



SANITARY SEWER SYSTEM INSPECTION, TESTING AND ACCEPTANCE GUIDELINE

(FORMERLY SANITARY SEWER COMMISSIONING GUIDELINES)

OCTOBER 2011



Table of Contents

	Page
1. General.....	1
1.1 General Requirements.....	1
2. Gravity Sanitary Sewer Testing Requirements	3
2.1 General Requirements.....	3
2.2 Test Method & Sequence	3
2.3 Exfiltration Test - Low Pressure Air	4
2.4 Infiltration Test	5
2.5 Exfiltration Test - Water	6
2.6 Joint Test – Concrete Pipe (Greater than 600mm Diameter).....	6
2.6.1 Supplementary Joint Testing	6
2.7 Mandrel Deflection Testing.....	7
2.8 CCTV Inspections.....	8
2.8.1 Video Inspection Equipment	8
2.8.2 Video Camera Transport Equipment	8
2.9 Testing Pressure Pipe Used as Gravity Sewer	9
3. Forcemain Testing Requirements	9
3.1 General Requirements.....	9
3.2 Hydrostatic Leak Test.....	9
4. Maintenance Hole Testing Requirements.....	10
4.1 General Requirements.....	10
4.2 Maintenance Hole Exfiltration Water Test	10
4.3 Maintenance Hole Infiltration Water Test	10
4.4 Negative Air (Vacuum) Test	10
4.5 Chimney Seal Leakage Test	11
5. Groundwater Measurement	11
6. Referenced Standards.....	12

1. General

This Guideline outlines the general procedures and minimum requirements required for inspection, testing and acceptance of new sanitary sewer systems commissioned in York Region and the nine (9) Local Area Municipalities. The Guideline is based on requirements and procedures from Ontario Provincial Standard Specifications (OPSS) and American Society of Testing Materials (ASTM).

Without limiting the foregoing, it is a set of standards that outline specific requirements for inspecting and testing the construction of sanitary sewer systems to help prevent Inflow and Infiltration (I/I) from entering new sanitary sewer systems. It provides direction for the preferred test methods, performance rates (testing limits) and specific requirements for the construction of sanitary sewer systems dedicated to York Region and the nine (9) Local Area Municipalities for the duration of the construction period, including the installation of lateral connections to property line.

The details in the Guideline only delineate specific features of sanitary sewer system construction that impact I/I reduction, and are not intended to supplement or replace current York Region or nine (9) Local Area Municipality Water and Wastewater Design Standards and Guidelines.

1.1 General Requirements

All newly constructed sanitary sewers and manholes shall be watertight and free from leakage.

The Contractor shall be responsible for payments and scheduling all testing required and informing the Municipality and their Qualified Representative (e.g. consulting engineer) of the planned commencement date ten (10) days prior to such commencement and reconfirm three (3) days prior to testing.

When specified in the Contract documents, leakage or water-tightness tests shall be carried out on completed pipe sewers 1,200mm in diameter and smaller. There shall be no visible leakage for pipe sewers larger than 1,200mm diameter. All tests shall be carried out in the presence of and accepted by the Municipality or their Qualified Representative. Results for tests conducted in the absence of the Municipality or their Qualified Representative will not be accepted.

The Municipality or their Qualified Representative shall inspect sanitary sewer and manhole installations and related work during all phases of the construction.

No part of the work will be accepted until the sanitary sewers are satisfactorily tested following completion of installation of service connections and backfilling. Upon completion, sanitary sewers and maintenance holes shall be inspected by visual observation and tested in accordance with this Guideline for each sewer section (maintenance hole to maintenance hole). When tests are unsatisfactory, the test section shall be repaired at Contractor's expense and retested until satisfactory results are obtained. If the defective portion of the sanitary sewer cannot be located or repaired, the Contractor shall remove and reconstruct as much of the work as is necessary to obtain a system that passes testing requirements. See Appendix A: York Region and Local Area Municipalities Sanitary Sewer Inspection, Testing and Acceptance Flow Charts for Concrete and Thermo-Plastic Pipes and Maintenance Holes.

The Contractor shall bear the complete cost and supply all equipment necessary to perform the tests required, refer to Appendix A for acceptable testing processes.

Sanitary sewer construction shall be inspected throughout the construction period for general adherence to Contract specifications and follow the sequence of testing provided in subsequent sections.

The test(s) shall be done after final backfill is placed in the trench and before asphalt has been placed (except where vacuum testing of maintenance holes has been requested by the Municipality or their Qualified Representative).

Where the groundwater table cannot be visually monitored in terms of elevation from the pipe, the Municipality or their Qualified Representative may request that groundwater level be measured with piezometers placed in representative locations throughout the length of sanitary sewers under construction and as detailed in Section 5.

Smoke and dye testing may be used only to locate leaks and in no case shall be considered conclusive.

General sequence of testing for sanitary sewer system is as follows (but not limited to):

1. Cleaning and flushing with high-pressure water blasting
 2. Deflection or out of round testing (for Thermo-plastic pipes only)
 3. Water-tightness (Leakage) testing
 4. CCTV (photographic record & inspection form for maintenance holes) after testing and at the start of maintenance
 5. Additional CCTV may be specified by the Municipality or their Qualified Representative at a time prior to Maintenance, and at the time prior to Assumption of the works.
- For testing requirements specific to gravity sanitary sewers refer to Section 2
 - For testing requirements specific to forcemains refer to Section 3
 - For testing requirements specific to maintenance holes refer to Section 4
 - For groundwater measurement refer to Section 5

2. Gravity Sanitary Sewer Testing Requirements

2.1 General Requirements

Gravity sanitary sewer pipes shall be cleaned and flushed with high pressure water blasting after construction and just prior to inspection and testing.

Testing shall be carried out from maintenance hole to maintenance hole and shall include lateral connections to property line. Testing shall be conducted prior to any service connections being made. All service laterals, stubs, and fittings shall be plugged or capped prior to testing.

Sanitary sewers shall be repaired and re-tested, as required, until the test results are within the limits specified. Visible leaks shall be repaired regardless of the test results.

The testing requirements follow the OPSS and ASTM standards and are generally described in each subsection of this section. Changes or deviations to the OPSS standards are as noted herein.

2.2 Test Method & Sequence

Water-tightness testing parameters are dependent on groundwater levels prior, during and after testing of the sanitary sewer, the static water level shall be recorded in accordance with Section 5.

The water-tightness test method for small diameter pipe (Thermo-plastic pipe 900mm diameter and less and concrete pipe 600mm diameter and less) shall be Exfiltration Test – Low Pressure Air (Air Exfiltration), see Section 2.3. In the event that air ex filtration testing fails and leak location and repair is unsuccessful, the use of other test methodology may be accepted at the discretion of the Municipality or their Qualified Representative. Any other water-tightness method will only be allowed following the submittal of the procedure to the Municipality or their Qualified Representative for review and upon their written approval.

The water-tightness test method for large diameter pipe (Thermo-plastic pipe greater than 900mm diameter and concrete pipe greater than 600mm diameter) and where the groundwater is at least 600mm above the highest sewer crown shall be Infiltration Test, see Section 2.4. In the event that groundwater levels are less than 600mm above the crown of the pipe, the Exfiltration Water Test or Joint Test as applicable shall be used only when specified by the Municipality or their Qualified Representative, see Sections 2.5 and 2.6 respectively.

When specified by the Municipality or their Qualified Representative, supplementary joint testing on large concrete pipe (greater than 600mm diameter) shall be conducted on representative joints, see Section 2.6.

2.3 Exfiltration Test - Low Pressure Air

Standard practice for testing, equipment used, and other specifications shall follow OPSS 410, ASTM C924, ASTM F1417-11 and as noted herein.

The Contractor is responsible for ensuring that the test is conducted in a safe manner and all applicable safety procedures are followed. Do not enter, or allow anyone to enter, the maintenance hole during testing.

Tests shall be conducted between two consecutive maintenance holes or to a stub end where the sewer does not terminate at a maintenance hole. The test section shall be plugged at each end. The test section shall be filled slowly until a constant pressure of 24kPa is maintained. If the groundwater is above the pipe sewer being tested, the air pressure shall be increased by 3.0kPa for each 300mm from interior pipe invert that the groundwater level is above the invert of the pipe.

Whereby the groundwater table cannot be visually monitored in terms of elevation from pipe, the Municipality or their Qualified Representative may request that groundwater level be measured prior to testing in accordance with Section 5.

The air pressure shall be stabilized for five (5) minutes and then regulated to maintain it to 20.5kPa plus the allowance for groundwater, if any. After the stabilization period, the time taken for a pressure loss of 3.5kPa shall be recorded.

The time taken for a pressure drop of 3.5kPa shall not be less than the times shown in Table 1 (Column B) for lengths equal to or less than the length shown in Table 1 (Column C).

Table 1: Exfiltration Test – Low Pressure Air Testing (OPSS 410)

Column A	Column B	Column C	Column D
Nominal Pipe Size (mm)	Minimum Time (min:sec)	Length of Pipe for Minimum Time (m)	Time Per Unit for Longer Lengths of Pipe* (sec/m)
100	1:53	182	0.623
150	2:50	121	1.140
200	3:47	91	2.493
250	4:43	73	3.893
300	5:40	61	5.606
375	7:05	48	8.761
450	8:30	41	12.615
525	9:55	35	17.171
600	11:20	30	22.425
675	12:45	27	28.382
750	14:10	24	30.040
825	15:35	22	42.397
900	17:00	20	50.450

*If the length of the test section is greater than the length shown in Column C, the testing time shall be the product of the length of the test section multiplied by the value in Column D (i.e. Minimum time = test length x Column D).

Determination of Acceptance

If the time shown in Table 1 for the designated pipe size and length elapses before the air pressure drops 3.5kPa, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued once the prescribed time has elapsed even though the drop 3.5kPa has not occurred.

Determination of Failure

If the pressure drops 3.5kPa before the appropriate time shown in Table 1 has elapsed, the air loss shall be considered excessive and the section of pipe shall be determined to have failed the test.

In the event that air exfiltration testing on the sanitary sewer system or any section thereof fails, and/or leak repair is unsuccessful, the use of other test methodology at the discretion of the Municipality or their Qualified Representative may be permitted. The Municipality or their Qualified Representative can also request air exfiltration testing again once the repair is complete. The Contractor may conduct a water infiltration test in accordance with Section 2.4 to establish whether the 0.0375 litres/millimeter diameter /100 metres of pipe sewer/hour maximum allowable infiltration rate is being exceeded. If the field conditions do not allow for infiltration test due to low groundwater table, a water exfiltration test in accordance with Section 2.5 may be used upon written approval from the Municipality or their Qualified Representative.

If the air test on the sanitary sewer system or any section thereof fails, but the water infiltration or exfiltration test on the sanitary sewer system or section thereof passes, the sanitary sewer system or section thereof shall be deemed acceptable. However, the Contractor shall be responsible for repairing all visible leaks regardless of the ability of the sanitary sewer system or section thereof to pass any established test criteria specified in this Guideline.

2.4 Infiltration Test

Standard practice for testing, equipment used, and other specifications shall follow OPSS 410, ASTM C969M and as noted herein

The rate of infiltration into the sanitary sewer system shall not be in excess of 0.0375 litres/millimeter diameter /100 metres of pipe sewer/hour.

Infiltration test shall be conducted only where the ground water level at the time of testing is 600mm or more above the crown of the pipe for the entire length of the test section, otherwise infiltration will be considered an invalid water tightness test.

Prior to testing, discontinue dewatering operations at least three (3) days before conducting the test and allow the groundwater level to stabilize. Measure groundwater levels in accordance with Section 5.

A V-notch weir or other suitable measuring device shall be installed at the downstream end of the test section. Infiltrating water shall be allowed to build up behind the weir until the flow through the V-notch has stabilized. Several tests (minimum three) at 15-30 minutes intervals shall be performed to ensure that the flow through the weir is steady and not changing. The rate of flow shall then be measured and shall not exceed the maximum allowable infiltration calculated for the test section.

2.5 Exfiltration Test - Water

Standard practice for testing, equipment used, and other specifications shall follow OPSS 410, ASTM C969M and as noted herein.

Exfiltration tests utilizing water shall be conducted where the groundwater level is lower than 600mm above the crown of the pipe or the highest point of the highest service connection included in the test section and only when specified by the Municipality or their Qualified Representative.

The leakage at the end of the one (1) hour test period shall not be in excess of 0.0375 litres/millimeter diameter/100 metres of pipe sewer/hour.

An allowance for each maintenance hole included in the test section shall be made in accordance with the exfiltration rate for maintenance holes detailed in Section 4.

Water shall be added to the pipeline prior to testing until there is a head in the upstream maintenance hole of the greater of 600mm minimum over the crown of the pipe or above the groundwater level (refer to Section 5 for Groundwater Measurement).

2.6 Joint Test – Concrete Pipe (Greater than 600mm Diameter)

Standard practice for testing, equipment used, and other specifications shall follow ASTM C 1103M and as noted herein.

This test shall be used when groundwater levels are less than 600mm above the crown of the pipe and only when specified by the Municipality or their Qualified Representative.

When directed to utilize this test method, all joints shall be tested unless otherwise directed by the Municipality or their Qualified Representative.

Equipment used shall be made specifically for joint testing of pipelines.

2.6.1 Supplementary Joint Testing

Standard practice for testing, equipment used, and other specifications shall follow ASTM C 1103M and as noted herein.

This test shall be used as an additional supplementary test only when specified by the Municipality or their Qualified Representative. After successful water tightness testing, supplementary joint testing is to be completed as an additional pass/fail test on selected joints on all precast concrete pipes greater than 600mm in diameter when specified by the Municipality or their Qualified Representative.

Representative testing on 5% of all joints, joints selected to be approved by the Municipality or their Qualified Representative, is to be conducted. Joints shall be selected evenly spaced along the complete pipe sewer. Failed joints are to be repaired.

All joints tested shall pass the test otherwise a different representative sample (5%) shall be tested following the same sequence.

Joints that fail to meet the verified test criteria (stated in ASTM C 1103M) shall be resealed and retested until the test criteria can be met.

2.7 Mandrel Deflection Testing

Standard practice for testing, equipment used, and other specifications shall follow OPSS 410.

Mandrel deflection testing shall be performed on all Thermo-plastic pipe sewers. The mandrel deflection test shall be performed no sooner than thirty (30) days after final backfill to road subgrade elevation has been placed.

The mandrel shall be cylindrical in shape, and constructed with an odd number of evenly spaced arms or prongs, minimum 9 in number. The minimum diameter of the circle scribed around the outside of the mandrel arms shall be equal to the allowable deflected pipe diameter \pm 1mm. The contact length of the mandrel shall be measured between the points of contact on the mandrel arm or between sets of prongs. This length shall not be less than that shown in Table 2.

The mandrel shall be checked with a go-no-go proving ring. The proving ring shall have a diameter equal to the allowable deflected pipe diameter \pm 0.1mm. An acceptable mandrel shall not pass through the proving ring. The proving ring shall be fabricated from steel a minimum of 6 mm thick.

For pipes 100mm to 750mm in diameter, the allowable deflected pipe diameter is 7.5% of the base inside diameter of the pipe. For pipes greater than 750mm in diameter, the allowable deflected pipe diameter is 5.0% of the base inside diameter of the pipe. The base inside diameter is defined in the CSA or ASTM standard to which the pipe is manufactured.

Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test.

All sections of pipe that fail the deflection test shall be repaired and retested. Re-rounding is not accepted. Retesting shall be carried out no sooner than 30 days after backfill has been placed.

Table 2 -Deflection Testing of Pipe Sewers (from OPSS 410)

Nominal Pipe Size (mm)	Mandrel Contact Length (mm)
150	100
200	150
250	200
300	250
350	300
375	300
400	300
450	350
500	400
525	450
600	500
675	575
750	675
900	750
1050	900
1200	1050

2.8 CCTV Inspections

Standard practice for testing, equipment used, and other specifications shall follow OPSS 409. Observations and defect coding standard shall be in accordance with Water Research Centre Publication Manual (WRc) Manual of Sewer Classification (3rd Edition).

Closed Circuit Television (CCTV) inspection 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 the Municipalities specifications.

Media storage shall be high quality CD or DVD (reference 409.05.01).

Each digital .MPEG file and inspection report shall consist of one pipe section only (unless a reversal is required), where two inspection records will be required. A record on CD or DVD of the internal condition of the piping system shall be provided in addition to a printed and digital inspection report. Two copies of the digital media (CD's or DVD's) shall be provided and 2 copies of the printed report (reference 409.07.05.01).

The camera lens should be positioned along the center axis of the pipe. Lighting in the sewer must be sufficient to illuminate approximately 2 m ahead of the camera and be evenly distributed around the periphery of the pipe without loss of contrast. The camera must maintain a speed that will allow for the defects to be observed clearly. The camera must stop and pan special features within the pipe, such as maintenance hole interfaces, junctions, service connections and major defects.

2.8.1 Video Inspection Equipment

The video shall be of quality that all minor defects (hairline cracks, etc.) are clearly visible and the colour of the pipe inspected is true to actual conditions. Should the video not be of this quality, as determined by the Municipality or their Qualified Representative, the Contractor shall be required to re-inspect the line to produce an acceptable quality video at no additional cost. The picture quality on the monitor shall provide a minimum continuous 460 line resolution video picture. Linear measure through pipes must be accurate to +/- 0.5%.

2.8.2 Video Camera Transport Equipment

The camera shall be transported through the sewer by means of a rubber tired or crawler tractor. The transport unit must be capable of passing over minor surface imperfections including but not limited to broken joints and solid debris up to 40mm in height.

Mounting of the camera on a float or skid for tow through the sewer shall only be permitted where the condition of the sewer precludes the use of a tractor and where authorized by the Municipality or their Qualified Representative. If the camera is towed the supporting equipment shall not impede the view of the camera and shall be stable to ensure steady and smooth progress.

The camera transport shall permit complete inspection of the sewer from the centre of the start maintenance hole to the centre of the finish maintenance hole. A remote reading counter shall be used to measure distance travelled from the centre of the start maintenance hole and measurements shall be recorded in metres to the nearest 100 mm.

2.9 Testing Pressure Pipe Used as Gravity Sewer

Standard practice for testing pressure pipe used for gravity sewer service, equipment used, and other specifications shall follow OPSS 412.

Test pressure shall be 1035KPa and test duration of 2 hours.

Allowable leakage shall be in accordance with OPSS 412; 0.082 litres per millimetre of pipe diameter per kilometre of pipe for the 2 hour test period.

3. Forcemain Testing Requirements

This section provides the testing requirements specific to forcemains and low pressure systems.

3.1 General Requirements

All forcemains for lift stations and common force mains in low pressure systems shall be tested for leakage by a Hydrostatic Leak Test

Forcemain construction shall be inspected throughout the construction period for general adherence to contract specifications and good practice.

The testing requirements follow the standards and are generally described in each subsection of this section.

Changes or deviations to the OPSS standards are as noted herein.

3.2 Hydrostatic Leak Test

Standard practice for testing, equipment used, and other specifications, shall follow OPSS 412.

A test section shall be either a section between valves or the completed forcemain. The forcemain to be tested shall be backfilled before testing commences.

Test pressure shall be as specified in the Contract Documents or be provided by the Municipality or their Qualified Representative.

The test section shall be filled slowly with water, and all air shall be removed from the pipeline. A 24-hour absorption period may be allowed before starting the test. The test section shall be subjected to the specified continuous test pressure for two (2) hours.

The leakage is the amount of water added to the test section to maintain the specified test pressure for the test duration.

No leakage will be permitted (the allowable leakage is zero (0)). All leaks shall be located and stopped and the test section shall be retested until leakage is zero (0).

All defective pipe, fittings, valves and other appurtenances discovered shall be removed and replaced with sound material and tests repeated until the leakage is zero (0).

4. Maintenance Hole Testing Requirements

4.1 General Requirements

Standard practice for testing, equipment used and other specifications shall follow OPSS 407 and ASTM C1244M.

Every maintenance hole shall be chimney seal tested and visually inspected, and whereby specified by the Municipality or their Qualified Representative shall be tested by either exfiltration water testing or infiltration water testing. As an alternative at the discretion of the Municipality or their Qualified Representative, testing may be performed by vacuum testing. Vacuum testing shall be conducted on un-backfilled maintenance holes in accordance with the standards noted above.

A photographic record and inspection with condition rating shall be completed on every maintenance hole, Municipality or their Qualified Representative to provide inspection form

Maintenance holes shall be inspected during all phases of construction. Each maintenance hole shall be visually inspected for leakage after assembly and backfilling.

4.2 Maintenance Hole Exfiltration Water Test

Each maintenance hole shall be tested for leakage after assembly and backfilling where requested by the Municipality or their Qualified Representative.

Leakage shall not exceed a rate of 3 litres per hour per metre of head above the lowest pipe invert in the maintenance hole.

Maintenance holes shall be repaired and re-tested, as required, until the test results are within the limits specified. Visible leaks shall be repaired regardless of the test results. The method of repair shall be per the approval of the Municipality or their Qualified Representative

4.3 Maintenance Hole Infiltration Water Test

This test shall be used in lieu of Maintenance Hole Exfiltration Water Test only when specified by the Municipality or their Qualified Representative.

Standard practice for testing, equipment used, and other specifications shall follow OPSS 407 or ASTM C1244M. The test shall be conducted as an Infiltration Water Test.

4.4 Negative Air (Vacuum) Test

All Joints between the top of the casting to the bottom of the maintenance hole base shall be included in the test.

Equipment used shall be made specifically for vacuum testing maintenance holes.

A vacuum will be drawn and the vacuum drop over a specified time period shall be within the limits in the standard to determine the acceptability of the maintenance hole.

The maintenance hole shall pass if the time for the vacuum reading to drop from 33.8 kPa of Hg to 30.4 kPa of Hg meets or exceeds the values in the Table 4 from ASTM 1244M.

If the maintenance hole fails the initial test, necessary repairs shall be made by an approved method. The maintenance hole shall then be retested until a satisfactory test is obtained. Visible leaks shall be repaired regardless of the test results.

4.5 Chimney Seal Leakage Test

If specified by the Municipality or their Qualified Representative, installed chimney seals (an internal flexible rubber frame seal) shall be tested in accordance with this guideline.

Install the chimney seal and only the bottom expansion band in accordance with the manufacturer's recommendation. Fully tighten the bottom band. Do not install the top expansion band.

Pull the top of the seal away from the maintenance hole's frame and pour approximately 4 litres of water behind the seal. Observe the bottom seal for a minimum of 1 minute for leakage. No leakage shall be allowed.

If the bottom expansion band holds water without leaking, the chimney seal will have passed the test.

If the bottom expansion band has any leakage during the test time, the chimney seal will have failed the test. The Contractor shall be required to remove, replace, or reposition the bottom expansion band and retest.

5. Groundwater Measurement

Whereby the groundwater table cannot be visually monitored in terms of elevation from the pipe, the Municipality or a Qualified Representative may request that groundwater level be measured with piezometers placed in representative locations throughout the length of sanitary sewers under construction.

The contractor shall provide all materials and equipment necessary for the construction of piezometers for measuring groundwater level and equipment to measure the water level within the piezometer.

Piezometers shall be placed in the excavation alongside the sewer at approved locations.

Piezometers shall be constructed of 19mm PVC pipe and shall be equipped with 1.0m well screens or sections of a slotted PVC pipe at the end with gravel pack filled in around the screen to approximately 0.5m - 1m above and below the screen.

All casing and screen material shall be assembled and installed with sufficient care to prevent damage to the sections and joints.

Prior to installation an end cap must be placed at the bottom of the PVC piping. During installation, a cap shall be placed on top of the casing to avoid materials from entering the PVC piping.

A completed monitoring piezometer shall be sufficiently straight to allow passage of measuring devices.

Provide a Water Level Indicator designed to measure groundwater levels in small diameter tubes and piezometers. The cable reel device shall be equipped with a probe that on entry to water completes an electrical circuit and sends a signal back to the reel where a light and audible buzzer are activated. The water level is then determined by taking a reading directly from the cable at the top of the piezometer casing. Prior, during and after testing of the sewer, the static water level shall be recorded.

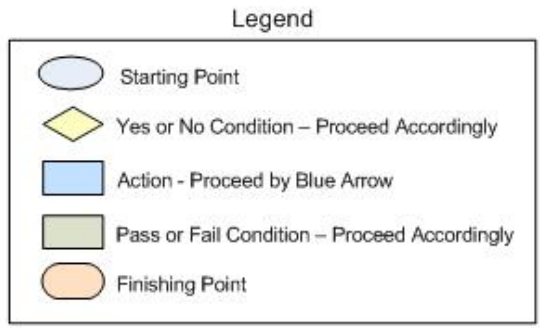
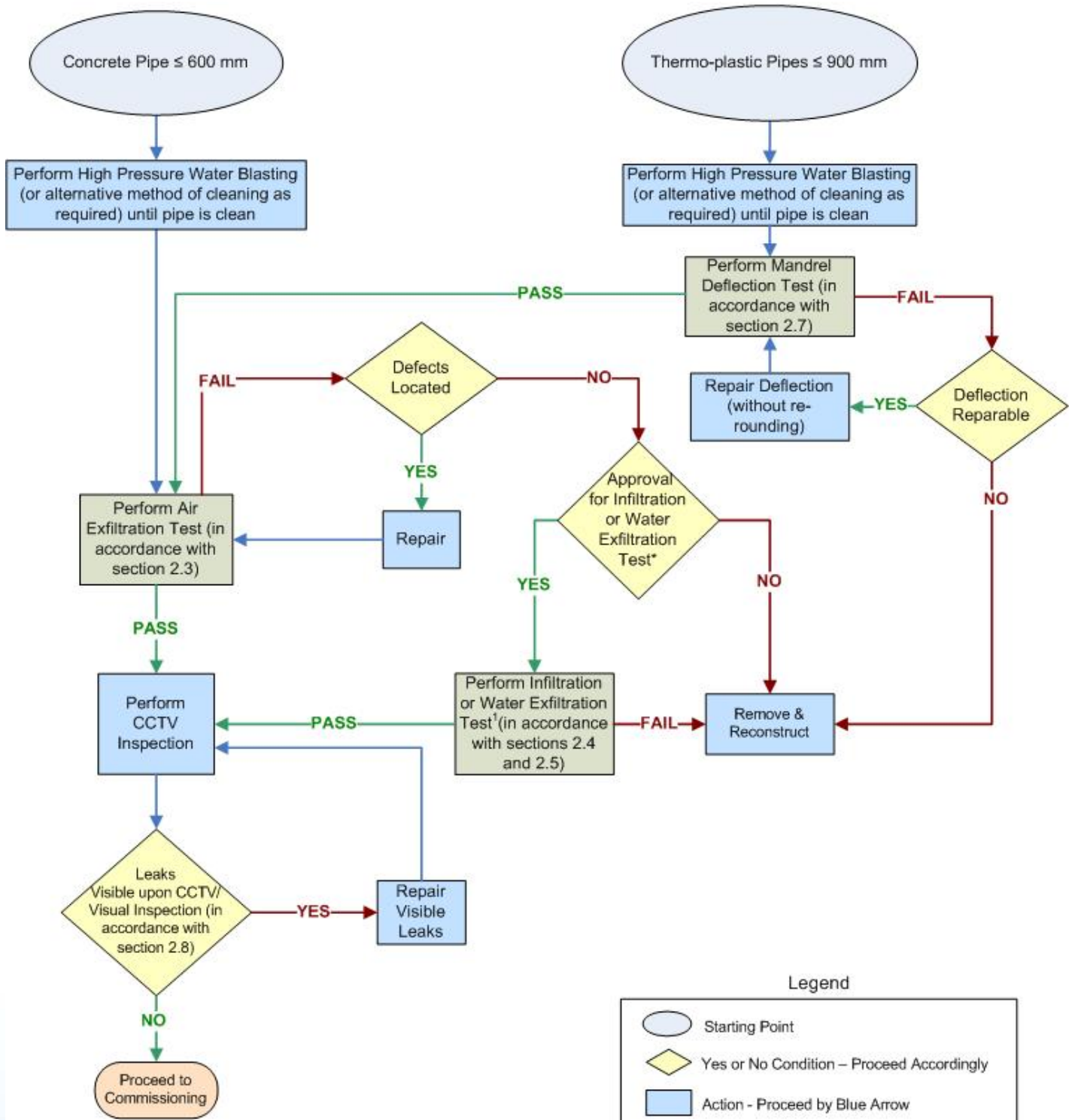
6. Referenced Standards

1. OPSS 407 Construction Specification for Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation
2. OPSS 409 Construction Specification for Closed-Circuit Television Inspection of Pipelines
3. OPSS 410 Construction Specification for Pipe Sewer Installation in Open Cut
4. OPSS 412 Construction Specification for Sewage Forcemain Installation in Open Cut
5. ASTM C924 - 02(2009) Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
6. ASTM C969M - 02(2009) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
7. ASTM C 1103 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
8. ASTM F1417 - 11 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
9. ASTM C1244M - 05ae1 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill (Metric)
10. Water Research Centre Publication Manual (WRc) Manual of Sewer Classification (3rd Edition).

Appendix A:

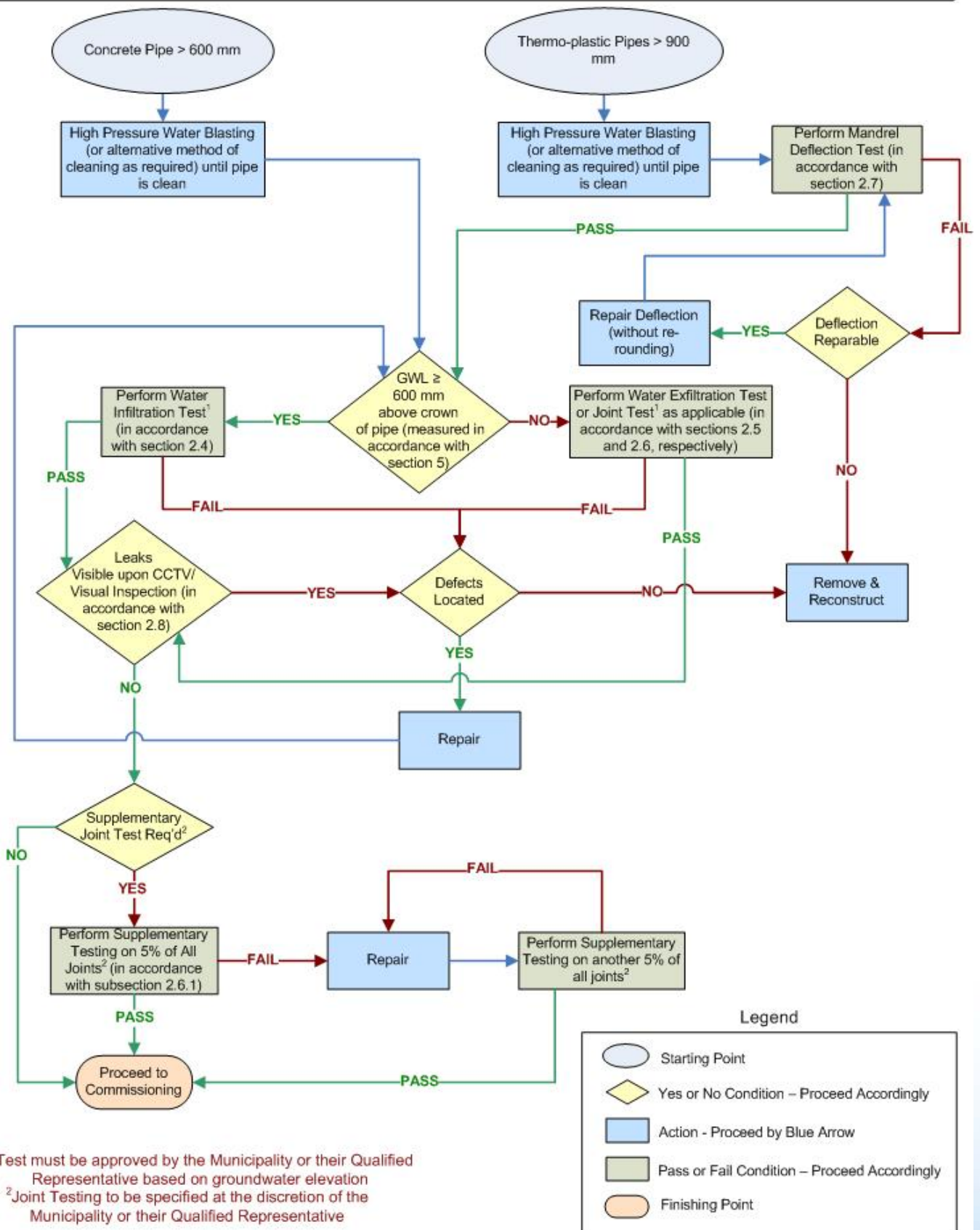
**York Region and Local Area Municipalities
Sanitary Sewer Inspection, Testing and
Acceptance Flow Charts for Concrete and Thermo-
Plastic Pipes and Maintenance Holes**

**York Region and Local Area Municipalities Sanitary Sewer
Inspection, Testing and Acceptance Flow Chart
for Concrete Pipes ≤600mm and Thermo-plastic Pipes ≤900mm**



¹ Infiltration or water exfiltration test must be approved by the Municipality or their Qualified Representative based on groundwater elevation

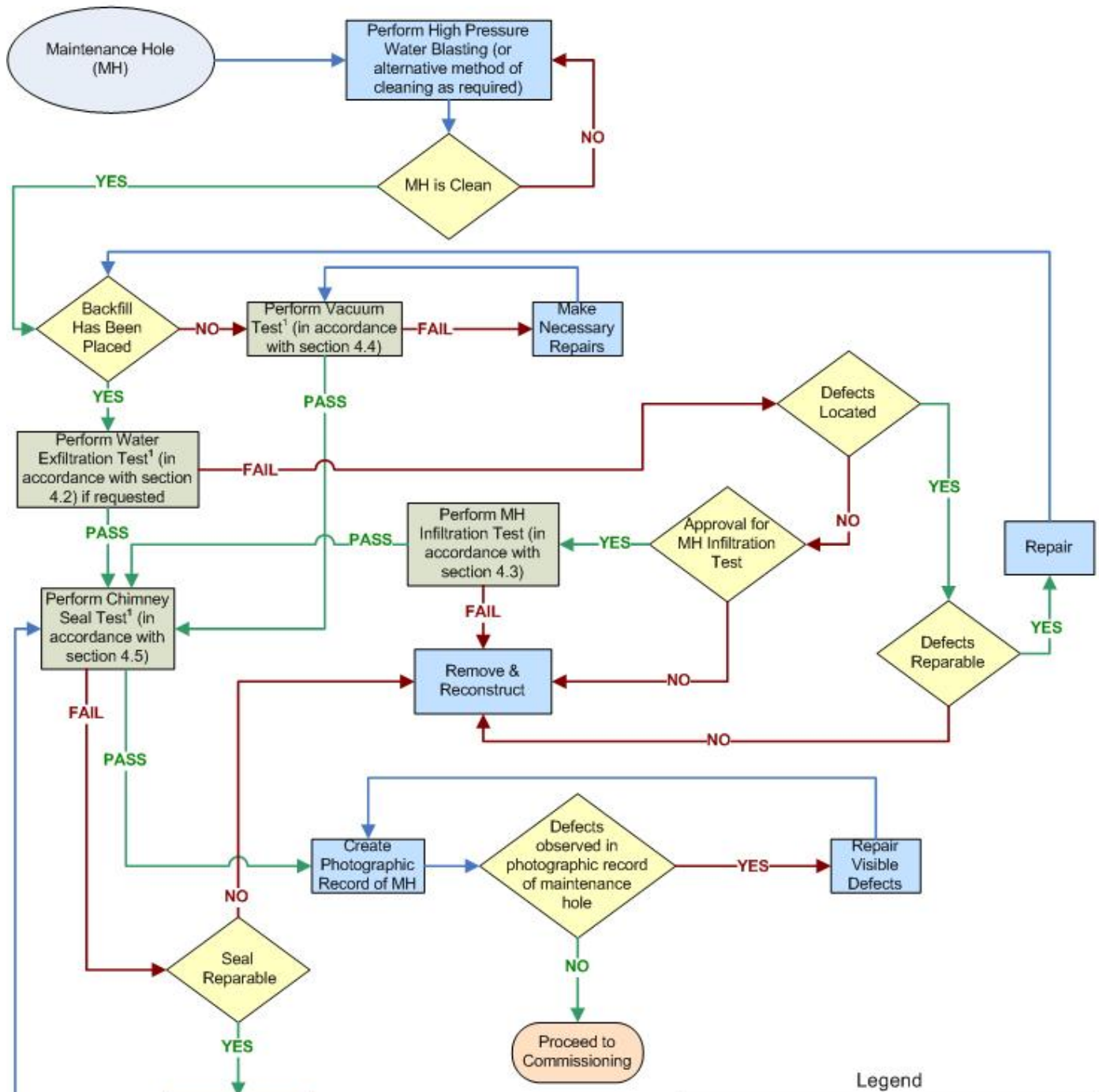
**York Region and Local Area Municipalities Sanitary Sewer
Inspection, Testing and Acceptance Flow Chart
for Concrete Pipes >600mm and Thermo-plastic Pipes >900mm**



¹ Test must be approved by the Municipality or their Qualified Representative based on groundwater elevation

² Joint Testing to be specified at the discretion of the Municipality or their Qualified Representative

**York Region and Local Area Municipalities Sanitary Sewer Inspection,
Testing and Acceptance Flow Chart for Maintenance Holes**



Legend

- Starting Point
- Yes or No Condition – Proceed Accordingly
- Action - Proceed by Blue Arrow
- Pass or Fail Condition – Proceed Accordingly
- Finishing Point

¹Vacuum, Infiltration or Water Exfiltration test to be specified by the Municipality or their Qualified Representative

Appendix B:

Glossary of Terms

Borehole: A hole drilled into the earth into which well casings or piezometers may be installed.

CCTV: Means closed-circuit television. An inspection method using a closed-circuit television camera system with appropriate transport and lighting mechanisms to view the interior surface of sewer pipes and structures.

CD: Means compact disc.

Contract: An agreement between two or more parties, one that is written and enforceable by law; the agreement between the Municipality and the Contractor for the construction of a sanitary sewer system or components.

Contractor: A properly licensed individual or company that agrees to furnish labour, materials, equipment and associated services to perform the work as specified for a specified price.

Crown: The top of the internal (the inside) cross section of the pipe.

Deflection: Any change in the inside diameter of the pipe resulting from installation and imposed loads. Deflection may be either vertical or horizontal and is usually reported as a percentage of the base (un-deflected) inside pipe diameter.

Exfiltration: Leakage or discharge of flows from sewer systems into the ground through leaks in pipes, joints, Maintenance holes or other sewer system appurtenances.

Forcemain: A pipeline that conveys sewage from one area to another under pressurized flow. The word "force" refers to the fact that the pipeline uses pressure, provided by pumping stations, rather than gravity to move flows.

Good Practice: Is the proven and accepted methods, procedures, and practices that provide appropriate, cost-effective, and well-documented solutions to meet user-requirements and compliance with applicable regulations.

Groundwater Level (table): Upper surface of the zone of saturation in permeable rock or soil.

Groundwater: All water under the surface of the ground whether in liquid or solid state. It originates from rainfall or snowmelt that penetrates the layer of soil just below the surface.

Head: Fluid mechanical energy per unit weight of fluid, which correlates to the elevation that water will rise to, also hydraulic head.

Hydrostatic Pressure: The pressure equal to that which is (or would be) induced by the weight of the overlying column of water, the height of water above the point in question.

Infiltration: The water entering a sewer system, including building sewers, from the ground through such means as defective pipes, pipe joints, connections or maintenance hole walls. Flow deriving from groundwater tends to be continuous and dependent on groundwater levels. Infiltration can experience seasonal changes as the groundwater table varies. Infiltration does not include inflow

Inflow: Water other than wastewater that enters a wastewater system and building sewer from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, maintenance hole covers, cross connections between storm drains and sanitary sewers, catch basins, cooling towers, storm-water, surface runoff, street wash waters, or drainage

Inspection: The act of inspecting. An official examination or review of the work completed or in progress to determine its compliance with contract requirements.

Invert: The lowest point of the internal cross section of a pipe or sewer.

Joint: The location at which two pieces of pipe or a pipe and a fitting are connected. The joint may be made by a mechanical device, such as threads or ring seals, by heat fusion and cementing, or by finished ends made to fit together (bell and spigot).

Lateral: Any pipe connected to the main sewer.

Maintenance (Manhole) Components: The sections of a maintenance hole are the base, the riser (which may include a conical section as the top riser), the cover section (a conical section is built to include the cover section), grade rings or chimney to adjust to final grade, and the maintenance hole's frame and cover.

Maintenance Hole (Manhole): A sewer access large enough for a person to enter to trouble-shoot service problems or perform maintenance work.

Mandrel: A rigid device - spindle or an axle – pulled through flexible thermo-plastic pipe to test alignment and deflection.

Monitoring Well: A well that is used to obtain water quality samples or measure groundwater levels.

Municipality: the Corporation of a municipal district being either The Regional Municipality of York or one of the nine local municipalities. The Corporation that the Provincial Government, through an act of the legislature, has granted decision-making power over a part of the province.

Operator/Owner: The party that has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications

Performance Test (Testing): *the technical investigation done to determine or validate the characteristics of the product under test.*

Piezometer: A measuring device for groundwater level. This typically is an instrument that measures fluid pressure or level at a given point.

Plastic: A material that contains as an essential ingredient one or more organic polymeric substances of large molecular weights, is solid in its finished state, and, at some stage in its manufacture or processing into finished articles, can be shaped by flow.

Qualified (Authorized) Representative: One hired by the owner or client to give professional advice and may be a consultant hired by the Municipality. A qualified individual authorized by the owner to assist in the administration of a specific construction contract.

Sanitary sewer: A sewer receiving and carrying liquid and water-carried wastes under gravity flow, to which storm, surface, or groundwater are not intentionally admitted.

Sewage (or wastewater) - The used water and added waste of a community which is carried away by drains and sewers

Sewer System: Any system of pipes, drains, pumping works, equipment, structures, and other things used for the collection, transportation or disposal of wastewater, but does not include any building drain, plumbing, or building sewer.

Specifications: A detailed, exact statement of particulars, especially statements prescribing materials and methods; and quality of work for a specific project.

Standard: The prescribed, concise set of conditions and requirements that must be satisfied by a material, product, process, procedure, convention, or test method; and the physical, functional, performance and/or conformance characteristics thereof.

Thermo-plastic: A plastic that repeatedly can be softened by heating and hardened by cooling through a temperature range characteristic of the plastic, and that in the softened state can be shaped by flow into articles by molding or extrusion. Thermo-plastic pipe is available in a variety of plastic compositions including the most common in sewer systems being Polyvinyl chloride (PVC), Polyethylene (PE), and Acrylonitrile-butadiene-styrene (ABS).

Visible Leak: Ingress or egress of water from the sewer system that can be seen by an inspection.

V-Notch Weir: A structure, such as a bulkhead or plate, across the pipe to intercept the water flowing down the pipe in order to determine flow rate. A V-Notch weir has a specially shaped 'V' opening or notch. The V-notch, sharp-crested weir is especially good for measuring low flow rates.

Water-Tightness: Put together in such a way that no water can get in or through- *except in quantities allowed by the performance test.*