipe segment. Note: If the CCTV software being used can only display the "from" and "to" manhole numbers rather than upstream and downstream numbers (as in the case of a reverse inspection), then the upstream and downstream manhole numbers should be clearly stated in the startup video narration.

c. During CCTV, the running screen must include the following information. The display of this information must in no way obscure the central focus of the pipe being inspected.

1) Running footage (distance traveled)

2) Upstream and downstream (or "from" and "to") node numbers of inspected pipe segment

d. The end point of the inspected pipe segment should be indicated with screen text for approximately fifteen (15) seconds. The ending screen text should indicate:

1) Ending Footage

2) Date and time of day

3) Upstream and downstream node numbers of inspected pipe segment

e. The CCTV video recordings should not contain inappropriate language, idle chatter, background noise, and discussions between the operator and other crew members. A voice narration must be included in the video recording. All video narration must be live by the CCTV operator. Digital voice narration is only allowed if specifically approved by the City. This narration must include the following information at the beginning of each pipe segment:

1) Upstream and downstream node numbers

2) Direction of camera travel

3) Purpose of inspection

4) Location

5) Date

6) Job number (if applicable) and/or project name

7) Pipe size

8) Pipe material

9) CCTV company

10) Operator's name

f. All observations along the length of the pipe shall be narrated, with a description of the type of defect or feature, clock position, footage, extent or other pertinent data. At the conclusion of the inspection of a pipe segment, the operator should state the final CCTV footage and indicate that the CCTV inspection of the pipe segment is complete. If the inspection had to be abandoned before reaching the ending manhole, then a statement to this effect should be made as part of the ending narration with a reason given as to why the inspection could not be completed.

g. The audio and video shall be free of electrical interference and excessive background noise. Digital video recording playback shall be at the same speed that it was recorded. The Contractor shall have all digital video and necessary playback equipment readily accessible for review by the City during the project, after which time the digital video shall be given typed labels and presented to the City. All DVDs, submitted to the City, shall remain property of the City. The Contractor may, at the discretion of the City, retain a copy. Should any portion of the inspection DVDs be of inadequate quality or coverage, as determined by the City, the Contractor will re-inspect the unacceptable portion at no additional expense to the City.

5. DVD Labels

DVD labels shall identify the disc number; city name; project name and contract (if applicable); Contractor name, address and phone number; date of inspection; and sewer segment by upstream and downstream manhole numbers (followed by "Rev" if a reverse set-up). All labels shall be typed, or computer generated. Handwritten labels are not acceptable.