FACILITIES CIVIL ENGINEERING STANDARD – STORMWATER SYSTEMS

MX-FAE-STD-C004

Facilities Architecture & Engineering
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METROLINX

Facilities Civil Engineering Standard – Stormwater Systems

MX-FAE-STD-C004

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Preface

This is the first edition of the Facilities Civil Engineering Standard—Stormwater Systems (MX-FAE-STD-C004). The purpose of this standard is to provide minimum civil engineering requirements and design guidance to designers for Metrolinx-owned assets.

This standard is to be followed by Engineering and Design Consultants working on Metrolinx projects and internal Metrolinx staff.

The technical content within the Facilities Civil Engineering Standard—Stormwater Systems (MX-FAE-STD-C004) was developed by the Metrolinx Facilities, Architecture, and Engineering's Civil Engineering Team within the Asset Management and Maintenance Division, which includes specialized subject matter experts.

This Standard is available for external users to download via the Metrolinx public download site at https://www.metrolinx.com/en/metrolinx-technical-standards

Suggestions for revision or improvements can be sent to Metrolinx Facilities, Architecture, and Engineering (FAE) Civil Engineering Team, Attention: Senior Manager, FAE Civil Engineering, who will introduce the proposed changes to Metrolinx FAE Civil Engineering. The Senior Manager, FAE Civil Engineering, ultimately authorizes the changes. A description of the proposed change shall be included along with information on the background of the application and any other useful rationale or justification. Proposals for revisions or improvements shall include your name, company affiliation (if applicable), email address, and phone number.

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1. General

1.1 Purpose

1.1.1 This standard outlines the requirements for stormwater systems, which consist of a network of drains, pipes, and other infrastructure designed to manage stormwater runoff at Metrolinx stations and facilities.

1.2 Scope

1.2.1 This standard establishes the design criteria, including water balance, water quality, and water quantity controls, to ensure stormwater is managed effectively, protects downstream systems, reduces flooding risks, and meets regulatory requirements. Following this, the standard provides specific technical requirements for the design of stormwater components such as pipes, ditches, culverts, pump stations, and stormwater ponds, while integrating low-impact development (LID) features where applicable. Quality assurance procedures are also addressed to ensure all systems are properly tested, inspected, and certified before handover to Metrolinx.

1.2.2 Stormwater systems serve multiple purposes, including:

a) Capture and conveyance of precipitation that falls on or enters a site from upstream properties to a downstream drainage system or watercourse;

b) Treatment of site drainage for protection of downstream natural systems;

c) Control of excess water generated from the introduction of hard surfaces through temporary detention, to slow the release of stormwater to pre-development conditions; and

d) Protection of groundwater, baseflow, and water levels in wetlands or woodlots, through management of the total volume of site drainage.

1.2.3 Stormwater systems are regulated in Ontario and are subject to review by municipalities, conservation authorities, and provincial ministries - Authorities Having Jurisdiction (AHJs). There are various processes requiring new developments or modifications to existing systems to undergo review and approval, to ensure compliance with the technical requirements of the respective AHJ. Overarching regulations include the Ontario Water Resources Act, Conservation Authorities Act, Drainage Act, Lakes and Rivers Improvement Act or others. Proponents shall review approval requirements when the scope of the project is defined, and consult with all applicable AHJs.

1.2.4 Stormwater systems may potentially impact Aboriginal Treaty Rights and interests. Each project shall review consultation needs on a project-by-project basis and reach out to Indigenous groups as required to obtain feedback on stormwater system designs.

1.2.5 This standard applies to stormwater systems at Metrolinx stations and facilities, as well as to related infrastructures, including associated roads and grounds. The following items are excluded from this standard due to lack of applicability:

a) Drainage systems within a rail corridor, including bridges and structures that cross the corridor;

b) Systems within a Bus Rapid Transitways (BRT) or Light Rail Transit (LRT) corridors, outside of BRT and LRT stations;

c) Rail maintenance and storage facilities;

d) Mechanical systems located within buildings, tunnels and/or other structures on Metrolinx stations and facilities; and

e) Requirements for managing drainage and/or soil on construction sites (erosion and sediment controls).

1.2.6 Stormwater management requirements at stations and facilities align with the policies and principles of the Metrolinx Sustainable Design Standard (DS-05). This includes incorporating future climate change projections into all designs, and implementing low-impact measures and water quality and quantity controls.

1.2.7 This document shall be read in conjunction with the Metrolinx Facilities Civil Engineering and Building Envelope Standard – General (MX-FAE-STD-C001).

2. Definitions & Abbreviations

2.1 Definitions

2.1.1 The capitalized terms used in this standard shall have the meaning prescribed in Table 1.

Table 1: List of Definitions

Term	Definition
Backwater Prevention Device	A mechanical device installed in drainage systems to prevent surcharge into a building's foundation or storm sewer.
Catchbasin	A stormwater inlet that collects surface runoff and directs it into the storm sewer system.
Climate Change Factor	An adjustment applied to rainfall intensity data to account for projected increases due to climate change.
Culvert	A drainage structure that allows water to pass under a roadway, railroad, or embankment.
Ditch System	A channel designed to direct surface water away from structures and roads, often used alongside culverts.
Drop Structure	A vertical pipe or structure inside a maintenance hole that reduces water velocity to prevent erosion.
Hydrologic Modelling	The process of simulating rainfall-runoff relationships to estimate stormwater flow rates, volumes, and infiltration based on watershed characteristics.
Hydraulic Modelling	The process of simulating the movement of stormwater through conveyance systems, such as pipes, culverts, and channels, to assess flow capacity, velocities, and water levels.
Intensity-Duration-Frequency (IDF) Curve	A statistical representation of rainfall intensity over different durations and return periods.
Low Impact Development (LID)	A design approach that minimizes stormwater runoff by retaining and/or infiltrating stormwater onsite using natural systems.
Maintenance Hole (MH)	A structure providing underground access for inspection and maintenance of stormwater infrastructure.
Oil Grit Separator (OGS)	A stormwater treatment device that removes oils, sediments, and debris from runoff before discharge.

Term	Definition
Overland Flow Route	A designed pathway for excess stormwater to flow safely in extreme weather events.
Pump Station	A facility that moves stormwater from lower to higher elevations when gravity drainage is not possible.
Rational Method	A hydrological equation used to estimate peak runoff rates based on rainfall intensity and watershed characteristics.
Storm Sewer	An underground pipe that transports stormwater runoff to a designated outfall.
Stormwater Flow Control Structure	A structure that regulates the rate at which stormwater is released from storage facilities.
Stormwater Management Pond	A constructed basin that temporarily holds stormwater to control flow and improve water quality.
Subdrainage System	A network of underground pipes designed to remove excess groundwater and prevent surface saturation.
Trench Drain	A linear drainage feature used to capture and convey surface runoff in paved areas.
Water Balance	A calculation that ensures a site’s stormwater retention and infiltration match pre-development conditions.
Water Quality Control	Measures taken to remove pollutants from stormwater before discharge to protect natural water bodies.
Water Quantity Control	Infrastructure and design elements that regulate the volume of stormwater runoff to prevent flooding.

2.2 Abbreviations

2.2.1 The abbreviations used in this standard shall have the meaning prescribed in Table 2.

Table 2: List of Abbreviations

Abbreviation	Definition
AHJ	Authority Having Jurisdiction
CSA	Canadian Standards Association
IDF	Intensity-Duration-Frequency (Curve)
LID	Low Impact Development
MH	Maintenance Hole
MESP	Master Environmental Servicing Plan
OGS	Oil Grit Separator
OBC	Ontario Building Code
OPSD	Ontario Provincial Standard Drawings
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance / Quality Control
SWM	Stormwater Management
TSS	Total Suspended Solids

3. Stormwater Systems

3.1 Design Requirements

3.1.1 Design Responsibility

3.1.1.1 The design of stormwater systems shall be undertaken and sealed by a Professional Engineer licensed to practise in the Province of Ontario.

3.1.2 Water Balance

3.1.2.1 The goal of a site water balance is to replicate pre-development water retention and infiltration, control runoff volumes, and minimize the environmental impact of urbanization on nearby watercourses. The following outlines the water balance requirements for each site:

a) For project sites where detailed water balance assessments have been conducted and approved by the local AHJ through a Source Protection Plan, Master Stormwater Management Plan, Master Environmental Servicing Plan (MESP), site-specific water balance assessment or other similar approach, the site's water balance requirements shall adhere to the outcomes of those detailed assessments;

b) Where no detailed assessment is available or required by the AHJ, runoff from the 90th percentile storm event shall be controlled through infiltration and/or filtration processes, unless technical justification demonstrates that controlling this volume is not feasible. This justification shall be submitted to and approved by the Owner of this Standard;

c) Where controlling the 90th percentile storm event is shown to be unfeasible through a technical justification, a step-down approach shall be taken. This involves assessing the feasibility of controlling progressively lower percentiles, such as the 80th and 70th, until reaching the 50th percentile as the minimum preferred level of control. This justification shall be submitted to and approved by the Owner of this Standard; and

d) Where controlling the 50th percentile average annual rainfall depth is not feasible, the proposed water balance approach shall be submitted to the Owner of this Standard for approval.

3.1.2.2 Where average annual rainfall depth percentiles are unavailable for a given municipality, City of Toronto data, as published in the City of Toronto Wet Weather Flow Management Guidelines (as amended), may be used to determine equivalent percentile storm events.

3.1.2.3 Wetlands and headwater drainage features located adjacent to Metrolinx stations and facilities shall be identified during the development of site alternatives. Consultation with the local Conservation Authority, Municipality and/or Indigenous community may be required where stormwater systems are being modified, and have a potential impact on these systems that may trigger the need for a feature-based water balance study to be completed.

Feature-based water balance studies shall be approved by the Conservation Authority, Municipality and/or Indigenous community as required.

3.1.3 Water Quality

3.1.3.1 Water quality controls are implemented on-site to capture pollutants, such as oils and grit, that can degrade downstream natural systems. The minimum level of service for water quality is as follows:

a) For new station projects, stormwater systems shall be designed to achieve a minimum Total Suspended Solids (TSS) removal of 80% or greater for the Metrolinx site;

b) For retrofit projects involving the construction of new stormwater systems that are not connected to any existing systems at the station property, water quality measures shall achieve a minimum TSS removal of 80% or greater for the areas from Metrolinx properties draining to the new proposed system;

c) For retrofit projects where modifications are proposed to any existing stormwater system, water quality measures shall achieve a minimum TSS removal of 50% or greater for all areas of the Metrolinx property draining into the most downstream point of sewer that has been modified;

d) For retrofit projects where modifications are proposed to both the stormwater sewer and the surface of the station, water quality measures shall be implemented to achieve a minimum TSS removal of 50% or greater for all areas from Metrolinx properties draining through the most downstream point of the sewer that is modified, and low impact development shall be implemented within the surface construction zone, where feasible;

e) For any storm sewer modifications or upgrades, a minimum of 50% TSS removal is required for the drainage area upstream from Metrolinx properties of the most downstream storm sewer being modified or upgraded;

f) Where more than 75% of the Metrolinx site drainage system drains through the sewer being modified or upgraded, consideration for providing a minimum of 50% TSS removal at the site outlet is required;

g) Where there is potential for oil spills, the designer shall incorporate additional water quality measures to enable oil capture and provide the capability to temporarily shut off system outflows to facilitate cleanup in the event of a major spill;

h) Water quality treatment is not required for projects involving storm sewer lining or like-for-like replacements; and

i) Where feasible, a treatment train approach shall be used to enhance on-site water quality.

3.1.4 Water Quantity

3.1.4.1 Water quantity controls are integrated into site stormwater management design to mitigate the increased peak flows caused by the introduction of new impervious surfaces, ensuring they remain at manageable levels to prevent downstream flooding and erosion. At a minimum, the requirements for water quantity controls shall be as follows:

a) Projects draining directly into watercourses regulated under the Conservation Authorities Act shall comply with erosion and flood flow requirements set by the local conservation authority, where applicable;

b) Projects draining into storm sewers or other municipal systems shall comply with flood flow requirements of the AHJ, which may include the local municipality, private landowner, or conservation authority;

c) Unless a watershed or master drainage plan dictates that flood control is unnecessary, new sites shall implement controls to ensure post-development stormwater runoff, with climate change factors as per Section 3.2 below, matches pre-development levels for all storm events up to and including the 100-year storm;

d) Climate change factors shall be used to upsize infrastructure, and shall not be the sole driver of the need for the implementation of storage on a Metrolinx station and/or facility;

e) A downstream capacity assessment is required for all projects draining towards a Metrolinx-owned and/or operated sewer or ditch system, to identify potential downstream capacity issues associated with Metrolinx-owned infrastructure;

f) If downstream capacity issues are identified, an assessment of available options for the prevention of damages to Metrolinx infrastructure is required, which shall include the use of overcontrol within the station property in addition to improving capacity of downstream capacity bottlenecks as a potential mitigation option;

g) If options associated with work at the station property are the most cost-effective in addressing downstream capacity issues, they shall be incorporated as part of the water quantity scheme implemented at the station;

h) Connections to combined sewers are prohibited unless technical justification shows that no other alternative is available. This justification shall be submitted to and approved by the Owner of this Standard; and

i) All designs shall incorporate climate change factors for post-development flow calculations when assessing storage and conveyance requirements as per Section 3.2.

3.1.5 Capture and Conveyance Criteria

3.1.5.1 Stormwater management systems are designed to capture and convey stormwater to a suitable receiving system. The following outlines the minimum allowable requirements for the level of service associated with capture and conveyance systems:

a) The site's stormwater drainage system shall be designed to safely convey the 100-year storm event using a combination of the on-site storm sewer and overland flow system conveyance, ensuring surface ponding no greater than 0.15 m;

b) The conveyance system shall protect all infrastructure from flood damages and maintain customer access to the station and facilities without disruption during the 100-year storm event;

c) The storm sewer capture and conveyance system shall be designed to convey a minimum of the 5-year storm event, without ponding on the surface in customer-facing areas such as parking lots and walkways;

d) An emergency overland flow route shall be provided to limit ponding on the site to no greater than 0.3 m in the event of a full blockage in the storm sewer conveyance system;

e) The emergency overland flow system shall not be directed towards the rail corridor, and under no circumstances should it flow over the rail track, unless no feasible alternatives exist;

f) Ditch and swale systems, including associated culverts, shall be sized to convey a minimum of the 25-year storm event;

g) The following requirements shall be applied to the design of bridges and culverts on station properties:

1) Culverts shall convey a 25-year flood without a static head at the inlet, unless tailwater conditions caused by downstream conditions prevent this from occurring;

2) Culverts shall convey the 100-year design flow with a minimum freeboard of 0.6 m to the base of the structure that the culvert is supporting, such as roadway or trail. Refer to Section 3.2 Computational Requirements;

3) The conveyance capacity of the structure may need to be increased to mitigate flood hazards. The structure shall be designed to prevent the increase in flood levels either upstream or downstream, and to ensure that impacts to Metrolinx-owned infrastructure or property are mitigated; and

4) Culvert sizing shall account for geotechnical or geomorphic hazards, and wildlife passage as required by the AHJ.

h) Tunnel portals and tunnels shall remain free from flooding during all storms up to and including the 100-year storm event and/or Regulatory storm event.

3.2 Computational Requirements

3.2.1 Design Storm Selection & Climate Change Factors

3.2.1.1 Intensity Duration Frequency (IDF) Curves and design storms shall be selected based on the following:

a) Intensity Duration Frequency (IDF) Curves shall be dictated by the AHJ (either the local municipality and/or conservation authority). Where no IDF curves are available, the designer may use the Engineering Climate Datasets from Environment Canada or MTO IDF Curve Lookup Utility for design purposes. The chosen station shall be near the site and have sufficient data to be statistically representative.

b) Design storms shall be dictated by the AHJ. Where they are not available from the AHJ, the designer shall select a storm distribution and duration that is suitable for the specific modelling application and provide an overview of the process of selection in the site stormwater management report.

3.2.1.2 All IDF curves and design storms shall be reviewed to determine whether factors accounting for future climate conditions have been included by the local AHJ. Where not included, the following modifications shall be made:

a) For peak flows computed using the Rational Method, increase the computed peak flow by 20% for all return periods; and

b) For peak flows computed using hydrologic modelling software and design storms, increase rainfall volumes within the design storm by 20%, distributed equally across the design storm duration.

3.2.1.3 Climate change factors shall only be incorporated into post-development storm calculations.

3.2.2 Hydrologic Modelling

3.2.2.1 For project sites under 5 ha (including external drainage areas), runoff calculations shall be completed using the Rational Method, unless more complex methods are required by the AHJ or designer.

3.2.2.2 For project sites greater than 5 ha (including external drainage areas), single-event hydrologic modelling software shall be used to perform hydrologic calculations.

3.2.2.3 All hydrologic modelling software shall be selected from products that are actively being updated by the developer and commonly used in the Greater Toronto and Hamilton Area (GTHA). Simulations shall be completed using a software version updated within the last 5 years, and be provided in a format that allows the models to be opened and fully run in the most up-to-date version of the software without conversion.

3.2.2.4 Where existing hydrologic modelling has been completed for the site through local drainage studies completed in the last 10 years, the model used for the local study shall be used for site modelling, unless technical justification supporting the use of alternative models and/or methods is provided and approved by the Owner of this Standard.

3.2.2.5 The designer shall select all hydrologic modelling parameters within published ranges suitable for the specific site, based on documented site conditions and technical studies. These selections shall be documented in the stormwater management report.

3.2.3 Hydraulic Requirements

3.2.3.1 Open channels with drainage areas less than 50 ha shall be modelled using methods selected by the designer, which may include spreadsheet calculations.

3.2.3.2 Open channels with drainage areas between 50 and 125 ha shall be modelled in hydraulic software selected by the designer based on the site-specific conditions, using models available from the local AHJ, where determined appropriate by the Professional Engineer. The Professional Engineer shall provide justification for the modelling methods employed in each situation.

3.2.3.3 Open channels with drainage areas greater than 125 ha shall be modelled using software capable of performing steady state, 1-dimensional flow calculations with backwater analysis, unless the Professional Engineer or AHJ dictates that an alternative modelling approach, such as 2-dimensional modelling, is required.

3.2.3.4 Most drainage areas greater than 125 ha in the GTHA, have been modelled by the local Conservation Authority or the municipality. Provided that the available models are actively being maintained, they shall be modified or extended with the most up-to-date and detailed information available for the purposes of assessing proposed conditions on each site. Any alternate approaches to modelling shall be approved by the owner of this standard.

3.2.3.5 Where no hydraulic models are available for the site, the Professional Engineer shall select an appropriate model based on the site-specific conditions, in consultation with the Owner of this Standard.

3.2.3.6 Pipe systems with upstream drainage areas less than 5 ha shall be modelled using Rational Method spreadsheets, unless a more complex approach is required by the AHJ or Professional Engineer.

3.2.3.7 Pipe systems with drainage areas greater than 5 ha shall be modelled using hydraulic modelling software. Alternative methods are acceptable if recommended by the Professional Engineer and approved by the Owner of this Standard, based on specific site conditions.

3.3 General Design Requirements

3.3.1 Geotechnical/Hydrogeological Requirements

3.3.1.1 Stormwater system designs shall be supported by a geotechnical report stamped by a Professional Engineer, that includes the following minimum design elements:

a) Bedding requirements;

b) Trench backfill requirements;

c) Dewatering requirements;

d) Soil disposal requirements;

e) Mitigation of buoyancy in high groundwater tables;

f) Sanitary system waterproofing and infiltration/inflow prevention; and

g) Construction methodologies.

3.3.1.2 Where below-grade infrastructure is proposed, technical studies shall be performed to assess the site's groundwater system, and its potential impact on the infrastructure. At a minimum, these studies shall include:

a) Multi-season water table assessments, including expected season highs, with extrapolated minimum and maximum extremes that are likely over longer periods of time;

b) Buoyancy impacts on proposed on-site infrastructure;

c) Dewatering requirements during construction and post-handover; and

d) Soil permeability studies, scoped to the proposed location where infiltration into the existing ground is proposed.

Where these studies cannot be completed, the designer shall propose alternative measures to assess groundwater impacts on the stormwater design, subject to review and approval by the Owner of this Standard.

3.3.2 External Drainage Areas

3.3.2.1 The size, runoff coefficient, and flow direction of the external drainage areas shall be identified and shown on a drainage or catchment area plan.

3.3.2.2 Flow from external drainage areas greater than 1 ha shall be separated and bypass the site's internal drainage system, where technically feasible.

3.3.2.3 Existing conveyance systems that drain external areas through the proposed work area shall be reviewed to ensure adequate capacity for both major and minor systems, preventing damage to Metrolinx infrastructure. Where capacity issues exist, mitigation measures shall be implemented to protect on-site assets.

3.3.3 Flood Storage System Selection

3.3.3.1 Where flood storage is required on site, a selection process shall be undertaken to evaluate various methods, such as surface storage, stormwater management ponds, underground storage tanks, and superpipes. The selection shall consider the following:

a) Construction Costs (Upfront capital costs and long-term maintenance/replacement costs);

b) Land Costs (loss of usable space within the station property);

c) Constructability; and

d) Feasibility of performing maintenance and replacement.

3.3.4 Existing System Abandonment

3.3.4.1 Existing storm sewer systems that will be abandoned or are already abandoned shall be removed during station retrofit projects to avoid constraints on future projects. Exceptions may be made if technical justifications demonstrate long-term cost benefits for abandoning the system in place, subject to approval by the Owner of this Standard.

3.4 Asset Specific Requirements

3.4.1 Storm Sewers:

a) The pipe material and class shall be selected based on site conditions to withstand all anticipated loads, with an appropriate safety factor.

b) Pipe size and slope shall be set to ensure self-scouring velocities are achieved (minimum of 0.6 m/s). The minimum allowable slope is 0.5%, or 0.3% for pipe larger than 600 mm diameter

c) Minimum pipe size diameter is 250 mm.

d) Pipe insulation is not preferred but may be used where adequate frost depth cannot be achieved (based on frost depth requirements for the specific location). Insulation shall be designed as per OPSD 1109.030, unless technical justification of an alternative is provided, subject to approval by the Owner of this Standard.

e) Maximum depth of cover for concrete pipes shall be in accordance with OPSD 807 010 for confined trench or OPSD 807.030 for embankment. For PVC gravity sewer pipes, the maximum cover shall be in accordance with OPSD 806.040 for trench or embankment.

f) Clearances between all watermains and sewers shall follow requirements by Ontario Procedure F-6-1, as amended.

g) Storm sewers shall be laid in a straight line unless a radius pipe has been designed. Radius pipe is only allowed for diameters of 675 mm and greater.

h) Storm sewers shall be installed in areas that do not experience heavy pedestrian and/or vehicle traffic during day-to-day operation at facilities site, where possible. The need for maintenance and replacement of this infrastructure shall be considered in placing the infrastructure on site.

3.4.2 Maintenance Holes:

a) Maintenance holes shall be designed in accordance with OPSD 701.010 to OPSD 701.015, 701.021, with lids as per OPSD 401.010, unless technical justification for an alternative or custom structure and/or lid is provided, subject to approval by the Owner of this Standard.

b) Minimum maintenance hole diameter is 1200 mm.

c) Maintenance holes shall not be located in the following areas, where applicable, unless no alternatives are available:

1) Parking spaces;

2) PUDOs;

3) AODA-accessible surfaces;

4) Within 5 m of building entrances/exits;

5) Bus loops;

6) Concrete surfaces; and

7) Other surfaces as dictated by architectural design standards.

d) Maintenance holes shall be arranged to minimize obstruction to vehicular and pedestrian access when open for inspection and servicing, and be located in areas that allow for ease of inspection and maintenance, while minimizing disruption to customer experience or operations at any station and/or facility.

e) Maintenance holes shall be spaced no more than 90 m apart, and located at changes in pipe direction, size, or slope in the sewer system.

f) A drop structure is required where the incoming sewer is more than 610 mm above the outfall invert. All drop structures shall be internal to the maintenance hole. Maintenance hole sizes shall be reviewed and increased where drop structures may reduce the space required for access to the structure.

g) Benching to pipe obvert connected to the maintenance hole is required in accordance with OPSD 701.021.

h) Obvert-to-obvert connections are preferred, but invert-to-invert connections can be designed with technical justification, subject to the Owner of this Standard.

i) A cleanout for maintenance shall be located within 30 m of the building connection.

j) A maintenance hole shall be located at the connection point into the municipal sewer system, sized to allow future water quality testing and flow monitoring devices to be installed and accessed.

k) Maximum change in pipe direction for sizes 675 mm and greater is 45 degrees.

l) Blind connections to the main line sewer are only permitted for catchbasin leads, roof drains, and foundation drains, provided the connecting pipe length is 30 m or less, and diameter is 300 mm or less but not larger than the main line sewer.

3.4.3 Oil Grit Separators:

a) TSS removal efficiencies for oil grit separators shall be certified under Canada’s Environmental Technology Verification (ETV) program.

b) Oil grit separators shall be designed and installed as per manufacturer requirements, with consideration for configuration (online vs. offline), backflow and tailwater effects from control structures, etc., in order to achieve TSS removal requirements as per ETV testing.

c) The device shall be located in areas that allow maintenance operations to occur while limiting disruption to the customer experience during normal site operations. The device may not be located in an area where Rail Corridor Access permits are required to maintain the device, unless technical justification is provided and approved by the Owner of this standard.

d) Surface treatments within the path for access and egress associated with OGS maintenance shall be sufficient for the loading by maintenance vehicles without damaging the surface.

e) A swept path analysis is required to show that the required maintenance vehicle can access the OGS, with minimal disruption to site operations. The swept path analysis shall identify any parking spaces that require closure to facilitate access of the maintenance vehicle. Any temporary disruptions to the site to facilitate maintenance operations shall be approved by Metrolinx Station Operations.

f) Devices with filtration units or cartridges shall only be specified when technical justification demonstrates they are the only option available to meet the water quality requirements of Metrolinx and the AHJ, or when a cost-benefit analysis shows they are the most cost-effective method of providing site water quality. Justification is subject to approval by the Owner of this Standard.

3.4.4 Catchbasins:

a) Catchbasin designs shall conform to OPSD 705.010 (single) or OPSD 705.020 (double), except for ditch inlet catchbasins.

b) Catchbasins shall use frame and grates/covers per OPSD 400.010, 400.020, 400.021, 400.050, 400.081, 400.082, 400.100, 401.080, or 401.081.

c) Specific grate and frame shall be selected based on specific type of traffic present, required functionality, and hydraulic capture rate of the structure.

d) In areas with regular traffic from heavy vehicles, such as buses, catchbasins shall be located along the curb line and use side inlet frames and covers per OPSD 400.082.

e) Catchbasins located on or near bike lanes shall have due regard for the direction of bicycle traffic and potential risks associated with grate lines running parallel to the direction of bicycle traffic.

f) On primary roadways with curbs and/or roadways within bus loops, catchbasins shall be located along the curb line of the road or bus loop, and be designed with a raised centreline and 2% crossfall, similar to a municipal roadway.

g) Catchbasins shall be located at the most upstream end of a system. Where a flow input from a storm sewer is introduced, a catchbasin maintenance hole shall be designed, both for new and retrofit situations.

h) For a single catchbasin, the minimum lead connection diameter shall be 250 mm, and the minimum grade shall be 1.0%.

i) For double catchbasins, the minimum lead connection diameter shall be 300 mm and the minimum grade shall be 0.7%.

j) A catchbasin lead greater than 30 m in length shall have an access point at the downstream end of the lead.

k) Ditch inlet catchbasins are only permitted in vegetated areas, and shall be designed as per OPSD 702.040 or 702.050, with grating per OPSD 403.010.

l) The stormwater capture system shall be laid out to ensure that no ponding is present in the parking area during all events up to and including the 5-year storm event. The surface inlet capacity of all capture devices shall be verified assuming 25% blockage in parking areas, and 50% blockage in vegetated areas.

m) Catchbasins shall be sited in a manner that prevents large amounts of stormwater from flowing across pedestrian crossings and/or pick-up areas.

n) Surface inlets are to be located away from high-traffic areas subject to heavy winter sanding and salting wherever possible. Surface inlets shall not be located within the vicinity of snow storage areas.

o) Curbs shall not be indented around CBs.

p) Inlet control devices that restrict catchbasin outflow are not permitted.

3.4.5 Trench Drains:

a) Trench drains are not preferred, but may be used in the following locations:

1) Ramps into below-grade parking or tunnels;

2) Plaza areas to improve walkability and reduce steep gradients; and

3) Platforms where space and grading requirements limit the feasibility of other drainage capture devices.

b) Trench drains in other locations may be approved by the Owner of this Standard with technical justification.

c) A review of the maximum potential structural loading on the trench drain shall be completed, and the Professional Engineer shall confirm that the trench drain is sufficiently designed to support all structural loads for the life of the product.

d) The bottom of the trench drain shall have a minimum slope of 0.5%.

e) The entire length of the trench drain shall be accessible for cleanout and maintenance, with a sump provided at the low point to facilitate sediment removal.

f) Grates shall meet Accessibility for Ontarians with Disabilities Act (AODA) requirements and be heel-proof in pedestrian zones.

g) Trench drains shall be heat-traced in accordance with manufacturer recommendations, where feasible.

3.4.6 Stormwater Flow Control Structures:

a) All control structures shall be located in a maintenance hole, with the downstream side of the control structure accessible for maintenance from within the maintenance hole.

b) The maintenance hole containing the control structure shall be placed in areas that are accessible during normal station operations (e.g. not within parking areas where parked cars could block access). The device shall be accessible for maintenance without need for Rail Corridor Access permits.

c) The minimum size for a steel plate orifice is 100 mm.

d) Where an orifice control structure less than 100mm in diameter is required, the design shall be enhanced to minimize clogging risks using products such as vortex flow regulators or other anti-clog devices.

3.4.7 Ditch Systems (Ditches and Ditch Culverts):

a) Ditch systems shall be located in areas that are not required for public access.

b) Side slopes shall not exceed a 3:1 ratio, unless approved by a geotechnical engineer.

c) Ditch systems shall incorporate measures to control erosion, through the incorporation of low-maintenance vegetation or rip-rap placement, based on the maximum design flow.

d) Ditch systems shall be offset more than 1 m from all walkways, curbs, retaining walls and other hard surfaces.

e) Culvert headwalls or end treatments shall only be permitted when a 3:1 slope is not feasible in the area on top of the culvert.

f) Where a culvert is to be placed less than 450mm below the surface, confirmation that the structure can support the design load for the crossing is required.

g) Culverts shall be constructed with granular bedding and backfill in accordance with OPSD 802.014 or 802.034.

3.4.8 Open Channels & Watercourses:

a) Where a natural channel is present on a site, and local regulations do not allow piping of that system, natural channel designs that allow watercourses to meander naturally over time and are protected using natural systems, such as trees and other vegetation, are preferred.

Proposals for hard infrastructure requiring perpetual inspection and maintenance shall be supported by technical justification demonstrating the necessity of and explaining why a natural channel design is not feasible. Justification is subject to approval by the Owner of this Standard.

b) Open channels shall be designed using fluvial geomorphic principles, addressing the following:

1) Channel morphology;

2) Channel bed and bank protection and stabilization, including substrate sizing;

3) Channel hydraulics, including erosion thresholds; and

4) Environmental impacts (terrestrial, fisheries, etc.).

3.4.9 Culverts:

a) Concrete or HDPE culverts are preferred for ditches and watercourse crossings, unless technical justification supports use of other materials. Justification is subject to approval by the Owner of this Standard.

b) Culvert design shall provide scour protection for all events up to and including the 100-year design storm.

c) Where overtopping and/or significant head buildup is expected on the upstream side of the culvert, the design shall incorporate features to allow the structure to withstand overtopping, seepage, and settlement.

d) Culvert designs shall account for the impact on the natural system, possibly requiring open-bottom structures or closed-bottom culverts with Riverstone fill.

e) Stone placed in or around the inlet or outlet of the culvert shall be appropriately sized to withstand flows and velocities expected during the 100-year storm event.

3.4.10 Backwater Prevention Valves:

a) Backwater prevention valves are required where basement foundation drains are connected to the storm sewer. The valves shall be accessibly located inside the building if a sump pump is part of the system, or outside the building with surface-level access for inspection and maintenance if there is no sump pump.

3.4.11 Roof Drain Connections:

a) Building roof drains shall be connected directly to the storm sewer, or discharged at onto a splash pad and then into landscaped areas. If the roof drain pipe is exposed to the elements, it shall be insulated or heat-traced.

3.4.12 Inverted Syphons:

a) Where gravity sewers are not feasible, inverted siphons are preferred over pumping stations.

b) All siphon designs shall include a maintenance plan detailing how the maintenance of the system will be completed, while keeping the station and/or facility in service. Twinning of the siphon to allow for continuous operation during maintenance is preferred.

c) Inlet and outlet chambers sized to facilitate inspection and maintenance are required on each siphon. Control gates/valves or alternatives shall be designed where twinning of the siphon is required to isolate flow in each siphon for maintenance purposes.

d) Gravity drainage or other dewatering methods shall be incorporated into the design to facilitate maintenance.

3.4.13 Pump Stations and Forcemains:

a) All proposed pump stations and forcemain systems shall be supported by an assessment of options, including inverted siphons and/or gravity sewers, which shows that a pump station and/or forcemain solution is the optimal solution for a site over a 50-year lifecycle. The assessment is subject to approval by the Owner of this Standard.

b) Pump stations shall be housed in concrete or prefabricated fibreglass maintenance holes.

c) All pump designs shall include a capacity assessment covering both the pumping capacity and associated wet well storage volumes. Wet well storage shall be able to manage onsite wastewater, with provisions for infiltration/inflow into the system during large rainfall events.

d) Grinder pumps shall be included in the system design to minimize the risk of clogging.

e) Pumping stations and forcemains shall be equipped with cleanouts, and other appurtenances, such as flushing ports and isolation valves, that are necessary in performing inspection and maintenance of the system.

f) Pumping station and forcemain infrastructure shall be located in areas where maintenance of the system can be performed without impacting normal station operations.

g) Additional wet well storage and/or backup power shall be incorporated into the pumping system design to ensure operation during power outages lasting 12 hours or more, preventing sewage backups.

h) Redundancy in the forcemain design shall be incorporated to facilitate maintenance of the forcemain without the need for station shutdowns.

i) Forcemains shall be constructed from PVC or HDPE, unless technical justification for other materials is provided by the Professional Engineer and approved by the Owner of this Standard.

j) All non-metallic components of the force main shall be equipped with tracer wire for the purposes of locating the pipe.

3.4.14 Outfalls:

a) Outfalls shall discharge at or above the 100-year flood level of the receiving watercourse where feasible, with a natural channel feature connecting the outfall to the low-flow channel, designed to withstand erosion associated with both the outfall and watercourse systems.

Where setting the outfall outside the 100-year flood zone is not feasible, the outfall shall be designed to withstand the flows and velocities of the 100-year flood.

b) A backwater analysis of the storm sewer system is required if outfalls are submerged. The storm sewer shall be modified to provide the required conveyance capacity under backwater conditions.

c) Erosion protection is required at outfalls, designed to withstand shear stresses associated with the 100-year storm event.

d) All outfalls to natural watercourses shall be concrete headwalls per OPSD 804.030 for pipes less than 900 mm diameter or OPSD 804.040 for larger pipes. If a custom structure is required, technical justification shall be provided by the Professional Engineer and approved by the Owner of this Standard. Custom outfall structures shall be reinforced concrete and designed by a qualified structural engineer.

e) Concrete headwall grating shall conform to OPSD 804.050.

f) Outfalls shall be accessible from the site for maintenance, with access designed based on anticipated maintenance needs. The outfall shall be accessible for maintenance without requiring Rail Corridor Access permits, where feasible.

3.4.15 Subdrainage Systems:

a) Site hydrogeological conditions shall be reviewed to assess the need for additional subdrainage on site.

b) Subdrainage systems are required for all paved areas and shall be designed in accordance with OPSD 207.030. Generally, subdrains shall be placed:

1) Along any curb conveying runoff;

2) Radiating from storm runoff inlet structures for 5 m on quadrant lines; and

3) Additional subdrainage shall be placed on the site to ensure that the surface base system remains dry during normal conditions.

3.4.16 Underground Storage Systems:

a) Product Selection

1) There are various underground storage tanks available on the market, that include plastic and concrete products with varying material shapes and sizes. A review of the site conditions and tank options available on the market shall consider the following:

i. Structural requirements of the system based on site conditions;

ii. Volume and space requirements;

iii. Ability to facilitate or prevent infiltration, depending on specific site conditions and stormwater management requirements;

iv. Ability to provide water quality control, if required, under site stormwater management requirements;

v. History of successful installations associated with the various tank products in the GTHA;

vi. Upfront capital costs; and

vii. Short and long-term maintenance requirements.

b) Field Investigations

1) Test pits or boreholes within the tank footprint to a minimum depth of 1.5 m below the proposed bottom elevation of the tank shall be undertaken. The minimum number of boreholes or test pits shall be in accordance with the requirements of the latest edition of the Canadian Foundation Manual.

2) Information on soil bearing capacity, total soil settlement (immediate, consolidated and creep settlements), groundwater depth, construction dewatering requirements and any other geotechnical factors shall be gathered to support the tank design.

3) Groundwater depth for non-watertight facilities shall be monitored over multiple seasons, including at least one spring and fall season.

4) If an infiltration tank is being considered, at least one test pit or borehole, with a corresponding infiltration test (by Guelph Permeameter method or approved equivalent), is required for every 450 m^2 of the proposed tank footprint.

c) Tank Siting

1) A single large underground stormwater storage tank is preferred over multiple smaller tanks on a site, for future site planning or technical reasons, as provided and approved by the Owner of this Standard.

2) Tanks shall be set back a minimum of 4 m from buildings, retaining walls, and other foundations.

3) Tanks shall be conveniently located for inspection, maintenance, and replacement. Avoid placing them in front of station buildings, PUDO areas, bus loops, main entrance or exit roads, under platforms, or within the rail corridor, unless no other options are feasible.

d) Structural Considerations

1) Plastic systems shall conform to the latest versions of CSA B184, and ASTM F2787 or ASTM F2418.

2) Cast-in-place concrete systems shall conform to the latest versions of CSA A.23.1/A23.2 and CSA A23.3. All Formwork and Falsework to comply with CSA S269.1.

3) Pre-cast concrete systems shall conform to the latest version of CSA A23.4.

4) Cast-in-place and precast systems shall both be designed for either exposure class C-1 or C-XL.

5) Tanks are considered structures and shall account for all applicable loading, including loads specific to transit sites. The tank design shall be prepared and sealed by a Professional Engineer with qualifications in structural engineering.

6) Liner requirements shall be assessed based on site conditions. Lined and watertight tanks are to be assessed for buoyancy by the structural engineer, and the liner material shall remain impermeable throughout the service life of the tank.

e) Subgrade Design Considerations

1) The bottom and outlets shall be below the anticipated maximum frost depth.

2) For non-watertight tanks, the lowest elevation where water will be stored shall be at least 0.5 m above the seasonally high groundwater level.

3) Trench plugs are required on inlet and outlet pipes when tanks are below the seasonally high groundwater level.

4) Tanks requiring clear stone shall use 19 to 50 mm uniformly graded, clean, crushed angular stone.

5) Sub-drains connected to outlet structures are required for infiltration facilities where soil infiltration capacity is less than 15 mm/hr. Sub-drains shall have a minimum diameter of 200 mm with smooth interior walls and cleanouts spaced no more than 30 m apart. No 90-degree couplings or bends are permitted for sub-drains (e.g. maximum bend angle is 45 degrees). Geotextile shall be placed above sub-drains that have perforations above the spring line to reduce migration of fines into the pipe.

6) Geotextile shall only be placed between the tank and the native soil if required by the supplier or geotechnical engineer to prevent fine material migration into the tank.

f) Operations and Maintenance Considerations

1) A tank is not considered an acceptable primary water quality treatment method. All influent into the tank shall be pre-treated to achieve a minimum TSS removal of 50%, in accordance with water quality criteria requirements.

2) The tank design shall include a dedicated area for sediment capture and retention, concentrating incoming water in this Section, similar to a sediment forebay in a stormwater management pond.

3) The sediment capture area shall have access infrastructure for high-pressure flushing equipment, and sediment shall be removable using a conventional vacuum truck.

4) If sediment removal is required in other parts of the tank during its lifecycle, additional access points for high-pressure flushing and vacuum equipment shall also be provided.

5) Access points for maintenance by flushing and vacuum equipment are required at the following locations and frequency:

i. Inlet: minimum one per inlet structure;

ii. Outlet: minimum one per outlet structure; and

iii. Sediment capture area: minimum one, with a maximum 30 m long unobstructed path without turns from at least one access point to all parts of the sediment capture area.

6) The bottom and sides of sediment capture areas shall be lined with material that can withstand high-pressure flushing for sediment removal without damage.

7) Access points for maintenance and inspection shall be integrated into the tank design, located to minimize disruptions to Metrolinx operations and public access, and shall comply with manufacturer specifications.

8) The design documentation shall include an estimate of annual sediment accumulation and clean-out frequency for both the primary sediment capture area and the remaining parts of the tank.

9) Access points and inspection ports shall be designed to accommodate commonly available maintenance equipment.

10) Access point frame and covers shall meet OPSD 401.020 or equivalent to allow personnel entry and use of high-pressure flushing and vacuum equipment.

11) Inspection ports that allow for measurement of water levels and sediment accumulation, are required at the following locations:

i. Minimum of one within the sediment capture area;

ii. Minimum of one per 30 m of length within all chambers and/or tank rows; and

iii. Throughout the remainder of the tank such to allow visual inspection of all areas.

12) Inspection ports shall be accessible during peak station use without obstructing parking. They shall not be placed under parking spots, except in overflow parking areas.

g) Stormwater Management Ponds

1) Stormwater Management Ponds shall be constructed as per the requirements of the local municipality where the station or facility is located.

h) Low Impact Development (LID)

1) The Low Impact Development (LID) requirements outlined in Metrolinx Sustainable Design Standard (DS-05) shall be followed.

3.5 Environmental Compliance Approval (ECAs)

3.5.1 All Metrolinx stations and facilities shall comply with the requirements of Environmental Compliance Approvals (ECAs) under the Ministry of the Environment, Conservation and Parks and obtain approvals as required by current legislation.

a) Maintenance Facilities: All Metrolinx maintenance facilities require ECAs, as they are classified as industrial properties.

b) Transit Sites: GO stations and transit sites with parking may be exempt from an ECA under O. Reg. 138/25, as amended (i.e., if they serve a single parcel, discharge to a storm sewer that is not combined, and are not located on or serving industrial land).

c) Other Sites: Where exemptions do not apply, an ECA shall be obtained prior to construction or modification of stormwater management works.

3.6 Quality Assurance and Quality Control (QA/QC)

3.6.1 The following QA/QC activities shall be included in the project agreement to ensure proper documentation and certification by the Professional Engineer responsible for the design throughout construction. At project completion, all QA/QC documentation shall be submitted to the Owner of this Standard for review and approval.

a) All sewers shall be flushed, cleaned, and inspected via CCTV prior to final handover;

b) CCTV inspections of all pipes shall be provided prior to final handover. CCTV inspections will be used to confirm that the pipes are in good condition and installed as per the design, without construction defects;

c) Maintenance holes, oil grit separators and other stormwater appurtenances shall be visually inspected to confirm they are constructed as per the design, free from defects, and effectively flushed and cleaned;

d) Deflection testing of plastic pipes shall be completed in accordance with OPSS.MUNI 410. Any pipe failing the mandrel test shall be replaced;

e) An operations and maintenance manual for each site shall be developed, detailing the maintenance schedule and procedures for all assets included in the design; and

f) The Professional Engineer shall provide stamped as-recorded drawings, along with a letter certifying that the stormwater management system conforms to the design approved for construction, including stormwater management reports, issued-for-construction drawings, and subsequent revisions.