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SECTION 5.0: SANITARY SEWER SYSTEM

5.1 GENERAL

In any project where sanitary sewers are required, the sewer system is to be designed to carry domestic, commercial, and industrial sewage for the area under consideration. Flow is to be by gravity and pumping. Low pressure sewer systems will only be considered where other alternatives are not possible and only with written approval from the Town.

If a pumping station concept is approved by the Town, it shall be designed in accordance with the current MECP guidelines and to the satisfaction of the Town and InnServices.

5.2 CONFIRMATION OF AVAILABLE CAPACITY

Prior to the commencement of any design, the developer and/or designer must contact the Town and confirm that there is adequate external trunk sewer, pumping station and treatment plant capacity to accommodate the proposed project.

5.3 SERVICE AREA

The system shall be designed to accommodate all on site drainage areas as well as all external tributary areas to their maximum future development capacity in accordance with the Town's Official Plan. Sanitary Drainage Plans identifying the internal and external drainage areas will be required.

5.4 DESIGN FLOWS

All sewers shall be sized for peak design flows, including an allowance for extraneous flow (Inflow & Infiltration) based on the following:

5.4.1 Residential Sewage Flows

The design population shall be derived using the proposed Plan of Subdivision and the following densities:

Single Detached and Semi-Detached Dwellings	3.36 ppu
Townhouses	2.70 ppu
Apartments	1.90 ppu

In the absence of detailed information, populations should be estimated based on drainage areas and proposed land uses identified in the Town's Official Plan or in the applicable Master Servicing Studies.

An average daily per capita flow of 250 L/cap/day (excluding extraneous flows) shall be used for average daily domestic flows in future sewered areas. For existing sewered areas, an average daily per capita flow of 275 L/cap/day (excluding extraneous flows) shall be used.

Peak domestic flows are to be calculated using the following formula:

$$Q(d) = \frac{P \times q \times M}{24 \times 60 \times 60} + Extraneous\ Flow(I\&I)$$

Where,

Q(d) = Peak domestic sanitary flow, including peak extraneous flows in L/s

P = Design population

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

M = Harmon Peaking Factor (see Section 5.5)

Extraneous Flow (I&I) for Single Detached, Semi Detached, and Townhouse Dwellings =

400 L/cap/day x Design population (Lakeshore System – Future)
600 L/cap/day x Design population (Lakeshore System – Existing)
400 L/cap/day x Design population (Cookstown System – Future)
600 L/cap/day x Design population (Cookstown System – Existing)

Extraneous Flow (I&I) for Apartments and Mixed Use = 20,000 L/ha/ day

5.4.2 Institutional Sewage Flows

Historical water use data at the subject site or a similar site (covering at least 2 years) of the facility or other similar facilities can be used to calculate average institutional flows. Where historical water use data is not available, the unit values for institutional flows listed in the MECP Design Guidelines ca be used. The designer shall use professional judgement to select appropriate flow rate within the range.

Average daily flow for elementary and secondary schools shall be calculated using 30 L/student/day. This rate does not include extraneous flows.

5.4.3 Commercial and Industrial Sewage Flows

Equivalent domestic flows for commercial and industrial areas are to be based on actual flow records for similar uses (covering at least 2 years) whenever possible. Where historical data is not available, the designer shall calculate flow rates based on a building floor area, or the lot area or the population basis and approved by InnServices prior to the start of the project.

Peaking factors shall be based on an individual assessment of each type of use or actual flow records whenever possible. In absence of such information, a peaking factor of two (2) may be used.

For more general applications, where the specific use is not known, an average design flow rate of 10 m^3/ha/ day and peak flow rate (including extraneous flows) of 20 m^3/ha/day shall be used.

5.5 RESIDENTIAL PEAKING FACTOR CALCULATION

Unless specifically defined in a standard flow rate, peak design flows shall be determined by applying a peaking factor to the average daily flows, based on the Harmon Formula, as follows:

$$M = 1 + \frac{14}{4+p^{0.5}}$$

Where,

M = Harmon Peaking Factor

p = Population (in thousands)

Maximum M = 4.0

Minimum M = 2.0

5.6 PIPE CAPACITY

The pipe capacity under full flow conditions is to be calculated using Manning's formula and a roughness coefficient of n = 0.013.

Sanitary sewers shall be upsized when flows exceed 85% of full flow under future peak flow conditions during inflow and infiltration.

Sanitary sewer design sheets will be used and included on the drainage area plans. The design sheets shall demonstrate that the proposed pipe capacity and velocities are in accordance with the Town's standards. All design sheets submitted for approval will be sealed, signed, and dated by a professional engineer licensed to practice in the province of Ontario

5.7 VELOCITIES

All gravity sanitary sewers shall be designed and constructed with slopes to provide at least 0.6 m/s of flow velocity, when flowing full to maintain solids in suspension.

The maximum allowable velocity shall be 3.0 m/s at peak flows.

5.8 PIPE SLOPES

The minimum pipe slope shall not be less than 0.5% or that which is required to meet the minimum velocity. Further reductions of the minimum slope must be approved by the Town and InnServices.

The first upstream leg of sanitary sewer shall have a slope of not less than 1.0%.

The maximum pipe slope shall be that which is required to meet the maximum velocity.

5.9 MINIMUM PIPE SIZE – SANITARY MAINS

The minimum pipe size of sanitary mains, including those constructed on private property (condominiums, etc.) shall be 200 mm in diameter.

5.10 DEPTH OF COVER – SANITARY MAINS

In areas servicing basements, a minimum depth of cover of 2.8 m below the centreline road elevation to the obvert of the sewer shall be provided or sufficient depth to connect basement floor drains by gravity using minimum pipe grade of 2% (use longest possible run).

In areas not servicing basements, minimum depth of cover for frost protection shall be 1.6 m below the centreline road elevation to the obvert of the sewer.

In special cases where sufficient cover does not exist, InnServices may consider shallower insulated sewers on an individual basis.

The maximum depth of cover is not to exceed applicable OPSD related to the pipe material unless pipe strength design calculations are provided for approval by the Town.

The maximum depth of sewers with direct lateral connections shall be 6.0 m below finished centreline to the obvert of the sewer. In cases where deeper sewers (>6.0m) are required (at the discretion of InnServices), these shall be considered as trunk sewers and no direct lateral connections will be permitted. Separate local sewers constructed above and adjacent to trunk sewers will be required for lateral connections.

5.11 BEDDING AND BACKFILL

Pipe embedment and backfill for flexible pipes shall be in accordance with OPSD 802.010 and 802.014. Pipe embedment for flexible shall be Granular ‘A’ in accordance with OPSS.MUNI 1010, unless otherwise approved by InnServices

Pipe bedding, cover and backfill for rigid pipes shall be in accordance with OPSD 802.030 to 802.032, inclusive. Pipe bedding for rigid pipes shall be Granular ‘A’ in accordance with OPSS.MUNI 1010, unless otherwise approved by InnServices. Pipe cover for rigid pipes shall be Granular ‘A’, or Granular ‘B’ (100% passing the 26.5 sieve), unless otherwise approved by InnServices.

Pipe bedding, cover Compaction is to be a minimum of 95% SPMDD and increased to 98% SPMDD within 1m of the road subgrade or as indicated in the approved Geotechnical Report. In soft or wet conditions, additional Geotechnical investigation and testing may be necessary to determine the appropriate bedding and backfill measures.

In areas where the invert of the pipe is below the groundwater table, clay or bentonite seals shall be installed at 50 m intervals as per OPSS 1205 and OPSD 802.095, and the Geotechnical Engineer's recommendation. Seals are to be 1.0 m thick measured along the pipe and are to replace the bedding and backfill.

Sanitary sewers installed lower than 0.5 m below the Seasonally High Groundwater Table (SHGWT) shall be designed to minimize infiltration.

The sewer pipes, pipe joints and connections shall be designed to withstand pressure in accordance with current MECP guidelines without leakage.

5.12 PIPE CLEARANCES

The minimum horizontal clearances shall be provided in accordance with MECP guidelines.

Whether the watermain crosses above or below the sewer, a minimum vertical distance of 0.5m between the outside edge of the watermain and the outside edge of the sewer must be provided. Generally, the watermain shall cross above sewers with sufficient vertical separation to allow for proper bedding and structural support of the watermain and sewer pipes.

When there is conflict with the elevation of the sewer and the watermain such that the watermain cannot pass over the sewer, then the watermain shall be designed such that it passes under the sewer subject to the following conditions:

a) There shall be a minimum vertical separation of 0.5m between the bottom of the sewer pipe and the top of the watermain;
b) The watermain shall be lowered below the sewer using vertical thrust blocks and restraining joints;
c) The length of the watermain pipe shall be centered at the point of crossing so that the joints are equidistant and as far as possible from the sewer, and;
d) The sewer shall be adequately supported to prevent joint deflection and settling.

A minimum vertical clearance of 0.3m shall be provided between the outside of pipe at the point of crossing for storm and sanitary sewers.

5.13 SEWER LAYOUT

Sanitary sewers shall generally be located as per the typical road cross-sections. Maintenance holes shall be located, whenever possible, with a minimum 1.0m clearance away from face of curb and/or any other service.

Where sanitary sewers are located in easements, the easement width shall be a minimum of 9.0m. However, the Town will review alternative easement widths on an individual basis in certain circumstances such as the utilization of a joint trench or installation of a sewer at a depth which is substantially greater than standard.

5.14 FORCEMAIN TRACER WIRE

Tracer wire shall be #12 AWG (0.0808" diameter" high strength copper clad steel conductor (HS-CCS), insulated with a 30 mm high density polyethylene (HDPE) insulation, rated for direct burial use at 30 volts.

Tracer wire shall be installed on forcemains for locate purposes. Tracer wire shall be brought to the surface every 300 meters using a test station. Each 300 m section of tracer wire is to be tested and confirmed acceptable prior to further pipe installation as per Contract or Agreement requirements.

Forcemains installed by trenchless technologies shall use extra-high strength copper-clad steel. A minimum of four (4) wires to be pulled during installation.

5.15 MAINTENANCE HOLES

5.15.1 General

Maintenance holes shall be as per OPSD 701. All maintenance holes shall be pre-benched up to obvert, to the satisfaction of InnServices and the Town. Sewer pipe connections to new maintenance holes shall have factory installed resilient connectors in the structure openings.

Safety platforms shall be installed in accordance with OPSD 404.020 for all maintenance hole depths of 5.0 m or greater.

5.15.2 Maintenance Hole Location and Spacing

Maintenance holes are to be placed at the beginning and end of each sewer line, at changes in pipe size and/or material, and at changes in grade and/or alignment.

A straight through maintenance hole with similar upstream and downstream sloped sewers shall be provided between new subdivisions and the existing municipal system for the purposes of flow monitoring.
The maximum spacing between maintenance holes shall be 120 m for all pipe sizes.

A maintenance hole will be required on the private property side for sanitary services to commercial, industrial, and institutional properties.

5.15.3 Maintenance Hole Waterproofing

A waterproofing membrane or petrolatum tape shall be applied externally around all joints of maintenance holes and chambers, including all Moduloc. Prior to installing membranes adhering surfaces shall be cleaned from debris/dirt and primed as per manufacturer's recommendation for priming. The membrane and primer shall be installed as per manufacturer's specifications and protected during backfill operations.

Where maintenance holes are located in areas to be flooded by the major storm design, low traffic areas or grassed areas, maintenance hole frame and covers shall be watertight. In all other areas, standard maintenance hole covers shall be used.

5.15.4 Maintenance Hole Frame and Cover

All maintenance holes within an asphalt roadway or maintenance access shall include a self-adjustable auto-stable frame. Structures outside roadways or existing frame and grates in base asphalt which require adjustment for top lift asphalt may use lift rings (when approved by the Town). Otherwise when adjusting the top elevation of maintenance holes, a minimum of one to a maximum of three precast adjustment units (Moduloc) shall be installed on the top of the structure. The maximum vertical adjustment of maintenance holes via Moduloc shall not exceed 300 mm. Any adjustment exceeding this amount shall consist of precast concrete riser sections.

5.15.5 Maintenance Hole New Development Bulkheads and Plugs

Sanitary sewers under construction shall be bulk headed and plugged to prevent infiltration or flushing water from entering the existing sewers, as per TOISD 612 . Generally, bulkheads and plugs are to remain in place until the first occupancy has been permitted. At the discretion of InnServices, bulkheads and plugs may be removed in advance of first occupancy to

accommodate testing of internal plumbing systems. Written approval from InnServices is required prior to the removal of bulkheads and plugs. Once the bulkheads and plugs have been removed, a flow meter will be installed, monitored and maintained by InnServices, at the Owner's expense, in the last downstream maintenance hole connecting to the existing sewer. Removal of flow meters is at the discretion of InnServices and must be coordinated accordingly.

5.15.6 Maintenance Hole Drops

A sufficient drop shall be provided across each maintenance hole to offset any hydraulic losses. The minimum drops across a maintenance hole shall be as follows:

Change in Direction	Minimum Drop
Straight run (0°)	0.025 m
1 - 45°	0.04 m
> 45°	0.06 m

The maximum change in direction permitted in a maintenance hole is 90°.

Drop structures shall be provided when the difference in the inlet and outlet inverts is equal to or greater than 610mm that cannot be eliminated by changing sewer grades. For new maintenance hole the internal drop structures are not permitted.

Obverts of inlet pipes shall not be lower than obverts of outlet pipes.

Except for special cases, the downstream pipe diameter shall always be greater than or equal to the upstream pipe diameter.

5.15.7 Maintenance Hole Frost Straps

Internal frost straps shall be provided on all sanitary maintenance holes, as per TOISD 611. Frost straps to extend to a depth of 3 m from finished grade. Internal frost straps shall be non-penetrating, anchored in the internal chamber wall as per pre-cast chamber manufacturer recommendations. To be factory cast inserts (pre-fabricated fastener sleeves).

5.16 FUTURE SANITARY CONNECTIONS

Where a sanitary sewer is to be stubbed, a sanitary maintenance hole will be required to limit infiltration into the existing system.

5.17 SANITARY SERVICE CONNECTIONS

Single connections for residential and industrial use shall be located in accordance with TOISD Division 600 for each type of residential lot.

All residential unit sanitary service connections shall be single type 125 mm diameter, with a 125 mm x 100 mm test fitting at property line. For new developments, the service shall be extended 3.0 m beyond property line, with an additional test fitting, plug, brace, and marker. Refer to TOISD 605. Connections for commercial, industrial and institutional will be considered on an individual basis but will generally be 150 mm diameter with a maintenance hole just beyond property line.

The minimum slope for all service connections shall be 2.0%.

Tees shall be installed at a 45° angle to the main, where possible, such that the invert of the tee is at the springline of the main.

Service connections shall be located at a minimum depth of cover of 2.6 m or sufficient depth for basement floor drains and frost cover. Service connections should cross under watermains.

Where the depth to the obvert of the sanitary main is deeper than 4.5 m from final road centreline elevation, the use of a sanitary riser is required. Controlled settlement joint fittings are to be used on all risers, conforming with the approved materials list.

Residential service connections are not permitted to connect directly to sanitary maintenance holes, unless approved by InnServices. Connections must occur on the sanitary main, a minimum of 1.0m away from the edge of the maintenance hole to ensure the structure of the main does not become compromised and result in issues with infiltration.

Sanitary service connections to new sewer mains shall be made with factory manufactured tees.

Sanitary service connections to existing sewer mains shall be made by coring and installing a gasket saddle tee.

Generally, if the sanitary service has a size greater than half the diameter of the mainline sewer, connection to a maintenance hole is required. New maintenance hole installations to existing mainline sewers are to be completed via doghouse maintenance hole structures. Consultation with InnServices is required for the design and construction of doghouse maintenance hole structures.

All floor drains are to be connected to the sanitary service connection. Foundation drains and roof water leaders are not to be connected to the sanitary system.

5.18 INSPECTION AND TESTING

The following inspection and testing requirements apply to all new sanitary sewers and maintenance holes. Any sections of sewer, maintenance hole or service connections which fail to meet the requirements shall be repaired or replaced at the direction of the Town and InnServices.

An Inspection and Testing Plan shall be prepared and submitted to InnServices at least two (2) weeks prior to the inspection or testing. Plan shall follow the requirements outlined in the most recent revision of the MECP Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under an Environmental Compliance Approval.

5.18.1Deflection Testing

All newly installed PVC sanitary sewers shall be subjected to deflection testing in accordance with OPSS 410.

5.18.2 Infiltration/Exfiltration Testing

All newly installed sanitary sewers shall be subjected to infiltration/exfiltration testing in accordance with OPSS 410. Groundwater levels must be considered when determining the appropriate testing method. The static water levels shall be measured and recorded by the Consultant Engineer.

Sanitary sewer infiltration testing is required when the groundwater level at the time of the testing is 600mm or more above the crown of the pipe for the entire length of the test section, per OPSS 410. Dewatering operations must be discontinued at least three days before conducting the test to allow the groundwater level to stabilize.

Sanitary sewer exfiltration testing is required when the groundwater level at the time of the testing is lower than 600mm above the crown of the pipe for the entire length of the test section or the highest point of the highest service connection included in the test section, per OPSS 410.

5.18.3 CCTV Inspection

All newly installed sanitary sewers shall be subjected to a CCTV Inspection. Refer to Appendix D for CCTV Inspection Requirements.

5.18.4 Visual Inspection – Maintenance Holes

All maintenance holes shall be visually inspected by the Town and InnServices for deficiencies. When requested by the Town, maintenance hole scans shall be provided by a qualified third-party sewer inspection firm. Scans must be completed using 100% digital panoramic scanning equipment. The digital files provided must include a distortion-free virtual pan and tilt to view the MH from any angle and at any depth. The Town must be able to view all pan, tilt, and unfolded views. If specific software is required, it must be provided to the Town with the digital files.

5.18.5 Testing – Maintenance Holes

Leakage testing is required on all new sanitary maintenance holes in high groundwater locations, at the discretion of InnSerivces. Testing methodology to be provided to InnServices for review and acceptance.

5.19 MATERIALS

Refer to Appendix B for a list of materials and specifications.