SECTION 02761
TELEVISION INSPECTION OF PIPELINES

1.0 GENERAL

1.1 DESCRIPTION

A. Scope

1. The Contractor shall perform internal inspections of the sewer mains and record any defects discovered. The intent of the inspection is to obtain data on the full circumference of the pipeline.

B. Requirements

1. CCTV Inspection. If directed by the Engineer, the Contractor shall inspect the pipeline interior above the flow line using a color closed circuit television camera (CCTV) and document the inspection on a digital recorder.
2. Conveyance. The Contractor may mount the CCTV camera on either a wheeled or tracked crawler or on a specially designed floatation device. The crawler may be either tethered or free roving.
3. Data Management. All inspection videos shall be submitted in MPEG file format (.mpg) and saved on CDs, DVDs, or external hard drives for submittal. Each inspected pipeline segment should have an associated MPEG file. Electronic PDF (.pdf) files of each inspection log and digital photographs (.jpg) files shall accompany the video inspections for each pipeline segment inspected. The nature of the inspections shall be to verify condition of the pipelines and to provide a permanent record of the existing pipeline condition as it relates to pipe dimensions, materials, obstructions, structural defects, connections, and deterioration.

1.2 QUALITY ASSURANCE

A. The Contractor shall have all CCTV operators who are responsible for logging defects into the data collection software successfully trained and certified through National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP).

B. The Contractor shall use CCTV defect logging software that is PACP-certified, which assures that the software can be used to export a database of all inspection and defect details that conform to the NASSCO PACP database standard. The Contractor shall add Owner specific defect codes to the database as required to insure uniform defect identification and naming.

1.3 SUBMITTALS

A. The following submittals shall be provided in accordance with Section “01340 – Submittals”:

1. Submit resumes and project references for the field personnel who will be employed for this project, including the NASSCO PACP Certification number for each operator.
2. See Section 3.8 for reporting submittal requirements.

2.0 PRODUCTS

2.1 TELEVISION CAMERA AND MONITOR

A. The camera(s) shall be operative in 100 percent humidity/submerged conditions. The CCTV camera equipment shall provide a view of the pipe ahead of the equipment and of features to the side and rear 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. The lights on the camera shall also be capable of panning 90-degrees to the axis of the pipe. If the equipment proves to be unsatisfactory, it shall be replaced with adequate equipment. The camera unit shall have sufficient quantities of line and video cable to inspect sewers with access as far apart as 2,500 feet.

B. The television camera, electronic systems and monitor shall provide an image that meets the following specifications:

1. The gray scale shall show equal changes in brightness ranging from black to white with a minimum of five stages.
2. With the monitor control correctly adjusted, the six colors - Yellow, Cyan, Green, Magenta, Red, and Blue, plus Black and White, shall be clearly resolved with the primary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no color tint.
3. The picture shall show no convergence or divergence over the whole of the picture. The monitor shall be at least 13 inches diagonally across the picture tube.
4. The live picture on the CCTV monitor shall be capable of registering a minimum of 500 lines horizontal resolution and be a clear, stable image with no interference.

C. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the sewers and laterals for all conditions except submergence. Under ideal conditions (no fog in the pipeline) the camera lighting shall allow a clear picture up to five pipe diameter lengths away for the entire periphery of the sewer. The lighting shall provide uniform light free from shadows or hot spots.

D. Camera focal distance shall be remotely adjustable through a range of 6 inches to infinity.

E. The monitor and software shall be able to capture and save screen images of typical pipeline details and all defects. Screen image files shall be named using pipeline segment number and footage and submitted on CDs, DVDs, or external hard drives following paragraph 3.08, this section.

2.2 VIDEO RECORDINGS

A. The video and audio recordings of all inspections shall be made using digital video equipment. The digital recording equipment shall capture pipeline inspection on CD, DVD, or external hard drive, with each segment inspection recorded as an individual movie file (.mpeg, .mpg). The files shall be named according to segment numbering system provided by the Engineer.

B. The audio portion of the composite CCTV video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Audio shall be recorded by the operating technician on the inspection video as the pipeline is inspected and shall include the pipeline segment identification number, location (address or cross streets) of starting point, inspection direction, length of inspection, flow information, complete descriptions of the pipeline conditions as they are encountered, and other relevant commentary to the inspections. In addition, the audio reports shall include the distance traveled on the specific run, a description of abnormal conditions in the pipeline as they are encountered, explanations for pausing, backing up, or stopping the survey, and the final measured distance. Audio dubbing after the inspection is prohibited.

C. The segments shall be inspected from upstream to downstream, wherever possible. The images recorded on the CCTV video shall be the same images that are required to be displayed on the CCTV monitor. The footage counter shall be zeroed at the beginning of each inspection and at each intermediate access point along the inspection run. The video recorder shall be paused if the camera progress is stopped for a period longer than 30 seconds due to breakdown of the equipment, or any purpose other than analyzing conditions of the pipeline. The operator shall document the delay on the recording when progress resumes.

D. The equipment used for the inspection must provide for simultaneous monitoring of the in-pipeline inspection by the Engineer or Owner.

E. Typed labels shall be attached to the face of each CD, DVD or external hard drive. The typed index labels shall include the following information:

1. Content
2. Contractor name
3. Type of survey
4. Interceptor name and ID number
5. Reaches included (Segment number, stationing)
6. Date of survey
7. Work order number (if applicable)

F. The inspection video shall be delivered on a medium that is not re-recordable. Contractor shall maintain a copy of all inspection documentation (CDs/DVDs, databases, and logs) for the duration of the work and warranty period.

3.0 EXECUTION

3.1 GENERAL

A. The CCTV camera shall be positioned as close to the spring line as possible while maintaining the required equipment stability. If the flow levels are above the spring line, then the vertical position of the camera shall be just above the free water surface.

B. The speed that the camera or survey unit is conveyed through the pipeline while performing general inspections shall be uniform and shall be limited to a maximum of 30-feet per minute. During CCTV inspection, the survey unit shall be slowed, stopped, or backed-up to perform detailed inspections of significant features. The camera shall be stopped at all defects, changes in material, water level, size, side connections, junctions, or other unusual areas. When stopped at the defect or feature, the operator shall pan the camera to the area and along the circumference of the pipe. The operator shall also record audio of the type of defect or feature, clock position, footage, extent, or other pertinent data. Still photographs or screen captures shall be taken at all defects and general line condition photographs should be taken at least every 200 feet.

C. During period of camera advancement along the reach, the operator should pan to view the flow line conditions along both sides of the pipe and the crown at regular intervals. This may be done while the camera is moving forward if the recorded picture quality is not adversely affected. When viewing the flow line area, the camera should be returned to the forward position providing a full view of the pipe before panning to view the opposite side of the pipeline or the crown conditions.

D. At the Contractor's discretion or direction of the Engineer, the camera shall be stopped or backed up (when conditions allow) to view and analyze conditions that appear to be unusual or uncommon for a sound pipeline. The lens and lighting shall be readjusted, if need be, to ensure a clear, distinct, and properly lighted feature. The video recorder shall be paused if the camera progress is stopped for a period longer than 30 seconds due to breakdown of the equipment, or any purpose other than analyzing conditions of the sewer. The operator shall document the delay on the recording when progress resumes.

3.2 LINEAR MEASUREMENT

A. The Contractor shall measure the camera progress along the full length of each segment. The length counter shall be zeroed at the beginning of each inspection, and at any intermediate access points. In the case of resuming an inspection at an intermediate point along the pipeline, the length counter shall start at the last point recorded. The Contractor shall ensure that the counter starts to register immediately when camera progress starts. Markings on the cable are not acceptable.

B. Prior to commencing inspections, the Contractor shall demonstrate compliance with the linear measurement tolerance specified below:

1. The equipment shall measure the location of the survey unit in 1-foot increments from the beginning of each continuous section. This footage location must be displayed on the CCTV monitor and recorded.
2. The accuracy of the measured location shall be within +0.5% of the actual length of the pipeline segment being surveyed, or 1 foot, whichever is greater.

3.3 CCTV MONITOR DISPLAY

A. The images displayed on the CCTV monitors shall be a view of the pipe above the water surface as seen by the CCTV camera as the unit is conveyed through the pipeline.

B. The camera lighting shall be fixed in intensity prior to commencing the survey and the white balance set to the color temperature emitted. To ensure color constancy, ideally no variation in illumination shall take place during the survey.

3.4 DATA DISPLAYS

A. The CCTV images shall include an initial data display that identifies the sewer reach being surveyed and a survey status display that provides continuously updated information on the location of the survey unit as the survey is being performed. These data displays shall be in alphanumeric form. The size and position of the data shall not interfere with the main subject of the monitor picture.

B. The on-screen text display should be white during inspections where the background behind the display is dark and, conversely, black where the background is light.

C. At the beginning of each pipeline segment being inspected, the following information shall be electronically generated and displayed on the CCTV monitors as well as included in the audio track:

1. Date of survey
2. Interceptor name/identification number
3. Segment identification number or stationing
4. Direction of survey (upstream or downstream)
5. Time of start of survey

D. During inspections, the following information shall be electronically generated, automatically updated, and displayed on the CCTV monitors:

1. Survey unit location in the pipeline in feet and tenths of feet from adjusted zero.
2. Pipeline diameter.

3.5 PHOTOGRAPHS

A. During CCTV inspections, screen captures shall be taken from the monitor images and saved electronically of typical conditions every 200 feet and at all defects. The screen capture shall have the interceptor name, segment identification number, survey direction, footage, and date when photograph was taken. The annotation shall be clearly visible and in contrast to its background, shall have a figure size no greater than 1/4-inch, and shall be type-printed. The annotation shall be positioned on the front of the photograph to not interfere with the subject of the photograph. Files shall be named using the segment identification numbers.

B. The image of the pipeline interior shall fill the photographic image. Photographs must clearly and accurately show what is displayed on the monitor, which shall be in proper adjustment. Where significant features exist within 6-feet of each other, one photograph shall be made to record these features. Where there is a continuous feature, photographs shall not be taken at intervals of less than 6-feet unless necessary to show a change in the feature.

C. The images shall be kept electronically, copied to a CD, DVD, or external hard drive, and submitted with the inspection videos and logs per paragraph 3.8 in this section.

3.6 PIPELINE IDENTIFICATION, INSPECTION FORMS AND DEFECT CODES

A. The Contractor shall use the Owner's pipeline identification numbering system and the segment identification system when performing the inspections for this project, as provided by the Engineer. CCTV inspection defect codes shall conform to those specified in the NASSCO PACP specification.

3.7 PRE-CLEANING INSPECTIONS

A. If the survey unit cannot pass the entire pipeline segment from its starting direction, the reach shall be inspected as much as possible, and the Contractor shall notify the Engineer immediately of the failure to complete and why inspection could not be completed. The Engineer and HRSD will determine if the Contractor shall proceed with cleaning of the pipeline as specified. The Engineer may also decide to clean the line prior to proceeding with inspection. The Contractor shall be prepared to clean all lines, at the Engineer's discretion, before, during or after inspection.

B. If any Contractor equipment becomes stuck in the pipeline, the Contractor shall be responsible for all costs associated with extracting the equipment from the main.

C. Any damages to public or private property resulting from Contractor activities shall be repaired by the Contractor at no cost to the Owner.

3.8 REPORT

A. Two copies of the inspection videos for each pipeline segment saved in mpeg format on CDs, DVDs, or external hard drives; electronic version (.jpg) of still photographs saved on CDs, DVDs, or external hard drives; a digital Microsoft Access database conforming to the NASSCO PACP database standard populated with all inspection and defect information; and hard copies and electronic PDF files of the inspection logs shall be submitted to the Engineer for review and approval. DVDs or sections thereof that do not conform to the specifications shall be re-recorded in the field at the Contractor's expense. Original DVDs and re-recorded runs shall be edited to provide a record with all inspections in sequential order from upstream to downstream. DVDs not in sequential order are unacceptable.

B. The inspection report shall include video recordings, pictures and any Owner required inspection forms and defect codes. Contractor shall provide equal documentation on both the videos and forms. Contractor shall maintain a copy of all report material. The Contractor shall provide comments as necessary to fully describe the existing condition of the pipeline, both through the voice over on the videos and on the inspection forms. Photographs shall further document both typical pipeline features, and defects.

C. Payment will not be made for any work until the Engineer has received, reviewed and approved up to date copies of all report documentation items specified in this paragraph 3.8. The Contractor shall submit these report documentation items a minimum of 10 business days in advance of any payment request to provide the Engineer ample time to review the files.

END OF SECTION