

**Construction Specification for
Pipes in Green Infrastructure**

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TS 856.01 SCOPE

This specification covers the requirements for the installation of perforated pipes and pipes in green infrastructure systems.

TS 856.02 REFERENCES

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

City of Toronto Standard Specifications

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|---------|--|
| TS 405 | Amendment to OPSS.MUNI – Construction Specification for Pipe Subdrains |
| TS 409 | Construction Specification for Closed-Circuit Television Inspection of Pipelines |
| TS 1010 | Amendment to OPSS 1010.MUNI – Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material |

Ontario Provincial Standard Specifications

| | |
|----------------|--|
| OPSS.MUNI 405 | Construction Specification for Pipe Subdrains |
| OPSS.MUNI 421 | Construction Specification for Pipe Culvert Installation in Open Cut |
| OPSS.MUNI 1840 | Material Specification for Non-Pressure Polyethylene Plastic Pipe Products |
| OPSS.MUNI 1841 | Material Specification for Non-Pressure Polyvinyl Chloride (PVC) Pipe Products |
| OPSS.MUNI 1860 | Material Specification for Geotextiles |

TS 856.03 DEFINITIONS

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

Backfilling means the operation of filling the trench with embedment and backfill material. **Backfill Material** means the material used to fill the trench above the embedment material and below the lower of the subgrade or finished grade or the original ground.

Bedding means the embedment material placed in the subdrain and outlet pipe trenches below the pipe.

CCTV means closed-circuit television.

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

Embedment Material means the material used to fill the trench from the bottom of bedding to the height specified in the Contract Documents.

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

Knitted Sock Geotextile means a textile structure produced by knitting in a continuous tube specifically intended to cover perforated subdrain. Knitted geotextiles are suitable only for wrapping of perforated subdrain pipe.

Outlet means the terminal 2.5 m of the outlet pipe.

Outlet Pipe means a non-perforated 200 mm diameter pipe that is placed for the purpose of conveying subsurface water from a subdrain to a proper outlet.

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.

Underdrain means a perforated 200 mm diameter pipe that is placed for the purpose of collecting subsurface water and conveying it to a proper outlet pipe. Also referred to as subdrain.

TS 856.04 DESIGN AND SUBMISSION REQUIREMENTS

TS 856.04.01 General

Any required submissions shall be submitted in digital form to the Contract Administrator at least three weeks prior to beginning of the work.

TS 856.04.02 Materials

Submit product data sheets, sieve analyses, and manufacturer's data for any pipes, perforated pipes, pipe fittings and appurtenances, granular or washed stone pipe surround, geotextile or filter sock material, bedding and backfill material.

TS 856.05 MATERIALS

TS 856.05.01 General

Underdrains in green infrastructure systems shall be perforated polyvinyl chloride pipe or high-density polyethylene pipe (HDPE). HDPE shall be according to OPSS.MUNI 1840.

Outlet pipe shall be non-perforated polyvinyl chloride pipe or high-density polyethylene pipe.

Pipe size shall be suitable to allow for CCTV inspection and jet vacuum cleaning, 200mm minimum.

Pipe fittings for cleanouts shall be 45 degrees maximum to allow for cleaning.

TS 856.05.02 Polyethylene Pipes and Fittings

Polyethylene pipe products shall be according to TS 405.05.03. Fittings shall be suitable for and compatible with the class and type of pipe with which they will be used. Caps shall be polyethylene.

TS 856.05.03 Polyvinyl Chloride Pipes

Polyvinyl chloride pipes shall be according to OPSS.MUNI 1841 and as specified in the Contract Documents. Fittings shall be suitable for and compatible with the class and type of pipe with which they will be used.

All polyvinyl chloride pipes for use in green infrastructure shall be DR 35.

TS 856.05.04 Geotextiles

Geotextiles shall be according to OPSS.MUNI 1860 and as specified in the Contract Documents.

TS 856.05.05 Granular

Granular material shall be according to TS 1010 or as specified in the Contract Documents.

TS 856.06 Construction

TS 856.06.01 General

Contractor inspection reports, pipe replacements, and pipe stability shall be according to the General clause in OPSS.MUNI 405.

TS 856.06.02 Excavation

Excavation shall be according to the Excavation clause in OPSS.MUNI 405.

TS 856.06.03 Unstable Foundations

Unstable foundations shall be according to the Unstable Foundations clause in OPSS.MUNI 405.

TS 856.06.04 Knitted Sock Geotextile

Knitted sock geotextile shall be according to the Geotextile clause in OPSS.MUNI 405.

TS 856.06.05 Bedding

Bedding shall be according to the Bedding clause in OPSS.MUNI 405.

TS 856.06.06 Laying Underdrain and Outlet Pipe

Pipe installation shall be according to OPSS.MUNI 421 and as specified below.

Pipe shall be placed firmly on the bedding and secured in place to prevent any movement or disturbance during backfilling. Pipe shall be smooth-walled HDPE or PVC with minimum ring stiffness of 320kPa. Underdrain pipe with perforations on only one side shall be installed with perforations down. Underdrain pipe with perforations around the pipe circumference shall include membrane strips taped to cover all top-side perforations. Pipe shall not be laid in water or on saturated or frozen bedding. Pipe shall not be used as a drain for Contractor's operation.

Connections between the underdrain and the outlet pipe shall be via a structure such as an overflow catch basin structure, or made with prefabricated 22.5, 30 or 45-degree elbows or curves as required. Underdrain pipe shall cease to be perforated for a distance of 300 to 1000 mm in advance of the connection with structure or outlet pipe. The non-perforated outlet pipe shall extend 300 mm into the green infrastructure system to reduce potential for soil migration. The geotextile wrap shall extend along the outlet pipe system for 600 mm.

Outlet pipe shall be installed at low lying areas, at the end of an underdrain, at the end of the green infrastructure system, and at a minimum uniform spacing of 100 m along the length of the green infrastructure system, unless otherwise noted on the Contract Drawings. Outlet pipe shall connect the system underdrain or overflow structure to the municipal storm sewer network. Outlets connected directly to underdrain shall have an accessible cleanout at the junction.

Underdrain and outlet pipe installation shall be inspected and approved by the Contract Administrator prior to backfilling.

TS 856.06.06.01 *Connections to Drainage Structures*

Connections to drainage structures shall be according to the Connection to Drainage Structures clause in OPSS.MUNI 405.

TS 856.06.07 *Embedment and Backfill Material*

Embedment and backfill material shall be according to the Embedment and Backfill Material clause in OPSS.MUNI 405.

TS 856.07 *Quality Assurance*

The Contractor shall demonstrate that the underdrain is on grade and unobstructed for its length after backfilling. The Contractor shall demonstrate that the outlet pipes are installed at the true low-points and are on grade and unobstructed for their length after backfilling.

At the end of all planned civil, landscaping and surface reinstatement works, prior to Substantial Completion, the Contractor shall provide CCTV inspection of all underdrain and outlet pipes including any connection structures. CCTV inspection and reporting shall be undertaken to NASSCO quality standards. The report shall be submitted to the City and shall demonstrate that all inspected pipe is in excellent condition – Grade 0 according to NASSCO rating criteria. If the CCTV inspection report identifies that any pipe installed by the Contractor is in a condition inferior to excellent – Grade 0 according to NASSCO rating criteria, the Contractor shall perform all necessary remedial measures to achieve an excellent rating in a subsequent inspection to be performed at the sole expense of the Contractor. The Contractor shall submit to the City one digital record copy of the investigation demonstrating satisfactory condition.

CCTV inspection shall be according to TS 409.

TS 856.07.01 Acceptance Criteria

Acceptance of the underdrain and outlet pipes shall be installation according to the requirements of the Contract Documents and no damage or defects are present, as approved by the Contract Administrator and upon submittal of the CCTV inspection digital footage. Any damaged or defected or incorrectly placed pipes shall be removed and replaced at no extra cost to the City.

TS 856.08 MEASUREMENT FOR PAYMENT

TS 856.08.01 Underdrain and Outlets

Measurement of underdrain shall be by the length in metres horizontally along the centerline of the pipe between the ends, including any outlets and overflow structures.

TS 856.09 BASIS OF PAYMENT

TS 856.09.01 Underdrain and Outlets – Item

Payment at the Contract Price for the above tender item shall be full compensation for all labour, Equipment and Material to do the work. Payment shall include all excavation, the supply, placing, levelling and compacting of all granular, the supply and placement of clean washed stone and geotextile surround, and the supply and placement of the pipe.

When excavation and backfilling of underdrain and outlet pipe overlaps the excavation and backfilling required for other work, payment for overlapping excavation and backfilling shall be made in accordance with the specifications for such other work as though no excavation and backfilling were required for pipe underdrain.