

**Construction Specification for
Monitoring Wells**

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TS 858.01 SCOPE

This specification covers the requirements for the installation of monitoring wells.

TS 858.02 REFERENCES

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

City of Toronto Standard Specifications

TS 2.10	Construction Specification for General Excavation
TS 401	Amendment to OPSS.MUNI 410 – Construction Specification for Trenching, Backfilling, and Compacting
TS 1350	Amendment to OPSS.MUNI 1350 – Material Specification for Concrete – Materials and Production

City of Toronto Standard Drawings

T-850.041	Monitoring Well
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Ontario Provincial Standard Specifications

OPSS.MUNI 180	Management of Excess Materials
OPSS.MUNI 402	Excavating, Backfilling, and Compacting for Maintenance Holes, Catch
OPSS.MUNI 1004	Aggregates - Miscellaneous
OPSS.MUNI 1205	Clay Seal
OPSS.MUNI 1440	Material Specification for Steel Reinforcement for Concrete
OPSS.MUNI 1841	Non-Pressure Polyvinyl Chloride Pipe Products

American Society for Testing and Materials

A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
C33	Standard Specification for Concrete Aggregates
D1784	Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D1785	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
F480	Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80

TS 858.03 DEFINITIONS

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

Monitoring Well means the vertical pipe that extends through the depth of a green infrastructure system and allows for the observation and monitoring of the water level stored in the subsurface.

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.

Undisturbed Earth means the native fill that has not been excavated or compacted or impacted by construction activities.

OBS means observation and is used as an identifier for the asset. This unique number can be used for green infrastructure assets to facilitate asset management.

TS 858.04 DESIGN AND SUBMISSION REQUIREMENTS

TS 858.04.01 Manufacturers Materials

Provide manufacturer's certification of ductile iron cover having met traffic loading requirements. Provide manufacturer's catalog product data, installation instructions and material safety data sheets for the safe handling of the specified materials and products.

TS 858.05 MATERIALS

TS 858.05.01 Monitoring Well

The monitoring well pipe shall be non-rigid non-pressure polyvinyl chloride (PVC) DR35, minimum 100 mm diameter, according to OPSS.MUNI 1841. Lower section to be slotted PVC well screen manufactured to ASTM D1784 and D1785 pipes and ASTM F480 and NTP threads. Slot spacing to be minimum 3 mm. The bottom 100 mm of the well to be non-perforated, non-rigid, non-pressure polyvinyl chloride (PVC) DR35.

TS 858.05.02 Backfill

Backfill material around the well shall suit the surrounding green infrastructure system backfill and shall be according to OPSS.MUNI 402.

TS 858.05.03 Bentonite Clay Seal

Clay seal material shall be according to OPSS.MUNI 1205.

TS 858.05.04 19 mm Type II Clear Stone

Clear stone shall be 19 mm Type II, according to OPSS.MUNI 1004 and meet the following physical properties.

Table 1: Clear stone – 19 mm Type II

Laboratory test	MTO test number	Clear Stone 19 mm Type II
loss by washing, pass 75µm sieve, % maximum	LS-601	2.0
percent crushed particles, % minimum	LS-607	60
micro-deval abrasion Loss, % maximum	LS-618	25

Clear stone shall be 19 mm Type II, according to OPSS.MUNI 1004 and meet the following gradation requirements.

Table 2: Clear stone – 19 mm Type II

Sieve sizes	Percent Passing (%)
63 mm	-
53 mm	-
26.5 mm	100
19.0 mm	90-100
16.0 mm	65-90
13.2 mm	-
9.5 mm	20-55
6.7 mm	-
4.75 mm	0-10
75 µm	0-2.0

TS 858.05.05 Pea Gravel

Choking course to be pea gravel according to ASTM C33 or approved equivalent.

TS 858.05.06 Geomembrane Liner

Geomembrane liner as specified in the Contract Documents to fulfill project specific water containment requirements, material workability, flexibility and resilience.

TS 858.05.07 Bottom Cap

PVC bottom plug shall be PVC DR35 with flush-joint coupling or approved equivalent.

TS 858.05.08 Rebar

Rebar shall be 15M according to OPSS.MUNI 1440.

TS 858.05.09 Cap and Cap Cover

Monitoring wells shall be capped with a removable PVC cap. In in-ground paved conditions the PVC cap shall be protected by a H-20 load rated cast iron bolted monitoring well cover with gray iron frame. Cover shall be stamped with "OBS" and a unique identifier provided by City. In above-ground unpaved conditions, the PVC cap shall be protected by a steel well protector cover and lockable cap. Cover shall be stamped with "OBS" and a unique identifier provided by City.

TS 858.06 EQUIPMENT

Monitoring wells shall be installed using the equipment required for the installation of the green infrastructure system.

TS 858.07 CONSTRUCTION

TS 858.07.01 Excavation

Prior to any excavation, the Contractor shall have all utilities located and clearly marked, including an areaway locate to mark all underground walkways, rooms, coal chutes and so on.

The excavation shall be to the lines and grades shown on the Contract Drawings for the green infrastructure system. Excavation to allow the well and surround to extend into the native material a minimum of 150 mm. All surplus or unsuitable material is to be disposed of, off the site, according to OPSS.MUNI 180.

Care shall be taken to avoid compacting the bottom of the bed during excavation of the area necessary for monitoring well installation.

The Contractor shall be required to make good all damage caused during the course of the construction to any part of the roadway, boulevard and private property and to restore the same, to as good or better condition as existed prior to commencement of work.

TS 858.07.02 Well Installation

Monitoring wells shall be installed prior to placement of aggregates / backfill in the green infrastructure system excavation. The monitoring well shall be located within the green infrastructure system as specified on the Contract Drawings. The monitoring well shall be placed in the excavated area and extend 150 mm into native earth beyond the base of the green infrastructure system for an unlined installation. For a lined installation, the well shall extend to the base of the green infrastructure system.

TS 858.07.02.01 Concrete Collar

Install a poured in place concrete collar around monitoring wells in unpaved conditions 150 mm in depth complete with welded wire mesh. Concrete shall be 32 MPa according to TS 1350. Welded smooth steel wire fabric shall be according to ASTM A185 and vertical steel rebar shall be 15M. Configuration shall be according to T-850.041.

TS 858.07.02.02 Base Rebar

Install a 400 mm long 15M rebar through the centre of the monitoring well base, as shown on T-850.041.

TS 858.07.02.03 19mm Clear Stone

Clear stone shall be placed in the monitoring well excavation area up to the top of the slotted section. Depth varies based on depth of green infrastructure system.

TS 858.07.02.04 Pea Gravel or Choker Layer

Pea gravel or equivalent choker layer is required for a monitoring well in an unlined installation. Pea gravel shall be installed above the 19 mm clear stone layer to a minimum depth of 150 mm.

TS 858.07.02.05 *Backfill*

Backfill above the pea gravel layer shall be placed according to the surrounding green infrastructures system.

TS 858.07.02.06 *Geomembrane Liner*

Geomembrane liner may be required based on green infrastructure system design. If monitoring well is installed in a membrane lined system, the bottom of the well shall not extend beyond the geomembrane liner. The geomembrane liner shall wrap around the clear stone layer and shall extend a minimum of 150 mm above the slotted section of the well. For liner details, see T-850.041. At the well penetration, the liner shall be placed around the solid well section for a minimum of 150 mm.

TS 858.07.03 *Cap and Cover*

Contractor shall place the well cap and cover and ensure it is secured in concrete collar or within paved surface restoration. Contractor to ensure that the cap and cover are flush with paved conditions and extend minimum 75 mm above the grade in unpaved conditions. Contractor to ensure cap and cover are secured, locked and appropriately rated for traffic conditions, if applicable. Where locks are provided, Contractor shall submit to the City two copies of lock keys with unique identification matching that of the lock.

TS 858.08 *QUALITY ASSURANCE*

The Contractor shall demonstrate that the monitoring well is installed in the correct location and is unobstructed for its depth after backfilling. The Contractor shall demonstrate that the cap and cover and concrete collar are installed appropriately based on the paved / unpaved condition.

TS 858.08.01 *Acceptance Criteria*

Acceptance of the monitoring well shall be installation according to the requirements of the Contract Documents and no damage or defects are present, as approved by the Contract Administrator. Any damaged or defected or incorrectly monitoring wells shall be removed and replaced at no extra cost to the City.

TS 858.09 *MEASUREMENT FOR PAYMENT*

TS 858.09.01 *Monitoring Well*

For measurement purposes, a count shall be made of the number of monitoring wells installed.

TS 858.10**BASIS OF PAYMENT****TS 858.10.01****Monitoring Well – 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, rebar, PVC pipe, backfill, geomembrane liner if specified, capping, bentonite clay seal and matching surface restoration conditions.