

Storm Sewers and Appurtenances

The purpose of this section is to outline the general design requirements for the design and construction of storm sewers and appurtenances to be assumed by the City. These requirements are general in nature and do not relieve the Developer of the responsibility for submitting a finished product of competent engineering design and construction. Any proposal to deviate from the minimum standards and requirements shall be discussed with, and approved by Engineering Services prior to making a formal submission.

This document shall be read in conjunction with the City of Pickering Development Services Design Standards, herein referred to as City Standards, as well as all applicable Ontario Provincial Standard Drawings (OPSD), Ontario Provincial Standard Specifications (OPSS) and Transportation of Canada (TAC) Specifications, Standards and Guidelines. Where conflicts occur, City Standards shall govern.

1.0 General Provisions

- 1.1 All stormwater management infrastructure (i.e. storm sewers, overland flow routes, stormwater management facilities, etc.), shall be designed in accordance with the City of Pickering's Stormwater Management Design Guidelines.
- 1.2 Storm sewer services must be provided and shown for all lands that are to be registered, and for adjacent future lands to be developed.
- 1.3 All sewers where external drainage areas are to be considered in the design are to be terminated at the subdivision limits. All sewers, which will not be extended in the future, must extend at least halfway across the frontage and/or flankage of any lot and/or block in the subdivision.

2.0 Sewer Design

- 2.1 All storm sewers shall be designed to capture the 5-year flow using the criteria and procedures in the City of Pickering Stormwater Management Design Guidelines.
- 2.2 Storm sizing calculations format must be as per the City of Pickering Storm Sewer Design Sheet (P-500) and submitted so that each sheet may be filed separately with the subdivision name in the right-hand corner of each sheet. Refer to City Standards P-500 Series for discharge flows and velocities for circular pipe design.
- 2.3 A minimum pipe diameter of 300 millimetres shall be provided for mainline sewers to be assumed by the City.

- 2.4 No decrease in pipe size downstream will be allowed regardless of increase in slope.
- 2.5 The first upstream leg of all storm sewers shall have a minimum slope of 1.0% unless future development(s) to the upstream side cannot accommodate the minimum grade.
- 2.6 100-Year Hydraulic Grade Line (HGL) calculations shall be performed as per the requirements of the City of Pickering Stormwater Management Design Guidelines. Adjustments to the 5-year design pipe slope and/or diameter shall be made, if necessary, in order to satisfy the criteria that all underside of basement slab elevations will be a minimum of 300 millimetres above the 100-year HGL.
- 2.7 All sewers shown within a road allowance are to be 3.0 metres apart, 1.5 metres on either side of the centre line of the road, unless otherwise approved by the Director, Engineering Services. Refer to the applicable City Standards P-700 Series.
- 2.8 Storm sewers are to be located to the south or west of the centre line of the road. Sanitary sewers and watermains are to be located to the north or east of the centre line of the road. Refer to the applicable City Standards P-700 Series.
- 2.9 A minimum cover of 1.8 metres from the future road elevation is required to the top outside edge of the pipe barrel for storm sewers.
- 2.10 Maximum depth of cover for concrete pipe will be in accordance with OPSD 807.010, 807.030 and 807.050. For PVC gravity sewer pipe, the maximum cover will be in accordance with OPSD 806.040. For HDPE gravity sewer pipe the maximum cover will be in accordance with OPSD 806.020 and 806.021.
- 2.11 The minimum clearances required when storm sewers cross other services will be measured from the outside wall to the outside wall of the pipe. Minimum clearances are as follows:

Location of Crossing	Minimum Clearance
over or under a storm sewer or roof drain collector	300mm
over a sanitary sewer	300mm
under a watermain 450mm diameter or less	300mm
over a watermain 450mm diameter or less	500mm
over or under a watermain greater than 450mm diameter	500mm

- 2.12 The minimum horizontal separation between a sewer and watermain is 2.5 metres. In cases where it is not practical to maintain separate trenches, or the recommended horizontal separation cannot be achieved, a deviation may be allowed, subject to approval from the Region of Durham and the City of Pickering.
- 2.13 A minimum clearance of 600 millimetres between the obvert of the sanitary sewer and the invert of the storm sewer must be provided if any sanitary service connections are required to cross under the storm sewer.
- 2.14 Dimension Ratio (DR) of PVC storm sewer pipes shall be 35.
- 2.15 Both rigid and flexible pipe are permitted in the construction of storm sewer systems, including municipal service connections and catchbasin leads. These materials include reinforced concrete (CONC), polyvinyl chloride (PVC) and high density polyethylene (HDPE). However, the bedding design must be compatible with the type of pipe material used. The following guidelines should be followed:

Diameter	Material
Less than or equal to 375mm	PVC or CONC
Equal or greater than 450mm	CONC

Rigid pipe is recommended in areas of high utility congestion when bedding may be undermined in the future. Ribbed pipe will not be allowed.

3.0 Maintenance Holes

- 3.1 All maintenance holes must be indicated with the actual shape on the plan. All non-standard maintenance hole details are to be shown in plan view and must be drawn at a scale of 1:50 in relation to the North arrow.
- 3.2 A detail must be shown for all maintenance holes when any of the following apply:
- 3.2.1. Benching differs from that shown on the Standard Drawings.
 - 3.2.2. Depth of maintenance hole requires additional reinforcing steel.
 - 3.2.3. Length or diameter (across base) of maintenance hole exceeds 2400 millimetres.
- 3.3 All maintenance hole chamber openings must be located on the upstream side of the maintenance hole.
- 3.4 Lockable maintenance hole covers shall be provided in park blocks and open space blocks.

- 3.5 The maximum change in direction of flow in maintenance holes, for storm sewer pipes 675 millimetres and over, shall be 45 degrees, unless approved by the Director, Engineering Services. For 675 millimetres and larger diameter pipes where the change in direction is greater than 45 degrees, additional maintenance holes will be required to reduce the angle. Any maximum change in direction greater than 45 degrees requires approval from the Director, Engineering Services.
- 3.6 The direction of flow in any maintenance hole will not be permitted at acute interior angles.
- 3.7 Suitable drops are to be provided across maintenance holes to compensate for the energy losses due to the change in flow velocity and to accommodate the difference in depth of flow in the upstream and downstream sewers. When the pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5 metres/second, the following allowances are to be made to compensate for hydraulic losses:

Alignment Change	Drop Required
straight run	grade of sewer or 30mm
15 – 45 degrees	30mm – MECP minimum 75mm preferred
45 – 90 degrees	60mm – MECP minimum 150mm preferred
junctions and transitions ¹	MECP calculations

1 For all junctions and transition maintenance holes and when the upstream flow velocity exceeds 1.5 metres/second, the drop required will need to be calculated using the MOE guidelines; "Hydraulic Calculations for Junction and Transition Maintenance Holes". Calculations for hydraulic losses are to be included in the design submission.

The engineer shall adhere to the following guidelines:

- 3.7.1 Endeavor to keep entrance and exit velocities equal. In order to reduce the amount of drop required, the engineer will try to restrict the change in velocity from one pipe to another in a maintenance hole to less than 0.6 metre/second.
- 3.7.2 No decrease in pipe diameter from a larger size upstream to a smaller size downstream will be allowed, regardless of an increase in grade.
- 3.7.3 When an increase in pipe size occurs at the downstream side of the storm maintenance hole, match obvert elevations of the incoming and outgoing pipes or have incoming pipe obverts higher than outgoing pipe obverts.

3.8 The benching in all maintenance holes must be greater than 225 millimetres in width at any point in the maintenance hole.

3.9 Maintenance holes shall have a maximum spacing as follows:

Pipe Size Diameter (in millimetres)	Maximum Spacing (in metres)
250 to 750	110.0
825 to 1200	120.0
Greater than 1200	150.0

3.10 Maintenance holes shall be provided at each change in size, alignment, slope and change in pipe material, at sewer junctions and at locations that will ensure that the maximum spacing between maintenance holes will not be exceeded.

4.0 Catchbasins

4.1 The maximum allowable spacing between a high point and a catchbasin, or between catchbasins is as follows:

Pavement Width (in metres)	Maximum Spacing (in metres)
8.0	90.0
8.5	90.0
9.75	80.0
11.0	75.0
13.5	70.0
15.25	60.0

Where the road grade exceeds 5.0%, the maximum spacing is to be reduced to 75% of the distances noted above.

4.2 At street intersections, catchbasins will be located immediately upstream of sidewalk or pedestrian crosswalks when road grade falls towards the intersection.

4.3 Catchbasins shall not be located within one metre of a driveway or walkway curb depression.

4.4 Catchbasins and their leads will be designed to capture the expected maximum flow.

4.5 Total Capture Inlets shall be designed with a Factor of Safety of 2 (i.e. assuming 50% blockage).

- 4.6 A double catchbasin is required where drainage is received from more than one direction such as a low point, except in the cases where back fall is required.
- 4.7 For a single catchbasin, the minimum catchbasin lead diameter will be 250 millimetres and the minimum grade will be 1.0%.
- 4.8 For doublecatch basins, the minimum catchbasin lead diameter will be 300 millimetres and the minimum grade will be 0.7%.
- 4.9 If two double catchbasins are required to be constructed as a “quad” catchbasin, they should be bolted together in a manner satisfactory to the City.
- 4.10 Fish Type Cover (OPSD 401.081) shall be used for road catch basins unless otherwise directed by the City.
- 4.11 A Beehive Catchbasin Frame and Cover (P-215) shall be used for a rear lot/yard catchbasin, except in high flow conditions when the Birdcage Grate (OPSD 400.120) shall be used. Justification for use of the Birdcage Grate is to be provided.
- 4.12 For a rear lot/yard catchbasin, the minimum catc basin lead diameter will be 250 millimetres with a minimum grade of 0.5% and the lead shall be concrete encased as per drawing P-408. Concrete encasement may be waived if the easement width is at least 3.0 metres. In 2.4 metre easements, the centre of the catch basin is to be located 0.6 metres from the property line. In 3.0 metre easements, the centre of the catchbasin is to be located 0.9 metres from the property line.
- 4.13 For a park/landscape area the minimum catchbasin lead diameter will be 250 millimetres and the minimum grade will be 0.7%.

5.0 Storm Service Connections

- 5.1 The minimum diameter and grade of a municipal storm service connection is 150 millimetres diameter at 2.0%.
- 5.2 House storm connections will not be permitted to connect directly into maintenance holes without approval from the Director, Engineering Services.

6.0 Orifice Tubes

- 6.1 Where orifice tubes are required to restrict flows from private property into the municipal storm sewer, pipe diameters smaller than the minimum may be accepted. Orifice tubes are to be located entirely on private property and the connection into the municipal storm sewer shall be designed similar to a typical storm service connection.

7.0 Major Overland Flow and Surface Ponding

- 7.1 Major system flow routes shall be sized to safely convey the flow from the Regulatory Event (the greater of the 100-year storm or Hurricane Hazel) and shall be designed in accordance with the criteria and procedures in the City of Pickering Stormwater Management Design Guidelines.
- 7.2 Major flows must be conveyed safely within the roadway or defined swales within the public right-of-way to a suitable outfall unless directed otherwise by the stormwater management strategy. If the overland flow cannot be accommodated within the right-of-way, a block or an easement will need to be conveyed to the City.
- 7.3 At least one traveled lane must remain clear during major storms on arterial roads for emergency access.
- 7.4 No surface ponding is allowed to accumulate on the catchbasin for a 1 in 5-year design storm.
- 7.5 Maximum water depth allowed on major overland flow routes is up to 300 millimetres over street catchbasins.
- 7.6 All storm outfalls that discharge into a ditch or watercourse must blend with the existing direction of flow. Storm outfalls are to be no greater than 90 degrees to a receiving ditch or watercourse.

8.0 Easements

8.1 The following storm sewer easements are required for underground infrastructure not located within the public road allowance:

Service, Size and Depth	Minimum Easement Width
rear lot catchbasin lead regardless of diameter and depth	3m (2.4m if encased in concrete)
single sewer less than 3.7m deep	3 – 4.5m*
two sewers in the same trench	7.5m
single sewer in excess of 3.7m deep	9m
combination of two sewers, less than 3.7m deep	9m
a combination of two sewers, in excess of 3.7m deep and no closer than 3m to easement limit	12m
major trunk sewer	20m**
three or more sewers, no closer than 3m to easement limits	add 3m for each additional sewer

*At the discretion of the Director, Engineering Services

**Note: sewer will be located off-centre in the easement to allow for future infrastructure