Part 1 - General

1.01 Description

.1 This Section specifies requirements for quality control and testing throughout progress of work.

1.02 Related Specification

.1 Construction Specification Section 02315 - Trenching, Backfilling and Compacting

.2 Construction Specification Section 02318 - Excavation, Backfilling and Compacting for Structures

.3 Construction Specification Section 02511 - Watermains

.4 Construction Specification Section 02530 - Pipe Sewers

.5 Construction Specification Section 02531 – Sewage Forcemains

.6 Construction Specification Section 02749 - Roadway and Driveway Construction

.7 OPSS.MUNI 310 - Construction Specification for Hot Mix Asphalt

.8 OPSS.MUNI 314 - Construction Specification for Untreated Subbase, Base, Surface, Shoulder, Selected Subgrade and Stockpiling

.9 OPSS.MUNI 409 – Construction Specification for Closed-Circuit Television Inspection of Pipelines

.10 Region of Durham Approved Manufacturer Product Listing

1.03 General

.1 Design, workmanship and materials used for structures shall comply with:

.1 Ontario Building Code

.2 Building By-Laws of Local Municipalities

.3 National Building Code of Canada

.4 Canadian Highway Bridge Design Code, CAN/CSA S6

.5 Contract Drawings and Contract Documents

.2 Remove from site all materials rejected after delivery.

.3 Adhere to manufacturer's recommendations with respect to handling, preparation, installation, testing, operation or protection of any product or material to be incorporated in work.

.4 Prior to installation check to ensure that all materials supplied are compatible with each other. Notify Contract Administrator of any materials that are non-compatible.

.5 The Contract Administrator may with the agreement of the Contractor conditionally accept any work which is not considered to be in strict conformance to the specification and extend the warranty period for such work.

1.04 Inspection

.1 All materials supplied by Contractor shall be subject to review and inspection by Contract Administrator at time of delivery and prior to installation or placement. Materials will be rejected if they do not meet contract specifications.

.2 Tests conducted by the Contract Administrator shall include, but not be limited to, the following:

.1 Analysis of granular and asphalt materials

.2 Compaction of backfill and granular material

.3 Concrete testing

.4 Non-destructive testing on elastomeric bearings

.5 Others as noted elsewhere

.3 The Contract Administrator may conduct Quality Assurance testing on materials and equipment to be incorporated into permanent works before delivery to site.

.4 Provide facilities for handling and inspection of materials.

1.05 Inspection of Granular Materials

.1 Supply representative granular materials for sampling and testing.

.2 Provide labour and equipment to obtain and handle samples at work site or at source of materials.

1.06 Compaction Testing

.1 On Region of Durham contracts, compaction testing will be performed by the Contract Administrator or his agent. This does not relieve the contractor from their responsibility to provide their own Quality Assurance compaction testing.

.2 On subdivision and private contracts, compaction tests shall be performed by a testing agency provided by the Owner or Owner's Agent unless otherwise specified. On Local Municipalities contracts, compaction tests shall be performed by a testing agency provided by the Local Municipalities or its agent unless otherwise specified. Forward testing result summary to Region of Durham's Materials Testing Laboratory weekly.

.3 Compaction testing to be performed throughout progress of work, using a nuclear densometer, to determine adequacy of compaction.

.4 Contractor's equipment and method of compaction are subject to the approval of the Contract Administrator.

.5 Co-operate with inspection staff during testing period.

.6 After the Contractor has completed his compaction, compaction tests will be taken randomly. Re-excavate and re-compact, at the Contractor's expense, any areas where the tests do not meet the specified degree of compaction. Compact native materials to 95% Standard Proctor Maximum Dry Density unless otherwise specified.

.7 On Region of Durham contracts, the following shall apply:

.1 Granular Material Quality Assurance

OPSS.MUNI 314 is amended by the addition of the following:

"Stockpile samples shall be tested by the Contract Administrator or his designated agent at least 7 days prior to the expected delivery of such materials to the site. Where the stockpile samples fail to pass the required tests, 2 more samples shall be taken from the same stockpile by the Contract Administrator or his designated agent. Both of these samples must pass the required tests prior to use of the stockpiled materials. Any further testing shall be at the expense of the Contractor.

The Contractor shall not supply materials from unapproved sources. Where such materials are delivered to the site, the Contractor shall immediately remove such materials from the site at his expense.

Stockpile samples passing an initial testing shall not be taken as final acceptance of materials for incorporation into the Work. Sampling and test results from these tests shall only determine acceptability of materials for delivered to the site. **Final testing of delivered materials shall be the determining factor for acceptance of materials into the Work.**"

.2 Random Testing of Delivered Granular Materials

Random testing of delivered granular materials shall be conducted by the Contract Administrator or his designated agent and at a frequency determined by the Contract Administrator.

Two samples shall be taken for testing. All sampling and testing shall be conducted in accordance with MTO and OPSS testing procedures and in compliance with the C.C.I.L. Aggregate Certification program. Testing of delivered granular materials shall include, as a minimum, gradation testing and percent crushed particles where applicable. The Contractor shall be notified in writing of any material test failures as soon as reasonably possible and a second test shall be arranged as soon as possible using the second sample. If the second sample fails to pass testing, the material shall be immediately removed and replaced with acceptable material.

The Contractor shall be responsible for notifying the Contract Administrator of expected delivery times for materials brought to the site in order that the Contract Administrator can obtain samples of delivered materials on a timely basis.

.3 Asphalt Quality Assurance

The Contract Administrator shall conduct Quality Assurance testing at a frequency deemed necessary by the Region for

the purpose of verification of mix compliance and density of the placed asphalt.

In the case of a dispute, the Contractor may request, in writing with technical reasons, the Region to undertake a coring and testing program to check the mix. If the rejectable mix is confirmed the Contractor shall be responsible for the cost of the coring and testing program. The Contractor shall be responsible for filling all holes resulting from coring with hot mix asphalt and shall provide compaction by means of a mechanical method acceptable to the Contract Administrator.

.8 The Region of Durham may, at its discretion, and with the agreement of the Contractor, conditionally accept borderline work and extend the warranty period by of a period of not less than 1 year.

1.07 CCTV Inspection

.1 All new main sewers installed, regardless of size, shall be inspected by a Closed-Circuit Television Camera (CCTV) unit. The Contractor shall perform the CCTV inspection except on Region of Durham contracts. On Region of Durham contracts, the Region shall perform the CCTV inspection unless specified otherwise and the Contractor shall perform all other requirements of this Section including but not limited to flushing of sewers.

.2 For Region of Durham contracts:

(1) Clean and flush pipe sewers according to RMDCS Section 02530 prior to the CCTV inspection.

(2) Coordinate the timing of CCTV camera inspection with the Region. The initial CCTV inspection shall be performed after maintenance holes are raised to grade and prior to base asphalt being placed. Provide minimum one week notice to Contract Administrator of the expected date when maintenance holes shall be completed to allow for the Region to arrange for the CCTV camera inspection.

(3) Allow a minimum of one week for completion of CCTV camera inspection by the Region’s CCTV inspection contractor and provide

adequate time and space separation from the Contractor's operations while the Region's CCTV inspection contractor is on site performing the CCTV inspection.

(4) All costs for the further CCTV inspections due to deficiencies in the Contractor's work shall be borne by the Contractor.

.3 CCTV inspections shall be performed in accordance with National Association of Sewer Service Companies (NASSCO) - Pipeline Assessment Certification Program (PACP) and as specified herein. The CCTV inspection shall be carried out after the maintenance holes are raised to grade and prior to base asphalt being placed. Where a conflict exists between this Section and NASSCO PACP, the requirements of this Section shall take precedence. CCTV operators shall have successfully attained NASSCO PACP certification.

.4 The Contractor shall ensure that the site is easily accessible by the CCTV inspection vehicle and the Region of Durham's Sewer Water Appurtenance testing (SWAT) crew vehicles.

.5 All main sewers which are to be placed into service immediately after installation (in order to remove a by-pass system) shall be CCTV inspected before being placed into service.

.6 Where new service connections are connected to an existing storm sewer or sanitary sewer, the mainline sewer shall be CCTV inspected.

.7 Complete the sewer system, flush the sewers and perform low flow simulation in Subdivisions in accordance with Section 02530 prior to carrying out the CCTV inspection.

.8 The CCTV inspection shall be performed by an experienced firm using at least 1 complete inspection CCTV unit with 1 competent and experienced operator and 1 helper.

.9 The CCTV inspection shall be normally performed from the upstream maintenance hole, on one maintenance hole-to-maintenance hole section of sewer at a time or a maximum of two sections if length, grade, direction and flow permit. The inspection shall be performed in a forward and/or backward direction, according to line conditions at the time of inspection.

.10 The contractor shall ensure that the start maintenance hole is clearly visible

on the video recording at the start of the inspection and perform the inspection from the centre of the start maintenance hole to the centre of the finish maintenance hole. At the start of the inspection record the length of the sewer from the centre of the maintenance hole to the cable calibration point and adjust the distance reading at the cable calibration point such that zero is at the centre of the start maintenance hole.

.11 The contractor shall ensure that the automatic distance measurement is displayed on-screen at all times during the inspection. Ensure that the distance measurement is accurate from the cable calibration point to the centre of the finish maintenance hole. Set a maximum camera speed of 9 metres/minute.

.12 Keep the video image in focus during the inspection from the point of observation to a minimum of two pipe diameters ahead. Stop the motion of the video camera for 5 seconds while continuing to record video images at major defects and connections, junctions, and major branches. Rotate and pan the video camera to provide perpendicular view of all major defects, connections, and junctions.

Major defects to include, but not to be limited to:

.1 deformed sewers

.2 holes

.3 large displaced joints

.4 missing mortar

.5 obstructions

.6 and large open joints.

In the event of the Contractor providing the Region with a poor quality inspection video, in the sole opinion of the Region, the Contractor shall perform additional CCTV inspections until the quality of the inspection video is approved by the Region, at no additional cost to the Region.

.13 Sewer laterals shall be CCTV inspected when ordered by the Contract Administrator when defects are suspected during CCTV inspection of sewer main (e.g. open joints, infiltration, steady flow). In such cases, the lateral will be inspected using a CCTV launch camera in accordance with NASSCO Lateral Assessment Certification Program (LACP).

.14 Each CCTV inspection vehicle shall be complete with a NASSCO PACP certified operator and one helper and any additional labour as required for the Contractor Traffic Control / Protection operations. Should any sewer laterals require a CCTV inspection, the lateral inspection vehicle will must have equipment for conducting high quality lateral launch inspections meeting NASSCO's current LACP specifications.

.15 The contractors equipment is to include an LED lit self-propelled steerable crawler system capable of continuous CCTV inspection of sewer mains ranging in size from 150mm to 2000mm, including trunk sewers with moderate to high flow levels. The equipment must have the following capabilities to enable clear, close-up images of all defects and observations:

.1 The camera will be pan and tilt type capable of panning 360 degrees and tilting 270 degrees. The adjustment of camera lens focus and iris will allow optimum picture quality and the camera lens focal range shall be adjustable from a distance of 100 mm to infinity.

.2 The LED light source will be adjustable to allow an even distribution of light around the sewer perimeter without loss of contrast, flare out of picture, or shadowing.

.3 Video overlay equipment to superimpose alpha-numeric information, including but not limited to chainage and start/finish maintenance hole detail, onto the video image and capable of providing a minimum of 15 lines of information, 30 characters per line.

.4 The crawler unit will be capable of moving the camera through the sewer on either a rubber tired or crawler tractor tracks and be capable of passing over minor surface imperfections, including but not limited to, broken joints and solid debris of up to 40 mm in height.

.5 Transport unit using float or skid tow through the sewer will only be permitted where the condition of the sewer precludes the use of a crawler and where authorized by the Region's Contract Administrator. If the camera is towed the supporting equipment will not impede the view of the camera and will be stable to ensure steady and smooth progress of movement during the inspection process.

.6 The crawler will permit complete inspection of the sewer from the centre of the start maintenance hole to the centre of the finish maintenance hole.

.7 The crawler and cable will be capable of inspecting a minimum of 200 metres per setup.

.16 Inspection Reporting and Submission Requirements

.1 The Contractor is required to provide three forms of data for each inspected sewer section as follows:

.1 CCTV Inspection Database File (Microsoft Access MDB),

.2 CCTV Inspection Reports (Hard Copy and PDF), and

.3 CCTV Digital Video Inspection.

.2 All CCTV inspection reports shall include two hard copies of each CCTV inspection report and a removable universal serial bus (USB) flash drive 3.0 with the corresponding CCTV digital video inspection (Original and conversion MP4), imagery, inspection database (MDB), and inspection reports (PDF). The inspections and corresponding data shall be completed adhering to the NASSCO PACP and LACP specifications and as outlined above.

.3 CCTV Inspection Database File (Microsoft Access MDB):

Contractor is required to produce and update a video index and condition database. The database is to be provided in a Microsoft Access (MDB) file and will follow the current PACP and LACP Standard Database Format. The database file is to include all detail pertaining to the inspection and condition of each pipe inspected through this contract and will include all relational tables for ease of integration into different applications for use by the Region.

.17 CCTV Inspection Reports:

.1 Each CCTV inspection is to cover a single length of sewer between consecutive maintenance holes (or catch basins, culvert ends, or junctions; as appropriate). If a reversal inspection is required, it's inspection report shall follow that of the initial inspection attempt. The report sequence in each bound section shall be in an order representative of the work orders. USB flash drives shall be attached to the inside of each respective section within the report binders.

.2 Each CCTV inspection report shall be clearly labelled with the following information (Examples):

.1 Region of Durham CCTV Inspection Reports

.2 Job Location: Main Street North

.3 Municipality: Whitby

.4 Contract #: D2018-001

.5 Inspection Date: YYYY/MM/DD

.6 Sanitary or Storm Video type

.3 Reports shall include an index page listing: City, Street, Report #., Upstream Area-MH #., Downstream Area-MH #., Pipe Segment (SL) #., and Page #.

.4 Reports shall identify the exact location of all service connections, including service connections to maintenance holes which include comments as to whether or not the connection is leaking, as well as each fault discovered by the inspection.

.5 Section length shall be measured from centreline of maintenance hole to centreline of maintenance hole and should agree with the CCTV inspection length except in reversals where the CCTV inspection length will be less than the section length. The section length shall be manually measured on all reversals.

.6 Separate final reports for each sewer system type (Sanitary / Storm /Lateral) and contracts shall be supplied to the Region.

.18 CCTV Digital Video Inspection

.1 CCTV digital video inspections shall be submitted with a high resolution original video (no audio) file of DVD quality; and a conversion DVD video (no audio) quality (720x480) MP4. The conversion file as a guideline shall be approximately 50 megabytes (Mb) for a ten minute CCTV inspection.

.2 A single, separate, digital video file is required for each inspection. Inspection videos are to be fully compliant with CSA's *Plus 4012-10 – Technical Guide: Visual inspection of sewer pipe* and all PACP specifications.

.3 Video inspections shall display the PACP header details at the start of the video as follows (examples):

.1 Street Location Main Street North, Whitby

.2 Diameter of Pipe 200 mm

.3 Material of Pipe Concrete

.4 Upstream Maintenance Hole MH-G14-0012

.5 Sewer Line ID SL-G14-0008

.6 Downstream Maintenance Hole MH-G14-0112

.7 Contractor Name Sewer Contractor

.8 Contract ID D2018-001

.9 Date YYYY/MM/DD

.10 Time 00:00:00

.11 Direction of CCTV Downstream or Upstream

.12 Measured Distance 97 m

.4 Video inspections shall display the PACP running details throughout the video as follows (examples):

.1 Maintenance Hole Start MH-G14-0012

.2 Sewer Line ID SL-G14-0008

.3 Maintenance Hole Finish MH-G14-0112

.4 Metre Counter 0.0 m automatic

.5 The digital inspection video shall be produced at a proper recording speed and level to facilitate clean, clear still images to be screen shot on a computer. Digital videos that do not provide sufficient resolution, lighting, or are obscured by fog will not be accepted.

.6 Reference to starting locations shall be made to include the distance away from the starting maintenance hole and also the position of the sewer leak or fault as referenced to the axis of the pipe. Each comment must have a starting and ending distance (where applicable), so that the elapsed distance can be calculated for such problems as deposits and ponding.

.7 The entire inspected sewer section shall be recorded in colour onto a single USB, containing the street name, area number, maintenance hole numbers, size and type of pipe and changes on a video overlay. Any sewer which is not located under a street shall be referred to as an easement and should reference the street it is connected to for clarification purposes. The USB shall be recorded in the same sequence as the corresponding typed report. A separate typed report shall be submitted with each USB. The program data must contain information requested by the Region, including, but not limited to, road surface, depth at maintenance hole, house number, and pipe size.

.8 The data file must be indexed to the corresponding typed report for each section of sewer inspected. The video recording must record the time index on the video which shows the image(s) corresponding to the typed report and data file. The indexing must include the start time of the entire video file and the exact time number for each sewer pipe feature /defect in a pipe.

1.08 Hydrostatic Testing

.1 Hydrostatic testing of new watermains, sewage forcemains and siphons shall be performed by the Region of Durham unless noted otherwise.

.2 Reference Section 02511 – Watermains and Section 02531 – Sewage Forcemains.

1.09 Watermain Disinfection

.1 Charging and Flushing: Disinfection of watermain and appurtenances shall be carried out by Region of Durham forces in accordance with AWWA 651 and Ontario Watermain Disinfection Procedures, unless specified otherwise.

.2 Reference Section 02511 - Watermains.

1.10 Basis of Payment

.1 Payment for all labour, equipment and materials to be included in Contractor's bid prices to do the work.

.2 Payment for any re-testing by Region of Durham required due to unsatisfactory results shall be borne by Contractor.

END OF SECTION