Amendment to OPSS.MUNI 410 (Nov 2018) – Construction Specification for Pipe Sewer Installation in Open Cut

OPSS 410.02 REFERENCES

Section 410.02 of OPSS.MUNI 410 is amended by the addition of the following standards:

Ontario Provincial Standard Specifications, Construction

OPSS 434	Laser and LiDAR Surveying of Pipelines
OPSS 438	Mandrel Deflection Inspections

ASTM International

C924 (2009)	Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Withdrawn 2013)
C969	Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines and Manholes
F1417	Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

OPSS 410.07 CONSTRUCTION

OPSS 410.07.13 Service Connection

Subsection 410.07.13 of OPSS.MUNI 410 is amended by the addition of the following paragraphs:

Where existing storm and sanitary sewers do not exist, the following shall apply:

The locations of all proposed service connections shown on the contract plans are schematic only. Service connections shall be installed to the property line at the specific location requested by the individual property owner. In the event that the property owner fails to specify a specific location, the service connection shall be installed at a location specified by the City, this is usually being at the centre of the property.

Storm and sanitary service connections in a common trench shall be installed in accordance with the following, in order that they may be accurately identified at the property line at a later date:

a) The sanitary connection shall be on the right hand side of the storm connection, while facing the property from the main sewer, with a clear horizontal distance of 250 mm between outside pipe walls.

b) The sanitary connection elevation shall be lower than the storm connection elevation with a clear minimum vertical distance of 100 mm between outside pipe walls.

c) Should the pipe material specified in the contract be locally available in white and non-white colours, the sanitary service connection shall be non-white in colour and the storm service connection shall be white in colour. Should the pipe material specified in the contract not be locally available in white and non-white colours, the end of the sanitary service connection pipe shall be spray painted with a non-white colour, and the end of storm service connection shall be spray painted white.

Subsection 410.07.13 of OPSS.MUNI 410 is amended by the addition of the following clause:

OPSS 410.07.13.01 Sanitary Sewers with Active Service Connections

For replacements of existing sanitary sewers with active service connections that cannot be plugged to complete leakage testing:

1) The service lateral connection to the sanitary sewer shall be completed with a manufactured gasketed tee connection or a cored connection with a manufactured insert. The work shall be inspected to ensure a water-tight connection is established between the service lateral and the sanitary sewer.

2) A waterproof membrane may be wrapped around the connection point of the service lateral to the main sanitary sewer, encasing the fitting and extending around the service lateral for added protection.

3) The sanitary maintenance holes shall be externally wrapped with Waterproof membrane placed externally around all precast joints, including joints below the maintenance hole frame and cover, with a minimum 300mm wide strip.

OPSS 410.07.16.04 Exfiltration Test

Clause 410.07.16.04 of OPSS.MUNI 410 is amended by the addition of the following sentence:

Exfiltration tests are required for new sanitary sewers and new sanitary sewer laterals in new greenfield or brownfield lands where no buildings are connected.

No exfiltration test is required where existing sanitary sewers are replaced in-situ, and live sewer laterals are cut and reconnected as the sewers are installed.

OPSS 410.07.16.04.02 Testing with Water

Clause 410.07.16.04.02 of OPSS.MUNI 410 is amended by the addition of the following sentence:

Testing shall be according to this specification herein or C969 if pipe material is concrete.

OPSS 410.07.16.04.03 Low Pressure Air Testing

Clause 410.07.16.04.03 of OPSS.MUNI 410 is amended by the addition of the following sentence:

Testing shall be according to this specification herein or C924 if pipe material is concrete or F1417 if pipe material is plastic.

OPSS 410.07.16.05 Deflection Testing of Pipe Sewers

Clause 410.07.16.05 of OPSS.MUNI 410 is amended by the addition of the following sentence:

Mandrel test shall be according to OPSS.MUNI 438. Laser profiling can also be used and shall be according to OPSS.MUNI 434.

OPSS 410.09 MEASUREMENT FOR PAYMENT

OPSS 410.09.01.01 Pipe Sewers

Clause 410.09.01.01 of OPSS.MUNI 410 is deleted in its entirety and replaced with the following:

Measurement of pipes shall be by length in metres horizontally over the centreline of the pipe when the grade of pipe is less than 10 per cent and in metres along the slope length of the pipe when the grade of the pipe is 10 per cent or greater.

Sewers will be paid for on a unit price basis per linear metre of sewer constructed, either single or dual sewer in trench as the case may be, and as stated in the Schedule of Unit Prices.

On storm and sanitary sewers in the same trench, measurements for payment will be made commencing from the outlet and measuring upstream along the storm sewer line, with all measurements being made from inside faces of exterior maintenance hole walls.

On storm and sanitary sewers in separate trenches, individual measurements for payment will be made on the storm sewer and on the sanitary sewer commencing from the outlet and measuring upstream along the sewer line, with all measurements being made from inside faces of exterior maintenance hole walls.

It is the intention of this specification that no payment will be made on the linear metre price bid for sewers for any pipe through any maintenance hole. All costs of any pipe between the inside faces of any maintenance holes are to be included in the lump sum price tendered for the maintenance hole.

Catch basin or ditch inlet leads shall be measured from the outside of the storm sewer at the point of connection to the inside face of the catch basin or ditch inlet at the point of connection.

CONSTRUCTION SPECIFICATION FOR PIPE SEWER INSTALLATION IN OPEN CUT

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410.01 SCOPE

This specification covers the requirements for the installation of storm and sanitary pipe sewers, laterals, service connections, and concrete appurtenances in open cut.

410.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

410.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

410.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 206	Grading
OPSS 401	Trenching, Backfilling, and Compacting
OPSS 404	Support Systems
OPSS 407	Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation
OPSS 409	Closed-Circuit Television Inspection of Pipelines
OPSS 490	Site Preparation for Pipelines, Utilities, and Associated Structures
OPSS 491	Preservation, Protection, and Reconstruction of Existing Facilities
OPSS 492	Site Restoration Following Installation of Pipelines, Utilities, and Associated Structures
OPSS 510	Removal
OPSS 517	Dewatering of Pipeline, Utility, and Associated Structure Excavation
OPSS 539	Temporary Protection Systems
OPSS 904	Concrete Structures
OPSS 905	Steel Reinforcement for Concrete

Ontario Provincial Standard Specifications, Material

OPSS 1004	Aggregates - Miscellaneous
OPSS 1205	Clay Seal
OPSS 1301	Cementing Materials
OPSS 1302	Water
OPSS 1350	Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete
OPSS 1801	Corrugated Steel Pipe Products
OPSS 1820	Circular Concrete Pipe
OPSS 1840	Non-Pressure Polyethylene Plastic Pipe Products
OPSS 1841	Non-Pressure Polyvinyl Chloride (PVC) Pipe Products

OPSS 1843 Non-Pressure Polypropylene (PP) Plastic Pipe Products
OPSS 1860 Geotextiles

CSA Standards

B182.1-11 Plastic Drain and Sewer Pipe and Pipe Fittings
[Part of B1800-11, Plastic Non-Pressure Pipe Compendium]

ASTM International

C 507-12 Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

410.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Backfilling means the operation of filling the trench with bedding, cover, and backfill material or embedment and backfill material.

Concrete Appurtenances means concrete head walls, cut-off walls, stiffeners, aprons, collars, and any other concrete fixtures associated with the pipe sewer, excluding concrete bedding or concrete structures specified in the Contract Documents.

Dimension Ratio means the average specified outside diameter of a pipe divided by the minimum specified wall thickness.

Drainage Structure means a maintenance hole, catch basin, or ditch inlet.

Excavation, Earth and Rock means the excavation classified as earth and rock according to OPSS 206.

Flexible Pipe means pipe that can deflect 2% or more without cracking, such as polyvinyl chloride or polyethylene or steel pipe.

Pipe Class means a pipe's physical material specification, such as load and pressure ratings, wall thickness, protective coatings, corrugation profiles, ring stiffness constants, and reinforcement.

Pipe Run means a section of a pipe sewer between two drainage structures or between a drainage structure and an outlet.

Pipe Sewer means an installation designed for the conveyance of sanitary sewage or storm water using preformed or precast pipe sections, circular or non-circular in cross-section, laid end to end using suitable jointing material and connected by maintenance holes for sanitary pipe sewers and by maintenance holes, catch basins, ditch inlets, or concrete appurtenances for storm pipe sewers.

Pipe Type means a pipe's inner wall design, which can be smooth or corrugated.

Polypropylene Plastic means a material made with virgin polymers in which propylene is essentially the sole monomer.

Service Connection means the pipe used to convey sanitary sewage or storm water from the property line to the main sanitary or storm pipe sewer respectively.

410.05 MATERIALS

410.05.01 Pipe Materials

410.05.01.01 General

Pipe sewer size, type, and class shall be as specified in the Contract Documents.

Pipe sewer size and class shall be consistent throughout a pipe run as specified in the Contract Documents. Pipe type shall be consistent throughout a pipe sewer as specified in the Contract Documents.

Fittings shall be suitable for and compatible with the pipe type and class for which they will be used.

410.05.01.02 Concrete Pipe

Circular concrete pipe and joints shall be according to OPSS 1820.

Elliptical concrete pipe and joints shall be according to ASTM C 507.

410.05.01.03 Corrugated Steel Pipe Products

Corrugated steel pipe products shall be according to OPSS 1801.

410.05.01.04 Polyethylene Pipe Products

Polyethylene pipe products shall be according to OPSS 1840.

410.05.01.05 Polyvinyl Chloride Pipe Products

Polyvinyl chloride pipe products shall be according to OPSS 1841.

Polyvinyl chloride service connection pipe shall be according to CSA B182.1 and shall have bell and spigot joints with elastomeric gaskets.

410.05.01.06 Polypropylene Plastic Pipe Products

Polypropylene plastic pipe products shall be according to OPSS 1843.

410.05.02 Mortar

Mortar for joints shall be composed of one part general use Portland cement and two parts mortar sand, wetted with only sufficient water to make the mixture plastic. The mortar sand shall be according to OPSS 1004, the general use Portland cement shall be according to OPSS 1301, and the water shall be according to OPSS 1302.

410.05.03 Clay Seal

Clay seal material shall be according to OPSS 1205.

410.05.04 Concrete

Concrete for concrete appurtenances shall be according to OPSS 1350 with a nominal minimum 28-Day compressive strength of 30 MPa.

410.05.05 Steel Reinforcement

Steel reinforcement shall be of the size and grade specified in the Contract Documents and shall be according to OPSS 1440.

410.05.06 Geotextile

Geotextile shall be according to OPSS 1860.

410.07 CONSTRUCTION

410.07.01 Site Preparation

Site preparation shall be according to OPSS 490.

410.07.02 Removals

Removals shall be according to OPSS 510.

410.07.03 Preservation and Protection of Existing Facilities

Preservation and protection of existing facilities shall be according to OPSS 491.

410.07.04 Protection Against Floatation

Damage to the pipeline due to floatation shall be prevented during construction and until completion of the work.

410.07.05 Cold Weather Work

All work shall be protected from freezing. Pipes and bedding material shall not be placed on frozen ground.

410.07.06 Transporting, Unloading, Storing, and Handling Pipe

Manufacturer's recommendations for transporting, unloading, storing, and handling of pipe shall be followed.

All pipes, fittings, and gaskets that are unsound or damaged shall be rejected.

410.07.07 Excavation

Excavation for the placement of pipe sewers shall be according to OPSS 401.

410.07.08 Support Systems

Support systems shall be according to OPSS 404.

410.07.09 Dewatering

Dewatering shall be according to OPSS 517.

410.07.10 Protection Systems

The construction of all protection systems shall be according to OPSS 539. When the stability, safety, or function of an existing roadway, railway, other works, or proposed works may be impaired due to the method of operation, such protection as may be required shall be provided. Protection may include sheathing, shoring, and the driving of piles, when necessary, to prevent damage to such works or proposed works.

410.07.11 Backfilling and Compacting

Backfilling and compacting shall be according to OPSS 401.

410.07.12 Pipe Installation

410.07.12.01 General

If a universal dimple coupler or any other coupler does not follow the contour of the flexible pipe sections to be joined, polyethylene gaskets shall then be installed at all joints when such couplers are used. Polyethylene gaskets shall be installed symmetrically about the pipe joint, between the coupler and the pipe, and shall be of sufficient length to equal the circumference of the pipe plus a minimum overlap of 300 mm.

Pipe shall be laid within the alignment and grade tolerances specified in the Contract Documents. When bell and spigot pipe is laid, the bell end of the pipe shall be laid upgrade.

Pipe shall be kept clean and dry as work progresses. The trench shall be kept dry. A removable watertight bulkhead shall be installed at the open end of the last pipe laid whenever work is suspended.

Pipe shall not be laid until the preceding pipe joint has been completed and the pipe is carefully embedded and secured in place.

When the Owner raises or lowers the invert of a pipe sewer by 150 mm or less, it shall not constitute a Change in the Work and no adjustment shall be made to the payment. When the invert of a pipe sewer is raised or lowered by more than 150 mm, it shall constitute a Change in the Work for the full extent of the change from the original grade.

When installing gaskets, all pipe ends shall be thoroughly cleaned. For gaskets requiring field lubrication, a lubricant recommended by the pipe manufacturer shall be used.

When gaskets have been affixed, the pipe shall be handled in a way so that the gasket is not damaged, displaced, or contaminated with foreign matter. Any gasket displaced or contaminated shall be removed, cleaned, and lubricated, if required, and reinstalled before closure of the joint is attempted. When specified in the Contract Documents, nitrile gaskets shall be used.

The pipe shall be properly positioned by means of an appropriate mechanism. Sufficient pressure shall be applied in making the joint to ensure that the joint is in position. Sufficient restraint shall be applied to the line to ensure that joints are held in this position.

Once the pipe has been jointed, a test shall be made with a feeler gauge at intervals around the joint to ensure that the gasket has not been displaced from the spigot groove. If the gasket is found out of position, the joint shall be opened and the gasket placed in its proper position. If necessary, a new gasket shall be installed.

410.07.12.02 Circular Concrete Pipe

All circular concrete pipe joints shall have elastomeric gaskets.

410.07.12.03 Non-Circular Concrete Pipe

Elliptical concrete pipes and joints shall be used for storm pipe sewers only.

All non-circular concrete pipe joints shall be according to the procedures recommended by the manufacturer.

410.07.12.04 Corrugated Steel Pipe Products

Corrugated steel pipe products shall be used for storm pipe sewers only.

Helical corrugated steel pipe without rerolled ends shall be installed so that the helix angle is constant for the total length of the installation. Each pipe section shall be installed next to the previous section so that the lockseam forms a continuous helix. For rerolled ends, the correct fit of the coupling system does not depend on the location of the helical lockseam and corrugation.

Corrugated steel pipe sections shall be joined by means of steel couplers. The couplers shall be installed to lap approximately equal portions of the pipes being connected so that the corrugations or projections of the coupler properly engage the pipe corrugations. As the coupler is being tightened, it shall be tapped with a mallet to take up the slack.

When joint seals are specified in the Contract Documents, they shall be installed immediately prior to the installation of steel couplers.

410.07.12.05 Polyethylene Pipe

Polyethylene pipe shall be jointed by one of the following methods, as recommended by the manufacturer:

a) Bell and Spigot

b) Welded Joint

c) Thermal Fusion Joint

d) Screw-on Coupler

e) Split Coupler

f) Threaded Joint

410.07.12.06 Polyvinyl Chloride Pipe

Polyvinyl chloride pipe shall be jointed, as recommended by the manufacturer, using a bell and spigot joint with an elastomeric gasket.

At the end of a day's work, the last pipe shall be blocked as may be required to prevent movement.

410.07.12.07 Polypropylene Pipe

Polypropylene pipe shall be jointed by means of a bell and spigot joint with elastomeric gasket or a coupler joint as recommended by the manufacturer to satisfy the pipe joint specification.

410.07.13 Service Connections

Service connections to the main pipe sewer shall be made using factory made tees or wyes, strap-on-saddles, or other approved saddles. Factory made tees or wyes shall be used for all service connections when the diameter of the main pipe sewer is:

a) less than 450 mm; or

b) less than twice the diameter of the service connection.

Strap-on-saddles shall be installed before laying the pipe.

Holes in the main pipe sewer shall be cut with approved cutters and shall be the minimum diameter required to accept the service connection saddle. If mortar-on saddles are used, the inside of the pipe shall be mortared at the connection.

Service connections shall be plugged at the property line with watertight caps or plugs. Plugs or caps shall be braced sufficiently to withstand test pressures.

When existing service connections shall be connected to new pipe sewers or service connections, proper jointing procedures shall be used.

410.07.14 Marking and Recording Service Connections

A painted temporary location marker consisting of a 50 x 75 mm stake or two short sections of lumber connected by a piece of heavy gauge wire shall be placed at the end of the plugged or capped service connection. The marker shall be placed from 300 mm below the finished grade to a point 300 mm above the plugged end of the service pipe.

A painted surface stake, 50 x 75 x 450 mm long, shall be placed after trench restoration.

Service connections shall not be backfilled until they have been inspected and measurements of location have been taken by the Contract Administrator.

410.07.15 Breaking into Maintenance Holes, Catch Basins, Ditch Inlets, Pipe Culverts, and Pipe Sewers

Openings shall be made as necessary in an existing maintenance hole, catch basin, ditch inlet, pipe culvert, or pipe sewer to install the new pipe sewer and connect it to the structure according to OPSS 407. Benching in existing maintenance holes shall be altered to accommodate the flow in the new pipe sewer system.

When specified in the Contract Documents, the opening for the connection of a subdrain outlet shall be formed by coring. The subdrain outlet pipe shall be sealed into place using non-shrink grout. When specified in the Contract Documents, a 50 mm diameter weep hole shall be cored into the same wall as the subdrain connection and at the same invert elevation.

410.07.16 Field Testing

410.07.16.01 General

Field tests described in this subsection shall be conducted when specified in the Contract Documents and applied to sanitary and storm pipe sewers. All tests shall be carried out in the presence of and accepted by the Contract Administrator.

When specified in the Contract Documents, leakage tests shall be carried out on completed pipe sewers 1,200 mm in diameter and smaller. There shall be no visible leakage for pipe sewers larger than 1,200 mm diameter.

Testing shall be carried out from maintenance hole to maintenance hole, including house service connections as work progresses.

The construction of new mainline pipe sewers shall not proceed when three previously placed sections of the pipe sewer have not been tested or have been tested and are unsatisfactory.

Leakage up to 25% in excess of the calculated limits shall be approved in any test section provided that the excess is offset by lower leakage measurements in adjacent sections so that the total leakage is within the allowable limits for the combined sections.

Pipe sewers shall be repaired and retested, as required, until the test results are within the limits specified in this specification. Visible leaks shall be repaired regardless of the test results.

No part of the work shall be accepted until the pipe sewers are satisfactorily tested following completion of installation of service connections and backfilling.

410.07.16.02 Prequalification Leakage Tests

Prequalification leakage tests shall be carried out as either infiltration or exfiltration tests, as required.

The test shall be performed on the first section of the pipe sewer of each size, not less than 100 m in length, installed by each crew in order to prequalify the crew and the material. Tests may be carried out prior to service connections being installed in the section being tested.

When tests are unsatisfactory, the test section shall be repaired and retested until satisfactory results are obtained.

410.07.16.03 Infiltration Test

Dewatering operations shall be discontinued at least three days prior to conducting the test and allow for the groundwater level to stabilize. Infiltration tests shall be conducted when the groundwater level at the time of testing is 600 mm or more above the crown of the pipe for the entire length of the test section. The test section is normally between adjacent maintenance holes.

A watertight bulkhead shall be constructed at the upstream end of the test section. All service laterals, stubs, and fittings shall be plugged or capped to prevent water entering at these locations. 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. The rate of flow shall then be measured. The rate of flow shall not exceed the maximum allowable infiltration calculated for the test section. Allowable infiltration shall be calculated as 0.075 litres/millimetre diameter/100 metres of pipe sewer/hour.

410.07.16.04 Exfiltration Test

410.07.16.04.01 General

Exfiltration tests shall be conducted when the groundwater level is lower than 600 mm above the crown of the pipe or the highest point of the highest service connection included in the test section.

The test section is normally between adjacent maintenance holes. The test section of the pipe sewer shall be isolated by temporarily plugging the downstream end and all incoming pipes of the upstream maintenance hole. All service laterals, stubs, and fittings are plugged or capped to prevent water entering at these locations.

410.07.16.04.02 Testing With Water

The test section shall be slowly filled with water ensuring that all air is removed from the line. A period of 24 hours for absorption or expansion shall be allowed prior to starting the test, except if exfiltration requirements are met by a test carried out during the absorption period.

Water shall be added to the pipeline prior to testing until there is a head in the upstream maintenance hole of 600 mm minimum over the crown of the pipe or at least 600 mm above the existing groundwater level, whichever is greater. The maximum limit of the net internal head on the line is 8 m. In calculating the net internal head, allowance for groundwater head, if any, shall be made.

The distance from the maintenance hole frame to the surface of the water shall be measured. After allowing the water to stand for one hour, the distance from the frame to the surface of the water shall again be measured. The leakage shall be calculated using volumes.

The leakage at the end of the test period shall not exceed the maximum allowable calculated for the test section. Allowable leakage shall be calculated as 0.075 litres/millimetre diameter/100 metres of pipe sewer/hour.

An allowance of 3.0 litres per hour per metre of head above the invert for each maintenance hole included in the test section shall be made.

Maintenance holes shall be tested separately, if the test section fails.

410.07.16.04.03 Low Pressure Air Testing

The Contract Administrator may allow or require testing by use of air when water is not readily available or the differential head in the test section is greater than 8 m or freezing temperatures exist.

Air control equipment that includes a shut off valve, safety valve, pressure regulating valve, pressure reduction valve and monitoring pressure gauge with pressure range from 0 to 35 kPa with minimum divisions of 0.5 kPa and accuracy of approximately 0.25 kPa shall be provided.

Tests shall be conducted between two consecutive maintenance holes. The test section shall be plugged at each end. One plug shall be equipped with an air inlet connection to fill the pipe sewer system with air.

The test section shall be filled slowly until a constant pressure of 24 kPa is maintained. If the groundwater is above the pipe sewer being tested, the air pressure shall be increased by 3.0 kPa for each 300 mm that the groundwater level is above the invert of the pipe.

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

The time taken for a pressure drop of 3.5 kPa shall not be less than the times shown in Table 1.

If the length of the test section is greater than the length for minimum time, the new testing time shall be a product of the length of test section multiplied by the time shown in Table 1 for the appropriate size pipe.

If the results of an air test are marginal, the Contract Administrator may require the section to be retested using water.

410.07.16.05 Deflection Testing of Pipe Sewers

Ring deflection testing shall be performed on all pipe sewers constructed using flexible pipe. The allowable deflected pipe diameter is calculated as:

Pipes 100 to 750 mm:	7.5% of the Base Inside Diameter of the Pipe
Pipes Greater Than 750 mm:	5.0% of the Base Inside Diameter of the Pipe

Where:

Base Inside Diameter is defined in the CSA or ASTM standard to which the pipe is manufactured.

A suitably designed device as defined below shall be pulled through the pipe sewer to demonstrate that the pipe deflection does not exceed the allowable deflected pipe diameter. The device shall be pulled manually through the pipe not sooner than 30 Days after the completion of backfilling and installation of service connections.

The suitably designed device shall be a mandrel, 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 $\pm$ 1 mm. 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 $\pm$ 0.1 mm. An acceptable mandrel shall not pass through the proving ring. The proving ring shall be fabricated from steel a minimum of 6 mm thick.

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.

410.07.16.06 Closed-Circuit Television (CCTV) Inspection

Pipe sewers shall be inspected using CCTV equipment. CCTV inspection of pipe sewers shall be according to OPSS 409.

410.07.17 Cleaning and Flushing of Pipe Sewers

When specified in the Contract Documents, all pipe sewers shall be cleaned and flushed immediately prior to inspection and acceptance.

410.07.18 Clay Seals

Clay seals shall be placed as specified in the Contract Documents and compacted to 95% of the maximum dry density.

410.07.19 Concrete Appurtenances

Concrete appurtenances shall be constructed as specified in the Contract Documents. Concrete in concrete appurtenances shall be placed according to OPSS 904. Steel reinforcement shall be placed according to OPSS 905. Steel grating shall be installed when specified in the Contract Documents.

410.07.20 Site Restoration

Site restoration shall be according to OPSS 492.

410.07.21 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

410.09 MEASUREMENT FOR PAYMENT

410.09.01 Actual Measurement

410.09.01.01 Pipe Sewers

Measurement of pipe sewers shall be by length in metres along the horizontal centreline length of the pipe from the centre of one drainage structure to the centre of another drainage structure or outlet end of the pipe sewer. When the grade of the pipe sewer is 10% or greater, the above measurement is then of the slope length.

410.09.01.02 Service Connections

Measurement of the service connections shall be by length in metres along its horizontal centreline from the centreline of the main pipe sewer to the end of the service connection.

410.09.01.03 Breaking into Maintenance Holes, Catch Basins, Ditch Inlets, Pipe Culverts, and Pipe Sewers

For measurement purposes, a count shall be made of the number of openings made in maintenance holes, catch basins, ditch inlets, pipe culverts and pipe sewers.

410.09.01.04 Concrete Appurtenances

Measurement for concrete appurtenances shall be by volume in cubic metres for the volume of concrete placed. Alternatively, concrete appurtenances may be a lump sum item.

410.09.01.05 Clay Seal

Measurement for clay seal shall be by volume in cubic metres for the volume of clay placed. Alternatively, clay seal may be a lump sum item.

410.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

410.10 BASIS OF PAYMENT

410.10.01 ***"size, type, class"*** **Pipe Sewers - Item**
Service Connections - Item
Breaking into Maintenance Holes, Catch Basins, Ditch Inlets, Culverts and Sewers - Item
Concrete Appurtenances - Item
Clay Seal - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

410.10.02 Closed-Circuit Television (CCTV) Inspection

When a CCTV inspection of pipe sewers is specified in the Contract Documents, payment for CCTV inspection shall be according to OPSS 409.

TABLE 1
Exfiltration Test - Low Pressure Air Testing

NominalPipe Size mm	MinimumTime min:sec	Length for Minimum Time m	Time For Longer Length sec
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	35.040
825	15:35	22	42.397
900	17:00	20	50.450

TABLE 2
Deflection Testing of Pipe Sewers

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

Appendix 410-A, November 2018
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Pipe sewer size, type, and class. (410.05.01.01)

- Pipe size. (410.05.01.01)

- Size and grade of steel reinforcement. (410.05.05)

- Alignment and grade tolerances for the pipe installation. (410.07.12.01)

- Placement of clay seals. (410.07.18)

- Requirements to construct concrete appurtenances. (410.07.19)

- Depth of backfill over the pipe sewer. (410.07.20)

The designer should determine if the following are required and, if so, add the requirement in the Contract Documents:

- Use of nitrile gaskets. (410.07.12.01)

- Use of joint seals with corrugated steel pipe products. (410.07.12.04)

- Coring for the installation of subdrain. (410.07.15)

- Coring of a 50 mm diameter weep hole. (410.07.15)

- Field tests. (410.07.16.01)

- Cleaning and flushing prior to inspection and acceptance. (410.07.17)

- Use of steel grating. (410.07.19)

- Payment of concrete appurtenances by volume or lump sum. (410.09.01.04)

The tender item description for pipe sewer should include reference to one or more of the attributes shown, i.e., *size, type, class*. (410.10.01)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Appendix 410-A

Related Ontario Provincial Standard Drawings

OPSD 708.010	Catch Basin Connection for Rigid Main Pipe Sewer
OPSD 708.020	Support for Pipe at Catch Basin or Maintenance Hole
OPSD 708.030	Catch Basin Connection for Flexible Main Pipe Sewer
OPSD 802.010	Flexible Pipe Embedment and Backfill Earth Excavation
OPSD 802.013	Flexible Pipe Embedment and Backfill Rock Excavation
OPSD 802.014	Flexible Pipe Embedment in Embankment Original Ground: Earth or Rock
OPSD 802.020	Flexible Pipe Arch Embedment and Backfill Earth Excavation
OPSD 802.023	Flexible Pipe Arch Embedment and Backfill Rock Excavation
OPSD 802.024	Flexible Pipe Arch Embedment in Embankment Original Ground: Earth or Rock
OPSD 802.030	Rigid Pipe Bedding, Cover, and Backfill, Type 1 or 2 Soil - Earth Excavation
OPSD 802.031	Rigid Pipe Bedding, Cover, and Backfill, Type 3 Soil - Earth Excavation
OPSD 802.032	Rigid Pipe Bedding, Cover, and Backfill, Type 4 Soil - Earth Excavation
OPSD 802.033	Rigid Pipe Bedding, Cover, and Backfill, Rock Excavation
OPSD 802.034	Rigid Pipe Bedding and Cover in Embankment, Original Ground: Earth or Rock
OPSD 802.050	Horizontal Elliptical Rigid Pipe Bedding, Cover, and Backfill, Type 1 or 2 Soil - Earth Excavation
OPSD 802.051	Horizontal Elliptical Rigid Pipe Bedding, Cover, and Backfill, Type 3 Soil - Earth Excavation
OPSD 802.052	Horizontal Elliptical Rigid Pipe Bedding, Cover, and Backfill, Type 4 Soil - Earth Excavation
OPSD 802.053	Horizontal Elliptical Rigid Pipe Bedding, Cover, and Backfill, Rock Excavation
OPSD 802.054	Horizontal Elliptical Rigid Pipe Bedding and Cover in Embankment, Original Ground: Earth or Rock
OPSD 802.095	Clay Seal for Pipe Trenches
OPSD 804.030	Concrete Headwall for Pipe Less Than 900 mm Diameter
OPSD 804.040	Concrete Headwall for Sewer or Culvert Pipe
OPSD 804.050	Grating for Concrete Endwall
OPSD 805.010	Height of Fill Table, Round Corrugated Steel Pipe and Structural Plate Corrugated Steel Pipe
OPSD 805.020	Height of Fill Table, Corrugated Steel Pipe Arch and Structural Plate Corrugated Steel Pipe Arch
OPSD 805.030	Height of Fill Table, Spiral Rib Round Pipe
OPSD 805.040	Height of Fill Table, Spiral Rib Pipe Arch
OPSD 806.020	Height of Fill Table, Dual Wall Corrugated Polyethylene Gravity Sewer Pipe, 210 and 320 kPa
OPSD 806.021	Height of Fill Table, Closed Profile Wall Polyethylene Pipe, RSC 160 and 250
OPSD 806.022	Height of Fill Table, Dual Wall Corrugated Polyethylene Gravity Sewer Pipe, RSC 100 and RSC 160
OPSD 806.030	Height of Fill Table, Dual and Triple Wall Corrugated Polypropylene Gravity Sewer Pipe, 320 kPa
OPSD 806.040	Height of Fill Table, Polyvinyl Chloride Gravity Sewer Pipe, 210, 320, and 625 kPa
OPSD 806.060	Height of Fill Table, Polyvinyl Chloride Pressure Pipe for Different Dimension Ratios
OPSD 807.010	Height of Fill Table, Reinforced Concrete Pipe - Confined Trench Class 50-D, 65-D, 100-D, and 140-D
OPSD 807.030	Height of Fill Table, Reinforced Concrete Pipe - Embankment Class 50-D, 65-D, 100-D, and 140-D
OPSD 807.040	Height of Fill Table - Nonreinforced Concrete Pipe Class 3
OPSD 807.050	Height of Fill Table, Horizontal Elliptical Concrete Pipe Class HE-A, HE-I, HE-II, HE-III, and HE-IV
OPSD 1006.010	Sewer Service Connections for Rigid Main Pipe Sewer
OPSD 1006.020	Sewer Service Connections for Flexible Main Pipe Sewer