



Division "A"
Sanitary Sewers
Standards and Specifications Manual



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Division “A” - Sanitary Sewers



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Section A1

Design Criteria - Sanitary Sewers

.1 Introduction

This Division provides design details, technical specifications, as well as material and equipment standards that are the requirements of the City of Richmond Hill.

The City requires and expects that the Consultant will comply with the requirements as specified herein as a minimum standard, but this shall not relieve the Consultant of the responsibility of ensuring the completeness and quality of their design.

It is the Consultant's responsibility to ensure they have fully understood the requirements of the project and provided their services to fulfill the specified scope of work.

.1.1 General

Sanitary sewers are to be designed to service the needs of all existing users, proposed users, and possible future development.

Systems are to be designed to perform under gravity conditions. The use of pressurized systems (forcemains and pumping stations) must be approved by the City.

.1.2 Permits and Approvals

The designer will be responsible for the preparation of all applicable approval/ permit applications necessary to construct the infrastructure (including initial submission, follow-up and securing of all approvals and permits).

.1.3 Other Applicable Acts, Codes, Standards, Legislation, Design Guidelines

This standard does not supersede, nor replace any legislation governing the design of such infrastructure. The Consultants must be fully familiar with all applicable legislation and design guidelines when carrying out the design of a sanitary sewer project.

.1.4 Non-Compliance with Design Manual

If the designer deems that deviation from this manual is in the best interest of the project, then the designer is required to make a formal request to the City's Project Manager with a memorandum identifying the deviations and an explanation of the benefits to the project for the City's consideration.

.2 Hydraulic Design

The design shall accommodate sanitary drainage from all sources, including the proposed development or project as well as any contributing external areas. The Engineer shall ensure that there is adequate system capacity to accommodate the proposed design.

Sanitary drainage area plans must be prepared to clearly define all tributary areas assigned to each maintenance hole and shall include land use, area, and population for each tributary area in order to determine the design flows. The sanitary sewer flows shall be calculated in accordance

with land use and population densities obtained from the City. In lieu of precise information on a development as a whole or in any part, reference will be made to the latest zoning plan issued by the Planning Department.

Design flows are to be calculated on a sanitary sewer design sheet. Sanitary sewer design flows prepared using hydraulic modelling software may be accepted. The Engineer is to confirm the software and suitability with the City prior to proceeding. The City may also request a traditional sanitary sewer design sheet.

.2.1 Residential Sanitary Flows

Sewage flows shall be calculated on the basis of:

- Average Flow: 365 litres/person/day
- Infiltration: 22,500 litres/gross/hectare/day when ex. foundation drains are known to be connected to the storm sewer (or when existing development is over 25 years old). Calculated on the number of gross hectares contributory to the sanitary sewers, including parks and valley land.

.2.2 Peaking Factor

$$KH = 1 + \frac{14}{4 + \sqrt{P}}$$

KH Maximum: 3.8

KH Minimum: 1.5

KH - Harmon peaking factor

P - Population in thousands

.2.3 Pre-Draft Plan Lands

Type of Housing	Persons/Hectare
Detached, Semi-detached and Townhouse Mix	52
Apartment	99

.2.4 Post-Draft Plan Lands

Type of Housing	Persons/Unit
Single & Semi-detached	3.8
Townhouse	3.4
Apartment	2.7

.2.5 Pre-Secondary Plan Lands

Future land use and population will be based on approved official plans and secondary plans.

When such information is not available for the land to be developed, the following standard will be used.

Land Use	Gross Residential Hectares per 100 ha of Developable Lands
Local Open Space	10.3
Residential	74.3
Commercial	5.1
Schools and Institutions	10.3

.2.6 Commercial Sanitary Flows

Average Flow: 180,000 litres/floor hectares/day including infiltration and peaking effect.

Floor space index: 0.50 of gross land area, unless designated otherwise in the secondary plan.

The area is calculated using the number of gross hectares of the commercial lot. The flow criteria will apply unless evidence exists which will require additional treatment or provide additional volume.

.2.7 Industrial Sanitary Flows

Average Flow: 180,000 litres/floor hectares/day including infiltration and peaking effect.

The area is calculated using the number of gross hectares included in the industrial block or development.

The flow criteria will apply unless evidence exists which will require additional treatment or provide additional volume.

.2.8 Schools and Institutional Sanitary Flows

Average Flow: 180,000 litres/gross hectare/day including infiltration and peaking effect.

Where the total floor area does not exceed the size of the lot, the area is calculated using the number of gross hectares included in the school or the institutional site.

This flow criteria will apply unless evidence exists which will require additional treatment or the provision of additional volume.

.3 Inflow and Infiltration Reduction Standard

York Region has developed the Inflow and Infiltration (I&I) Reduction Design, Construction, Inspection and Testing Standard for Sewers Servicing New Development (the Region Standard) for new gravity sanitary collection installations. The Region Standard can be found here: <https://www.york.ca/media/99176/download> and applies to new subdivisions, site plans, industrial, commercial and institutional developments and single service retrofit connections within York Region.

The engineers, designers and constructors shall use and reference the Region Standard when designing and constructing new gravity sanitary sewer collection installations.

The Region Standard shall be used in conjunction with City's standards and specifications.

As a minimum, the following considerations shall be made in the design of the sanitary sewer system:

- All sanitary sewers shall have watertight joints and heavy wall (SDR 26) gasketed fittings.
- Sanitary sewer maintenance holes shall be in accordance with OPS specifications, except that all joints and pipe connections are to be wrapped in water-proofing membrane. Controlled settlement joints are required on all risers greater than 4.5 m depth.
- All maintenance hole adjustment rings shall be mortared between all rings and from the outside of the structure prior backfilling.
- Clay/collar plugs shall be provided in bedding (at a minimum 40 m interval).
- Flow monitoring may be required at the discretion of the City if deemed necessary to verify infiltration and inflow (I/I) are within acceptable levels.

.4 Sanitary Sewer Design

.4.1 Pipe Capacities

Sewer pipe capacities will be computed by using Manning's Formula on the basis of sewer pipe flowing full.

.4.2 Roughness Coefficients

For all sizes and pipe material, $n = 0.013$

.4.3 Velocity and Grade

- Minimum velocity: 0.75 m/second
- Maximum velocity: 3.65 m/second
- Minimum grade: 0.5% for all local sewers
- Minimum grade of the first upstream leg: 1.0%

Velocity change from one pipe to another in a maintenance hole is not to exceed 0.60 m/second.

.4.4 Minimum Size

The first leg of a sanitary sewer will be sized at a minimum of 200 mm. All other lengths will be a minimum of 250 mm diameter.

.4.5 Layout - Location, Depth and Clearance

Sanitary sewers shall be located as shown on the City Standard Cross-Section Drawings included in Division C. The standard location is 1.5 m offset from the centerline of the road allowance with a minimum depth measured from the final centerline, finished road elevation to the sewer obvert as follows:

- Residential areas: minimum 2.5 m
- Industrial areas: minimum 2.5 m
- Commercial areas: minimum 3.65 m

The designer must ensure the depth of the sanitary sewer is sufficient to service existing and planned development. Consideration for clearance between basement elevations and pipe obverts or the hydraulic grade line must be provided.

As per Ministry guidelines and procedures, a minimum horizontal clearance of 2.5 m shall be provided from all watermains to any sanitary sewer or maintenance hole, measured from the nearest outside edge. In cases where this is not achievable and the obvert of the sewer is at least 0.5 m below the watermain invert, a closer clearance may be considered. If these conditions cannot be achieved, the sewer shall be built to watermain standards of construction and pressure tested as per OPSS.MUNI 441.

In a crossing situation, watermain inverts should cross above the obvert of the sewer by at least 0.5 m to allow for proper bedding and support. Where a watermain cannot cross above, clearances shall follow Ministry guidelines and procedures.

Sanitary sewers shall not be located in easements, where possible. Where locating in an easement is unavoidable, easement requirements must be reviewed and approved by the City.

Deviations from the above may only be considered in specific situations and will be reviewed on a case-by-case basis.

.5 Forcemains

Where required and approved on a case-by-case basis, sanitary forcemains shall be designed in accordance with Ministry Design Guidelines for Sewage Works. Division G, Wastewater Pumping Stations provide further details and criteria for forcemains.

.6 Maintenance Hole Design

- a) Maintenance holes will be provided at each change in alignment, grade, material and at all junctions, except where radius pipe is used in sizes 1050mm diameter and over.
- a) Maximum spacing for maintenance holes will be based on pipe size as follows:
 - 200 mm to 450 mm diameter: 110 m
 - 525 mm to 750 mm diameter: 120 m
 - Greater than 750 mm diameter: 150 m

- b) All sizing of maintenance holes shall be based on incoming and outgoing pipe sizes. The minimum diameter for a maintenance hole is 1200 mm.
- c) Type and size of maintenance holes will be specified on the drawing profile and a detail of the benching will be shown in the plan view portion of the drawing for cases where the benching differs from OPSD 701.021.
- d) All maintenance hole openings will be located on the upstream side of the structure.
- e) Where the depth from invert to top of the maintenance hole exceeds 5 m, a safety platform shall be provided as per OPSD.
- f) The maximum change in the direction of flow in any sanitary sewer maintenance hole shall be 90°.
- g) A sufficient drop will be provided across the maintenance hole to compensate for energy losses due to changes in flow direction and velocity.
- h) Where the difference in elevation between the maintenance hole inlet and outlet pipes exceed 600 mm, a drop structure shall be provided as per OPSD and Section A5.4. Where the drop is between 200 mm and 600 mm, the pipe grades shall be adjusted, such that the maximum drop is 200 mm. No internal drop structures will be permitted unless approved by the City.
- i) The obverts on the upstream side of a maintenance hole will in no case be lower than those on the downstream side.
- j) All maintenance holes shall be benched to the spring line for pipe sizes up to 250mm and to the obvert for pipes over 250 mm in diameter as per OPSD and Section A5.2.
- k) All benching inside maintenance holes shall be a minimum of 230 mm in width.
- l) No maintenance hole shall be located closer than 1.50 m from any curb face or other utility.
- m) The designer is to individually analyze each maintenance hole with respect to the application of OPSD standards with consideration of soil conditions, groundwater, buoyancy, loading and other pertinent factors to determine structure suitability. In all cases where the standards are not applicable, maintenance holes must be individually designed and detailed.
- n) When any horizontal dimension of a maintenance hole exceeds 2.4m, the structure must be individually designed and detailed.
- o) A minimum clearance of 300 mm shall be provided between the outside of all pipe barrels at all points of pipe crossings. Where the minimum clearance cannot be obtained, the crossing is to be encased in 15 MPa concrete.
- p) Maintenance holes shall be required at the property line for all sanitary service connections to commercial, industrial, institutional and multiple residential blocks. Refer to Division M for additional details and exceptions.
- q) Watertight bolt down covers shall be provided on sanitary maintenance holes located in easements or areas susceptible to flooding and/or vandalism. Where significant sections of sanitary sewers are provided with watertight covers, extended vents shall be required. The elevation of the vents shall be above the Regional floodline.

- r) For Industrial/Commercial/Institutional (ICI) Developments, maintenance holes shall be located outside the surface ponding areas on areas of high ground.
- s) In flood prone areas, maintenance holes shall be located outside of the Regional floodline boundary whenever possible. Where a maintenance hole cannot be located outside the floodline boundary, it shall be elevated to minimum 100-Year elevation and the top of the maintenance hole covers shall be watertight and anchored properly so that it cannot be easily displaced or shifted due to high flows.
- t) Within municipal right-of-ways, maintenance holes shall be placed in areas where storm water does not pond and away from curb. Bituminous seal tape shall be placed around rings on maintenance holes to prevent direct inflow by sealing it water tight.

.7 Sanitary Sewer Rehabilitation

Methods of sewer rehabilitation include internal and external repairs, sealing cracks and joints, application of coating or spray and partial replacement of a component of the sewer.

Trenchless technology can be considered to repair or replace pipes with minimal digging or disruption to property including pipe bursting, relining and cured-in-place pipe.

Sewer rehabilitation will be considered by the City on a case-by-case basis in accordance with ASTM and OPSS.

.8 Pipe Plugging, Blocking and Bypass Pumping

Where possible, scheduling work for off-peak flow times shall be implemented during pipe plugging, blocking and pumping activities. The upstream blocked flow shall be monitored.

When flow cannot be controlled by plugging and blocking methods, bypass methods should be undertaken by directing flows by closed pipeline to a downstream maintenance hole or by truck to an approved disposal site.

Emergency operations to prevent the discharge from the sewer system or to prevent sewer back ups during construction and inspection shall be considered during design. This shall include considerations for emergency power on-site, flow control and bypass pumping.

Dewatering is not permitted to the sanitary sewer.

.9 Bulkheads on Open Pipe Ends

All pipes shall be bulkheaded when no work is being performed on the pipe. The bulkhead must be capable of preventing water from entering or exiting the pipe.



Section A2

Design Criteria - Sanitary Service Connections

.1 General

Complete sanitary service connections shall be installed in accordance with City Standards to service each lot, block and unit. OPSD 1006.010, and 1006.020 Sewer Service Connections are revised by Section A5.4.

.2 Inflow and Infiltration Reduction Standard

York Region has developed the Inflow and Infiltration (I&I) Reduction Design, Construction, Inspection and Testing Standard for Sewers Servicing New Development (the Region Standard) for new gravity sanitary collection installations. The Standard applies to new subdivisions, site plans, industrial, commercial and institutional developments and single service retrofit connection within the York Region.

The engineers, designers and constructors shall use and reference when designing and constructing for new gravity sanitary sewer collection installations.

The Region Standard shall be used in conjunction with City's standards and specifications.

.3 Sanitary Sewer Connection

The connection to the main sewer will be made with an approved manufacturer's tee.

The type of pipe and size will be:

- a) Single Family units - minimum 125 mm PVC
- b) Semidetached units - minimum 125 mm individual PVC
- c) Multiple Family and Other Blocks, Commercial/Industrial and Institutional areas will be sized individually according to the intended use and the requirements of the Ontario Building Code.
- d) PVC sanitary service connections shall be of any color other than white or blue.

A 125 mm x 100 mm Cast Iron or PVC test fitting shall be installed by the owner on the street line and a stub section with a plug will be installed within the private property. The test plate located on top of the fitting will be clearly marked "Sanitary".

The use of test fittings and vertical riser cleanouts shall not be permitted in the installation of lateral/service connections.

The minimum depth of services for residential units at street line shall be 2.5 m and the maximum depth 4.0 m, measured from the final centerline road elevation. Risers will be used when the invert depth of the sewer main exceeds 4.5m. and will not exceed 3.0m in height without approval of the City.

- Minimum low flow velocity - 0.75m/sec.
- Maximum velocity - 3.0m/sec.

The grade for sanitary sewer connection shall be a minimum of 2%.

An inspection maintenance hole will be required for all connections to a multiple family, industrial, institutional, commercial and other blocks. The maintenance hole will be located approximately

1.5m from the main property line to centre of maintenance hole frame and cover. The outside wall of the maintenance hole shall not encroach on the public right-of way. The connection obverts shall be matched with the main sewer obvert.

An inspection maintenance hole will also be required at the mainline sanitary sewer for connections to townhouses/condominiums, industrial, institutional, commercial and other blocks.

.4 Connection to Mainline Sanitary Sewer

The Region Standard Section 5.4 shall be followed except as modified herein:

- Using saddles for installing service connections to existing flexible pipe sewer mains shall be permitted unless otherwise advised by the City.

.5 Abandoning Service Connections to Flexible Pipe Mainline Sewer

The Region Standard Section 5.4.1 shall be followed except as modified herein:

- Abandoning of existing sanitary services shall be at the point of connection to the sewer main.
- When the existing sewer main is not reachable, the existing sanitary services shall be capped at the property line and grouted as directed by the City's representatives.

.6 Locations

Residential sanitary sewer connections shall be located 2.5 m from the water service, outside of driveways, and away from other potential areas of interference.

A reducer is to be placed at property line, with no riser or test fitting.



Section A3

Specifications - Sanitary Sewers

.1 Construction Specifications - Drainage and Tunnels (OPSS Division 4)

OPSS	Date	Description	Subsection	Comment
MUNI 401	Nov. 2021	Trenching, Backfilling and Compacting		<p>1.All earth materials placed within 1.0m of a road sub-base and in all fill areas shall be compacted to 98% Standard Proctor Density.</p> <p>2.All granular material placed shall be compacted to 98% Standard Proctor Density.</p>
MUNI 402	Nov. 2016	Excavating, Backfilling and Compacting for Maintenance Holes, Catchbasins, Ditches and Valve Chambers		
MUNI 403	Nov. 2016	Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut		
MUNI 407	Nov. 2021	New Maintenance Hole, Catchbasin, Ditch Inlet and Valve Chamber Installation		
MUNI 408	Nov, 2021	Adjusting or Rebuilding Maintenance Holes, Catchbasins, Ditch Inlets and Valve Chambers		
MUNI 410	Nov. 2018	Pipe Sewer Installation in Open Cut		
MUNI 412	Nov. 2018	Forcemain Installation in Open Cut		
MUNI 415	Nov. 2018	Pipeline Installation by Tunnelling		
MUNI 416	Nov. 2018	Pipeline Installation by Jacking and Boring		
MUNI 491	Nov. 2017	Preservation, Protection and Reconstruction of Existing Facilities		



OPSS	Date	Description	Subsection	Comment
MUNI 492	Nov. 2020	Site Restoration following Installation of Pipelines, Utilities and Associated Structures		

.2 Construction Specifications - Miscellaneous (OPSS Division 5)

OPSS	Date	Description	Subsection	Comment
MUNI 501	Nov. 2017	Compacting		All earth materials placed within 1.0m of road sub-base and in all fill areas shall be compacted to 98% Standard Proctor Density.
MUNI 510	Nov. 2018	Removal		
MUNI 517	Nov. 2021	Dewatering for Excavations		
MUNI 518	Apr. 2017	Control of Water from Dewatering Operations		
MUNI 539	Nov. 2021	Temporary Protection Systems		

.3 Material Specifications - Aggregates (OPSS Division 10)

OPSS	Date	Description	Subsection	Comment
MUNI 1004	Nov. 2021	Material Specification for Aggregates - Miscellaneous		
MUNI 1010	Nov. 2013	Material Specification for Aggregates Base, Subbase, Select Subgrade, and Backfill Material	1010.01	Reclaimed material shall not be used.

.4 Material Specifications - Cement and Concrete (OPSS Division 13)

OPSS	Date	Description	Subsection	Comment
MUNI 1351	Nov. 2019	Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers	1351.05.06	Amend to read: "Steel steps plastic encased or not, shall not be used in the City"
MUNI 1359	Nov. 2016	Material Specification for Unshrinkable Backfill		

.5 Material Specifications - Pipes and Associated Drainage Items (OPSS Division 18)

OPSS	Date	Description	Subsection No.	Comment
MUNI 1841	Nov. 2019	Non-Pressure Polyvinyl Chloride (PVC) Pipe Products		
MUNI 1842	Nov. 2020	Pressure Polyethylene Pressure Pipe		
MUNI 1850	Nov. 2020	Frames, Grates, Covers and Gratings		



Section A4

Adopted Ontario Provincial Standard Drawings

.1 Frames and Grates (OPSD Division 400)

OPSD	Date	Description	Addition or Revision
401.010	Nov. 2018	Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes	1. Type "A" cover to be stamped "Sanitary Sewer" or "FDC Sewer".
401.030	Nov. 2018	Cast Iron, Square Frame with Circular Watertight Cover for Maintenance Holes	1. To be used for all sanitary installations within easements. 2. Covers shall be clearly stamped as to type of sewer installation.
402.010	Nov. 2019	Cast Iron, Square Frame with Circular Cover and Plug for Valve Chambers	1. Only for use with Forcemains 2. Cover to be Stamped "Sewage Forcemain"
402.020	Nov. 2019	Cast Iron, Raised Frame with Circular Cover and Plug for Valve Chambers	1. Only for use with Forcemains 2. Cover to be Stamped "Sewage Forcemain"
402.030	Nov. 2019	Cast Iron, Rectangular Frame with Two Piece Cover for Meter and Valve Chambers	1. Only for use with Forcemains 2. Cover to be Stamped "Sewage Forcemain"
404.020	Nov. 2018	Aluminum Safety Platform for Circular Maintenance Holes	1. Detail "B" installations only are approved by City.

.2 Catchbasins and Maintenance Holes (OPSD Division 700)

OPSD	Date	Description	Addition or Revision
701.010	Nov. 2014	Pre-cast Maintenance Hole 1200mm Diameter	<ol style="list-style-type: none"> 1. Backfill around maintenance hole to be Granular "B". 2. Adjustment units range to be 200mm minimum to 300mm maximum. 3. For flexible pipe type support at maintenance hole as per OPSD 708.020 is to be used. 4. All maintenance holes shall be benched to the spring line for pipe sizes up to 250mm and to the obvert for pipes over 250 mm in diameter.
701.011	Nov. 2014	Precast Maintenance Hole 1500mm Diameter	<ol style="list-style-type: none"> 1. Backfill around maintenance hole to be Granular "B". 2. Adjustment units range to be 200mm minimum to 300mm maximum. 3. All maintenance holes shall be benched to the spring line for pipe sizes up to 250mm and to the obvert for pipes over 250 mm in diameter.
701.012	Nov. 2014	Pre-cast Maintenance Hole 1800mm Diameter	<ol style="list-style-type: none"> 1. Backfill around maintenance hole to be Granular "B". 2. Adjustment units range to be 200mm minimum to 300mm maximum. 3. For flexible pipe support at maintenance hole as per OPSD 708.020 is to be used. 4. All maintenance holes shall be benched to the spring line for pipe sizes up to 250mm and to the obvert for pipes over 250 mm in diameter.
701.013	Nov. 2014	Pre-cast Maintenance Hole 2400mm Diameter	<ol style="list-style-type: none"> 1. Backfill around maintenance hole to be Granular "B". 2. Adjustment units range to be 200mm minimum to 300mm maximum.

OPSD	Date	Description	Addition or Revision
			<ul style="list-style-type: none"> 3. For flexible pipe type support at maintenance hole as per OPSD 708.020 is to be used. 4. All maintenance holes shall be benched to the spring line for pipe sizes up to 250mm and to the obvert for pipes over 250 mm in diameter.
701.021	Nov. 2014	Maintenance Hole Benching and Pipe Opening Alternatives	<ul style="list-style-type: none"> 1. All maintenance holes shall be benched to the spring line for pipe sizes up to 250mm and to the obvert for pipes over 250 mm in diameter.
701.030	Nov. 2014	Precast Concrete Maintenance Hole Components 1200mm Diameter Tapered Top and Flat Cap	<ul style="list-style-type: none"> 1. See 701.010
701.040	Nov. 2014	Precast Concrete Maintenance Hole Components 1500mm Diameter Transition Cone and Slabs	<ul style="list-style-type: none"> 1. See 701.011 2. Minimum 1.80m of headroom above spring line of sewer is required.
701.050	Nov. 2014	Precast Concrete Maintenance Hole Components 1800mm Diameter Transition Slabs	<ul style="list-style-type: none"> 1. See 701.012 2. Minimum 1.80m of headroom above spring line of sewer is required.
701.060	Nov. 2014	Precast Concrete Maintenance Hole Components 2400mm Diameter Transition Slab	<ul style="list-style-type: none"> 1. See 701.013 2. Minimum 1.80m of headroom above spring line of sewer is required.
703.011	Nov. 2014	Precast Concrete Single Inlet Flat Cap 1500mm Diameter	
703.012	Nov. 2014	Precast Concrete Single Inlet Flat Cap 1800mm Diameter	
703.013	Nov. 2014	Precast Concrete Single Inlet Flat Cap 2400mm Diameter	
707.010	Nov. 2019	Precast Concrete Maintenance Hole Manufactured Tee	<ul style="list-style-type: none"> 1. Granular "B" backfill required around structure.
708.020	Nov. 2016	Support for Pipe at Maintenance Hole	<ul style="list-style-type: none"> 1. Class "A" bedding not required when flexible pipe is used.

.3 Culverts and Drains (OPSD Division 800)

OPSD	Date	Description	Addition or Revision
802.010	Nov. 2014	Flexible Pipe Embedment and Backfill, Earth Excavation	1. Embedment material shall be Granular "A" conforming to OPSS 1010 unless other approved by the City.
802.013	Nov. 2014	Flexible Pipe Embedment and Backfill, Rock Excavation	1. Embedment material shall be Granular "A" conforming to OPSS 1010 unless otherwise approved by the City.
802.014	Nov. 2014	Flexible Pipe Embedment in Embankment Original Ground, Earth of Rock	1. Embedment material shall be Granular "A" conforming to OPSS 1010 unless other approved by the City.
802.030	Nov. 2015	Rigid Pipe Bedding, Cover, and Backfill. Type 1 or 2 Soil, Earth Excavation	1. Minimum bedding shall be Class "B" Granular "A" conforming to OPSS 1010 unless otherwise approved by the City.
802.031	Nov. 2015	Rigid Pipe Bedding, Cover, and Backfill, Type 3 Soil, Earth Excavation	1. Minimum bedding shall be Class "B" Granular "A" conforming to OPSS 1010 unless otherwise approved by the City.
802.032	Nov. 2015	Rigid Pipe Bedding, Cover, and Backfill, Type 4 Soil, Earth Excavation	1. Minimum bedding shall be Class "B" Granular "A" conforming to OPSS 1010 unless otherwise approved by the City.
802.033	Nov. 2015	Rigid Pipe Bedding, Cover, and Backfill, Rock Excavation	1. Minimum bedding shall be Class "B" Granular "A" conforming to OPSS 1010 unless otherwise approved by the City.
806.060	Nov. 2019	Height of Fill Table, Polyvinyl Chloride Pressure Pipe for Different Dimension Ratios	
807.010	Nov. 2018	Height of Fill Table, Reinforced Concrete Pipe - Confined Trench Class 50-D, 65-D, 100-D, and 140-D	
808.010	Sept. 1996	Pipe Protection Against Heavy Construction Equipment	

.4 Sanitary Sewer (OPSD Division 1000)

OPSD	Date	Description	Addition or Revision
1003.010	Nov. 2016	Maintenance Hole Drop Structure Tee	1. OPSD 1003.01 to be used for sanitary sewer installations only.
1006.010	Nov. 2021	Sewer Service Connections - For Rigid Pipe	<ol style="list-style-type: none"> 1. Cast iron test fittings (Crowle or approved equal) shall be installed at streetline for all sewer connections and clearly marked "sanitary". Fitting shall be 125 x 100mm 2. For vertical riser installations bedding and cover shall be H18 graded limestone. 3. Maximum connection angle is 45° for both standard and vertical riser connections. 4. Bedding shall be used as follows, unless otherwise directed by the Engineer: <ul style="list-style-type: none"> - Sanitary - OPSD 1005.01 Class "B"
1006.020	Nov. 2011	Sewer Service Connections - Flexible Pipe	<ol style="list-style-type: none"> 1. Cast iron test fittings (Crowle or approved equal) shall be installed at streetline for all sewer connections and clearly marked "sanitary." Fitting shall be 125 x 100mm 2. For vertical riser installations bedding and cover shall be H18 graded limestone. 3. Maximum connection angle is 45° for both standard and vertical riser connections. 4. For sewer invert depths exceeding 4.5m, risers shall be used. Risers shall not exceed 1.0m in height for flexible pipe installations without prior approval by the City. 4. Bedding shall be as per OPSD 1005.02. 5. Dual sanitary sewer connections are not permitted.



OPSD	Date	Description	Addition or Revision
1007.010	Dec. 1983	Utility Supports - Up to 300mm Diameter	



Section A5

List of Approved Manufacturers and Products for Sanitary Systems

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
Sewer Pipe					
	Concrete Pipe & Fittings	<ul style="list-style-type: none"> CSA A257 (Precast Reinforced Circular Concrete Manhole Sections, and Fittings) OPSS.MUNI 1820(Circular and Elliptical Concrete Pipe) CSA A257.1-03 (non-reinforced pipe), CSA A257.2-03 (reinforced pipe), CSA A257.3-03 (joints and gaskets) (Precast Reinforced Circular Concrete Manhole Sections, and Fittings) 	Co-Pipe Products Inc. Con Cast Pipe Inc DECAST Ltd. Forterra M CON Products Inc. M-Con Pipe & Products Inc.		<ul style="list-style-type: none"> CSA A257.1 and A257.3 (450 mm to 900 mm in dia.). CSA A257.2 and A257.3 (> 900 mm in dia.)
	Polyvinyl Chloride (PVC) Pipe, Fittings, Joints & Gaskets	<ul style="list-style-type: none"> 375 mm in diameter or smaller Max. SDR 35, Min. pipe stiffness 320kPa Green or any other colour (not white or blue) Sewer fittings, joints and gaskets CSA B182.1, CSA B182.2 and CSA B182.4 	Galaxy Plastics Ltd. IPEX Inc NAPCO Royal Pipe & Fittings Pro-Line Fittings East Inc. : TIGRE-ADS USA	Galaxy DR35 and DR28 Ring-Tite® Fittings STI Gasketed Sewer Fittings, including 2-piece Service Tees Inserta-Tee® PVC Gasketed Sewer Fittings TIGRE-ADS DR 35 and DR 28	<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard
	Rigid Pipe Non-reinforced concrete sewer and fittings <300mm	<ul style="list-style-type: none"> Class 65-D as a minimum CSA-A257.1 min. Class 3 or latest amendment unless otherwise noted 			<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard
	Rigid Pipe Joints and gaskets – Rigid Pipes	<ul style="list-style-type: none"> CAN/CSA-A257.3 Oil resistant gaskets shall be specified for sanitary sewer downstream of industrial sewage flows 			<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard
	Tees and wyes	<ul style="list-style-type: none"> Shall be pre-manufactured 			

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
	Cast Iron and Ductile Iron	<ul style="list-style-type: none"> ANSI A21.10 (American National Standard For Ductile-Iron And Gray-Iron Fittings, 3 In. Through 48 In. (76 Mm Through 1,219 Mm), For Water) AWWA C111 (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings) 	Sigma Star Biby		
	HDPE Pipe & Fittings	<ul style="list-style-type: none"> OPSS 1842 (Pressure Polyethylene Pipe Products) CAN/CSA-B137 (Thermoplastic Pressure Piping Compendium) RMDCS 02530(Pipe Sewers) AWWA C906-07 (Polyethylene (Pe) Pressure Pipe and Fittings, 4 In. (100 Mm) Through 63 In. (1,600 Mm), For Water Distribution and Transmission) OPSS 1840 (Prestressed Concrete Pressure Pipe, Steel-Cylinder Type) CSA B182.6-06 (PVC Sewer Pipe and Fittings (PSM Type)) 	Infra Pipe Solutions Ltd.	Sclairpipe®	<ul style="list-style-type: none"> use virgin resin, Circular PE pipe and fittings with a minimum pipe stiffness of 320 kilopascals and 100 kilopascals gasketed joints HDPE pipe use only as forcemain Inflow and Infiltration Reduction Standard
	Sanitary Forcemain Material				<ul style="list-style-type: none"> material selected for forcemain must not be colour coded blue
	Concrete Pressure Pipe	<ul style="list-style-type: none"> (Prestressed Concrete Pressure Pipe, Steel-Cylinder Type) AWWA C303-08 (400 mm dia.) (Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type) RMDCS 02511 (Watermains) 	DECAST Ltd. Forterra	LCP-C301 (600 mm dia. and larger) BWCC C-303 (400 mm dia.) LCP C-301 (600 mm dia. and larger) 750mm to 3660mm	

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
	Connector & Flexible Rubber Connector	<ul style="list-style-type: none"> CSA A.257.3(Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings) ASTM C923M-07 (to connect pipe to maintenance hole) (Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals (Metric)) 	Fernco Connectors Ltd.	QS4/6/8 (QwikSeal Cored Connector), EZ Tap (100mm and 150mm)	<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard
	Polypropylene (PP)	<ul style="list-style-type: none"> ASTM D2412-11 (Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading) ASTM D3212-07 (Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals) ASTM F2736-13e1 (Standard Specification for 6 to 30 in. (152 To 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe (Withdrawn 2018)) 	ADS Canada	SaniTite® HP Polypropylene (PP) Dual-Wall Pipe (300 mm to 450 mm dia.)	<ul style="list-style-type: none"> max diameter of 450 mm
Sanitary Service Connection					
	PVC	<ul style="list-style-type: none"> CSA and ASTM standards See Design Criteria – Section A2 Service Connections See Municipal Inspection and Construction Guidelines - Section G – Sewers 			<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
Sewer Related Appurtenances					
	Maintenance Hole and Catch basin Adjustment Units	<ul style="list-style-type: none"> Maintenance holes must be either pre-cast or poured/cast-in-place Designed and constructed as per City Standards and OPSD. Precast maintenance holes shall conform to CSA-A257.4 and OPSS 1351 OPSS 1853/ASTM D 412 (rubber adjustments) (Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension) 	Armtec Brooklin (Brooklin Concrete) DECAST Ltd FJ Turner Company Ladtech, Inc. Structure Shims Inc. Underground Technologies	Multi-Loc Adj. Ring Grade Adjustment Ring Riser Ring Adjustment Ring HDPE Structure Shims	<ul style="list-style-type: none"> Concrete adjuster thickness no greater than 300mm Concrete- total height no more than 300 mm. EPS- Elevation units used with system sealant and adhesive. HDEP- thickness no more than 25 mm. Rubber- thickness no more than 38 mm Inflow and Infiltration Reduction Standard
	Maintenance Hole Safety Platforms and Grates	OPSS 407	Trade Tech Industries		<ul style="list-style-type: none"> OPSS 407 (Maintenance Hole, Catch Basin, Ditch Inlet RMDCS 02631(Maintenance Holes, Catch Basins, Ditch Inlets
	Maintenance Holes Frame and Covers	OPSD 401.010	Bibby-Ste-Croix DECAST Ltd EJ Canada Sigma Corporation Star® Pipe Canada Inc. R.B. Agarwalla	JW150 (401.010), JW153 (401.030), JW150L (401.060), C-50-M-ONT Integrated Frame and Cover 1200mm Diameter Product ID 00302201 401.010, 401.030 401.03, 401.01 401.01, 401.03	<ul style="list-style-type: none"> OPSS 1850 (Frames, Grates, Covers and Gratings) RMDCS 02631(Maintenance Holes, Catch Basins, Ditch Inlets ASTM A48/A48M-03(2012) (Standard Specification for Gray Iron Castings) Inflow and Infiltration Reduction Standard
	Maintenance Hole Safety Steps	<ul style="list-style-type: none"> OPSS 407 (Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation) 	MSU Mississauga Ltd Trade Tech Industries		

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
		<ul style="list-style-type: none"> ▪ RMDCS 02631(Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers) 			
Air Valves	Combination Air Release/Vacuum Breaker	<ul style="list-style-type: none"> ▪ AWWA C512-07 (Air-Release, Air/Vacuum, And Combination Air Valves ▪ RH 406.01 (Precast Chamber for Combination Air Release/Vacuum Break Valve) 	<p>A.R.I. Flow Control Accessories</p> <p>Hydro-Logic Environmental/VENT-O-MAT</p> <p>Cla-Val Canada</p> <p>Crispin Valves</p> <p>GA Industries, LLC</p> <p>Val-Matic Valve and Manufacturing Corp.</p> <p>ARI</p>	<p>Model D-020, Stainless steel body only.</p> <p>VENT-O-MAT Series RGX</p> <p>36-ww</p> <p>X, S/SL, US</p> <p>X94255, 942</p> <p>VM-801A, VM-801AS, VM-802A, VM-803A, VM-804</p> <p>D020, D025P, D025SS</p>	<ul style="list-style-type: none"> ▪ Shall be tall bodied valves complete with flushing port and flood safe
Casing Spacers	Mechanical	<ul style="list-style-type: none"> ▪ RMDCS 02530(Pipe Sewers) ▪ RMDCS 02531(Sewage Forcemains) 	<p>Raci Spacers North America Inc.</p> <p>Advance Products & Systems (APS) Inc. BWM Company</p> <p>Cascade Waterworks Mfg Co</p>	<p>SSI, SI, CI, P SS-8, SS-12, FB-8, FB-12</p> <p>CCS-1320-8, CCSPL, CCE-ER</p>	<ul style="list-style-type: none"> ▪ Ultra high molecular weight polymer runners (or equivalent), Position of pipe within liner to be centered and restrained, sufficient to provide no less than 19mm clearance between casing and bell of pipe, Pipe
Couplings		<ul style="list-style-type: none"> ▪ CAN/CSA-B602-10(Mechanical couplings for drain, waste, and vent pipe and sewer pipe) ▪ OPSS 1841(Non-Pressure Polyvinyl Chloride (PVC) Pipe Products) 	<p>Fernco Connectors Ltd.</p> <p>Mission Rubber Company</p> <p>Preper Inc.</p>	<p>5000 Series Strong Back (RC) Shielded Stock</p> <p>Flex-Seal Adjustable Shielded Standard</p>	<ul style="list-style-type: none"> ▪ Clamping bands must be Grade 304 Stainless Steel.

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
		<ul style="list-style-type: none"> CSA B182.2 (PVC Sewer Pipe and Fittings (PSM Type)) 	Rollee	<p>Series 1,2,3,4,5,51,55,56</p> <p>Kwik Coupling</p>	
	Ductile Iron	<ul style="list-style-type: none"> RMDCS 02530(Pipe Sewers) RMDCS 02531 (Sewage Forcemains) 	<p>Cascade Waterworks Mfg Co</p> <p>Victaulic Company of Canada</p>	<p>Rapidfit Couplings and Flange Adapters</p> <p>Coupling Style #44 with Grade "E" EPDM Gasket</p>	
	Rubber	<ul style="list-style-type: none"> RMDCS 02530(Pipe Sewers) RMDCS 02531(Sewage Forcemains) CAN/CSA-B602-10 (Mechanical couplings for drain, waste, and vent pipe and sewer pipe) 	<p>Fernco Connectors Ltd.</p> <p>Mission Rubber Company</p> <p>Preper-PLS Tech Inc</p>	<p>1000 Series</p> <p>Mission Standard Couplings (All Rubber)</p> <p>Flex-Seal Adjustable Repair Couplings</p>	<ul style="list-style-type: none"> Clamping bands shall be Grade 304 Stainless Steel
	Stainless Steel	<ul style="list-style-type: none"> RMDCS 02530(Pipe Sewers) RMDCS 02531(Sewage Forcemains) ASTM F1476-07(2013) (Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications) AWWA C227-11(Bolted, Split-Sleeve Restrained and Non- restrained Couplings for Plain-End Pipe) 	Straub Tadco Inc.	<p>Straub Flex (Non-Restrained)</p> <p>Straub Open-Flex (Non-Restrained)</p> <p>Straub-Clamp. Repair clamp only.</p>	<ul style="list-style-type: none"> Strap-On Saddles permitted only for tapping into existing sanitary main sewers with consent of the Region. All service connections to new sanitary main sewers shall be made using injection moulded or fabricated tees as specified.
Service Saddles		<ul style="list-style-type: none"> CSA B182.2 (PVC Sewer Pipe and Fittings (PSM Type)) RMDCS 02531(Sewage Forcemains) RMDCS 02530(Pipe Sewers) 	<p>ADS Canada</p> <p>Fernco Connectors Ltd.</p> <p>Specialty Products 2000</p> <p>Clow Canada</p>	<p>Inserta-Tee</p> <p>EZ Tap</p> <p>Core Bell Adaptor Cast Iron Universal Type, D-50</p> <p>Inserta-Tees®</p>	<ul style="list-style-type: none"> Strap-On Saddles permitted only for tapping into existing sanitary main sewers with consent of the City. All service connections to new sanitary main sewers shall be made using injection molded or fabricated tees as specified. Inflow and Infiltration Reduction Standard

Product	Type	Required Accreditation	Manufacturer	Model/Type	Other Specification
			Forterra NAPCO Royal Pipe & Fittings National Pipe & Plastics, Inc.		
Joint Restraints			Ford Meter Box Co. Inc	UniFlange Series 1300C, 1350C, 1500C (PVC pipe) UniFlange Series 1390D, 1400D (Ductile Iron pipe)	<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard
Repair Clamps		<ul style="list-style-type: none"> CSA B602 (Mechanical couplings for drain, waste, and vent pipe and sewer pipe) 	Rolle Mission Rubber Co. Cambridge Brass Romac Industries	Kwik Coupling Flex-Seal – ARC Series 425 SS Repair Clamp	
Service Plugs		<ul style="list-style-type: none"> CSA B182.2(PVC Sewer Pipe and Fittings (PSM Type)) 	Galaxy (plastic, zinc plated) Crowle (epoxy coated)		<ul style="list-style-type: none"> Inflow and Infiltration Reduction Standard
Warning Tape			Seaton	Catalog #48284 (1000' roll)	<ul style="list-style-type: none"> 150 mm wide, 4 mil polyethylene, Tape Colour: Green, Text Colour: Black, Message: "Caution-Buried Sewer Line Below" or similar message



Section A6

Testing, Inspection and Acceptance Procedures - Sanitary Sewers

.1 General

The general procedures and minimum requirements required for inspection, testing and acceptance of new sanitary sewer systems are outlined herein, in conjunction with the York Region "I&I Reduction Standard for Sewers Servicing New Development", and based on requirements and procedures from Ontario Provincial Standard Specifications (OPSS) and American Society of Testing Materials (ASTM).

No part of the work will be accepted until the sanitary sewer system has been tested to the City's satisfaction.

.2 Gravity Sanitary Sewer Testing Requirements

The requirements for testing gravity sewers follow the OPSS, ASTM standards and York Region Guidelines, including the following:

- CCTV Inspections (see below)
- Air Testing Mainline Sewer and Service Connections – to be performed by developer and reviewed/approved by the City representative
- Mandrel Testing – to be performed by developer and reviewed/approved by the City representative
- Maintenance Hole Testing – to be performed by developer and witnessed by the City representative

.2.1 Closed Circuit Television (CCTV)

The Region Standard Section 7.2.12 shall be followed except as modified herein:

- For single family dwelling (infill) CCTV inspection to be performed by City's operations and paid for by developer.
- CCTV for subdivisions:
 - CCTV inspection at Mainline and laterals to be performed at building permit stage and paid by the developer, City representative to review and inspect.
 - CCTV inspection for Private and public laterals (from cleanouts to main, 100% of the pipes) to be performed at external plumbing approvals. This inspection is to be performed by developer, City representative to review and inspect.
 - CCTV inspection for Mainlines to be performed at assumption. Developer to pay the City to perform the CCTV along with inspection.

Standard practice for equipment used for Closed Circuit Television (CCTV) inspection and other specification shall follow the most current version of OPSS.MUNI 409 where details are described in this section or in the York Region Guidelines.

CCTV inspections shall be performed to observe and record structural and service defects, construction features, and to assess thoroughness of cleaning. Defects to be repaired shall be in accordance with OPSS and ASTM Standards.

The camera is to be positioned along the center axis to see the full periphery of the pipe. Lighting of the sewer must be sufficient to illuminate the camera view and be evenly distributed around the periphery of the pipe without loss of contrast. Extra lighting will be needed for large pipe. The camera must maintain a speed that will allow for the defects to be observed clearly. Start the video inspection in the centre of the upstream maintenance hole where you can visibly view the pipe entrance way. The camera must stop and pan/tilt toward the maintenance hole, pipe entrance, connections, junctions and major defects. When arriving at a connection/junction, the camera shall stop and pan/tilt toward the entrance, then direct the camera to look directly into the connection/junction and note any defects. Pipe flow should not be more than 50% of pipe at any point during inspection.

.2.2 CCTV Inspection Reports

Each digital MPEG file and inspection report shall consist of one pipe section only (unless a reversal is required). In the event that a reversal is required the inspection is to be done immediately. Record of the CCTV inspection shall be provided as follows:

- Inspection reports are to be MPEG-2 format submitted on external hard drive or USB 2.0 or higher compatibility.
- Resolution: 720x480
- FPS: 30
- Bitrate: 2000kb/s minimum, 5000kb/s maximum
- Audio: None
- PDF version of the CCTV reports
- Any sewer.dat has to be replaced with "PACP compliant Access database file."

An example of submission format about following the City's folder structure for submitting files is:

"RFQ-123-15 2015/Laterals/Infill Lat/1234 Yonge Street/<File>.mpg"

The external hard drive or USB flash drive is to contain a digital version of the report generated by the CCTV inspection program, specifically:

- PDF version of the inspection detailed and summary reports
- PACP compliant Access database file

The field survey must record the time index on the video, which shows the image(s) corresponding to the text record. The indexing must include the start time of the entire survey and the exact time number for each pipe feature/defect recorded in the data. The indexing will permit the user to view a particular sewer pipe or a particular feature/defect in a pipe, after advancing to the stored time index in the MPEG file, then displaying the image(s).

.2.2.1 Coding

All observations shall be coded in accordance with NASSCO's "Pipeline Assessment and Certification Program", 7.03 Edition. No other CCTV inspection defect coding program shall be allowed. Condition coding shall only be performed by operators who have

successfully attained the CSA/NASSCO's Pipeline Assessment Certification Program of Visual Inspection of Sewer Pipe including Manhole Assessment and Lateral Assessment Certification Program.

.2.2.2 Video

At the start of each survey a video overlay system shall be used to clearly display, on the monitor and video recording, the following minimum alpha-numeric information for 30 seconds:

- Line 1: Contract ID
- Line 2: Street Name
- Line 3: Start MH to Finish MH, Names and Depths
- Line 4: Sewer Size, Type, Material
- Line 5: Start MH, ID Number
- Line 6: Finish MH, ID Number
- Line 7: Name of person performing Inspection
- Line 8: Date and Time of Inspection
- Line 9: Direction of Inspection
- Line 10: Direction of Flow
- Line 11: Start MH to Finish MH Steel Tape Measured Distance

.2.2.3 File Submission

The Supplier shall have a CCTV app that could be able to interface with the CTSPEC app the City uses. Nevertheless, the supplier is responsible for uploading the pertaining CCTV information directly into the City's Cloud. Additionally, the supplier shall submit the same information on External Hard Drive or USB flash drive as described above.

The Supplier is to provide the technical expertise to ensure that a seamless transfer of the information to the City's data files.

The external hard drive or USB flash drive shall be provided weekly. The Supplier is required to provide the external hard drives or USB flash drives to facilitate this process. The external hard drive or USB flash drive will be returned to the Supplier after each successful transfer of data.

In addition to the above, individual file transfers for lateral CCTV inspections and emergency CCTV service shall be made available to the City online on the same day that the service has been completed via the internet and/or individual DVDs provided as requested.

.2.2.4 Equipment Specifications

Mainline Camera Equipment

Minimum of 300 m of main line TV inspection cable; minimum of 470 H lines of resolution (for a sharp picture); minimum of 10x:1 10X optical zoom and 4x digital zoom total 40.1

zoom capability for inspection and assessment; minimum of 400-degree rotation with optical viewing angle and minimum of 331-degree pan viewing angle range to view minute defects; camera must have a manual override of the focus, iris and shutter: flexible for special conditions.

Lateral Launch Equipment

Must be pan/tilt and be able to traverse multiple 45 and 90-degree bends and go up wye connections. The inspection cable should be at least 45 m long. The launch camera must be able to launch with or against the flow into a minimum 100mm diameter connection/junction. Mini TV inspection camera equipment must be able to pan/tilt, or be a self-levelling camera to carry out the inspection of 100mm to 150mm diameter pipe. Each lateral camera must have a built-in sonde in the camera head for locating.

.2.2.5 Fog Removal

The operator shall provide all necessary equipment to produce "fog free" conditions in the sewer. The camera lens must be free from debris to ensure high picture quality. Videos with excessive fog will not be accepted and the sewer lines must be re-inspected.

.2.2.6 Suppliers Certification

The Supplier shall provide competent operators that are fully trained in NASSCO's coding (which have replaced the WRC coding and NAAP certification) and shall perform all main inspections and coding. An inspection crew must include one (1) NASSCO certified worker.

Prior to commencement of services, a copy of the Supplier's current PACP (Pipeline Assessment Certification Program) certification is to be submitted to the City. A copy of each operator's PACP certification is required for all operators performing the services on this contract.

NASSCO's PACP certification is required for all operators performing services on this contract. In the event that NASSCO is no longer a viable organization, the City will consider alternate organization authenticating operator competency in NASSCO's coding.

All CCTV Operators must possess NASSCO PACP with CSA 4012-10 Technical Guide Visual Inspection of Sewer Pipe, Certification. The Supplier is required to submit a listing of PACP Certification Numbers of their existing staff for the Cleaning and CCTV.

A test video and report may be requested from each operator, to be assessed for video quality and to ensure adherence to defect codes of a Mainline and Lateral prior to approval to proceed from the City.

.2.2.7 Calibration of TV Inspection Counter

Prior to the first camera inspection of the day, the camera shall be set-up in the centre of the upstream maintenance hole and the meter counter shall be set to zero. The operator shall then press record on the camera and proceed forward with the camera (until the back end of camera unit is in the pipe) and then reset meter counter. **The operator must know the length of their camera and transport/crawler for the reset of their meter counter.**

The operator shall then continue the inspection starting from the upstream maintenance hole and proceed to the centre of the downstream maintenance hole. The operator shall then record the meters of pipe inspected as measured by the CCTV equipment on a calibration form. Then from the upstream maintenance hole to the downstream maintenance hole the operator shall do a surface measurement that is accurate. If the two measurements do not agree, the operator must recalibrate their CCTV equipment meter counter and redo the above steps until the two measurements agree.

.2.2.8 Calibration Form

A Calibration Form shall be created that must have the time, date, street name, municipality, contract number, upstream and downstream maintenance hole numbers, the length of the sewer section inspection, surface measurement, drawing measurement, CCTV inspection truck number, operator name and helper name. This must be submitted each week at the request of the City.

.2.2.9 Timing of Inspection and Cleaning of Sewer

All mainline sanitary sewers and laterals (from the mainline sewer to the property line) must be cleaned and CCTV inspected prior to the installation of base asphalt.

All mainline sanitary sewers must be again cleaned and CCTV inspected prior to the installation of top asphalt.

All sewer laterals (100%) are to be CCTV inspected immediately prior to occupancy. Two videos shall be completed from the test fitting: one (1) video from the test fitting to the sewer main and one (1) video from the test fitting to the building face.

All maintenance holes are to be inspected at the time of top asphalt via visual inspection or with 3D maintenance hole wireless maintenance hole scanning equipment at the request of the City.

.2.2.10 Review and Reporting of CCTV Videos

All CCTV videos shall be reviewed and commented on as outlined in the current NASCO standard.

.3 Forcemain Testing Requirements

For the testing requirements specific to forcemains and low-pressure systems, refer to York Region Sanitary Sewer Inspection, Testing and Acceptance Guideline.