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SECTION 1 INTRODUCTION

1.1 General Considerations

The general intent of this document, along with various By-Laws and other studies, is to provide guidance and clear directions for Owners, developers and Engineers seeking to pursue development opportunities in the various municipalities located within the United Counties of Stormont, Dundas & Glengarry, and to identify design criteria considered as minimum guidelines by the local municipality under typical conditions. Ultimately, the goals of this document are to minimize surprises during the development process, allow for efficient and expedient design and construction of various projects, and promote consistency & quality in the design of infrastructure.

Generally, no variance will be allowed from the guidelines and minimum requirements contained in this document. Deviation may however be possible in some cases at the discretion of the local municipality or Council through a special request. The onus will be on the Developer to justify deviation from these guidelines.

In all cases, it is recommended that the local municipality be pre-consulted as soon as possible in the planning process. In addition, the local municipality should be contacted if any section of this document is unclear, if additional information is needed, or in special conditions.

Lastly, this document is meant to be a 'living document' which may be amended or modified as required. Note that Municipality By-laws and/or other applicable provincial or federal regulations which may come into force after the writing of this manual shall take precedence over this manual.

1.2 Definitions & Abbreviations

AODA: shall mean the "Accessibility for Ontarians with Disabilities Act",

AWWA: shall mean the "American Water Works Association"

CBO: shall mean the "Chief Building Official", the officer or employee of the Municipality charged with the duty of enforcing the provisions of the Building Code Act, together with any regulations made thereunder, and the provisions of the Building By-law

CA: shall mean the "South Nation Conservation" or "Raisin Region Conservation Authority"

Council: shall mean the "Council of the Corporation of the Township of North Dundas, South Dundas, North Stormont, South Stormont, North Glengarry or South Glengarry"

County: shall mean the "United Counties of Stormont, Dundas and Glengarry"

CSA: shall mean the "Canadian Standards Association"

CUP: shall mean "Composite Utility Plan"

ECA: shall mean "Environmental Compliance Approval" as issued by the MECP

Engineer: shall mean a professional holding a license or temporary license to practice engineering in the province of Ontario, holding a Certificate of Authorization from Professional Engineers Ontario, and having valid professional liability insurance

Developer: shall mean the person or company proposing and undertaking the proposed project, whether it consists of a subdivision or a site plan project

Easement: shall mean the legal right acquired by contract to pass over, along, upon or under the lands of another

kPa: shall mean "kilopascal" (1,000 N/m^2)

LID: shall mean "Low-Impact Development"

MECP: shall mean the "Ministry of the Environment, Conservation and Parks"

MRD: shall mean "maximum relative density" of asphalt

MTO: shall mean the "Ministry of Transportation"

Municipality: shall mean the Municipality of North Dundas, South Dundas, North Stormont, South Stormont, North Glengarry or South Glengarry

Municipal Official: shall mean any staff and/or Engineer designated by the Municipal Council

MUTCD: shall mean "Manual on Uniform Traffic Control Devices" as published by TAC

OBC: shall mean "Ontario Building Code"

OPSD: shall mean "Ontario Provincial Standard Drawings" which are available online at: http://www.raqsa.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage

OPSS: shall mean "Ontario Provincial Standard Specifications" which are available online: http://www.raqsa.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage

OTM: shall mean "Ontario Traffic Manual" as published by the MTO (latest edition) and which are available online: http://www.mto.gov.on.ca/english/publications/mto-research-library-online-catalogue.shtml

psi: shall mean "pounds per square inch"

SPMDD: shall mean "standard proctor maximum dry density"

Surveyor: shall mean a professional land surveyor designated as an Ontario Land Surveyor (OLS) by the Association of Ontario Land Surveyors (AOLS)

TAC: shall mean "Transportation Association of Canada"

TSS: shall mean "total suspended solids"

1.3 General Responsibilities of the Developer

The Developer will be responsible to employ competent Engineers registered with PEO and having valid professional liability insurance to design, supervise and construct any and all infrastructure required at its own cost.

Additionally, the Developer or its Engineer will be responsible to obtain all necessary approvals from relevant senior approving authorities at its own cost and pay for reasonable fees and disbursements incurred by the Municipality. Such fees may include, but are not limited to, planning fees, legal fees, engineering/peer review fees, inspections, testing, etc.

The Developer will also be responsible to pay the water and wastewater connection fee of $5,000 each, per lot, or per the current By-Law.

1.4 Typical Project & Review Process

Typical flow charts attached show typical project process for subdivision and site plan projects. These flow charts are intended as general guidelines and may vary from project to project. The flow charts may be found in Appendix “A”.

1.5 Relevant Legislation, Guidelines, Policies & By-laws

Applicable legislation, policies and Municipal By-laws may include, but are not limited to, the following. Note that the following and any other applicable regulations that may come into force take precedence over this manual.

Provincial Legislation:

- Occupational Health and Safety Act and Regulations,
- Ontario Building Code,
- Ontario Planning Act,
- Ontario Water Resources Act.

Policies & Design Guidelines, MECP:

- Design Guidelines for Sewage Works, 2008 (MECP),
- Design Guidelines for Drinking-Water Systems, 2008 (MECP),
- Procedures to Govern Separation of Sewers and Watermains (MECP Procedure F-6-1),
- Stormwater Management Planning and Design Manual, 2003 (MECP).

Policies & Design Guidelines, MTO:

- Drainage Management Manual, 1995-1997,
- Gravity Pipe Design Guidelines, 2007,
- Ontario Provincial Standard Drawings (OPSD), latest version,
- Ontario Provincial Standard Specifications (OPSS), latest version,
- Ontario Traffic Manual, latest version,
- Roadside Safety Manual, 1993.

Municipal By-laws and local policies (latest versions):

- Parking By-law,
- Sewer Use By-law,
- Zoning By-law,
- South Nation Source Protection Plan,
- SDG Counties Official Plan.

1.6 Pre-Consultation

For all projects, early pre-consultation with the Municipality and County is required. Pre-consultation will help to identify requirements early in the process and will help expedite subsequent steps.

SECTION 2 GENERAL REQUIREMENTS

2.1 Off-Site Improvements

Off-site improvements such as sewer extensions, upsizing/reconstruction of existing infrastructure, construction of new road turning lanes, sidewalk and/or roadway extensions, new pumping stations, modifications to existing pumping stations, etc. may be required to support proposed development.

The need for off-site improvements will be evaluated on a case-by-case basis and may require additional studies by the Developer where information is not readily available. The Developer will further be responsible for costs related to design, construction, inspection, etc. Cost sharing may be possible if the improvements benefit other parties.

2.2 Urban vs. Rural Cross-Section

Two major distinct types of development will be possible for subdivisions, consisting of either an urban or a rural roadway cross-section. The applicable type will depend on zoning and on desired lot frontage. Deviation from this standard may only be possible with approval of Council. Pre-consultation with the Municipality will serve to establish the required roadway cross-section.

2.3 Approvals & Agreements

As previously mentioned, the Developer is responsible to pay for and obtain all necessary approvals. These may include, but are not limited to:

- Clearance letter or other approvals from CA (as required),
- Approvals from the County and/or MTO as required,
- All other necessary approvals from other approving authorities, such as, but not limited to railways, utility companies, Canada Post, etc. as may be required.

Furthermore, the Developer will be required to enter into an agreement with the Municipality, the type of which depends on the project being proposed.

2.3.1 Subdivisions

For subdivision projects specifically, the Developer will be required to enter into a Subdivider's Agreement with the Municipality.

A typical agreement may be found in Appendix "B". Note that this typical agreement will be modified to reflect the proposed development and that clauses may be added or deleted as appropriate.

2.3.2 Site Plan Projects

Likewise to above, the Developer will be required to enter into a Site Plan Agreement with the Municipality for site plan projects.

A typical agreement may also be found in Appendix "B". Note that this typical agreement will be modified to reflect the proposed development and that clauses may be added or deleted as appropriate.

The Developer will also need to enter into a Service Extension Agreement with the Municipality in cases where off-site improvements are required within the Municipality's right-of-way (such as service extensions, road widenings, etc. as discussed in Section 2.1).

2.4 Drawings

General requirements for design drawings for all projects are as follows:

- Drawings must be in metric units and to scale,
- Printed on Architectural D (24" x 36") or A1 (594 mm x 841 mm) format,
- Must be clear and concise,
- Must include a legend, scale, north arrow, street names, name of Developer and revision history.

Additional requirements apply for subdivision or site plan projects, as further listed below.

2.4.1 Subdivisions

The following design drawings are required for subdivision projects specifically:

- Cover sheet with key project information,
- Overall site plan showing entire project, easements and phasing requirements, legal boundary information,
- Plan & profiles for all roadways, scale of 1:250 or 1:500 (horizontal) and 1:50 (vertical),
- Plan & profiles for all rear-yard catch basins, scale of 1:250 or 1:500 (horizontal) and 1:50 (vertical)
- Grading plan showing existing and proposed geodetic elevations, at a scale of 1:500 or larger, and shall include the following information:
    - Existing and final geodetic elevations at all lot corners,
    - Existing and final geodetic elevations at the centreline of the road at maximum spacing of 25 meters,
    - Detailed intersection grading plans,
    - Finished geodetic elevation of all critical points,
    - Arrows indicating the direction of flow of all surface water and major flow routes,
    - Extents of surface ponding if applicable,
    - Location and details of all swales,
    - Location and details of all surface water outlets.
- Storm & sanitary catchment area plan showing the respective infrastructure,
- Details and OPSD's including all relevant details and enlargements as required,
- Street lighting including location of street lights, wire routing and all relevant details & OPSD's,
- Composite utility plan (CUP) including location of servicing trenches, easements, location of transformers, pedestals, conduits, existing utility poles, etc.

2.4.2 Site Plan Projects

The following design drawings are required for site plan projects subject to Site Plan Control (refer to Section 15.1 for additional information):

- Overall site plan showing entire site, easements, legal boundary information,

- Servicing plan showing location and depth of watermains, sanitary sewers, storm sewers, forcemains, utilities, etc.
- Grading plan showing existing and proposed elevations (geodetic), scale of not more than 1:500,
- Details and OPSD's including all relevant details and enlargements as required,
- Street lighting including location of street lights, wire routing and all relevant details & OPSD's,
- Building elevation drawings (prepared by an architect),
- Building floor plan drawings (prepared by an architect),
- Final drawings and drawings submitted as part of a Site Plan Control application must be stamped and signed by an Engineer or Architect as appropriate.

2.5 Reports & Studies

Detailed requirements are not provided for reports and studies as they will vary greatly based on the type of report being prepared. Refer to Section 3.1 for a non-exhaustive list of reports and studies which may be required to support the proposed development.

Generally, all reports and studies must be clear and concise and must include all necessary calculations, supporting information and sketches as required. Final reports and reports submitted as part of a Site Plan Control application must be stamped and signed by an Engineer.

2.6 Submittals

The following requirements apply for submittals with regards to subdivision and site plan projects.

2.6.1 Subdivisions

The Draft Plan of subdivision shall be submitted to the County and meet their requirement for submittal.

Detail design drawings and reports must be submitted to the Municipality in PDF format and in 3 hard copies.

2.6.2 Site Plan Projects

Detail design drawings and reports must be submitted to the Municipality in PDF format and in 3 hard copies, along with completed application form and application fee.

2.7 Municipality Reviews & Peer Reviews

The Municipality reserves the right to review all drawings and reports submitted and provide comments.

Reviews may also or instead include a technical peer review completed by an impartial third-party Engineer selected by the Municipality. Developer will be responsible for all costs related to the peer review. The Municipality will be the final authority in case of any disagreement between the Developer's Engineer and the peer reviewing Engineer.

Developer is encouraged to submit high-quality and thorough documents to facilitate and expedite reviews. Incomplete submissions or submissions found to contain excessive omissions or errors may be returned without review or comment.

2.8 Financial Security

Developer will be required to provide financial security to the Municipality prior to starting construction. The purpose of this is to ensure that the Municipality is able to complete the works in the event that the Developer is unable to proceed with the completion, or to address deficiencies.

Financial security shall consist of a certified cheque or bank draft only. Letter of Credit, bonding, or lots in lieu of deposit will not be accepted.

The amount required for financial security varies depending on the type of project, as discussed below.

2.8.1 Subdivisions

For all subdivision projects, financial security is to be provided in an amount equal to 100% of the value of the underground work, based on the Engineer's estimate. Unit prices are to be reflective of current market conditions and the Municipality reserves the right to review the estimate and unit prices.

For the purpose of the estimate, underground works are generally considered to consist of the following:

- Watermains, valves, hydrants, services, and other appurtenances,
- Sanitary sewers, maintenance holes, laterals, pump stations, forcemains, etc.
- Storm sewers, maintenance holes, catch basins, ditch inlets, laterals, etc.
- Pipe insulation,
- Removals related to the above,
- Connections to existing infrastructure.

Likewise, aboveground works are generally considered to consist of the following:

- Roadway granulars, asphalt, perforated subdrains, lighting,
- Concrete curbs & sidewalks,
- Fencing,
- Lot grading and retaining walls,
- Removals related to the above and any required surface reinstatement,
- Traffic control, insurance, and other soft costs.

The Engineer's estimate shall clearly indicate which items are "underground works" and which items are "aboveground works".

Financial security may be reduced as construction advances, as discussed in Section 14.6.

2.8.2 Site Plan Projects

For all site plan projects, the required financial security amount will be as per the following table:

Building Value (as indicated on Building Permit)	Financial Security
Under $500,000	$5,000
$500,000 to $1,000,000	$10,000
$1,000,001 to $2,500,000	$20,000
Over $2,500,001	$25,000

The financial security main not be reduced as construction advances and will only be released once construction is complete, once Municipality has completed inspection and once all deficiencies are addressed to the satisfaction of the Municipality.

Additional financial security may also be required for work within Municipality right-of-way (service extensions, road widenings, etc. as discussed in Section 2.1). The financial security amount for such work will be calculated as discussed in Section 2.8.1.

SECTION 3 PLANNING REQUIREMENTS

3.1 Supporting Studies & Reports

Supporting studies and reports that may be required includes, but is not limited to the following:

a. Capacity of public service facilities
b. Water and sewer servicing capacity
c. Servicing options report
d. Stormwater management
e. Location within an influence area
f. Transportation study
g. Noise and vibration
h. Minimum distance separation I and II
i. Impact assessment
j. Water resources conservation
k. Flood proofing, protection works, restoration
l. Organic soils
m. Geotechnical studies for unstable slopes
n. Contaminated sites
o. Heritage impact/archeological assessment
p. Land use compatibility studies
q. Topographic survey and associated technical information;
r. Wildland Fire Assessments

Pre-consultation with the Municipality and County will serve to establish which studies will be required to support the proposed project.

3.2 Parkland

A minimum of 5% of park space will be required for all residential subdivisions per Section 42 and 51.1 of the Planning Act. Undevelopable land, stormwater management facilities, or land within the flood plain will not be accepted as parkland. Parkland left in a natural state (i.e. wooded) may be acceptable at the Municipality's discretion.

Developer will be responsible for grading of the parkland to provide positive drainage, fencing (where adjacent to residential properties) and topsoil and seed. Walkways, servicing to property line and/or other improvements may also be required at the discretion of the Municipality.

In some cases, cash-in-lieu of parkland at time of registration may be acceptable or may be required for smaller developments. Pre-consultation with the Municipality will serve to establish this requirement. Value of the cash-in-lieu of parkland will be based on the value of the land the day before Draft Plan of subdivision is approved.

3.3 Phasing

The Developer is to determine phasing based on expected sales. Extents of phasing and any required temporary construction (temporary cul-de-sacs, temporary sewer stubs, storm sewer outlets, etc.) are to be clearly shown on the design drawings.

The Municipality will review proposed phasing to avoid temporary dead-ends as much as possible.

Furthermore, the Municipality reserves the right to request that work of future phases be done as part of an earlier phase (for example, looping of a watermain or construction of a second vehicular access).

3.4 Easements & Blocks

The Developer is to provide easements and blocks as required by the Municipality and utilities.

Generally, 0.3 m reserves will be required at dead-ends and open side(s) of a right-of-way and blocks will be required for parkland, stormwater management facilities, walkways or other property to be transferred to the Municipality.

Temporary easements will be required for the construction of temporary turning circles and all other infrastructure constructed on property to be part of future phase(s).

Similarly, permanent easements will be required for infrastructure constructed on land to remain property of the Developer, along swales, underground infrastructure and utilities not located within the right-of-way as detailed in other Sections of this manual.

3.5 Street Names

Streets are to be named by the Developer to the satisfaction of the Municipality and County and shall be shown on plans.

3.6 Civic Address / Sign

The Developer will be required to install civic address numbers in urban (hamlet) areas or signs in rural areas as per the requirements of the current Civic Address By-law and as summarized below.

In rural areas, the civic address number is to be placed on a sign post meeting the requirements below:

- height of not less than 1.5 m and not greater than 1.8 m,
- distance not exceeding 1 m from the property line of the street,
- distance not exceeding 1 m from the driveway,
- number to be placed perpendicular to the travelled portion of the street and clearly visible to traffic travelling in either direction,

In urban (hamlet) areas, the civic address number is to be placed on the dwelling unit or structure parallel to the travelled portion of the street.

3.7 Fencing

Wood screening fence will be required where residential back yards abut a commercial zone or public roadway and is to be installed by the Developer. Fencing is to be installed entirely within private property and may not be located in swales.

A typical wood screening fence is shown on Municipality detail SD.17; other designs may be acceptable at the discretion of the Municipality.

A clause is to be added to the agreement of purchase and sale of the lot such that all future maintenance and/or replacement of the fence will be the responsibility of the purchaser of the lot.

Wood screening fencing or chainlink fencing will also be required as described in other sections of this manual.

SECTION 4 SANITARY SEWERS

4.1 Hydraulic Design

Sanitary sewers are to be designed to the general requirements of the MECP's Design Guidelines for Sewage Works (2008), based on an average flow of 450 L/person/day, 3 persons per residential unit and an infiltration and inflow allowance of 0.19 L/s/hectare. For commercial or industrial developments, average flows are to be based on Table 8.2.1.3.B of the OBC.

Peaking factor calculation for domestic flows shall be based on the Harmon formula as given below:

$$PF = 1 + \frac{14}{4 + P^{0.5}}$$

Where: PF is the peaking factor (minimum of 2.0, maximum of 4.0)
P is the population in thousands

Pipes are to be sized to accommodate the peak flow and infiltration and inflow allowance using the Manning formula as given below, and a Manning roughness coefficient (n) of 0.013 to achieve a full flow velocity between 0.6 m/s to 3.0 m/s:

$$Q = \frac{1{,}000}{n} A R^{2/3} s^{0.5}$$

Where: Q is the flow capacity of the sewer (L/s)
n is the Manning roughness coefficient (0.013)
A is the flow cross-sectional area
R is the hydraulic radius (area of flow / wetted perimeter)
s is the slope (m/m)

All sanitary sewer mains shall be a minimum of 200 mm in diameter. Note that oversized sewers may not be used to justify using flatter slopes and that flow is to be sub-critical where possible.

4.2 Other Design Considerations

Sanitary sewers are to be installed in the right-of-way as shown on Municipality detail SD.1 or SD.2.

Sanitary sewers not located in the right-of-way require minimum 3.0 m wide easements, or wider depending on the depth and/or diameter of the sewer. Poor geotechnical conditions may also require the use of a wider easement.

Where possible, it is preferred that 2.8 m of cover be provided on sanitary sewers, and/or as demonstrated by Engineer to allow for gravity drainage of basements. Where gravity drainage of basement(s) is not possible for any given lot, the Developer shall inform prospective purchasers through a clause in the agreement of purchase and sale.

In all cases, sewers and laterals are to be insulated as per Municipality detail SD.6 if not installed below Engineer's calculated frost depth.

Maintenance hole spacing shall be a maximum of 120 m for sewers smaller than 450 mm diameter and a maximum of 150 m for sewers 450m diameter or larger. Maintenance holes will also be required at all changes in grade and/or slope.

4.3 Connection to Existing Infrastructure

All connections to existing sanitary sewers will need to be made at a maintenance hole. Where a maintenance hole already exists, core drill existing structure and make watertight connection with Link-Seal as per Municipality detail SD.8.

Where a maintenance hole does not exist, cut existing pipe and provide bypass pumping as required, install new maintenance hole with new 1.0 m long stubs on both sides, and connect to existing sanitary sewer pipe with flexible couplers. Note that maintenance holes with cast-in-place base (“horseshoe”) will not be permitted.

4.4 Approved Materials

Main sanitary sewer pipe shall be PVC DR 35 to CSA B182.2, while laterals in residential subdivisions are to be 100 mm diameter SDR 28 to CSA B182.2, white in colour.

Pipe insulation shall be rigid high-density insulation with minimum compressive strength of 275 kPa (40 psi) to ASTM C578 Type VI.

Maintenance holes shall be precast concrete to OPSS 1351, to the OPSD 701.0XX series of standards and to the general requirements below:

- 1,200mm minimum structure diameter or larger as required to suit proposed sewers,
- Flat caps allowed for shallow structures only,
- Adjustment units to be concrete as per OPSD 704.010,
- Frame, outside roadways: to OPSD 401.010 (outside roadways)
- Frame, inside roadways: self-level adjusting frame (C-50M-ONT/AutoStable by Bibby-Ste-Croix or approved equivalent),
- Cover, located outside ponding areas: circular closed cover to OPSD 401.010 Type A,
- Cover, located in ponding areas: circular watertight to OPSD 401.030,
- Benching to OPSD 701.021,
- Safety platform to OPSD 404.020, 404.021, or 404.022 where depth exceeds 5.0 m,
- Ladder rungs to OPSD 405.010,
- Drop structure to OPSD 1003.010 where drop between inverts exceeds 600 mm,
- Interior drop structures to OPSD 1003.030 may only be done in existing maintenance holes and will be reviewed on a case-by-case basis.

4.5 Servicing

Servicing for residential dwellings is to be as per Municipality detail SD.4 or SD.5. In rural cross-sections, servicing may extend beyond the utility easement as shown on Municipality detail SD.7.

Generally, laterals a minimum of 100mm in diameter are to be installed perpendicular to the sanitary sewer main and temporarily capped at the property line using a watertight cap. A wooden marker post is to be installed at the termination of laterals and shall extend a minimum of 1.0 m above finished grade.

Connection to new sanitary sewer mains shall be made using pre-manufactured tees, while connection to existing sanitary sewer mains shall be using strap-on saddles. Connection shall not be made directly into maintenance hole, except for cul-de-sacs. In such case, connection should be aligned within 15 degrees of the main sewer outlet and a 100 mm drop is to be provided between inverts.

Laterals are to be installed to OPSD 1006.020 at a minimum 2% slope and maximum 8% slope. A vertical riser is to be used where maximum slope would be exceeded.

A maximum of two horizontal 22.5-degree long sweep bends are permitted per service.

Sump pumps and rainwater leaders may not be connected to a sanitary lateral or sewer.

When gravity sanitary servicing of basements is provided, a normally open backwater valve is to be installed inside the building per the requirements of the OBC to protect fixtures located in the basement. Backwater valves are strongly recommended where gravity servicing of basements is not provided.

SECTION 5 SANITARY PUMP STATIONS & FORCEMAINS

5.1 General Chamber Design Guidelines

Sanitary pump stations are to be designed to the general requirements of MECP's Design Guidelines for Sewage Works (2008). Pumping stations shall consist of a wet well with a minimum of two submersible pumps, each sized to operate independently and to operate satisfactorily over full range described below.

More specifically, pumping station and forcemain sizing is to be based on system-head calculations and curves for three conditions using the Hazen-Williams coefficients as follows:

- Low sewage level in wet well, C = 120
- Median sewage level over the normal operating range in wet well, C = 130
- High sewage level in wet well, C = 140

Level control shall be with ultrasonic sensors with backup mechanical floats, and alarms are to be integrated into the Municipality's SCADA system.

Lastly, all chamber ventilation piping will require carbon filters.

5.2 General Forcemain Design Guidelines

Sanitary forcemains are to be designed to the general requirements of MECP's Design Guidelines for Sewage Works (2008) to achieve a minimum velocity of 0.6 m/s and maximum velocity of 3.0 m/s at design pumping rates.

Forcemains shall have a minimum cover of 2.4 m and a minimum diameter of 75 mm; however, a minimum diameter of 100 mm is preferred.

5.3 Approved Materials

The list of approved materials for sanitary pumping stations and forcemains is as follows:

- Pumps: Xylem or Sulzer, with variable frequency drives (VFD),
- Chamber: concrete precast or cast-in-place,
- Access hatches: aluminum with stainless steel hinges, with 90 degree hold open arm, recessed drop handle, lockable tab and shall have hydraulic lift assist;
- Access ladders: aluminum per OPSD 406.010, and egress from wet well shall have retractable ladder (MSU Mississauga Ltd. Model #1105 complete with #3105 safety handle, or approved equivalent),
- Pump lifting system: sliding guide and brackets, and portable lifting davits with chair hoist,
- Chamber piping, fittings and joints: Schedule 10S 304L stainless steel,
- Control panel: NEMA 4X enclosure mounted on a concrete pad,
- Forcemain piping: PVC DR-25, Class 165, to AWWA C900,
- Forcemain fittings: PVC to AWWA C907,
- Forcemain tracer wire: TWU or RWU, 10 gauge, 7 strands or more, 60 C or higher, 600 V plastic coated.

5.4 Backup Power

All sanitary pumping stations will require backup power through a natural gas generator, to be sized based on peak power demand. A propane generator may instead be installed where natural gas is not available.

5.5 Other Requirements

The site will need to be protected with chainlink fence as per OPSD 972.130, with top rail. All fence posts are to be set in concrete to OPSD 972.132 and shall consist of Schedule 40 galvanized steel pipe with diameters to OPSD 972.132. Likewise, fence fabric is to be galvanized, 9 gauge, 1,800 mm high, Type 1, Class A, medium style, and double knuckled selvedge.

A lockable single or double swing gate must be provided to OPSD 972.102 to a minimum width of 4 m for access. Gate is to be hot-dip galvanized after fabrication.

A granular access to be provided for operation and maintenance, extending from the closest public roadway to the pumping station. Access is to be a minimum of 3.5 m wide, and constructed of a minimum of 150 mm Granular “A” to OPSS.MUNI 1010 compacted to 100% SPMDD and 300 mm Granular “B” Type II to OPSS.MUNI 1010 compacted to 100% SPMDD.

Easements are to be provided if required, and an operation & maintenance manual is to be provided to the Municipality.

SECTION 6 STORM SEWERS & CULVERTS

6.1 Design Methods – Storm Sewers

Storm sewers to be sized to accommodate the 5-year storm runoff flow as calculated from the Rational method, without surcharging. Likewise, ditches and overland flow routes are to be sized to accommodate the 100-year storm runoff flow as calculated from the Rational method.

The sizing of storm sewers that are part of the major system is to be confirmed using a spreadsheet-based hydraulic grade line analysis (using the Darcy-Weisbach equation) to accommodate the 100-year storm runoff flow. The 100-year storm runoff flow is to be calculated from the Rational method. A hydraulic grade line verification must also be completed when an outlet is submerged or partially submerged.

In all cases, a minimum 300 mm freeboard is required between the 100-year water elevation and the finished ground at building(s).

Dynamic computer models must be used for developments larger than 5 ha or for more complex developments to evaluate the storm sewer design when subjected to larger storm events. At the Engineer's discretion, dynamic computer models may also be used for smaller developments.

Acceptable modeling software consist of XPSWMM, PCSWMM, SWMM, OTTHYMO and MIDUSS. Other software may be acceptable but must be approved by the Municipality.

6.2 Design Methods – Culverts

All cross-culverts are to be sized based on the "Culvert Hydraulics" section of the MTO Drainage Management Manual (1995-1997) using expected tailwater elevation. A minimum freeboard of 150mm is to be provided between the 100-year water elevation and centerline of road or driveway.

Driveway culverts will also need to be sized per the same method, if the catchment area exceeds 2 hectares.

Design software or dynamic computer models may be used in performing calculations (CulvertMaster, Hydraflow Express, dynamic modeling software as discussed above, etc.).

In all cases, cross-culverts shall be a minimum of 600 mm in diameter while driveway culverts in residential subdivisions shall be a minimum of 400 mm in diameter.

6.3 Rational Method Flow Calculation & Parameters

The Rational method to be used in establishing flows is as follows:

$$Q = 2.78CiA$$

Where: Q is the peak runoff (L/s)
C is the runoff coefficient
i is the storm intensity in mm/hr for a given time of concentration
A is the area in hectares

6.3.1 Runoff Coefficient

Runoff coefficient shall be as per following table, where the lower value of the range may be used for moderate to flat slopes, and the higher value of the range is to be used for steeper slopes:

Source	**Runoff coefficient (C)**
Asphalt, concrete, roof areas	0.90 – 1.00
Grassed areas, parkland	0.15 – 0.35
Gravel areas	0.50 – 0.60
Precast paving areas	0.70 – 0.80
Commercial	0.75 – 0.85
Industrial	0.65 – 0.75
Residential:	
Single family (urban)	0.40 – 0.45
Single family (rural)	Calculate weighed C based on lot size
Row housing, townhouses	0.50 – 0.70
Apartments	0.60 – 0.75
Institutional	0.40 – 0.75

Adapted from MECP Design Guidelines for Sewage Works (2008)

The surface type coefficients should be used when designing at the site plan level, and the development type coefficient may be used when designing at a higher level.

6.3.2 Time of Concentration

The time of concentration is the time required for storm runoff to reach a particular point in the storm sewer system from the most hydraulically distant point of the watershed, not necessarily the most physically distant point.

Initial time of concentration is to be calculated per the formula below. Alternatively, the minimums below are to be used:

- 10 minutes when designing at the site plan level,
- 15 minutes for urban developments,
- 20 minutes for rural developments.

Acceptable methods to calculate time of concentration consist of the Airport formula where the runoff coefficient is less than 0.40, or the Bransby Williams formula where the runoff coefficient is greater than 0.40.

The Airport formula is given below:

$$t_c = \frac{3.26(1.1 - C)L^{0.5}}{(s^{0.33})}$$

Where: t_c is the time of concentration (min)
C is the runoff coefficient (< 0.40)
s is the average slope of the watershed (%)
L is the length of the watershed (m)

While the Bransby Williams formula is given below, and may only be used for runoff coefficients greater than 0.40:

$$t_c = \frac{0.057L}{(s^{0.2}A^{0.1})}$$

Where: t_c is the time of concentration (min)
L is the length of the watershed (m)
s is the average slope of the watershed (%)
A is the area of the watershed (ha)

6.3.3 Rainfall Intensity

Rainfall intensity for the project site is to be derived from MTO's IDF Curve Lookup tool, which may be found online at http://www.mto.gov.on.ca/IDF_Curves/terms.shtml.

The A and B parameters given in the "Coefficient summary" table are to be substituted in the formula below, where i is the rainfall intensity for a given period (in mm/hr), and t_c is the time of concentration (in hours) as calculated in Section 6.3.2:

$$i = A(t_c)^B$$

6.4 Modeling Flow Calculations & Parameters

Modeling shall be performed based on the following parameters. Engineer will be required to justify any deviation from the below.

6.4.1 Depth of Rainfall

The depth of rainfall for the project site shall be established from the MTO's IDF Curve Lookup tool, which may be found online at http://www.mto.gov.on.ca/IDF_Curves/terms.shtml.

6.4.2 Storm Event Distribution

For urban areas, either the Chicago storm or the AES 30% Southern Ontario distribution may be used in modeling. The Chicago storm must have a duration at least twice the basin's time of concentration and a time step of not less than 10 minutes. Likewise, the AES 30% Southern Ontario shall have a duration of 12 hours and at least twice the basin's time of concentration, and a time step of not less than 10 minutes.

For rural areas, the SCS Type II storm distribution is to be used. Both the 12-hour and 24-hour storm durations are to be verified.

6.4.3 Depression Storage

As per the City of Ottawa's Sewer Design Guidelines, depression storage is to be 1.57 mm for impervious areas and 4.67 mm for pervious areas.

6.4.4 Curve Numbers

Refer to Appendix "C" for curve numbers to be used in modeling.

6.4.5 Width Parameter

The width parameter in modeling is the dimension of the flow plan that is perpendicular to the direction of flow. For a typical urban area, this is equal to twice the length of the street segment where there are properties on both sides of the street.

If no detailed information exists for an area, a typical value of 225 m per hectare is to be used.

6.5 Sewer Design Parameters

Storm sewers are to be designed to the general requirements of MECP's Design Guidelines for Sewage Works (2008).

Pipes are to be sized to accommodate the peak flow using the Manning formula as given below, to achieve a full flow velocity between 0.6 m/s to 3.0 m/s:

$$Q = \frac{1{,}000}{n} A R^{2/3} s^{0.5}$$

Where: Q is the flow capacity of the sewer (L/s)
n is the Manning roughness coefficient as per the Table below
A is the flow cross-sectional area
R is the hydraulic radius (area of flow / wetted perimeter)
s is the slope (m/m)

Manning roughness coefficients are to as follows:

Material	**Manning Coefficient**
Smooth walled PVC, Concrete, HDPE	0.013
Corrugated steel pipe, 68 x 13mm profile	0.024 (refer to Design Chart 2.01 in MTO Drainage Management Manual for other profiles / special cases)
Grass, riprap	0.035
Concrete gutter	0.015
Asphalt	0.016

Adapted from MTO Drainage Management Manual Design Chart 2.01

All storm sewer mains shall be a minimum of 250 mm in diameter. Note that oversized sewers may not be used to justify using flatter slopes and that flow is to be sub-critical where possible.

Where possible, outlet sewers should be installed high enough to not be fully submerged when subjected to the 5-year storm.

6.6 Other Design Considerations

Storm sewers are to be installed in the right-of-way as shown on Municipality detail SD.1 or SD.2.

Storm sewers not located in the right-of-way require minimum 3.0 m wide easements, or wider depending on the depth and/or diameter of the sewer. Poor geotechnical conditions may also require the use of a wider easement.

In all cases, sewers and laterals are to be insulated as per Municipality detail SD.6 if not installed below Engineer's calculated frost depth. Engineer shall also calculate required frost protection widths and thicknesses.

Maintenance hole spacing shall be a maximum of 120 m for sewers smaller than 450 mm diameter and a maximum of 150 m for sewers 450m diameter or larger. Maintenance holes will also be required at all changes in grade and/or slope.

6.7 Connection to Existing Infrastructure

All connections to existing storm sewers will need to be made at a maintenance hole. Where a maintenance hole already exists, core drill existing structure and make watertight connection with Link-Seal as per Municipality detail SD.8 or non-shrink grout.

Where a maintenance hole does not exist, cut existing pipe and provide bypass pumping as required, install new maintenance hole with new 1.0 m long stubs on both sides, and connect to existing storm sewer pipe with flexible couplers. Note that maintenance holes with cast-in-place base ("horseshoe") will not be permitted.

6.8 Approved Materials

Storm sewer mains shall be either PVC DR 35 to CSA B182.2, HDPE to CSA B182.8 (320 kPa), or reinforced concrete to CSA A257.2, minimum Class 65-D or greater as required based on burial depth.

Laterals shall be 100 mm diameter SDR 28 to CSA B182.2, green in colour.

Pipe insulation shall be rigid high-density insulation with minimum compressive strength of 275 kPa (40 psi) to ASTM C578 Type VI.

Catchbasins shall be precast concrete to OPSD 705.010 (600 x 600 mm single inlet) or 705.020 (600 x 1,450 mm twin inlet) depending on calculated design flows, while ditch inlets shall be precast concrete to OPSD 705.030 (600 x 600 mm) or 705.040 (600 x 1,200 mm Type A or B) again depending on calculated design flows.

Maintenance holes shall be precast concrete to OPSS 1351, to the OPSD 701.0XX series of standards and to the general requirements below:

- 1,200mm minimum structure diameter or larger as required to suit proposed sewers,
- Flat caps allowed for shallow structures only,
- Adjustment units to be concrete as per OPSD 704.010,
- Frame, outside roadways: to OPSD 401.010 (outside roadways)
- Frame, inside roadways: self-level adjusting frame (C-50M-ONT/AutoStable by Bibby-Ste-Croix or approved equivalent),
- Cover: circular open cover to OPSD 401.010 Type B,
- Benching to OPSD 701.021,
- Safety platform to OPSD 404.020, 404.021, or 404.022 where depth exceeds 5.0 m,
- Ladder rungs to OPSD 405.010,
- Drop structure to OPSD 1003.010 where drop between inverts exceeds 600 mm.

Culverts may be either HDPE to CSA B182.8 (320 kPa) or CSP with corrugation profile of 68 x 13 x 2.0 mm, complete with aluminized Type II coating to CSA G401.

6.9 Servicing

Servicing for residential dwellings is to be as per Municipality detail SD.4 or SD.5. In rural cross-sections, servicing may extend beyond the utility easement as shown on Municipality detail SD.7.

The purpose of storm servicing is to provide building foundation drainage only. A gravity connection is preferred wherever possible. If not, sump pumps will be required. Roof drains, downspouts and/or surface catch basins may not be connected to the storm lateral.

Generally, laterals a minimum of 100mm in diameter are to be installed perpendicular to the sanitary sewer main and temporarily capped at the property line using a watertight cap. A wooden marker post is to be installed at the termination of laterals and shall extend a minimum of 1.0 m above finished grade.

Connection to new sanitary sewer mains shall be made using pre-manufactured tees, while connection to existing sanitary sewer mains shall be using strap-on saddles. Connection shall not be made directly into maintenance hole, except for cul-de-sacs. In such case, connection should be aligned within 15 degrees of the main sewer outlet and a 100 mm drop is to be provided between inverts.

Laterals are to be installed to OPSD 1006.010 or 1006.020 at a minimum 2% slope and maximum 8% slope. A vertical riser is to be used where maximum slope would be exceeded.

A maximum of two horizontal 22.5-degree long sweep bends are permitted per service.

Lastly, backwater valves are strongly recommended.

SECTION 7 DITCH FILL-IN

7.1 General Requirements

The main purpose of open ditches is to drain the roadway and its granular base and sub-base. In rural areas, Developers are encouraged to design, obtain proper approvals and construct filled-in ditches as part of the subdivision.

In some areas and/or in some cases, the Municipality may prevent property owners from constructing ditch fill-ins. In such cases, the Developer will be required to inform prospective purchasers through a clause in agreement of purchase and sale.

When the work is proposed by a private property owner for a single lot, the property owner will be required to submit an application to the Municipality for the work and will be responsible for all costs associated with construction. Ditch fill-in installed without proper authorization from the Municipality will not be allowed and may be removed by the Municipality at the cost of the abutting property owner.

7.2 Design

The hydraulic design of the ditch fill-in must be by an Engineer to accommodate the catchment area's ditch flow for a storm event with return period of 5 years. More specifically, the ditch fill-in is to be designed to the requirements of Section 6.5. Refer to Municipality detail SD.14 for additional information.

Existing and proposed elevations must also be provided by the Engineer for pipe inverts and for grading of the swale and driveway.

7.3 Other Design Considerations

A minimum of one catchbasin will be required. Additional catch basins will be required to not exceed a maximum spacing of 15 m between catchbasins.

Surface drainage is to be directed towards the swale (centered on pipe) and towards the catchbasin(s).

Sump pump connections may only be done at a catch basin.

7.4 Approved Materials

Pipe for ditch fill-in shall consist of 320 kPa high-density polyethylene (HDPE) perforated pipe as per CSA B182.8, surrounded with a geotextile filter sock as per OPSS 1860. The catchbasins are similarly to consist of HDPE premanufactured fittings (cross), a minimum of 300 mm in diameter and shall have a HDPE or iron grate.

Pipe bedding, surround and cover shall consist of 19 mm clear stone (type 1) as per OPSS.MUNI 1004, covered with a non-woven geotextile as per OPSS 1860.

7.5 Construction & Inspection

Property owner is to contact the Municipality for inspection at two key milestones:

- Once pipe bedding, pipe, and catch basin(s) are installed, and prior to backfilling,
- Once work is complete.

Note that a minimum 24 hour notice is required for all inspections.

7.6 Maintenance

Any future maintenance of such systems will be the abutting property owner's responsibility. The Municipality reserves the right to perform maintenance for any reason, at the cost of the abutting property owner.

SECTION 8 STORMWATER MANAGEMENT

8.1 General Requirements

Stormwater management will be required for all developments, unless deemed not required by the Municipality and/or CA.

For all projects, a stormwater management report will need to be submitted to Municipality, including all necessary calculations per the Stormwater Management Planning and Design Manual (2003, MECP) and/or model results.

The Municipality encourages low-impact development (LID) but recommends pre-consulting.

8.2 Quantitative Requirements

8.2.1 Design Parameters

As a minimum, the post-development peak flows must not exceed the pre-development values. Two design storm events are to be considered, the storm event with a 5-year return period and the storm event with a 100-year return period.

Note however that the Municipality may impose stricter quantitative requirements based on available capacity in receiving storm sewers.

Uncontrolled areas may be allowed on a case-by-case basis, but 'overcontrolling' will be required such that the sum of peak flows leaving the site does not exceed pre-development values.

8.2.2 Sizing Methods

Stormwater management facilities for developments smaller than 5 ha may be designed with the Modified Rational Method (MRM), while stormwater management facilities servicing larger or more complex developments must be designed with modeling. Refer to Section 6.1 for more information on approved models.

An example of the MRM is given below for the 100-year storm in Morrisburg, assuming an area of 2.0 ha with a post-development weighed runoff coefficient of 0.50 and an allowable release rate of 100.00 L/s:

Column #1 Time (min)	Column #2 Intensity (mm/hr)	Column #3 Peak Flow (L/s)	Column #4 Release Rate (L/s)	Column #5 Storage Rate (L/s)	Column #6 Required Volume (m^3)
5	253.3	704.30	100.00	604.25	181.28
10	156.0	433.82	100.00	333.82	200.29
15	117.5	326.75	100.00	226.75	**204.08**
20	96.1	267.23	100.00	167.23	200.68
25	82.2	228.64	100.00	128.64	192.96
30	72.4	201.28	100.00	101.28	182.30
35	65.0	180.72	100.00	80.72	169.51
40	59.2	164.61	100.00	64.61	155.07

More specifically:

- Column #1 includes the design time step, recommended to be taken as 5 minutes,
- Column #2 includes the calculated rainfall intensity for the 100-year storm in Morrisburg,
- Column #3 is calculated from the Rational method based on parameters given above (Peak flow = 2.78CiA = 2.78(0.50)(253.3mm/hr)(2.0 ha) = 704.30 L/s for the 5 minute time step for example),
- Column #4 is the calculated allowable release rate, taken as 100 L/s in this example,
- Column #5 is the difference between column #3 and column #4,
- Column #6 is the product of column #1 (converted to seconds) and column #5, then converted from L to m^3.

The required storage volume corresponds to the time step with the greatest required volume and is shown in bold in the above table.

8.3 Qualitative Requirements

8.3.1 Design Parameters

As a minimum, 80% total suspended solids (TSS) removal is to be provided for all developments. Qualitative treatment facilities are to be designed to meet the requirements of the Stormwater Management Planning and Design Manual (2003, MECP). All sizing and TSS removal calculations are to be included in the stormwater management report.

8.3.2 Subdivisions

The following qualitative treatment methods (or combination thereof), as further described in the Stormwater Management Planning and Design Manual (2003, MECP), are accepted for use in the Municipality:

- Wetlands,
- Wet pond,
- Dry pond,
- Infiltration basin where soils permit,
- Oil & grit interceptor.

Enhanced grassed swales with check dams along roadways will not be accepted.

8.3.3 Site Plan Projects

The following qualitative treatment methods (or combination thereof), as further described in the Stormwater Management Planning and Design Manual (2003, MECP), are accepted for use within private property:

- Wetlands,
- Wet pond,
- Dry pond,
- Infiltration basin where soils permit,
- Oil & grit interceptor,
- Surface storage (maximum depth of 300 mm),
- Underground storage (concrete tanks, HDPE chambers, oversized pipes, etc.),
- Rooftop storage,

- Enhanced grassed swales (on private property),
- Other forms of LID.

8.4 Other Requirements

Chainlink fencing is to be provided adjacent to stormwater management facilities as per the requirements of Section 5.5 and at the discretion of the Municipality.

A granular access is to be provided for operation and maintenance of the stormwater management facility and must extend from the closest public roadway to the forebay, to the pond itself and to its outlet. Width and material thicknesses of the granular access shall be as per the requirements of Section 5.5.

Easements are to be provided as required for the Municipality for access, storm sewer inlets, storm sewer outlets or for other reasons.

Lastly, an operation and maintenance manual is to be provided to the Municipality.

SECTION 9 WATERMAINS

9.1 Hydraulic Design

Watermains for subdivisions and site plans are to be designed to the general requirements of the MECP's Design Guidelines for Drinking-Water Systems (2008, MECP) for domestic demands and to the requirements of the Fire Underwriters Survey (FUS) method for fire protection demands, as further discussed below.

9.1.1 Domestic Demand

For residential developments, the average daily domestic demand is to be determined based on an average flow of 450 L/person/day and an average of 3 persons per residential unit.

Domestic demand for commercial or industrial developments is to be based on Table 8.2.1.3.B of the OBC.

9.1.2 Fire Protection Demand

Fire protection demand for all types of development is to be determined based on the FUS or OBC method, or may instead be based on the actual sprinkler demand calculated by the mechanical engineer, where applicable.

9.1.3 Design Parameters

As per the MECP Guidelines, the following Hazen-Williams C-factors are to be used in design:

- New 150 mm diameter watermains = 100
- New 200 – 250 mm diameter watermains = 110
- New 300 – 600 mm diameter watermains = 120
- New > 600 mm diameter watermains = 130

Again as per the MECP Guidelines, the peaking factors given in the Table below are to be applied to average domestic demands to evaluate various scenarios:

Population	Minimum Hour Factor	Maximum Day Factor	Peak Hour Factor
30 – 149	0.10	9.50	14.30
150 – 299	0.10	4.90	7.40
300 – 449	0.20	3.60	5.40
450 – 499	0.30	3.00	4.50
500 – 1,000	0.40	2.75	4.13
1,001 – 2,000	0.45	2.50	3.75
2,001 – 3,000	0.50	2.25	3.38
> 3,000	Refer to MECP Design Guidelines (2008)		

Adapted from Table 3-1 and Table 3-3 of MECP Design Guidelines for Drinking-Water Systems (2008)

Calculations shall then be done to ensure compliance with all minimum and maximum pressures given in the Table below for the various scenarios listed, again as per the requirements of the MECP Guidelines:

Scenario	Minimum Pressure		Maximum Pressure	
	kPa	psi	kPa	psi
Maximum Day + Fire Flow	140	20	n/a	n/a
Average Day	350	50	480	70
Maximum Day	350	50	480	70
Maximum Hour	275	40	n/a	n/a
Minimum Hour	n/a	n/a	700	100

Adapted from MECP Design Guidelines for Drinking-Water Systems (2008)

9.1.4 Sizing Methods

Watermains are to be sized using modeling software (WaterCAD, WaterGEMS, EPANET, or similar) and must include boundary conditions replicating actual flow curves as measured in the field through hydrant flow testing. Hydrant flow testing is to be completed at the Developer's cost and shall be coordinated with the Municipality.

In some cases, and at the discretion of the Municipality, simplified calculations (head loss spreadsheet) may be acceptable for smaller developments.

9.2 Other Design Considerations

New watermains are to be located in the right-of-way as per Municipality detail SD.1 or SD.2 and shall be installed with a minimum of 2.4 m of cover. Watermains will need to be insulated where the required cover is not achieved (for example, at sewer crossings) and the Engineer shall calculate required frost protection widths and thicknesses based on design cover and frost depth.

In all cases, horizontal and vertical separation between watermains and storm or sanitary sewers shall meet the requirements of MECP Procedure F-6-1, Procedures to Govern Separation of Sewers and Watermains.

New watermains are to be a minimum of 200 mm in diameter, however smaller mains may be allowed on a case-by-case basis. Minimum diameter of services shall be 19 mm for a residential dwelling, or larger as required for longer services or for other uses. The Engineer is to confirm sizing of services.

A minimum of two (2) valves will be required at tee intersections, while a minimum of three (3) valves will be required at cross intersections. Valves will also be required at a maximum spacing of 400 m along straight sections of watermain.

Hydrants are to be installed at a maximum 150 m spacing in residential developments, and at any dead-end watermains. For site plan projects, hydrants are to be installed to meet the travel distance requirements of the OBC.

9.3 Approved Materials

Watermain pipes are to be PVC DR-18, Class 235 to AWWA C900/C909, certified to CSA B137.3, UL Listed, NSF-61 Certified and FM approved, with cast iron fittings to AWWA C110 or C153, cement lined to AWWA C104.

Thrust restraints will be required on all horizontal bends, vertical bends, tees and caps. The standard of acceptance for mechanical restraints will be Uni-Flange Series 1350; concrete thrust blocks will not be allowed.

Valves are to be resilient-seated gate valves to AWWA C509 and shall open counter-clockwise (black nut).

Hydrants are to be Canada Valve Century EM, painted yellow with a bonnet reflector for available fire flows (red for < 1,900 L/min, yellow for 1,901 – 3,784 L/min, green for 3,785 – 5,676 L/min and blue for > 5,680 L/min). Hydrants shall open counter-clockwise and have drain holes open. Each hydrant shall also have an isolation valve.

For services, Type K copper pipe is preferred. Crosslinked polyethylene (PEX) pipes may however be used with a tracer wire.

9.4 Servicing

Water servicing for residential dwellings is to be as per Municipality detail SD.4 or SD.5. In rural cross-sections, servicing may extend beyond the utility easement as shown on Municipality detail SD.7.

Generally, water services are to be installed perpendicular to the watermain and temporarily capped at the property line at the curb stop. A wooden marker post is to be installed at the termination of laterals and shall extend a minimum of 1.0 m above finished grade.

Connection to the watermain shall be as per OPSD 1104.010 or 1104.020 with double bolt stainless steel service saddles (Ford Meter Box Company Model FS202 or approved equivalent).

SECTION 10 ROADS & SIDEWALKS

10.1 Layout

Local roadways are to be designed to discourage through or transient traffic and cul-de-sacs are to be avoided where possible.

In some cases, a traffic study and off-site improvements (for example, left-turning lanes) may be required to maintain an acceptable Level of Service.

10.2 Geometric Design

Geometric design of roadways shall be as per the general requirements of TAC Geometric Design Guide for Canadian Roads (1999). Parameters given in the table below are to be used for design and are based on the above design guide.

Road class	Design Speed (km/h)	Right-of-Way (m)	Asphalt Width* (m)	Min. / Max. Slopes (%)	Min. Horizontal Curve Radius (m)		Vertical Curves		
					Normal crown	Reverse crown	Min. Coefficient		Min. Length (m)
							Crest	Sag	
Local, rural	50	20	8.5	0.5 / 7.0	105	86	7	12	50
Local, urban	50	20	8.0	0.5 / 8.0	105	86	7	12	50
Cul-de-sac, rural	40	20	8.5	0.5 / 7.0	60	47	7	12	50
Cul-de-sac, urban	40	20	8.0	0.5 / 8.0	60	47	7	12	50

* Including paved shoulders for rural cross-sections

A vertical curve will be required where the algebraic difference in slopes is greater than 2%, for example where a +1.3% slope meets a -1.0% slope. Higher crest or sag coefficients should be used whenever possible when a vertical curve is required.

10.3 Intersections

Tee intersections are preferred, with roadways intersecting at right angles. A minimum spacing of 60 m shall be provided between intersections, measured at the centerlines of intersecting streets.

A minimum corner radius of 9.0 m is to be provided at intersections to new or existing local roads, while a minimum corner radius of 11.0 m is to be provided at intersections with County roads.

At tee intersections, the crown of the major road (through street) is to be maintained through the intersection and the profile of the intersecting road is to be adjusted as per OPSD 300.010 (fill) or OPSD 300.020 (cut) in both urban and rural cross-sections to avoid abrupt slope change at the “edge of asphalt” of the through road.

At cross intersections of two roadways of equal classification (for example, within a subdivision), the intersection may be graded as per TAC Figure 2.3.2.5 or 2.3.2.6, or one roadway may be designated as the major road.

A detailed intersection grading plan will be required for both tee and cross intersections to ensure adequate drainage.

10.4 Cross-Section & Materials

Refer to Municipal detail SD.1 and SD.2 for dimensions of lanes, shoulders, etc.

A geotechnical investigation will be required to establish the required materials for roadways, as well as thicknesses and compaction effort. At a minimum however, the following materials are to be used in the compacted thicknesses noted below:

- 40 mm HL-3 hot mix asphalt to OPSS 1150, compacted to minimum 92% of MRD,
- 40 mm HL-8 hot mix asphalt to OPSS 1150, compacted to minimum 92% of MRD,
- 150 mm Granular “A” to OPSS.MUNI 1010, compacted to 100% SPMDD,
- 300 mm Granular “B” Type II to OPSS.MUNI 1010, compacted to 100% SPMDD,
- Geotextile if deemed required by geotechnical investigation or due to conditions during construction,
- Select subgrade material or structural fill (depth as required to achieve design underside elevation of Granular “B”),

10.5 Curbs & Sidewalks

10.5.1 General Requirements

The requirement for curb and sidewalks will vary based on the required roadway cross-section (urban vs. rural) and is further discussed below. Refer to Section 2.2 for requirements pertaining to the roadway cross-section.

In all cases, a minimum of 0.5% slope will be required along curbs, while a slope of 1% is preferred. Monolithic curb and sidewalk will not be allowed.

10.5.2 Rural cross-section

In rural cross-sections, semi-mountable curbs with standard gutter as per OPSD 600.060 will be required at all intersection radii (along entire radius) and along the interior radius of a horizontal curve.

Curbs are to be offset 0.5 m from the edge of asphalt as per OPSD 304.010 (Plan C) and are to be terminated as per OPSD 608.010. Curb outlets as per OPSD 604.010 are to be installed at low point(s), complete with rip-rap pad as per OPSD 810.010 Type B (with geotextile).

Concrete sidewalks will not be required in rural sections; however, paved shoulders will be required.

10.5.3 Urban cross-section

In urban cross-sections, concrete barrier curbs will be required for all new roads, and concrete sidewalks will be required for all new roads except for cul-de-sacs shorter than 175 m.

Concrete curbs are to be with standard gutter as per OPSD 600.040 and concrete sidewalks are to be as per OPSD 310.010 to a minimum width of 1.5 m.

Thickness of sidewalks shall be a minimum of 125 mm and shall be increased to 150 mm at residential driveways or 200 mm at commercial/industrial driveways. Sidewalk cross-slope shall be a maximum of 4%, however 2% is preferred.

Sidewalk ramps are to be provided at unsignalized intersections as per OPSD 310.033 and at signalized intersections as per OPSD 310.030 (separate crosswalks) or as per OPSD 310.031 (intersecting crosswalks), complete with tactile walking surface indicator plates as per OPSD 310.039.

In all cases, it is preferred that utilities not be installed in sidewalks. Where this is not possible, utilities are to be isolated from the concrete as per OPSD 310.040.

Driveway curb depressions may be done during construction if driveway locations are known, or may instead be cut at a later time.

10.6 Asphalt Walkways

Asphalt walkways as per Municipality detail SD.16 may be required to provide pedestrian access from and to parks, schools, commercial areas, etc. Pre-consult with the Municipality to identify this requirement.

At a minimum, the following compacted thicknesses and materials shall be used:

- 50 mm HL-3 hot mix asphalt to OPSS 1150, compacted to minimum 92% of MRD,
- 150 mm Granular “A” to OPSS.MUNI 1010, compacted to 100% SPMDD,
- 300 mm Granular “B” Type II to OPSS.MUNI 1010, compacted to 100% SPMDD,
- Geotextile if deemed required by geotechnical investigation or due to conditions during construction,
- Select subgrade material or structural fill (depth as required to achieve design underside elevation of Granular “B”),

Lastly, chainlink fencing will be required along both sides of walkway where it abuts a residential property. Fencing shall be to the requirements of Section 5.5, but with a height of 1.2 m.

10.7 Driveways

All driveways are to be located as far as possible from intersections and shall be connecting to the minor street where possible.

Urban residential driveways shall be as per OPSD 351.010, while rural residential driveways are to be as per OPSD 301.010 or 301.020. A maximum of one driveway will be allowed per residential lot.

Urban commercial driveway as per OPSD 350.010, to a minimum width of 3.6 m wide for one-way access or to a minimum width of 6.0 m for two-way access. A maximum of two accesses will be allowed per commercial or industrial lot.

Refer to the Municipality’s current Driveway By-law for additional information.

10.8 Signs

The Developer will be required to pay for and install all required street signs (stop, dead end / no exit, speed limits, warning signs, etc.) and street name signs. All signs are to comply with the Manual on Uniform Traffic Control Devices (MUTCD) and with the latest edition of the Ontario Traffic Manual.

10.8.1 Regulatory Signs

Regulatory signs shall be as per OTM Book 5 – Regulatory Signs. Reflectivity for regulatory signs shall be Type III High Intensity Grade or Type IV High Intensity Prismatic for the signs listed in the table below:

Sign Number	Sign Name
Ra-1, Ra-1t	STOP Sign & ALL-WAY Tab Sign
Ra-2, Ra-2t	YIELD Sign & Tab
Rb-21	ONE-WAY Sign
Rb-19, Rb-19t, Rb-20	DO NOT ENTER Signs & Tabs
Rb-92	ROAD CLOSED Sign

For all other regulatory signs, reflectivity shall be Type I Engineering Grade as a minimum.

10.8.2 Warning Signs

Warning signs shall be as per OTM Book 6 – Warning Signs. Reflectivity for warning signs shall be Type III High Intensity Grade or Type IV High Intensity Prismatic for the signs listed in the table below:

Sign Number	Sign Name
Wa-8, Wa-8L, Wa-8R, Wa-8LR	CHECKERBOARD Sign (various directions
Wa-9	CHEVRON ALIGNMENT Sign
Wa-17	DOUBLE ARROW Sign
Wa-32t	KM/H Tab Sign
Wa-33L, Wa-33R, Wa-33LR	OBJECT MARKER Sign (various directions)

Adapted from OTM Book 6 – Warning Signs

For all other warning signs, reflectivity shall be Type I Engineering Grade as a minimum.

10.8.3 Temporary Signage

Temporary signage to be as per OTM Book 7 – Temporary Conditions.

10.8.4 Sign Posts

Sign posts for roadways with barrier curbs and posted speeds less than 70 km/h are to be non-breakaway u-flange posts per OPSD 990.110, up to the following maximum dimensions:

- Maximum sign width of 90 cm,
- Maximum sign height of 90 cm,
- Total sign area (including tabs) not exceeding 0.56 m^2.

10.9 Line Painting

Line painting shall be to the general requirements of OTM Book 11 – Markings and Delineation. More specifically, 300 mm wide white stop bars are to be painted at all stop signs, complete with a 100 mm wide yellow centerline tails at all stop signs (minimum 15 m long).

White directional arrows are to be painted per the general requirements of OTM Book 11 – Markings and Delineation, in turning lanes or in other locations as required by the Municipality.

In rural cross-sections, a 100 mm white solid line is to be painted along paved shoulders.

Line paint shall be water-borne to OPSS 1716, with glass beads to OPSS 1750.

10.10 Roadside Safety & Guiderails

A clear zone is to be provided per the requirements of the MTO Roadside Safety Manual (1993).

10.10.1 Clear Zone Width

In rural cross-sections, the clear zone shall be a minimum of 3 m wide when design speed is less than 60 km/h and an extended clear zone is to be provided where non-recoverable slopes are proposed. Refer to the Roadside Safety Manual for more information and for clear zone width requirements for higher design speeds.

In urban cross-sections, the clear zone shall be a minimum of 0.5 m wide when the design speed is less than 60 km/h.

10.10.2 Protection

Hazards such as exposed ends of cross-culverts, deep ditches and/or steep side slopes, etc. located within the clear zone must be protected by a guiderail per OPSD 912.130, complete with end treatments at both ends of the guiderail, as per OPSD 922.530 or equivalent as approved by the Municipality.

The guiderail length is to be calculated as per the Roadside Safety Manual (Figure 3.4.2 for approach length “La” and Figure 3.4.3 for approach length “Là”).

10.11 Road Cuts

It is preferred that underground infrastructure road crossings be done with trenchless methods where this is possible and/or practical. Where this is not possible and/or practical, road cuts may be done as required to complete the work.

In all cases, a permit will need to be obtained from the Municipality or County as appropriate, fees will need to be paid and the work must not begin before the Municipality or County has given approval to proceed. The Developer or Contractor must also notify the Municipality or County at least two working days in advance of commencement of work.

Reinstatement of the roadway shall match existing granular and asphalt thicknesses, while maintaining the minimum thicknesses given in Section 10.4. Note however that reinstatement thicknesses may be increased for County or provincial roads. All connections to existing asphalt are to be step connections as per Section 10.12.

The Developer will be responsible to have compaction testing done on the backfill and granular material by a third-party geotechnical testing firm.

10.12 Connection to Existing Asphalt

At all connections to existing asphalt, the existing asphalt will need to sawcut to full depth to produce a clean, straight edge. Asphalt is to be sawcut shortly before reinstatement work is undertaken. Any damaged or broken edge of asphalt is to be re-sawcut prior to the final connection being made.

The existing top lift of asphalt is to be milled approximately 40 mm deep and a minimum of 1,000 mm wide to create step connection as per Municipality detail SD.15.

Tack coat is to be installed where new asphalt meets existing asphalt, on both horizontal and vertical surfaces.

A butt joint may instead be done only where the existing depth of asphalt is equal to or less than 50 mm. Tack coat will be required on the vertical surface.

SECTION 11 GRADING

11.1 Typical Lot Grading

Split lot grading as per Municipality detail SD.9 is preferred where possible. In other cases, back-to-front lot grading as per Municipality detail SD.10 may be done. Walkout basements may be done as per Municipality detail SD.11, however these lots must be clearly designated and designed as such.

Existing elevations are to be matched along all property lines, and existing drainage patterns must not be impeded. Off-site grading modifications may be done; however, the Developer will be responsible to review and coordinate with the adjacent property owner, obtain written permission and reinstate the area.

Likewise, the written permission of the Municipality will be required to modify or interfere with existing drains or water courses.

11.2 Design Slopes & Terracing

The following minimum or maximum slopes are to be achieved:

- Minimum of 0.5% along curbs, however 1% is preferred where possible,
- Minimum of 1% for asphalt or concrete areas,
- Minimum of 2% for grassed areas,
- Maximum of 5% for back yards in residential subdivisions,
- Maximum of 7% for front yards and driveways in residential subdivisions.

4H:1V terracing or retaining walls per Section 11.3 may be done where the abovementioned maximum slopes are exceeded.

11.3 Retaining Walls

Retaining walls may be done where the maximum slopes discussed above are exceeded, however will not be permitted within Municipality right-of-way and within easements. Retaining walls are to be constructed of cast-in-place concrete, precast concrete or armor stone.

All retaining walls exceeding 1,000 mm in height must be designed to the requirements of the Ontario Building Code, shall be protected by guards on all open sides and must be designed and stamped by a structural Engineer.

The height of the wall will be measured from the lowest finished ground elevation at the bottom of the wall to the highest finished ground elevation at the top of the wall. Retaining walls may be stepped, but the horizontal distance between two walls must be at least twice the height of the highest wall. For example, two stepped retaining walls with a height of 700 mm and 500 mm must be separated by at least 1,400 mm.

Lastly, a subdrain is to be provided behind the base of the wall for drainage with an adequate outlet.

Provide subdrain behind wall, swale along top of wall & adequate surface drainage.

11.4 Swales

New swales are to be provided as per Municipality detail SD.12 and as required to achieve positive drainage and must have a minimum slope of 1.0%. The minimum slope may be reduced to 0.5% if perforated subdrains are installed. Subdrains are to outlet into a catchbasin or into a CSP pipe as per Municipality detail SD.13.

When abutting existing (neighbouring) property, swales are to be located entirely on the new lot or property, whereas swales located between two newly created lots may be located on the common lot line.

Lastly, 3.0 m wide easement will be required along rear yard swales.

11.5 Rough Lot Grading

The Developer is responsible for rough lot grading of all lots, and the satisfactory completion of rough lot grading is one requirement of building permit issuance.

Generally, lots shall be shaped or contoured as necessary to provide positive drainage, and temporary culverts, ditches, etc. are to be provided as required. All lot corners and swales shall be graded from 0 to 300 mm below the finished grade shown on the approved lot grading plan. The Developer also must establish ground elevation at foundation wall consistent with the lot grading plan.

The Developer's Engineer will be responsible to prepare and submit a "Rough Lot Grading" certificate to certify rough lot grading, which shall include the 'as-constructed' rough lot grades.

11.6 Final Lot Grading

The purchaser of the lot is responsible for final lot grading, and must submit a detailed grading plan for Municipality review, including the actual footprint and location of the dwelling, meeting the general intent of the subdivision lot grading plan and also meeting the requirements of Sections 11.1 to 11.4, inclusively.

A $2,000 deposit will be taken as part of the building permit process specifically for the final lot grading.

Upon completion of final lot grading, the purchaser of the lot is to retain the services of a professional civil or municipal Engineer or Surveyor to verify the "as-constructed" elevations and general compliance with design, and to prepare the "as-constructed" grading plan.

The Engineer or Surveyor must be accredited under Professional Engineers Ontario (PEO) or under the Association of Ontario Land Surveyors (AOLS), respectively, and must have valid liability insurance.

Final lot grades must be within +/- 50 mm of design elevations, positive drainage must be achieved throughout, and the general intent of the grading plan must be met. The previously mentioned deposit will be reimbursed only when these conditions are met, and upon the receipt of the "as-constructed" grading plan.

SECTION 12 STREET LIGHTING

12.1 Design

Street lights should be located on or near side property lines where possible. Where this is not possible or practical, street lights will need to be coordinated with the proposed driveway locations.

Street lights shall be installed at all intersections, at all horizontal curves and throughout the proposed development at a maximum spacing of 75 m. Street lights shall be placed at the cross-sectional location shown on drawings SD.1 or SD.2.

12.2 Approved Materials

All street lighting shall be one of the three standardized LED luminaires:

- Philips Lumec StreetView (105W)
- Philips Lumec L40U (108W)
- Philips Lumec Urbanscape (108W)

SECTION 13 UTILITIES

13.1 Design & Coordination

The Developer will be responsible for the design and coordination of all utilities as discussed below as well as all associated deposits, fees, etc.

Developer is to prepare a Composite Utility Plan per the requirements of Section 2.4.1.

13.2 Hydro, Communications, Natural Gas

The Developer will be responsible to provide hydro servicing, Bell, cable (where available) and natural gas (where available). All utilities are to be installed in a joint utility trench as per Municipality detail SD.19, with road crossings as per Municipality detail SD.20 or as otherwise acceptable by all parties.

13.2.1 Rural Cross-Section

In rural cross-sections, the joint utility trench is to be installed within 3.0 m wide utility easements, which are to be located outside the right-of-way as shown on Municipality detail SD.2.

13.2.2 Urban Cross-Section

In urban cross-sections, the joint utility trench is to be installed within the right-of-way as shown on Municipality detail SD.1.

13.3 Canada Post

Lastly, the Developer will be responsible to coordinate with Canada Post for the location of supermailbox(es) as required. Proposed location(s) shall also be acceptable to the Municipality. Concrete pads (precast or cast-in-place, at the discretion of Canada Post) and sidewalk access will need to be provided at all supermailbox(es) by the Developer.

Refer to Municipality detail SD.18 for additional information.

Prospective buyers will also need to be informed of the location of supermailbox(es) through a clause in the agreement of purchase and sale.

SECTION 14 CONSTRUCTION

14.1 Meetings

A pre-construction meeting is to be held prior to start of construction and is to be attended by representatives of the Developer, the Developer's Engineer, the Municipality, the Contractor and any other parties as required.

Regular construction meetings or other coordination meetings are to be held as required.

14.2 Coordination of Work

The Developer or Contractor will be responsible to coordinate with the Municipality and affected residents for road closures, driveway closures, road cuts, watermain shutdowns, etc. as required to complete the work. The Developer or Contractor will also be responsible to coordinate with other authorities (utilities, County, etc.) as required.

14.3 Pre-Construction Surveys

The Developer shall arrange and pay for a photo and/or video pre-construction survey where work is proposed in proximity of existing dwellings or structures, or elsewhere as deemed required by the Municipality.

A pre-construction survey with vibration monitoring to OPSS standards will also be required for blasting of bedrock.

14.4 Health & Safety

The Contractor must follow all relevant health and safety laws and guidelines and must notify the Ontario Ministry of Labour prior to beginning work.

Traffic control on public roadways shall be as per the Ontario Health and Safety Act and OTM Book 7. Traffic control plan is to be forwarded to Municipality for review prior to beginning work.

Complete road closures will typically not be allowed on public roadways. A minimum of one 3.5m wide lane must always be kept open and traffic must be controlled with Traffic Control Persons (TCP) or Portable Temporary Traffic Signals (PTTS).

14.5 Insurance

The Developer will be required to obtain an insurance policy with an insurance company satisfactory to the Municipality to ensure for the joint benefit of the Owner and the Municipality against any liability that may arise out of the construction or installation or maintenance of any work to be performed.

The insurance policy is to extend until the roads are assumed by the Municipality and shall carry limited liability in an amount to be specified by the Municipality, but no less than $5,000,000, inclusive, of public liability and property damage. The policy shall name the Municipality.

Additional insurance will be required for blasting operations.

14.6 Financial Security Reduction

Prior to starting work, the Developer will be required to provide financial security as discussed in Section 2.8.

The financial security may be reduced as work progresses. Reduction requests must include:

- Updated construction cost estimate clearly indicating the value of work completed and the value of outstanding work,
- letter from Developer's Engineer confirming that the completed work was inspected and is in general compliance with the design,
- reduction request processing fee of $250 or per the current Fees & Rates By-Law.

Value of the financial security ("underground works") will not be reduced to less than the value of the outstanding "aboveground works" at any time during construction. Additionally, the value of the financial security will not be reduced to more than 95% of the initial amount for the length of the warranty period discussed in Section 14.13.

The financial security will be entirely released only when "final completion" is achieved per the requirements of Section 14.15.

14.7 Inspection Requirements

The Developer shall arrange and pay for inspection services during construction. Full time inspection will be required during construction of any underground infrastructure, during pouring of concrete curbs and sidewalks, and during placement of asphalt. Periodic inspection will be required during installation of roadway granulars, lot grading and miscellaneous reinstatement.

Inspection is to be performed by a qualified engineering consulting firm. Both the firm and its site staff performing inspections must have experience and knowledge of municipal infrastructure and construction methods.

The Municipality may provide additional engineering review services as required, and on a case-by-case basis. Costs of such review and inspection shall be paid for by the Owner.

14.8 Construction Testing Requirements

14.8.1 Watermains

Hydrostatic watermain testing to OPSS.MUNI 441 is to be done on all watermains by the Contractor. Testing is to be witnessed by the Developer's Engineer.

Watermains are also to be disinfected, flushed and sampled to the requirements of AWWA C651 (latest version) by the Contractor. Water samples are to be tested for e. coli, total coliform and heterotrophic plate count. Sampling is to be witnessed by the Developer's Engineer and by the Municipality.

14.8.2 Storm & Sanitary Sewers

Closed-circuit television (CCTV) inspections are to be done on all storm and sanitary sewers as per the requirements of OPSS 409.

14.8.3 Forcemains

Hydrostatic forcemain testing to OPSS 412 is to be done on all forcemains by the Contractor. Testing is to be witnessed by the Developer's Engineer.

14.9 Materials Testing Requirements

The Developer or Contractor shall arrange and pay for material testing & geotechnical reviews during construction. All materials testing to be performed by a qualified geotechnical engineering firm.

The Municipality requires testing be done to the frequencies listed in the table below:

Related Work	Testing	Frequency / Order of Precedence
General	Gradation & Proctor for Granular "B", Granular "A" and select subgrade material	Once per material. Re-test if material source changes, if material visibly changes or if test results are older than 1 year
Sewers, watermain	Compaction for granular trench bedding, surround and cover.	Random inspections, 2 to 3 times per week
Sewers, watermain	Compaction for trench backfill (select subgrade material)	Random inspections, 2 to 3 times per week
Roadway	Subgrade visual inspection	Entire subgrade, prior to placing Granular "B"
Roadway	Compaction for Granular "B"	Every 25 m, prior to placing Granular "A"
Roadway	Compaction for Granular "A"	Every 25 m, prior to placing asphalt
Roadway	Compaction for asphalt	Every 25 m, each lift
Roadway	Full Marshall asphalt testing	1 test per day, per type of asphalt
Roadway	Asphalt temperature verification	Every truck load – may be done by Developer's Engineer instead of by a geotechnical firm
Curbs, sidewalks	Compaction for Granular "A"	Every 25 m, prior to pouring concrete
Curbs, sidewalks	Concrete air & slump	Every load
Curbs, sidewalks	Concrete strength (cylinders)	Every day or every 20 m^3, whichever occurs first

14.10 Close-out Documentation & "As-Built" Records

The Developer's Engineer and Contractor will be responsible to assemble and submit the close-out documentation to the Municipality, consisting of digital and hard copies of the following:

- All watermain test results (hydrostatic and bacteriological),
- All CCTV inspection reports & DVD's for sanitary and storm sewers,
- All material testing & geotechnical testing results and reports per Section 14.9,
- Service location sheet for each lot as per Municipality detail SD.21 or SD.22, including location of services in relation to the lot corners, and geodetic elevation of services at property line,
- A copy of all approvals (CA, MECP, etc.),
- Approved shop drawings,
- Operation & maintenance manual for stormwater management facilities, oil & grit separators, etc.,
- Operation & maintenance manual for pumping stations,

- "As-built" drawings, in both AutoCAD and PDF file formats.

The "as-built" drawings are to be updated (red-lined) as construction progresses and final (clean) drawings are to be prepared by the Developer's Engineer at the end of project.

At a minimum, the "as-built" drawings shall include:

- invert elevations of all storm and sanitary sewers at all structures,
- invert elevations of all culverts and ditches at maximum 25 m spacing,
- watermain obvert elevations at maximum 25 m spacing,
- rough lot grading elevations (red-lined),
- any changes made during construction (in plan view and profile view).

14.11 Building Permits & Occupancy

Building permits will be issued by the Municipality when all the following conditions are met:

- Developer's Engineer is to issue a letter to confirm that the underground infrastructure is in general compliance with the design and recommends acceptance of the works,
- the Municipality has approved the underground infrastructure,
- The Plan of Subdivision, easements and land dedications have been registered,
- The rough lot grading is complete per Section 11.5 and has been certified by an Engineer or Surveyor,
- Road Granular "A" base has been installed and is within +/- 50 mm of design grade,
- Service location sheets have been provided to the Municipality.

Occupancy permits will be issued once the roads are assumed by the Municipality.

14.12 Substantial Completion (Preliminary Approval)

The works will be given preliminary approval by the Municipality when all the following conditions are met:

- The work is ready for use, or is being used for its intended purpose,
- A deficiency walkthrough has been completed with the Municipality, the Developer and its Engineer,
- The value of incomplete work and deficiencies is less than:
  - 3% of the first $1,000,000, plus
  - 2% of the next $1,000,000, plus
  - 1% of the balance of the Engineer's estimate for the work
- The base lift of asphalt is installed,
- CCTV inspections are completed on all sanitary & storm sewers,
- Watermain testing (hydrostatic and bacteriological) is complete,
- The Developer's Engineer has issued a letter to confirm that the works are in general compliance with the design and recommending preliminary acceptance of the works.

14.13 Warranty Period

A one-year warranty period will apply, starting on the substantial completion date.

5% of the financial security will be held back for the duration of the warranty period and will be released only when “final completion” is achieved per the requirements of Section 14.15.

14.14 Maintenance & Damages

The Developer will be responsible for maintenance of works until final approval is granted by the Municipality. Any maintenance work performed by the Municipality at the request of the Developer or due to emergencies will be carried out at the Developer’s expense.

Municipality will perform snow removal only after the first lift of asphalt is installed and ramping of asphalt has been done.

The Developer will also be responsible for sweeping existing or new roadways dirtied by construction activities, will be responsible to flush new and existing storm & sanitary sewers if dirtied by construction activities and will be responsible for all damages caused to existing infrastructure (private or public).

14.15 Final Completion & Acceptance

The works will be given final acceptance by the Municipality when all the following conditions are met:

- Warranty period is over,
- All deficiencies, incomplete work and any warranty issues have been addressed,
- All closeout documentation and “as-built” records have been provided to the Municipality per Section 14.10,
- A final walkthrough has been completed with the Municipality, the Developer and its Engineer,
- Developer’s Engineer has prepared a letter to confirm that all deficiencies have been addressed and recommending final acceptance of the works,
- All other requirements of the subdivision agreement have been met.

SECTION 15 SITE PLAN CONTROL REQUIREMENTS

15.1 Applicability & Exemptions

Site plan control is used by the Municipality to ensure that proposed developments are functional, appropriately designed and minimizes impacts to neighbouring properties.

Site plan control will apply to commercial, industrial, institutional and multi-unit residential developments and will not be required for agricultural uses, for single detached residential dwellings and for semi-detached or duplex dwellings. Pre-consultation with the Municipality will serve to establish this requirement.

15.2 Parking & Site Access

On-site parking and site access will need to be provided to the requirements of the Municipality's current Zoning By-law for the proposed use.

Individual parking stalls are to be a minimum of 2.75 m wide and 5.50 m long, while access and parking aisles are to be a minimum of 3.6 m wide for one-way access, or 6.0 m wide for two-way access. Parking lots and site access(es) are to be surfaced in concrete or asphalt.

15.3 Loading Spaces

Loading spaces for loading or unloading good, merchandise or materials will need to be provided to the requirements of the Municipality's current Zoning By-law for certain proposed uses. Loading spaces may not be located on a street, within a required parking area, within a front yard or exterior side yard.

The loading space is to be a minimum of 3.6 m wide and 13.0 m long and shall have a vertical clearance of 4.2 m and is to be accessed with a lane having a minimum width of 3.5 m for one-way traffic or 6.0 m for two-way traffic.

15.4 Barrier Free Requirements

Barrier free parking stalls are to be provided to the requirements of the Municipality's current Zoning By-law and with the latest version of the Accessibility for Ontarians with Disabilities Act (AODA).

A minimum of one "Type A" barrier free parking stall will be required and shall be a minimum of 3.4 m wide by 5.5 m long. An access aisle a minimum of 1.5 m wide must be provided adjacent to all barrier free parking stalls. The access aisle may be shared by two adjacent barrier free parking stalls.

"Type B" barrier free parking stalls are also to be provided to the requirements of the AODA. Type "B" stalls shall however be a minimum of 2.75 m wide to match the width given in the Municipality's current Zoning By-law for a standard parking stall by 5.5 m long. An access aisle a minimum of 1.5 m wide must also be provided and may again be shared by two adjacent barrier free parking stalls.

15.5 Firefighting

Fire route(s) are to be provided to the requirements of the OBC.

Hydrant(s) must also be provided on site if required to meet the travel distance requirements of the OBC.

15.6 Landscaping

A landscape open strip must be provided between a parking area (more than 4 parking spaces) and either a residential area or a public street, to a minimum width of 3.0 m.

15.7 Signs

Fire route signs and barrier free parking signs are to be provided to the requirements of the OBC, Highway Traffic Act, and Municipality current By-laws.

Commercial signs shall meet the requirements of the current Sign By-law and will require a permit from the Municipality.

15.8 Grading & Retaining Walls

Grading and retaining walls on proposed site plan developments shall meet the requirements of Section 11.1 to 11.4, inclusively.

15.9 Servicing

Servicing shall generally meet the requirements of Section 4, Section 5, Section 6 and Section 9 of this manual, of the OBC and all other applicable design guidelines.

15.9.1 Storm Sewer

The storm sewer service and on-site storm sewers are to be sized per Section 6.5 to accommodate 5-year storm. Stormwater runoff is to be calculated per Section 6.3.

Where flat roofs with roof drains are proposed, the storm sewer shall be sized to include the design flow from the roof drains as calculated by the mechanical Engineer to the requirements of the OBC.

Where sloped roofs are instead proposed, downspout(s) may not be directly connected to the storm sewer – an air gap must be provided to avoid surcharging the storm sewer. Location of all downspouts are to be clearly shown on the drawings.

The storm sewer service and on-site storm sewers are to be installed with clean-outs or maintenance holes per the requirements of the OBC.

Storm sewer services which are 150 mm in diameter or smaller are to be connected to an existing storm sewer as per OPSD 1006.010 or OPSD 1006.020 using a “Kor-N-Tee” saddle or approved equivalent. Storm sewer services that are larger than 150 mm in diameter are to be connected to an existing storm sewer as described in Section 6.7.

15.9.2 Sanitary Sewer

The sanitary service shall be designed per Section 4.1 to accommodate the peak design flow. To do so, the average daily flow is to be distributed over a reasonable time frame (for example, 7 hours for a school) and a peaking factor will need to be applied.

Average daily flows are to be calculated from Table 8.2.1.3.B of the OBC based on the proposed use.

The sanitary sewer service is to be installed with clean-outs or maintenance holes as per the requirements of the OBC. Oil and grease interceptors are also to be installed per the requirements of the OBC and the Municipality's current Sewer Use By-law. In some cases, a monitoring maintenance hole may be required near the property line.

Backwater valves (inside the building) are to be installed to the requirements of the OBC.

Sump pumps and rainwater leaders may not be connected to sanitary sewers.

Connection of new 100 mm or 150 mm laterals to an existing sanitary sewer shall be as per OPSD 1006.010 (rigid pipe) or OPSD 1006.020 (flexible pipe) using Kor-N-Tee saddle or approved equivalent. Larger laterals are to be connected to an existing sanitary sewer as described in Section 4.3.

15.9.3 Water

The water service shall be designed per Section 9.1 to accommodate the peak flow. To do so, the average domestic daily flow is to be distributed over a reasonable time frame (for example, 8 hours for a school) and a peaking factor will need to be applied.

Average domestic daily flows to be calculated from Table 8.2.1.3.B of the OBC based on the proposed use.

Simplified water service sizing calculations (head loss spreadsheet) will be acceptable for unsprinklered buildings only.

In cases where sprinklers are proposed, the water service is to be sized to accommodate the fire flow calculated per the Fire Underwriters Survey – Water Supply for Public Fire Protection (1999) or based on the actual sprinkler demand as calculated by the mechanical Engineer. Calculations shall be done with modeling software (WaterCAD, WaterGEMS, EPANET, or similar), and based on actual flow curves as measured in the field.

New water services shall connect to an existing watermain using a wet tap connection where possible.

15.10 Stormwater Management

Stormwater management will be required for all projects, unless otherwise noted.

A detailed stormwater management report and calculations to be prepared by an Engineer and provided to the Municipality.

Quantitative stormwater control is to be provided per requirements of Section 8.2, while qualitative treatment is to be provided per requirements of Section 8.3. See also Section 8.3 for approved stormwater management methods.

15.11 Garbage & Recycling

A garbage and recycling enclosure is to be provided, unless otherwise noted. The enclosure is to be sufficiently large to accommodate all proposed garbage and recycling bins.

15.12 Construction & Inspection

The Municipality does not have any requirements for inspection of work on private property, other than the need for the architect/engineer to provide general reviews per the requirements of the OBC. All general review reports are to be forwarded promptly to the Municipality CBO.

The following requirements apply for all work within Municipality right-of-ways:

- Meetings and coordination will be required as discussed in Section 14.1 and Section 14.2,
- Traffic control will be required as per Section 14.4,
- Insurance will be required as per Section 14.5,
- Inspection will need to be provided as per Section 14.7,
- Material testing will need to be provided as per Section 14.8,
- Close-out & as-built documentation will need to be provided as per Section 14.10.

Appendix “A”

Subdivision Process – Step by Step

Site Plan Process – Step by Step

Appendix “B”

Typical Subdivider’s Agreement

Appendix “C”

Curve Numbers

Appendix “D”

Municipality Details