
Preconditioning and Cleaning of Underground Sewer Pipelines

Part 1 General

1.01 Scope

The work covered by this Section includes furnishing all labor, material, equipment and services required for cleaning all sewer pipelines, prior to inspection of the sewers, by closed circuit television, authorized by the Engineer, as shown on the Drawings and/or specified herein. The objective of preconditioning and cleaning is to maximize sewer and manhole service efficiency and effectiveness. Preconditioning and cleaning involves removal of silt, which is defined as any and all solid or semi-solid materials, including fine and granular material, such as sand, grit, gravel, and rock as well as debris, grease, oil, sludge, slime, or any other loose material or encrustation lodged in the manhole or sewer. Preconditioning and cleaning also involves removal of invading roots, corroded concrete, intruding laterals and any other extraneous debris.

1.02 Definition

The term "clean" as used in this Section, shall mean removing all sand, dirt, roots, cobwebs, grease and all other solid or semi-solid materials from the sewer pipelines, so that a closed circuit television camera can be used in the internal pipeline inspection for the purpose of discerning structural defects, misalignment and infiltration/inflow sources.

"Heavy Cleaning" shall be defined as the pipe being more than 25% full of debris or requiring the use of apparatus other than normal high-pressure jetting equipment (i.e. buckets, "pigs", power-rod machines, grinders, or dragging devices). The Contractor shall be paid for "Heavy Cleaning" on the basis of the distance loosened debris is moved to the nearest point of extrication from the sewer. Payment shall be calculated on a lineal foot basis and be paid in addition to the normal cleaning rate shown on the bid form. **"Heavy Cleaning" must be clearly documented with evidence submitted to ensure compliance approval from OWNER/ENGINEER.**

Part 2 Products

2.01 General

- A. The Contractor shall certify that sufficient cleaning units can be provided, including standby units in the event of breakdown, in order to complete the work within the contract period. Further, the Contractor shall certify that standby or back-up equipment can be delivered to the site within 24 hours in the event of equipment breakdown.
- B. Prior to the commencement of work, the Contractor shall coordinate access to water with the local water utility. Water will not be furnished by the Owner.
- C. All details of the point of water connection, backflow protection, conveyance methods, draw-off rates, times and all local conditions regarding the use of water

shall be approved by the Engineer and the utility providing the water prior to commencement of work. All equipment, labor, and material required for obtaining water for the work shall be provided by the Contractor. The Contractor must ensure that a 6 inch minimum air gap is maintained at the water supply point on desilting/cleaning/jetting equipment or any other receiving apparatus used to obtain water from the utility's hydrants.

Part 3 Execution

3.01 Cleaning

- A. Cleaning will be accomplished by utilizing a high pressure, hydraulic sewer pipeline cleaner. Pressure jetting equipment used shall be sufficient for the purposes of attaining the degree of cleanliness in sewers as specified without exceeding the maximum pressures indicated below and damaging the pipelines.
- B. The cleaning unit(s) shall be capable of operating routinely, up to a minimum of 500 feet from the point of access to the sewer; minimal hose diameter shall be 1 inch.
- C. The Contractor's rates specified in the Proposal Forms shall be for jetting in sewers both upstream and downstream.
- D. Successive passes using constantly moving pressure jetting techniques shall be applied to sewers until they are cleaned to the level specified. Nozzle hold-time (stationary time), for any particular location, shall not be more than 60 seconds in order to forestall damage to the pipe being cleaned. Ideally nozzles shall have jet angles of between 130° to 145°. "High efficiency nozzles" (discharging "pencil jets") with jet angles lower than this figure shall not be allowed to be stationary at any time. The maximum pressure applied utilizing a stationary jet nozzles shall not exceed 3,000 psi in PVC and HDPE pipelines and shall not exceed 2,500 psi in vitrified clay pipelines. The maximum pressure applied utilizing rotary jet nozzles shall not exceed 3,500 psi in VCP pipelines, 5,500 psi in PVC pipelines and 7,000 psi in HDPE pipelines.
- E. Cleaning shall be done immediately prior to the internal inspection to preclude the build-up of debris from infiltration/inflow sources and upstream manhole sections. Should television inspection reveal that a sewer pipeline is not clean; the cleaning operations shall be repeated until the sewer pipeline is clean. This additional cleaning shall be done at the expense of the Contractor, at no additional cost to the Owner.
- F. During preconditioning and cleaning work and all other associated Contract operations, sewer services shall be maintained at all times. This requirement may be relaxed only with the written approval of the Engineer.
- G. The manholes and sewers to be preconditioned and cleaned convey sanitary sewage or combined sewage. In many instances such sewers are subject to high flows, either continuously or in a periodically varying cycle, due to rainfall, infiltration, and/or pumping operations. The Contractor shall include in his proposal

provisions for dealing with such variations, and where necessary, schedule Work to accommodate such variation in flows.

- H. Cleaning shall include the trapping and removal of all sediments and residual wastes from successive manholes as the cleaning progresses. When hydraulic cleaning equipment is used, a suitable weir or dam shall be constructed in the downstream manhole, in such a manner, that the solids and water are trapped. Under no circumstances shall sewage or solids removed there from, be dumped onto streets, in catch basins or in storm drains. Material which could cause pipeline stoppages, accumulations of sand in wet wells, or damage to pumps, shall not be permitted to pass from manhole section to manhole section. The cost of trapping, removing, hauling and disposing of the residual wastes shall be included in the cost of cleaning. Disposal of residual wastes shall be in accordance with, and at a location approved by the Engineer and the Owner.
- I. The Contractor shall provide for the pumping down of any surcharged manhole section and provide all bypass pumping, if required, during the cleaning operation. All bypass pumping shall be approved by the Engineer.
- J. The Contractor shall submit a comprehensive equipment list to the Engineer before commencement of the Work. The complete list, which shall include all backup and standby equipment, shall be broken down into the following categories (at a minimum):
 - 1. Safety equipment
 - 2. Manhole preconditioning and cleaning equipment
 - 3. Sewer preconditioning and cleaning equipment
 - 4. Flow diversion and flow control equipment
 - 5. Traffic control equipment
 - 6. All other equipment necessary for the completion of the work.
- K. Blockages in the system shall be reported to the Engineer immediately.
- L. A responsible representative of the Contractor shall be present on the site of the work, or other location approved by the Engineer, to provide supervision of the work. At all times, and especially when a change of work location is underway, the Contractor's representative shall keep the Engineer continuously aware of the location, progress, planned execution of the work, and problems encountered.

3.02 Precautions

- A. The Contractor shall take all necessary precautions to ensure that water used does not flood property or buildings served by the sewer pipeline being cleaned.
- B. No fire hydrant shall be obstructed, in case of a fire in the area served by the hydrant.

- C. The Contractor shall take all necessary precautions to protect the sewer pipelines from damage that might be inflicted by improper use of cleaning equipment and shall repair, at no cost to the Owner, any damage caused by the cleaning operation.
- D. The Contractor shall furnish, to the Owner, certification of the accuracy of the automatic counter before any work shall begin on this Project. If, at any time, the Engineer has reason to believe that the counter is inaccurate; the calibration of the counter will be checked before any more work progresses.
- E. The Contractor shall provide, operate, maintain and subsequently remove on completion, adequate ventilation apparatus in the form of blowers and/or fans. The ventilation apparatus shall introduce a fresh air supply to support a safe environment for Work in sewers, manholes and all other confined spaces, which shall be kept free from dangerous, toxic and/or explosive gases, whether generated from sewage, soil strata or other source.
- F. The Contractor shall employ the “best practicable means” to minimize and mitigate noise as well as vibration resulting from operations. Mitigation measures shall include the utilization of sound suppression devices on all equipment and machinery particularly in residential areas and in the near vicinity of hospitals and schools, especially at night.
- G. The Contractor shall inform the Engineer before the commencement of any portion of the work of any significant change in the methods of noise attenuation from those previously approved.
- H. All pumps, generators, combination cleaners or other noise emitting equipment shall be suitably screened to minimize nuisance and noise pollution. This requirement shall not be taken as preventing or prohibiting the execution of work necessary for the saving of life, protection of property, or safety of the personnel and/or facilities. The Contractor shall notify the Engineer of such use of plant or equipment in an emergency situation as soon as practicable.

3.03 Data Collection

- A. The Contractor shall complete a cleaning report for each sewer segment cleaned. A copy of this report in either excel or another database format pre-approved by Engineer shall be furnished on a weekly basis to the Engineer via uploading to a cloud-based server provided by either Engineer or Contractor. The information required on the cleaning report shall be as follows:
 - 1. Location, size and condition of sewer line. Location will be indicated by road name or intersection(s). Size will be indicated by nominal internal diameter.
 - 2. Length of sewer cleaned.
 - 3. Estimated amount and types of debris and sediment removed. Indicate

approximate location

4. Grease build-ups. Indicate approximate location.
5. Structural failures. Indicate approximate location.
6. Blockages. Indicate percent blockage or free area,
7. Method and man hours actually expended for cleaning.

END OF SECTION

Close Circuit TV Inspection of Existing Underground Sewer Pipelines

Part 1 General

1.01 Scope

The work covered by this Section includes furnishing all labor, materials, equipment and services required to perform the closed circuit television (CCTV) inspection of the specific sewer pipelines authorized by the Engineer.

1.02 Definition

"Internal inspection" shall consist of using a closed circuit television within a designated sewer pipeline segment to detect point sources of infiltration/inflow or exfiltration and to determine the physical condition of the sewer pipeline.

1.03 CCTV Camera Operator Certification Requirements

- A. The Contractor will provide current certification that operators conducting CCTV inspections have undergone National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP[®]) training prior to commencement of inspection activities. Defect coding, as well as material, shape, and lining coding used throughout the project will conform to most current NASSCO PACP standard version.
- B. Each operator must have at least 1 years' experience in the coding of NASSCO CCTV inspections and must have reported upon more than 150,000 feet of CCTV. The Contractor must use NASSCO certified data collection software (most current PACP version), with final approval by the Engineer prior to the start of the Contract.

Part 2 Products

2.01 Television Equipment

- A. The camera unit shall be a color pan and tilt unit. The television camera shall have a resolution of at least 500 lines minimum and shall have a source of illumination attached to it. With the monitor adjusted for correct saturation, the six colors plus black and white shall be clearly resolved with the primary and complementary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no tint. To ensure the camera shall provide similar results when used with its own illumination source, the lighting shall be fixed in intensity prior to commencing the inspection. In order to ensure color constancy, no variation in illumination shall take place during the inspection. The televised image shall be displayed on a monitor, located in an enclosed space in the television inspection vehicle.

- B. CCTV Focus/Iris/Illumination: The adjustment of focus and iris shall allow optimum picture quality to be achieved and shall be remotely operated. The adjustment of focus and iris shall provide a minimum focal range from 6 inches in front of the camera's lens to infinity. The distance along the sewer in focus from the initial point of observation shall be a minimum of twice the vertical height of the sewer. The illumination must allow an even distribution of the light around the sewer perimeter without the loss of contrast picture, flare out or shadowing.
- C. The camera shall be self-propelled or mounted on skids and drawn through the sewer by winches for pipelines with an equivalent diameter from 6 to 36 inches. The use of winches and skids shall be approved by the Engineer prior to CCTV inspection services. The inspecting equipment shall be capable of inspecting a length of sewer up to at least 1,000 ft. when entry into the sewer may be obtained at each end and up to 750 feet where a self-propelled unit is used, where entry is possible at one end only. The Contractor shall maintain this equipment in full working order and shall satisfy the Engineer at the commencement of each working shift that all items of equipment have been provided and are in full working order.
- D. Each inspection unit shall contain a means of transporting the CCTV camera equipment in a stable condition through the sewer under inspection. Such equipment shall ensure the maintained location of the CCTV camera on or near to the central axis of a circular shaped sewer when required in the prime position.
- E. Where the CCTV camera head is towed by winch and bond through the sewer, all winches shall be stable with either lockable or ratcheted drums. All bonds shall be steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera and/or Sonar equipment. All winches shall be inherently stable under loaded conditions.
- F. Each unit shall carry sufficient numbers of guides and rollers such that, when inspecting, all bonds are supported away from pipe and manhole structures and all CCTV cables and/or lines used to measure the CCTV camera's head location within the sewer are maintained in a taut manner and set at right angles where possible, to run through or over the measuring equipment.
- G. The Contractor shall use a suitable metering device, which enables the cable length to be accurately measured; this shall be accurate to within +/- 2 inches. When requested by the Engineer in writing at any time during a survey or inspection, the Contractor shall demonstrate compliance with the above tolerance. The device used by the Contractor to measure the footage along the sewer will be compared with a standard tape measure. The results will be noted. If the Contractor fails to meet the required standard of accuracy, the designated Engineer shall instruct the Contractor to provide a new device to measure the footage.
- H. The in-sewer photographic/video camera system and suitable illumination shall be capable of providing an accurate, uniform and clear record of the sewer's internal condition. In-sewer lighting standards shall meet the requirements of the designated Engineer and applicable codes regarding safety and power.
- I. A reserve television camera shall be available to replace the regular television camera in the event of a breakdown. Should the reserve equipment malfunction, another camera shall be provided within 24 hours.

- J. Suitable flow control devices shall be plugs designed and manufactured for use in sanitary sewers. Sand bags or other types of devices shall not be used within sanitary sewer pipelines or manholes.

2.02 Television Equipment Operation

Operation of the television inspection equipment shall be controlled from above ground, with a skilled technician at the control panel in the television inspection van controlling the movement of the television camera. The technician shall have the capability to: adjust the brilliance of the built-in lighting system; change the focus of the television camera by remote control; control the pan and tilt feature of the camera; control the forward and reverse motion of the camera; and determine the camera's position, at any time. Operators of the television inspection equipment shall meet the requirements stated in Section 1.03 of this Specification.

Part 3 Execution

3.01 Procedure

Prior to starting each inspection, the operator shall pan and tilt the surrounding above ground area of the entrance manhole. The CCTV video shall include the view of the camera as it is placed within the manhole and shall show which pipe in which the CCTV camera is inserted. Prior to entering the pipeline, the camera shall be tilted upwards and pan the interior of the manhole. **A measuring rod shall be placed at the mouth of the pipe (and included on video) to verify the diameter of the pipeline being inspected.** The diameter shall be noted in the inspection database and on the inspection video. The television inspection shall be performed in one section of the sewer pipeline at a time, between adjacent manholes. A complete inspection as per NASSCO standards shall be conducted. The inspection shall be performed by pulling or propelling the television camera through the section of the sewer along the centerline axis of the pipeline. A position tolerance of $\pm 10\%$ of the vertical sewer pipeline diameter dimension will be allowed (i.e. for an 8-inch diameter pipeline the camera shall be centered within ± 0.8 -inches of the center of the pipeline). The inspection shall be performed in a forward and/or backward direction, as dictated by the pipeline conditions at the time of the inspection. During the inspection of the sewer pipeline, every possible means shall be taken to ensure total viewing of the inside periphery of the pipeline. The inspection shall be conducted in such a manner as to determine that the line is clean and to locate all leaking joints, breaks, defects and faults in the pipeline. The operator shall bring the camera to a complete stop and the television camera movement shall be temporarily halted at each defect/observation/tap in order to pan or tilt the camera head and observe the full extent of the defect/observation/tap in full detail, and to allow for a clear photograph. Camera movement will not resume with visible point sources of infiltration/inflow until the leakage rate from the source is quantified. The camera shall also be stopped at service connections where flow is discharging. If the discharge persists, the property involved shall be

checked, at the ground surface level, to determine whether or not the discharge is wastewater. If checking determines that the discharge is not wastewater, it shall be considered infiltration/inflow. The leakage rate of each infiltration/ inflow source shall be estimated in gallons per day (gpd), when possible. When reaching an end point manhole, the camera should be maneuvered to the center of the manhole and tilted upward and slowly panned in order to view the interior of the manhole.

3.02 Provisions

- A. The Contractor shall maintain on site at all times a competent field supervisor in charge of the inspection. The field supervisor shall be responsible for the safety of all site workers and site conditions as well as ensuring that all work is conducted in conformance with these specifications and to the level of quality specified.
- B. The Contractor shall provide bypass pumping, where necessary, to prevent flooding or sanitary sewer overflows.
- C. The Contractor shall provide for the pumping down of any surcharged manhole section, if required, before television inspection commences. Bypass pumping must be approved by the Engineer prior to set up.
- D. The Contractor shall furnish, to the Owner, certification of the accuracy of the automatic counter before any work shall begin on the Project. If, at any time, the Engineer has reason to believe that the counter is inaccurate, the calibration of the counter will be checked before any more work progresses.
- E. CCTV Camera Head Speed: The speed of the CCTV camera in the sewer shall be limited to 30 feet per minute for inspections to enable all details to be extracted from the final video recording.
- F. At the start of each sewer length being surveyed or inspected and each reverse set-up, the length of pipeline from zero footage (middle of the man) up to the cable calibration point shall be recorded and reported in order to obtain a full record of the sewer length. Only one inspection shall be indicated in the final report. All reverse set-ups, blind manholes, and buried manholes shall be logged on a separate log. Each log shall make reference to a start (ST) and finish (FH) manhole unless abandonment took place because of blockage. **Prior to initiating the survey, the contractor shall make sure that the camera is outside of the pipeline to be inspected and a full panoramic video of the pipe entry or exit into the manhole is captured. A grade rod shall be inserted into the manhole so that the diameter of the pipeline to be inspected is accurately measured and shown in the video and documented in the PACP database.** The grade rod shall be shown at the beginning manhole survey and again at the end of the pipeline survey. Any leaks or infiltration sources shall be thoroughly videoed and annotated in the PACP form.
- G. Should the Contractor encounter a buried manhole during the course of inspection that cannot be readily accessed, the Contractor shall notify the Engineer, and shall make note of such in the appropriate field on the inspection

header.

- H. If during the course of CCTV Inspection, a protruding tap is discovered in the pipeline that will not allow the passage of a CCTV inspection camera and a reverse setup cannot be completed, then the Contractor will be required to remove the protruding tap via a remotely controlled robotic cutting device. Prior to removing the protruding tap, the Contractor must receive approval from the Engineer.
- I. If for any reason the camera becomes disabled inside the sewer and cannot further proceed, the Contractor shall be responsible for retrieving the camera at no additional cost to the Owner.
- J. All digital video shall be continuous with no evidence of missed footages or “blink- outs.” That the entire pipeline segment was traversed and inspected shall be obvious on the final video recording.
- K. Prior to inspection, each length of sewer shall be cleaned pursuant to Specification 33 01 30.14. All inspected pipe should be free of debris to allow for a complete, unobstructed view of the pipe. If upon viewing a final inspection, the Engineer deems that the view is obstructed, the pipe will be cleaned and re-televised at no cost to the Owner.
- L. All mainline CCTV surveys must be full PACP surveys, continuous from a starting manhole or access point to a finishing manhole, access point, or utility feature where possible. Any line that is not televised from a starting manhole, access point, or utility feature to a finishing manhole, access point, or ending utility feature will be considered as a partial or incomplete survey and will be rejected unless specified to do so otherwise or if the camera cannot not pass through the entire line due to an obstacle or other defect.
- M. Each CCTV survey shall televise the pipeline completely and shall pan the upstream and downstream manholes or access points and document all notable observations found in them.
- N. While in motion, the CCTV camera is to be fully zoomed out and fixed to what is known as “home position” where the camera head is kept at the level horizon and is centered and pointed true down the alignment of the pipe for the duration of each CCTV survey.
- O. During CCTV inspection, lighting intensity shall be adjusted as necessary to minimize glare and maximize viewing ability to provide an in-focus picture of the entire periphery of the pipeline for all conditions encountered.
- P. If during a normal flow CCTV survey the televising camera cannot pass through the entire pipe section due to a defect, anomaly, or obstruction in the pipe, the contractor perform a reverse set up in order that an inspection can be performed from the opposite manhole, wet well, or access point.
- Q. If the camera lens becomes covered with sewage, grease, deposits etc. resulting in

poor picture quality then the inspection shall be suspended and the camera shall be removed and cleaned. The inspection can then be resumed at the last clear camera location.

- R. Prior to beginning a CCTV inspection, the operator shall verify the diameter of the pipeline to be inspected by inserting a surveying rod into the manhole and measuring the pipeline diameter to the nearest 1/10th foot.

3.03 Data Collection

- A. The Contractor shall furnish all equipment and software required for taking photographs and videos of the view which appears on the monitor. Digital Video will be used to record all point sources and defects, severe leaks, holes, collapses, misalignments, etc. Still pictures shall be taken of all coded observations. Only one still photo of each defect should be included. Additional photos of a defect shall be coded as a "General Observation" for each additional photo taken. Data logging and defect coding conforming to the NASSCO PACP will be required as part of all pipeline inspections.
- B. All inspection information shall be captured utilizing NASSCO certified data collection software and following all NASSCO PACP (most current version) standard data fields, formats, and conventions provided by the Engineer.
- C. All inspection media file naming formats and folder organizational structures must remain consistent throughout all internal inspections. See naming conventions in Section 3.04, Part E.
- D. A digital encoded inspection video shall be continuously captured for the entire length of each inspection. All digital encoded inspection video files shall be in MPEG-1 or MPEG-2 file format. For all digital encoded inspection videos, the file naming format shall be generated using a concatenation of standard PACP database fields in the format "Upstream_MH"_"Downstream_MH"_"Direction"_"Date"_"Time". CCTV inspections in which the camera lens is or becomes obstructed, dirty, greasy, etc. during the inspection, and remains so for up to two (2) feet, will not be accepted.
- E. A digital still image shall be captured for each coded observation. All digital still images shall be in JPEG file format. For all digital still images, the file naming format shall be generated using a concatenation of standard PACP database fields in the format "InspectionID"_"ConditionID"_"Distance"_"PACP_Code".
- F. Each digital encoded inspection video shall begin with the camera facing towards the bottom of the manhole and oriented so that the outgoing sewer connection is at the 6 o'clock position. This position shall be held during video recording for a minimum of five (5) seconds prior to lowering the camera to the bottom of the manhole. Once the camera has been lowered into the manhole and oriented in its direction of travel, the camera shall be directed towards the top of the manhole, with this position held during video recording for a minimum of five (5) seconds prior to advancement into the sewer.

- G. A comprehensive summary inspection report shall be generated for each inspection, and shall be in Portable Document Format (PDF). The report shall include the findings on major defects, including but not limited to fractures, displaced joints, deformation, corrosion, lateral intrusions, and dominant surface features including encrustation and silt depths. All pdf report files shall be in a dedicated folder called "PACP_Reports"
- H. Each sewer length (the length of the sewer between two (2) consecutive manholes) will be entered into the PACP database field "Total_Length". If field maps are provided for the project area and include a total length, then this value will be entered into the field "Total_Length".
- I. When a length of sewer between two (2) consecutive manholes cannot be inspected for practical reasons, the reason for abandonment shall be described in the PACP database field "Additional_Info". At unmapped manholes, a new inspection will be started and the footage re-set to zero (0.0).
- J. When the Contractor elects to "pull through" a manhole during a CCTV and/or Sonar Inspection, a new inspection will be started at the manhole "pulled through", and the footage re-set to zero (0.0) at the manhole wall where the pipe exits/enters the manhole.
- K. When a reverse or second inspection is required to complete the inspection of a sewer, the PACP database field "Reverse_Setup" shall be populated with corresponding inspection number. The "Reverse_Setup" field shall be null for all inspections that are not reverse or follow-up inspections.
- L. When an unmapped manhole is discovered during an inspection, the Contractor shall assign a temporary field-assigned ID to the manhole. This temporary manhole ID shall be the downstream manhole ID plus a letter designation beginning with the letter "A". For example if inspecting from upstream manhole ID "61" to downstream manhole ID "48", a new manhole is discovered, this manhole will be identified as manhole ID "48A". If an additional line is entering the new manhole ID "48A", the next upstream manhole shall be identified as manhole ID "48A1". This temporary field ID shall be entered into the appropriate PACP database field (either "Upstream_MH" or "Downstream_MH"), and the comment "Unmapped MH" shall be entered in the PACP database field "Additional_Info". The inspection shall be terminated and a new inspection shall begin, so that the unexpected manhole effectively divides the pipe into two segments. The "Total_Length" field for the terminated inspection shall be populated with the distance in feet at which the unexpected manhole was discovered during inspection. The pipe segment receiving the next inspection shall be assigned a temporary field ID, and the newly-discovered manhole ID shall be entered into the corresponding "Upstream_MH" or "Downstream_MH" field. The proposed naming scheme for unmapped manholes and pipes shall be approved by the Engineer prior to start of inspections. The Contractor shall ensure that each newly-discovered manhole and pipe is given an ID that is not already assigned to another manhole or pipe. The contractor shall also ensure that the field-assigned ID of each newly-discovered manhole is consistent between PACP and MACP submittals.

- M. At the start of each sewer length, a data generator shall electronically generate and clearly display on the viewing monitor and subsequently on the final recording a record of data in alpha-numeric form containing the following minimum information:
1. Automatic update of the camera's footage position in the sewer line from adjusted zero.
 2. Sewer dimensions in inches
 3. Manhole numbers (must conform to Owner's identification number)
 4. Date of survey
 5. Road name (nearest)/location
 6. Direction of survey, i.e., downstream or upstream
 7. Time of start of survey
 8. Material of construction of the pipe
 9. Contractor
 10. Engineer
- N. The size and position of the data display shall be such as not to interfere with the main subject of the picture.
- O. Once the survey of the pipeline is under way, the following minimum information shall be continually displayed:
1. Automatic update of the camera's footage position in the sewer line from adjusted zero.
 2. Sewer dimensions in inches
 3. Manhole numbers (must conform to Owner's identification number)
 4. Direction of survey, i.e., downstream or upstream
- P. At each defect of any kind, the camera movement shall be halted, and the camera shall be tilted and panned as necessary to observe the full extent of the defect before it is electronically coded.
- Q. At each coded observation, the following minimum information shall be displayed:
1. The PACP code and/or PACP code description.
 2. The footage position of the defect.
 3. The "Additional_Info" field in any cases where it is utilized.
- R. The actual field work will be monitored by the Engineer. A Project representative will be available during internal television inspection, and no work shall be performed without the Engineer's Project representative present, unless authorized by the Engineer.
- S. The contractor shall take caution to ensure that the pipe ID's and manhole ID's entered into the PACP database are correct, free from typos, and consistent with the data supplied by the Engineer. Databases with substantial rates of error in these fields will not be accepted.
- T. The Contractor must have an internal quality assurance/quality control system (QA/QC) in place, and all inspection data shall be subjected to the

procedures prior to submittal to the Engineer. The Engineer will perform QA/QC audits on submitted data. Any data or files not meeting these specifications or NASSCO standards will be returned to the Contractor for correction at no additional cost to the Owner/Engineer. Contractor shall present their proposed QA/QC system to the Engineer prior to the start of the Contract.

3.04 CCTV Inspection Deliverables

- A. All the supplied data and information will become the property of the Owner.
- B. Sample Submittal: An example of a typical CCTV Inspection final deliverable will be submitted for approval by the Engineer prior to the start of work. The example deliverable will contain the following:
1. A sample NASSCO PACP Standard Exchange Database, most current version, in Microsoft Access file format (.mdb), as exported from the Contractor's data collection software.
 2. A proprietary database as generated by the Contractor's data collection software.
 3. Example media files, including observation photos, CCTV videos, and reports; with all files consistently utilizing the required file naming conventions and folder structures.
 4. The proposed viewing software to be used with the proprietary inspections database and related media.
 5. NASSCO PACP validation report in PDF format, demonstrating the sample is fully conforming to NASSCO PACP standards and conventions. Validation reports can be obtained by submitting a sample database to:

http://www.nassco.org/training_edu/te_database_upload.aspx.
 6. Inspections database(s) shall be fully cross-referenced to the videos, images, and reports.
 7. Example reports will be presented in both hard copy and in PDF format, and all other sample data will be presented in digital format on an external hard drive.
- C. Intermediate Submittals: No later than every fourteen (14) days following the completion of a pipeline inspection, the Contractor will submit the following:
1. Two (2) hard copies of full details report for each inspection, showing the position and full text of each defect encountered and their grades.
 2. An overall summary report detailing major defects and inspections that require attention.

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3. A list of unmapped manholes and/or pipe segments that were identified during inspections but were not shown on field maps. This list shall include the field-assigned ID and a geographic reference or description (street address, intersection, etc.).
 4. A statistical report showing lengths of sewers inspected and a breakdown of sizes and lengths inspected.
 5. At regular agreed intervals, Contractor shall upload all CCTV to date to a cloud-based server provided by either the Engineer or Contractor, containing a single NASSCO PACP Standard Exchange Database (most current version) and containing all inspections to date, encoded videos, observation photos, inspection reports in PDF format, and support files. The supplied data and information will become the property of the Owner.
- D. Final Submittal: At the completion of all inspection work, the Contractor will supply the following to the Engineer on an external hard drive:
1. A single, consolidated NASSCO PACP Standard Exchange Database (Version 7 or Newer) in Microsoft Access file format (.mdb) containing all inspections.
 2. NASSCO PACP validation report for the consolidated database (See Section 3.04.B.5.).
 3. All encoded inspection videos, observation photos, and inspection reports using required file naming formats.
 4. Any free-issue software needed for the viewing of proprietary inspections database and related media from within the database.
- E File Formatting and Naming Conventions: All submittals shall have the following file formatting and naming conventions, unless otherwise approved by the Engineer.

SUBMITTAL DESCRIPTION	FILE NAMING CONVENTION	FILE FORMAT
Digital encoded videos	"Upstream_MH" "Downstream_MH" "Direction" "Date" "Time"	.mp4
Digital still images of all observations	"InspectionID" "ConditionID" "Distance" "PACP_Code" (multiple digital still images may have "-01", "-02", "-03" at end of file name)	.jpg or .jpeg
Color, Hi-res Laser profiling image of pipe 50' cross-sections	"InspectionID" "ConditionID" "Distance" "PACP_Code"	.jpg or .jpeg
Pipe Segment Cleaning Report	CR-"Pipe_Segment_Reference"	.pdf
Pipe Segment Inspection Report	"Upstream_MH" "Downstream_MH" "Direction" "Date" "Time"	.pdf
NASSCO PACP Validation Report	"yyyymmdd(date of submittal)" "Project Name" "Validation Report"	.pdf
NASSCO PACP Exchange Database	"yyyymmdd(date of submittal)" "Project Name" "StandardPACPExchange"	.mdb

F. Cloud Based Server Requirements

Cloud based servers shall have the ability for the Engineer to download full CCTV reports and videos without restrictions. Account and passwords shall be provided to the Engineer to successfully login to the server and download the necessary CCTV reports and videos.

G. NASSCO PACP Compliance

The submitted database(s) should consist of, at a minimum, all NASSCO PACP data fields, formats, and conventions as set forth in this specification and Attachment A – Field Data Delivery Format Requirements.

END OF SECTION

Part 1 General

1.01 Scope

Sewer flow control required to conduct the sewer line television precleaning operations or inspection of the interior of the sewer pipeline. Flow control will be required for inspection or other maintenance operations when sewer line flows are too large to allow an uninterrupted visual inspection of the interior of the pipeline or manhole.

1.02 Performance Requirements

It is essential to the operation of the existing sewerage system that there is no interruption in the flow of sewage throughout the duration of the Project. To this end, CONTRACTOR shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as necessary to intercept the sewage flow before it reaches the point where it would interfere with their work, carry it past their work and return it to the existing sewer downstream of their work or cause a sanitary sewer overflow or backup into adjacent structures.

1.03 Submittals

A. Informational Submittals:

1. Flow Control Plan: Submit at least 48 hours prior to controlling flows. Include, as a minimum, the following:
 - a. Estimate of peak amount of flow to be controlled.
 - b. Detailed procedures for handling peak estimated flow.
 - c. Schedule.
 - d. Drawing of plug, bypass pump, and pipeline locations.
 - e. Listing of equipment.
 - 1) Bypass pump sizes, capacities, number of each size to be onsite, and power requirements including standby equipment.
 - 2) Bypass pipeline sizes and material types.
 - f. Sewer user notification plan.
 - g. Operation plan.
 - h. Emergency procedures.
2. Permits to locate and operate flow control system.

- #### B. Each operator must have at least 1 years experience in the coding of CCTV

inspections and must have reported upon more than 150,000 feet of CCTV. The Contractor must use NASSCO certified data collection software (PACP version 6.0.2), with final approval by the Engineer prior to the start of the Contract.

Part 2 Products

2.01 Flow Control System

- A. General: Provide adequate capacity and size to handle existing flows plus additional flows that may occur during periods of rainstorm. Estimate peak amount of flow to be bypassed and provide bypass flow capacity of at least 125 percent of peak flow estimate.
- B. Plugs:
 - 1. Provide with taps for connection of pressure gauges and air hoses, and flow-through capability.
 - 2. Pipe Diameters 24 inches and Smaller: Use mechanical plugs with rubber gaskets or pneumatic plugs with rubber boots.
 - 3. Pipe Diameters Larger than 24 inches:
 - a. Use inflatable bag stoppers made in two or more pieces.
 - b. Manufacturer: Lansas, Cherne Industries.
- C. High-Density Polyethylene (HDPE) or Ductile Iron Discharge Piping:
 - 1. Leak free.
 - 2. Pressure rating at least 1.5 times the operating pressure.
 - 3. HDPE Pressure Piping:
 - a. In accordance with ASTM D3350.
 - b. SDR of 32.5, maximum.
 - c. Joints: Butt-fusion welded.
 - 4. Ductile Iron:
 - a. AWWA C151/A21.51, Centrifugally cast, Grade 60-42-10 iron.
 - b. Joints: Rubber gasketed push-on in accordance with AWWA C111/21.11
 - c. Fittings: In accordance with AWWA C110/A21.20.
 - 5. May reuse for subsequent flow bypass pumping system placements. OWNER, at their sole discretion, shall have right to reject sections deemed unserviceable.
- D. Flexible Discharge Pipe:
 - 1. Small diameter flexible pipe may be used for low pressure and low flow conditions, as determined by the OWNER.
 - 2. Use of this material is limited to controlling flow from 8-inch diameter collector sewer lines.
- E. Bypass Pumps:
 - 1. Fully automatic, self-priming units that do not require use of foot valves or vacuum pumps in priming system.
 - 2. Open impeller design with ability to pump minimum 3-inch diameter solids.
 - 3. Able to run dry for long periods of time to accommodate cyclical nature of flows.
 - 4. Engine: Equipped to minimize noise. Noise levels shall not exceed 86 dBA at a distance of 50 feet from the source.
 - 5. Standby Pump: One of each size to be available onsite.

Part 3 Execution

3.01 General

- A. Notify OWNER at least 48 hours prior to implementing flow control system.
- B. Operate and maintain flow control system 24 hours per day, 7 days per week, including holidays, as required, to control flow.
- C. When depth of flow in a pipe section is above the maximum depth specified for television inspection reduce flow by plugging, diverting, or pumping flow around Work area.
- D. Except at pipe sags, depth of flow during television inspection and joint testing shall not exceed fifty percent of the pipe diameter. Appropriate measures should be undertaken to pull flow from camera units utilizing hydraulic cleaning devices or removable dams to allow an uninterrupted view of the full interior of the pipeline.
- E. Eliminate all flow from sewer manhole-to-manhole segments during spot repair, service connection rehabilitation, manhole construction, and sewer pipe replacement or lining within that segment.
- F. If flow reaches peak estimated flow that flow control system was designed for, stop all Work that requires flow control, secure work area, and restore flow in sewer until flow recedes.
- G. After the Work is completed, return flow to replaced sewer and remove temporary equipment.

3.02 Plugging or Blocking

- A. Flow control may consist of blocking flow with mechanical or pneumatic plugs if only a small amount of flow needs to be controlled and adequate storage is available.
- B. Use primary and secondary plugs for each flow control location.
- C. When blocking flow is no longer needed for performance and acceptance of the Work, remove plugs in a manner that permits sewage flow to slowly return to normal without surcharging or causing other major disturbances downstream.
- D. Remove temporary plugs at end of each working day and restore normal flow. If downstream work is not or cannot be completed during the workday provide, operate, and maintain bypass pumping system.
- E. Use bypass pumping if the Work cannot be scheduled at a time when flow is low or completed during low flow period.

3.03 Bypass Pumping

- A. The CONTRACTOR shall obtain approval and secure all permits for placement of temporary bypass pumping system and pipeline within public right-of-way.
- B. Flow bypass shall be done in such a manner that will not damage private or public property, or create a nuisance or public menace. Pumped sewage shall be in an enclosed pipe that is adequately protected from traffic, and shall be redirected into sanitary sewer system or alternatively into an enclosed tank for hauling to the wastewater treatment plant. Dumping or free flow of sewage on private or public property, gutters, streets, sidewalks, or into storm sewers is prohibited.
- C. The CONTRACTOR shall submit to the ENGINEER for approval a description of the bypass pumping methodology, and bypass pumping plan before CONTRACTOR commences sewage bypass pumping.
- D. The CONTRACTOR shall furnish, install, and maintain power, primary and standby pumps, appurtenances, and bypass piping required to maintain existing flows and services.
- E. The CONTRACTOR shall equip pump engines with noise suppression devices to keep pump noise to a minimum and comply with applicable noise ordinances.
- F. The CONTRACTOR shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer main during the execution of the Work, and shall also bypass the main sewer flow around the pipe to be replaced, or into adjacent sanitary sewers, if available.
- G. The pumps and the bypass lines shall be of adequate capacity and size to handle all flows without sewage backup to private property.
- H. Disconnected sewer service lateral connections shall be accommodated by bypass pumping or containment of from time of disconnection to time of reconnection. This shall be accomplished by a mechanical pump and manifold system or by storage system such as a bladder tank system. The storage system shall be capable of holding adequate sewage from each sewer service connection for period of 24 hours. Each storage system shall be emptied or pumped during each 24-hour period and properly disposed of in accordance with TDEC requirements.
- I. The CONTRACTOR shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.
- J. The CONTRACTOR shall submit to the ENGINEER specifications for all pumping equipment to be used on the job (including all sizing calculations) and a list of all backup pumping equipment to be held in reserve on the Site.
- K. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows.
- L. After Work is completed, flow shall be returned through replaced sewer and temporary

equipment removed.

3.04 Service Lateral Disconnection

- A. When it is necessary to shutdown a private service line while work is in progress and before the service lines are reconnected, the ENGINEER shall be notified by CONTRACTOR at least one week prior to the shutdown.
- B. The CONTRACTOR will notify building occupants twice regarding service lateral disconnection by placing door hangers: (1) not less than 1 week prior and (2) not more than 24 hours prior to disconnection.
- C. When a service lateral must be disconnected from the main for more than 1 work day, the lateral shall be positively drained or pumped a minimum of once every 24 hours. Monitor status of flow and storage. Pump lateral more frequently where flows exceed the storage capacity of the lateral or such temporary storage as may be provided by CONTRACTOR.
- D. Temporarily restore services in uncompleted sections during nonwork hours.
- E. Notify building occupants when work is complete and full uninterrupted service restored.
- F. No service is to remain shut down for more than a period of 8 hours, unless CONTRACTOR provides substitute services for the residents or tenants. If the service is to be shut down for more than 8 hours and CONTRACTOR cannot provide substitute services, then CONTRACTOR shall be required to provide temporary living quarters (i.e. hotel) for the resident at no additional cost to OWNER or the resident. Temporary living quarters shall be approved by OWNER and coordinated through OWNER's Customer Support Representative.

3.05 Field Quality Control and Maintenance

- A. Test: CONTRACTOR shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. Prior to operation, test each section of discharge piping with maximum pressure equal to 1.5 times the maximum operating pressure of system. ENGINEER shall be given 24 hours' notice prior to testing.
- B. Inspection: CONTRACTOR shall inspect bypass-pumping system every 2 hours to ensure that system is working correctly.
- C. Maintenance Service: CONTRACTOR shall ensure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.

3.06 Cleaning

- A. Before bypass pumping system is broken down, and moved to next section or removed at the completion of the Work, discharge sewage remaining in bypass discharge pipeline and pumping equipment to working sewer.
- B. Disturbed Areas: Upon completion of bypass pumping operation, clean disturbed areas and restore to condition, including pavement restoration, at least equal to that which existed prior to start of the Work.

3.07 Liability

- A. CONTRACTOR shall be responsible for damages to private or public property that may result from his sewer flow control operations. CONTRACTOR shall be responsible for any violations of laws, regulations or permits and shall indemnify and hold OWNER harmless for any and all damages, including but not limited to, fines and penalties that arise from such violations.

END OF SECTION

Part 1 General

1.01 Scope

- A. The bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the bid.
- B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the bid, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices for the various bid items. The Contractor shall prepare the bid accordingly.
- C. Work includes furnishing all labor, equipment, tools and materials, which are not furnished by the Owner and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings and Specifications.

1.02 Descriptions

- A. Measurement of an item of work will be by the unit indicated in the bid.
- B. Final payment quantities shall be determined from the documented field measurements. The precision of final payment quantities shall match the precision shown for that item in the bid.
- C. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the bid.
- D. Unless otherwise stated in individual Sections of the Specifications or in the bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the price Bid for item of which it is a part.
- E. Payment will be made by extending unit prices multiplied by quantities provided and then summing the extended prices to reflect actual work. Such price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials not furnished by the Owner and for performing all operations required to provide to the Owner the entire Project, complete in place, as specified and as indicated on the Drawings.
- F. "Products" shall mean materials or equipment permanently incorporated into the work.

1.03 Cash Allowances

- A. The Contractor shall include in the Bid Total all allowances stated in the Contract Documents. These allowances shall cover the net cost of the services provided by a firm selected by the Owner/ Engineer. The Contractor's handling costs, labor, overhead, profit and other expenses contemplated for the original allowance shall be included in the items to which they pertain and not in allowances.
- B. Should the net cost be more or less than the specified amount of the allowance, the Contract will be adjusted accordingly by change order. The amount of change order will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance.
- C. Documentation
 - 1. Submit copies of the invoices with each periodic payment request from the firm providing the services.
 - 2. Submit results of services provided which verify required results.
- D. Schedule of Cash Allowances
 - 1. Water for Cleaning – Contractor shall obtain a water meter from the OWNER, pay the appropriate rental fee, and pay for the total amount of water used. This allowance gives the CONTRACTOR a means to be reimbursed from costs incurred for water usage to clean and access to the water meter. All documentation and invoices shall be submitted with each progress payment when requesting monies from the allowance.
 - 2. Traffic Control – When necessary and pre-approved by the ENGINEER/OWNER, the Contractor shall install traffic control measures when performing CCTV work in a busy road or state route. All efforts shall be made to minimize traffic control measures by adjusting working hours or other means acceptable to the OWNER.

1.04 Clearing and Sewer Easement Access

- A. No separate payment shall be made for clearing and constructing access roads to sewer easements.
- B. The cost of moving and reestablishing landscape features, including labor and materials shall be included in the unit price bid for the item to which it pertains.
- C. The Contractor is responsible for access needed outside of the existing easements. Access plans should be approved by the OWNER/ENGINEER prior to implementation.

1.05 Erosion and Sedimentation Control

No separate payment shall be made for temporary and/or permanent erosion and sedimentation controls or replacement of landscaping disturbed by inspection, replacement or rehabilitation activities.

1.06 Precondition and Cleaning

1. The work covered by this line item includes furnishing all labor, material, equipment and services required for cleaning all sewer pipelines, prior to inspection of the sewers, by closed circuit television, authorized by the Engineer, as shown on the Drawings and/or specified herein. The objective of preconditioning and cleaning is to maximize sewer and manhole service efficiency and effectiveness. Preconditioning and cleaning involves removal of silt, which is defined as any and all solid or semi-solid materials, including fine and granular material, such as sand, grit, gravel, and rock as well as debris, grease, oil, sludge, slime, or any other loose material or encrustation lodged in the manhole or sewer. Preconditioning and cleaning also involves removal of invading roots, corroded concrete, intruding laterals and any other extraneous debris so that the camera unit may traverse the length of the line being investigated. This is normally accomplished by 1 to 4 successive passes utilizing constantly moving pressure jetting techniques per Section 33 01 30.14 of the Specifications. Preconditioning and cleaning shall be calculated from the point at which the cleaning equipment/nozzle enters the pipeline for the entire length of the pipeline from manhole to manhole. Subsequent or multiple passes for the length of the same pipeline or portions of the same pipeline will not be counted separately for payment purposes.
2. Payment for heavy cleaning shall be made at the unit bid price as authorized by Owner/Engineer. Heavy Cleaning shall be defined as those pipes that have greater than twenty-five percent (>25%) of their cross-sectional area full of debris, silt, roots, sand, grit, gravel, rock, grease, oil, sludge, slime or any other loose material or encrustation. Heavy Cleaning shall be defined as requiring the use of mechanical apparatuses (i.e. buckets, pigs, rodding, machines, grinders, root cutters, etc.) to remove debris, heavy roots, and/or obstructions from a pipe or by making three or more passes to remove debris. Heavy cleaning footage shall be calculated from the point at which heavy cleaning begins to the point of nearest extraction. If it is determined that "heavy cleaning" is required, the Contractor shall provide sufficient evidence to the ENGINEER proving that the pipe is greater than twenty-five (25%) obstructed. If there is no evidence provided or the evidence is insufficient, the heavy cleaning line item pay request shall be rejected.

1.07 Closed Circuit Televising

1. Final inspection videos complying with Section 33 01 30.16 shall be submitted and reviewed by the ENGINEER and/or Owner's Representative following the completion of ALL work along the mainline segment. Payment will not be considered without video documentation.
2. No additional or separate payment shall be made for flow control, however Section 33 01 30.17 of the specifications shall govern.
3. Payment for removing intruding taps per Section 33 01 30.16, Article 3.02, Item H shall be made at the unit price bid as authorized by Owner/Engineer.
4. All costs related to the implementation of the easement and permit stipulations shall be included in the unit price bid for the item to which it pertains.
5. No separate payment will be made for clean-up.

1.08 Bypass Pumping

A. By-Pass Pumping

1. No separate or additional payment will be made for any special or unique method, means, techniques or equipment necessary for the Contractor's compliance with these Specifications, regulatory requirements, permits, laws or regulations which govern this Project.

1.09 Overflow Response

1. Contractor shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways, and streets does not occur. In the event that such spillage or overflows do occur during the course of or as a result of the Work, the Contractor performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up. On elimination of the spillage or overflow, the Contractor is to clean up and disinfect the area per Federal, State, and Local guidelines. Work to stop or contain such events is to be deemed emergency in nature and sufficient justification for total mobilization of resources, the use of overtime or double time, and any other reasonable measures to assure correction of the problem without delay. Damages arising from blockages, back-ups, spillage, or overflows of sewage during the course of the Work or because of the Work shall be the sole responsibility of the Contractor.

1.10 Additional Work if Ordered

- A. Payment shall be made at the unit price bid as shown in the Bid for Unit Price Contract. No separate or additional payment will be made for completing this work.

END OF SECTION