2025 - Sanitary Infrastructure Guidelines

Engineering and Corporate Assets

Kawartha Lakes
Jump In

City of Kawartha Lakes Infrastructure Guidelines – Sanitary

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1.0 Introduction

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1.1 Purpose

The City of Kawartha Lakes Sanitary Sewer Design Guidelines shall be read in conjunction with the Ministry of the Environment (MOE) Design Guidelines for Sewage Works (2008), Ministry of Environment Conservation and Parks (MECP) Sanitary and Storm Design Criteria and Ontario Provincial Standards and Specifications (OPSS). In cases where the standards and specifications presented herein differ from the MOE or OPSS guidelines, the City of Kawartha Lakes Guideline shall supersede the MOE, MECP or OPSS.

Sanitary sewers designed and constructed in accordance with the most recently revised specifications of the City of Kawartha Lakes shall be required in all residential subdivisions unless specifically exempted from this requirement by the City. All sanitary sewers shall be designed in such a manner and be of adequate size and depth to provide for the service of adjacent lands where so required by the Director of Engineering & Corporate Assets.

1.2 MECP Consolidated Linear Infrastructure Environmental Compliance Approval

The City is in possession of Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) from the MECP for its sanitary sewers and treatment facilities. Through this process the City is able to approve certain alterations and extensions to the existing approved sanitary system. For any proposed alteration or expansion of the existing system the designer shall have consideration for the items laid out in this document as well as any requirements found in the MECP document listed in the section above. All detailed design proposals for alterations and or expansion of the existing system shall include the following CLI ECA related items a **Form SS1** and or a **Form SS2** as well as a "**CLI ECA Application Form**" all of which can be found the Development Engineering website.

1.3 Definitions

1.3.1 Public Sewage Systems

A Public Sewage System is a piped collection system that transports wastes of domestic origins and other such wastes suitable for treatment at a sewage treatment facility in accordance with City By-Law 2016-006, Management and Use of the Sewage Works in the City of Kawartha Lakes and City By-Law 2021-162, Regulate Water and Wastewater Services, both as amended and updated.

1.3.2 Private Sewage Systems

A sewage system (or systems) with a total design capacity of less than 10,000 litres per day, shall be designed, constructed, operated, and maintained in accordance with Part 8 of the Ontario Building Code (OBC).

A sewage system (or systems), with a total design capacity greater than 10,000 litres per day, falls under the jurisdiction of the MECP.

1.3.3 Separated Sewer

A separated sewer system is one in which all municipal sewage is conveyed to sanitary sewers and all surface runoff and foundation drain flow is conveyed to a storm sewer. These types of systems are standard for all new development.

1.3.4 Combined Sewer

A combined sewer system is a system that receives both incepted surface runoff and municipal sewage. The construction of new combined sewers is not permitted.

1.3.5 Non-Permitted Flows

Non-Permitted Flows include connections from foundations, weeping tile drainage or roof drainage. These flows are not permitted to enter the sanitary sewer system, in accordance with the City By-Law 2016-006, as amended.

1.4 Location and Alignment

Generally sanitary sewers shall be located in front of, or in locations accessible to each lot and block facing a Municipal road. Sanitary sewers are to be located 1.5 metres from the centreline of the road. Sanitary sewers are to be located upon the inside loop of a proposed crescent or cul-de-sac with the maintenance hole located at a 1.5 metre offset from the centreline of the road.

When a maintenance hole is proposed/designed to be located within the vicinity of a roundabout, it shall be located in the asphalt area of the roundabout. Sanitary maintenance holes are not permitted within the grassed area of the roundabout.

1.5 Sanitary Sewers on Private Property

Sanitary sewers on private property are regulated by the OBC. Where specific regulations do not appear within the OBC, details from this manual will govern. Refer to block requirements for the purposes of sanitary infrastructure that crosses private property.

2.0 Blocks

Note that Block conveyance is the required method of land transfer through the development process for any new development. The design of a sanitary sewer system must ensure that all proposed municipal infrastructure is located within municipal property. The requirements are as follows,

Table 2.1: Minimum Block Requirements

If service, size, and depth is	**The required block width is**
Single sewer less than 600mm in diameter, and less than 3.7 metres deep	6 metres
Single sewer larger than 750mm in diameter and/or in excess of 3.7 metres deep	9 metres
A combination of two mains less than 3.7 metres deep	9 metres
A combination of two mains greater than 3.7 metres deep	12 metres
Major trunk sewer	20 metres (Sewer main will be located off centre in the easement for future infrastructure.)

3.0 Drainage and Sub-Drainage Area Plans

3.1 Sanitary Drainage Area Plan

The tributary areas used in the evaluation of the design flows shall be shown on a plan to a scale of 1:5000. This plan shall indicate the land use, area, population density, number of units, and the design flow (l/s). For each area included on the design sheet, the maintenance hole numbers, the size and grade of the sewers, and the plan number of the details plan and profile for each section of the sanitary sewers shall also be specified.

3.2 External Sewershed Limits and Drainage Areas

Designs must accommodate future development, draft plan approved, or otherwise as directed by City of Kawartha Lakes Engineering & Corporate Assets Department, that will contribute capacity to the proposed development. When a design abuts an undeveloped or draft plan approved area, the external sewershed must be identified and designed for.

4.0 Design Parameters and Considerations

4.1 Residential

When lands are zoned for a specific residential use, the following population densities shall apply.

Table 4.1: Residential Population Densities (per Hectare) for Design

Unit Type	Person Per Hectare
Affordable Housing Blocks	115
All other Residential	92

*Corresponding to 50 units per hectare for all affordable housing blocks and 40 units per hectare for all other residential designs.

Development Proposed Land – when the number and type of housing units within a proposed development are known, the calculation of population for the proposed development shall be based on the following:

4.2 Per Unit Populations

Table 4.2: Residential Population Densities (per unit type) for Design.

Unit Type	Person Per Unit
Residential	2.3

*All types.

4.3 Peak Flow

Table 4.3: Peak Flow Design Parameters

Design Flow Type	Peak Flow Design Parameters
Residential	450 L/capita/day
Commercial	0.4 L/sec./ha
Industrial	0.4 L/sec./ha
Schools and Institutions	0.32 L/sec./ha

4.4 Infiltration

When foundation drains are **not** connected to the sanitary sewer a value of 0.28 L/sec./ha shall be used.

When foundation drains are connected to the sanitary sewer a value of 0.56 L/sec./ha shall be used (Retrofit and Reconstruction instances only).

The Calculations are based on the number of gross hectares of residential, commercial, industrial, schools and institutions lands tributary to the sanitary sewer systems.

5.0 Design Flows

Sanitary sewer design calculations for approved drainage area plans are to be completed on the City of Kawartha Lakes Sanitary Sewer Design Sheet, available on the Development Engineering webpage.

5.1 Peak Flow Calculation

Peak flow calculations are to be completed using the following formula:

$$Q = \frac{P \times q \times M}{86.4} + IA$$

Where:

P= Population (in thousands)

q= Average daily per capita domestic flow (L/cap/day)

M= Harmon Peaking Factor

I= Unit of peak extraneous flow (infiltration)

A= Gross tributary area (in hectares).

5.2 Peaking Factor Calculation

Peaking Factor is to be determined based on Harmon Formula:

$$M = \left[1 + \frac{14}{4 + P^{\frac{1}{2}}}\right]$$

Where:

P=Population (in thousands)

M=Ratio of peak flow to average flow

M_{MAX}=Maximum 4.0

M_{MIN}= Minimum 2.0

5.3 Pipe Capacity (Q)

Pipe size is calculated using Manning's Formula where the pipe design flow is equal to or greater than the calculated peak design flow:

$$Q = \frac{1}{n} \times A \times R^{\frac{2}{3}} \times S^{\frac{1}{2}}$$

Where:

Q = Design flow (m^3/s)

n = Manning's roughness coefficient

A = Cross sectional flow area

R = Hydraulic radius ($R = \frac{A}{WP}$)

S = Slope (m/m) %.

5.4 Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all concrete and PVC pipe.

5.5 Flow Velocity

Velocities in sanitary sewers shall be calculated using the following formula:

$$V = \frac{Q}{A}$$

Where:

V = Flow velocity (m/s)

Q=Design flow (m^3/s)

A = Cross sectional flow area (m^2)

5.5.1 Velocities and Grade

Minimum velocity permitted in sanitary sewers is 0.6m/s and minimum grade is 0.5% for all local sewers. A minimum grade of 1% is required for the first upstream leg.

Maximum velocity permitted in sanitary sewers is 3.0m/s.

Velocity change from one pipe to another in a maintenance hole shall not exceed 0.6m/s.

Peak flow shall be less than 80% of the full capacity of the pipe to prevent surcharging.

To determine sewage velocities based on actual flows refer to hydraulic elements graph.

5.6 Pipe Materials

Both rigid and flexible pipe are permitted in the construction of sanitary sewer systems including private drain connections. These materials include concrete and polyvinyl chloride (PVC) and must conform to OPSS.MUNI 1820 Material Specification for Circular and Elliptical Concrete Pipe and OPSS.MUNI 1841 Material Specification for Non-Pressure Polyvinyl Chloride (PVC) Pipe Products, respectively.

Mainline PVC sewer shall be used up to 375mm in diameter and will have a dimensions ratio (DR) 35 and be green in colour.

PVC or reinforced concrete pipe shall be used for 450mm in diameter sanitary sewers.

Mainline reinforced concrete sewer pipes shall be used for pipes greater than 450mm in diameter and will be a minimum class of 65-D, conforming to OPSS.MUNI 1820.

In industrial areas, vitrified clay (VC) pipe shall be used up to and including 600mm in diameter, reinforced concrete pipe shall be used for pipes greater than 600mm in diameter.

On private property, materials for sanitary building sewers and private sewers shall comply with Part 7 of the OBC.

Ribbed or corrugated pipe is not approved for the use as a sanitary sewer.

The class and type of pipe shall be shown on all of the profile drawings.

5.7 Bedding Material

The class and type of bedding shall be selected to suit loading and proposed construction conditions.

The pipe material, class, and type of bedding shall be shown on the profile drawing for each section of sanitary sewer.

Bedding materials shall conform to OPSS.MUNI 401 Construction Specification for Trenching, Backfilling, and Compacting.

Compaction of granular bedding and backfill materials shall conform to OPSS.MUNI 402 Construction Specification for Excavating, Backfilling, and Compacting for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

When the groundwater table is above the base of the trench bedding shall be 19mm Clear Stone Type I conforming to OPSS.MUNI 1004 Material Specification for Aggregates - Miscellaneous, 150mm in depth.

The class and type of bedding shall be shown on the profile drawings.

5.8 Minimum Size of Pipe

Minimum size of pipe shall be 200mm in diameter.

5.9 Minimum Depth of Pipe

Table 5.1: Minimum Sanitary Sewer Depth.

Land Use	**Minimum Depth**
Residential, Commercial, and Institutional	2.75 metres
Industrial	2.15 metres

The minimum depth of a sanitary sewer will be measured from the centre line of the road to the obvert of the sewer.

5.10 Parallel Installations and Crossing Clearances

Parallel installations and crossing clearances shall be as per Ministry of the Environment, Conservation and Parks **F-6-1 Procedures to Govern Separation of Sewers and Watermains**.

For a sanitary sewer crossing over or under a storm sewer a minimum clearance of 300mm is required.

5.11 Concrete Encasement

If concrete encasement is necessary for rigid pipe, a detailed design shall be submitted for approval. Concrete encasement shall be designed from maintenance hole to maintenance hole to prevent pipe shear. All concrete encased pipes shall be upsized one size to allow for potential future liners.

5.12 Sanitary Sewer Testing

Low pressure air testing shall be performed on all sanitary sewer pipes as per OPSS.MUNI 410 Construction Specification for Pipe Sewer Installation in Open Cut.

Deflection testing of pipe sewers shall be performed on all sanitary sewer pipes as per OPSS.MUNI 410 Construction Specification for Pipe Sewer Installation in Open Cut.

Video inspection shall be conducted for all sanitary sewer pipes, both main line sewers and service laterals. The inspection shall be as per OPSS.MUNI 409 Construction Specification for Closed-Circuit Television (CCTV) Inspection of Pipelines. Video inspection of service laterals is required prior to permission to place surface asphalt and following occupancy of said lot.

6.0 Maintenance Holes

Maintenance holes shall be constructed of pre-cast concrete as detailed within the standard drawings. A separate Maintenance Hole shall be provided 1.5 metres inside the property line for developments requiring site plan approval.

6.1 Spacing of Maintenance Holes

Table 6.1: Maximum Maintenance Hole Spacing by Pipe Size.

Sewer Diameter	**Maximum Spacing**
200mm – 750mm	120 metres
825mm – 1200mm	125 metres
Greater than 1200mm	155 metres

6.2 Maintenance Hole Bedding

Bedding materials shall conform to OPSS.MUNI 401 Construction Specification for Trenching, Backfilling and Compacting.

Compaction of granular bedding and backfill materials shall conform to OPSS.MUNI 402 Construction Specification for Excavating, Backfilling and Compacting for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers.

When the groundwater table is above the base of the trench, bedding shall be 19mm Clear Stone Type I conforming to OPSS.MUNI 1004 Material Specification for Miscellaneous Aggregates, 150mm in depth.

6.3 Maintenance Hole Sizing

All sizing of sanitary precast maintenance holes is based on incoming and outgoing pipe sizes and will be sized in accordance with OPSD 701.021 Maintenance Hole Benching and Pipe Opening Alternatives.

The type, size and top elevation of the maintenance hole shall be specified on the profile drawings.

6.4 Maintenance Hole Frame and Covers

Maintenance hole frame and covers are required for all maintenance holes, shall be in accordance with OPSD 401.010 type 'A' closed – Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes, and shall be clearly labelled "Sanitary" or "SAN.".

Maintenance hole frame and cover will be clear of curb and gutters and clear of bends in the road for new construction.

All maintenance hole chamber openings will be located on the upstream side of the maintenance hole.

6.5 Maintenance Hole Inflow Dishes

Upon completion of base asphalt all sanitary maintenance holes located within storm low points, ponding areas and over flow routes shall be fixed with an Inflow Dish manufactured by Cretex Specialty Products or approved equivalent made of High Density Polyethylene (HDPE) meeting the requirements of ASTM D-1248 Class A, Category 5. All maintenance hole inflow dishes shall be equipped with a tether attached to the top of ladder or step, or anchored to the wall, tether to be 0.125mm vinyl coated aircraft cable or polyweb strap complete with aluminum spring snap bolt. All maintenance hole inflow dishes shall come with a manufactured strap for removal and an appropriate valve for venting gas and relieving vacuum pressure.

6.6 Watertight Maintenance Hole Lids/Covers

Watertight bolt down covers are required when sanitary maintenance holes are located within storm low points, ponding areas and overland flow routes. Overland routes can include flood plain areas, walkways within an easement, open space areas, gutter locations or any other location where overland flow is directly over and adjacent to the maintenance hole lid. Watertight maintenance hole lids will also be required to be installed at locations where it is necessary to protect against sanitary surcharge conditions.

6.7 Lockable Maintenance Hole Covers

Lockable maintenance hole covers are required to control access and to protect the public. We recommend that they be located through park blocks, open space blocks, pumping stations or water pollution control plants.

Maintenance holes located within easements in parks, open space or other locations deemed necessary shall be equipped with lockable watertight maintenance hole covers.

6.8 Maintenance Hole Risers

For maintenance holes, precast concrete adjustment units shall be as per OPSD 704.010 Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.

Adjustment units shall be set in full bed of mortar at structure and frame. A layer of blueskin waterproofing membrane or approved equivalent, shall be adhered to the outside surface of the adjustment units with primer and overlapped a minimum 300mm over structure and at joints.

All maintenance holes that have a deviation in excess of 10mm from surface asphalt elevation shall be milled, re-adjusted, and re-paved to suit final grades.

6.9 Maintenance Hole Steps

For pre-fabricated maintenance holes, steps will be solid circular steps as per OPSD 405.020 Maintenance Hole Steps - Solid.

6.10 Drop Structures

Sewer systems shall be designed to avoid the use of drop structures.

If the design of the sewer system is such that the difference in elevation between the maintenance hole inlet and outlet will exceed 0.25 metres, then a drop structure shall be required.

A maximum drop of 0.25 metres will only be permitted if the design of the sewer cannot be modified to reduce the drop or modified to accommodate the drop structure.

6.11 Maintenance Hole Safety Landings

Safety platforms shall be required in all maintenance holes when the invert to top of maintenance hole exceeds 5 metres in depth. Safety platforms shall not be more than 5 metres apart as per OPSD 404.020 Aluminum Safety Platform for Circular Maintenance Holes. Access hatches in safety grating are required to line up to allow proper use of fall arrest equipment.

6.12 Benching

Benching of maintenance holes shall conform to the most recent revision of OPSD 701.021 Maintenance Hole Benching and Pipe Opening Alternatives.

Benching height will extend from the pipe obvert to improve hydraulic performance. All benching is required to slope at 2% and the sewer shall extend 150mm into the maintenance hole before a change in alignment.

If the benching is to vary from the OPSD, and be designed a detail is to be shown on the design drawings.

6.13 Connections to Maintenance Holes

A flexible joint shall be installed at all maintenance hole structures 300mm from the outside face of the maintenance hole in accordance with OPSD 708.020 Support for Pipe at Catch Basin or Maintenance Hole.

All PVC inlet and outlet pipes, including outlets for future extensions shall be securely set into structure's concrete base and walls using factory installed rubber gaskets (boots) and shall be water tight.

The outlet for future extensions is to have a watertight plug installed.

6.14 Hydraulic Losses at Maintenance Holes

When pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5m/s, the following allowances shall be made to compensate for hydraulic losses:

Table 6.2: Hydraulic losses for non-pre-benched maintenance holes.

Alignment Change	**Drop Required**
Straight run	Grade of sewer
15-45 degrees	30mm
45-90 degrees	60mm
Junctions and transitions	Physical modeling recommended.

7.0 Sanitary Service Laterals

New sanitary laterals shall be PVC SDR 28 and shall be green in colour. Sanitary service laterals shall be installed with the bell end of the pipe laid upgrade in accordance with OPSS.MUNI 410 Construction Specification for Pipe Sewer Installation in Open Cut.

All service connections to the mainline sewer will be made that the invert of the service connection is above spring line of the main pipe and shall be installed using a manufactured tee or approved saddle. A 'WYE' service connection shall be installed on the services of the first upstream leg.

Risers shall be used when the obvert depth of the sanitary main exceeds 4.5 metres, rise connection shall not exceed 3 metres in depth and shall be in accordance with OPSD 1006.010 Sewer Service Connections for Main Pipe Sewer.

Under no circumstances will flow from the service connection enter the main against the flow.

Where horizontal or vertical bends are required, long radius sweeps shall be used. Short bends are not permitted.

7.1 Minimum and Maximum Size and Grade

For all single detached, semi-detached residential and townhouse unit types the minimum service size shall be 100mm in diameter at a grade of 2% minimum – 10% maximum. For all other development types (Multi-Residential, Non-residential, Commercial and Institutional Blocks), the minimum service size shall be 150mm in diameter at a grade of 1% minimum – 10% maximum.

Note: The actual size of a private sanitary sewer connection for multi-Residential, non-residential, commercial, and institutional blocks is dependent on the flows and design.

8.0 Forcemains

The following requirements should be considered in conjunction with the City's Sanitary CLI ECA granted by MECP. Additional design requirements can be found on the Development Engineering Website in the document titled **MECP Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alteration Authorized under Environmental Compliance Approval**.

At design pumping rates, a desired cleansing velocity (of at least 0.9m/s) shall be maintained. The minimum force main size for raw wastewater shall not be less than 100mm in diameter.

An air relief valve shall be at high points in the forcemain to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains. The force main configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Fittings and isolation valves shall be stainless steel.

Forcemain design shall include transient analysis and consider the provision for water hammer relief.

Forcemain should enter the gravity sewer system at a point not more than 200mm above the flow line of the receiving maintenance hole. Where flows entering the gravity system exceed 30L/s a transition maintenance hole shall be provided at forcemain discharge point.

Pipe and joints shall be equal to water main strength materials suitable for design conditions. The forcemain, reaction block, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal or stresses that are expected with the cycling of wastewater lift stations. The need for surge protection chambers shall be evaluated. Forcemain pipe materials shall be approved by the Director of Engineering and Corporate Assets.

Forcemain construction near streams or water works structures and at watermain crossings shall meet all applicable requirements.

Friction losses through forcemains shall be based on the Hazen - Williams formula or other acceptable methods. When the Hazen Williams formula is used the following "C" shall be used regardless of the pipe material:

Table 7.1: Hazen Williams C Factors

Pipe Diameter	**C - Factor**
100mm - 150mm	100
200mm - 250mm	110

Pipe Diameter	C - Factor
300mm - 600mm	120
Greater than 600mm	130

When initially installed, forcemains may have a significantly higher "C" factor.

The forcemain shall be appropriately identified when they are constructed of material that may cause the forcemain to be confused with potable watermains.

Tracer wire shall be installed on all forcemains. Tracer wire shall be brought to the surface using valve boxes 50mm in diameter spaced at 300 metre intervals along the forcemain.

Forcemains shall be tested to ensure there is no leakage as per OPSS.MUNI 412 Construction Specification for Sewage Forcemain Installation in Open Cut.

9.0 References

- Ministry of the Environment and Climate Change, Design Guidelines for Sewage Works, 2008.
- Ministry of the Environment Conservation and Parks, Design Criteria: Sanitary Sewers, Storm Sewers & Forcemains for Alterations Authorized Under an Environmental Compliance Approval
- Ontario Ministry of Transportation, Ontario Provincial Standards for Roads and Public Works.