THE MUNICIPALITY OF
LAMBTON SHORES

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MUNICIPAL DEVELOPMENT AND SERVICING STANDARDS

Updated February 2026

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INTRODUCTION

The following Municipal Development and Servicing Standards provide a means of standardization for the design and construction of sanitary and storm sewers, watermains and roads in the Municipality of Lambton Shores for both new and reconstruction projects.

These standards have been developed with the intention of identifying which items should be considered in the design and construction of the various services to be provided in the development. However, reference should also be made to existing standard methods of design outlined in the Municipal Engineers Association Design Manual, Ministry of Environment, Conservation and Parks Design Guidelines, Ministry of Transportation Geometric Design Standards (Roads) and the Ontario Provincial Standard Specification and Drawing Manuals.

The following guidelines and standards should be applied wherever possible in the design and construction of the various services outlined herein. Where deviations in the standards are warranted, the necessary approvals outlining the changes must be obtained from the Municipality of Lambton Shores.

Periodic revisions or additions to these guidelines and standards may occur. All users are required to keep their copy of the guidelines and standards current by obtaining all revisions and additions from the Municipality as they become available.

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SECTION 1.0 – GENERAL

1.1 PURPOSE

The purpose of these guidelines and standards is to aid in the standardization of the design and construction of municipal services for residential, commercial and industrial areas and developments in the Municipality of Lambton Shores.

This is also intended as a guide for developers, builders and the general public in the development process for subdivisions, developments by severance, and for individual site developments.

1.2 DESIGN GUIDES

These guidelines and standards should be followed wherever possible. Should special or unique conditions occur, minor deviations from these guidelines and standards may be considered and are subject to the written approval of the Municipality. In addition, the Municipality reserves the right to require compliance with one or more of the standards and processes included herein, to require variations from these standards at the Municipality's discretion and to require additional information, standards, services, etc. further to those included herein. For example, the Municipality may require higher standards to accommodate higher density developments, collector and arterial roads, heavy industry, etc.

These guidelines and these standards are to be used in conjunction with standard engineering practices and design tests as well as the standards, regulations, design manuals and guidelines of the Municipal Engineers' Association (MEA), Municipal Electrical Association, Ontario Hydro Distribution Standards, Ministry of Environment, Conservation and Parks (MECP), Ministry of Transportation (MTO), Ontario Provincial Standard Drawings (OPSD), Ontario Provincial Standard Specifications (OPSS), MECP Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning (NPC-300), Ministry's Standard Operating Policy for Sewage Works, National Fire Protection Association, Hydraulic Institute Standards, Canadian Standards Association (CSA), Technical Standards and Safety Authority (TSSA), and various other government Ministries and other regulatory agencies.

1.3 DEVELOPMENT PROCESSES AND APPROVALS

Depending on the location and nature of the development, the Developer may be required to obtain approvals from various other regulatory agencies including (but not limited to) one or more of the following and in addition to and/or prior to obtaining approval from the Municipality's Engineer.

a) the Ministry of Environment, Conservation and Parks (MECP)
b) the Ministry of Transportation (MTO)
c) the Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF)
d) the Ministry of Municipal Affairs (MMA)
e) the Lambton Health Unit
f) the County of Lambton
g) the Ausable Bayfield Conservation Authority (ABCA)
h) the St. Clair Region Conservation Authority (SCRCA)

It is the responsibility of the Developer to provide the Municipality with suitable written documentation of approval from the regulatory agencies.

The development will be subject to the requirements of one or more Municipal by-laws such as:

a) the Zoning By-law
b) the Official Plan
c) the Building By-law
d) the Site Plan Control By-law
e) Sewage By-laws
f) Water By-law
g) Grading By-laws
h) Occupancy Permit By-law

The Developer shall be required to enter into a Development or Subdivision Agreement with the Municipality and pay fees to the Municipality such as application fees for Zoning and Official Plan amendments, severances and development agreements, development charges and such other fees as may be required.

Appendix A includes copies of the following:

- General Procedural Guidelines for Subdivision Development
- Subdivision Requirements Checklist

The noted documents are provided for information purposes and the Developer and/or their agent should familiarize themselves with the Procedures and Requirements associated with the Subdivision Development process.

1.4 ENGINEERING

The Developer shall retain a Professional Engineer licensed in the Province of Ontario for the design of all services, the preparation of plans and specifications, and the supervision and inspection of all construction of the works.

The Developer may be required to submit a hydrogeological study and/or geotechnical report prepared by a Geotechnical Engineer licensed in the Province of Ontario. Elevations

of ground surface at boreholes and test pits shall relate to geodetic datum. The geotechnical report may be required to address the suitability of the soils at the site and shall make recommendations pertaining to the use of native soils for trench backfill, roadway pavement design, earthworks for site grading, and comments on foundation design. Where such reports are required, a minimum of two (2) hard copies of each shall be submitted to the Municipality, in addition to digitally for all submission files.

The Developer's Engineer and Planner must consider the overall servicing and development of adjacent lands in the watershed which may be affected by the development, when submitting the development proposal. Where applicable, such considerations and recommendations concerning existing sanitary sewage treatment plants, sewage collection systems, storm water management, water supply/storage and distribution facilities, pumping stations, and oversizing of mains, as well as traffic studies may be required to be submitted by the Developer. The layout of internal roads should also consider the future development of abutting lands. The Developer may be required to enter into agreements with the Municipality concerning such items as development charges, cost sharing for oversizing and front-end financing to allow for proper and orderly future development of the neighbouring lands as well as the proposed site.

For all developments, the Developer's Engineer shall submit sufficient copies of the preliminary design brief, outlining the proposed design criteria as well as commenting on and making recommendations on any previous reports or studies completed for the area of proposed development. In addition the pre-design brief should address all necessary preliminary investigations and explorations, include an analysis of existing conditions and of all possible alternatives, including financial considerations and of all preliminary estimates of cost, as a basis for conclusions and recommendations to be included in the report to the Municipality, for review. The minimum requirements of the applicable statutes, by-laws, Ministries and regulatory agencies must be satisfied.

The Developer's Engineer shall provide evidence of Professional Liability Insurance from their Engineer's Professional Liability Insurance Insurer, in the amount of $2,000,000 (minimum), prior to the review of any reports/briefs by the Municipality of Lambton Shores.

1.5 UTILITIES

The Developer shall coordinate the installation of utilities including T.V. cable, Ontario Hydro, Bell Canada, Enbridge Gas, and others as required. These utilities shall be installed in accordance with the "Typical Cross-Sections", as noted in Appendix B.

SECTION 2.0 – SUBMISSION OF PLANS, REPORTS AND STUDIES

2.1 SUBMISSION PROCEDURE

All submissions of plans, specifications, documents, reports, studies, preliminary design criteria proposals, etc. shall be made to the Clerk of the Municipality in sufficient quantities as may be required for distribution by the Clerk to such persons as the Project and Infrastructure Manager, Building Official, Planner, Municipality's Consulting Engineer, Fire Department, Hydro etc.

2.2 GENERAL PLAN REQUIREMENTS

All drawings shall be standard A-1 Metric drawing size (594mm x 841mm). All drawings are to be signed and sealed by a Professional Engineer licensed in the Province of Ontario. General plan layout shall be in accordance with standard engineering practice. All elevations on grading plans, site plans, servicing plans, and profiles, etc. shall relate to Geodetic Survey of Canada Datum.

2.3 DRAWINGS TO BE SUBMITTED

In general, the following drawings are required for subdivision developments. Some of the following may also be required for individual site plan control developments.

a) A key plan, to scale of not less than 1: 10,000 showing the general location of the development to be serviced.
b) One or more general servicing plans, to a scale of not less than 1: 2,000 showing all services to be constructed, including storm sewers, sanitary sewers, the water distribution system, roads, street lighting systems and sidewalk including details on tie-in to existing adjacent services.
c) A lot grading plan, to a scale of not less than 1: 500 and including sufficient areas of adjacent land with contours where applicable to illustrate total drainage patterns.
d) Plan and profile drawings for each street to be constructed, reconstructed, widened, etc., and for each service easement to a scale of 1: 500 horizontally and 1: 50 vertically.
e) A storm drainage area plan to a scale of not less than 1: 2,000 and including all interior and exterior tributary areas which contribute to the storm sewer and/or storm water management design. Storm sewer design charts shall be included on the storm drainage plan or submitted on a separate sheet, where applicable. The design charts should include criteria used for design.

f) A sanitary drainage area plan, to a scale of not less than 1: 2,000 and including all interior and exterior tributary areas. Where applicable sanitary sewer design charts shall be included on the sanitary drainage plan of submitted on a separate sheet, where applicable. The design charts should include criteria used for design.

g) Plans of the entire water system shall be submitted to the Ministry of the Environment, Conservation and Parks and the Municipal Engineer for approval and prepared in accordance with the Ministry of the Environment, Conservation and Parks Requirements and the Municipal Drinking Water Licensing Program (as applicable). This submission shall consist of an overall plan, a plan and profile of each watermain drawn to the same scale as the roads, together with typical details of house service connections, pipe bedding and other appurtenances. Approval for construction will not be given until all the requirements of the Ministry of the Environment, Conservation and Parks and the Municipal Drinking Water Licensing Program are fulfilled and the necessary approvals received.

h) Such other drawings showing notes, details, typical sections, etc. as may be necessary for the proper construction of the works, such as:

   i. typical road cross-section
   ii. typical lot grading section
   iii. typical swale details
   iv. geotechnical report information
   v. legend
   vi. storm sewer outfall structures/erosion protection and sedimentation controls
   vii. materials
   viii. trench details
   ix. pumping facilities
   x. storm water management systems and facilities
   xi. water pumping and storage facilities; water distribution systems; design data and calculations including domestic and fire design flows used, location of fire demand flows and resulting head loss in each section of the distribution system; and any other information or plans which the Municipality may require
   xii. details of other items not covered by the OPSD, etc.

One or more of the above drawings which are to become part of the construction drawing package, shall include sufficient legal survey monumentation, dimensions, etc. to enable the Contractor and/or Engineer to locate and/or layout the road rights-of-way, easements, and/or lot corners, as may be required.

The Subdivision Requirements Checklist included in Appendix A should be referenced when preparing drawings to confirm that the appropriate information has been provided.

2.4 FINAL APPROVAL / SUBMISSION

After final approval has been given by the Municipality and all other regulatory agencies, and after all plan/documentation revisions have been made by the Developer's Engineer, a final (full & complete) submission of plans and documentation shall be made to the Municipality in sufficient quantities as the Municipality may require for distribution as noted in Clause 2.1 above. No construction shall proceed until such submission is made by the Developer and has been accepted as satisfactory by the Municipality.

Such final submission shall include the latest revision of all plans, storm sewer design charts, sanitary sewer design charts, completed Form 1 documentation and supporting water distribution system analysis and calculations, copies of Environmental Compliance Approval Applications (eg. for sewage works) from the Ontario Ministry of the Environment, Conservation and Parks, approvals from the Ministry of Transportation where required, etc.

The plans shall contain sufficient information so that the Municipality can be reasonably assured of such details (without having to refer to the Developer's/Contractor's Contract documents) as pipe locations, pipe sizes, materials, locations of services, road structure, pipe bedding, trench backfill materials, etc. For purposes of approval by the Municipality, information shown on the plans shall be deemed to take precedent over conflicting or alternate information listed in the Developer's/Contractor's Contract documents.

Any changes to approved plans, which are proposed by the Developer or his agents, must be resubmitted to the Municipality for review and approval prior to such changes being made in the installation.

2.5 "CONSTRUCTION RECORD" DRAWINGS

"Construction Record" drawings are to be submitted to the Municipality to show the services and works as they were actually constructed. The Consultant/Developer shall provide the Municipality appropriate drawings applicable to the project in both paper and digital (electronic) format. "Construction record" drawings shall include water service locations with ties, and chainages for private drain connections measured from the nearest downstream manhole.

Plan and profile drawings must be prepared in a digital format, which is compatible with the current version of AutoCAD, for all new development/infrastructure construction within the Municipality. The digital files and drawings, including those digital plans showing details of special structures, details, etc., shall be prepared by the Developer's Engineer and turned over to the Municipality as a permanent record prior to the acceptance of services required

to be provided by the Developer. All digital files are to be geographically referenced in a format suitable for insertion into a geographic information system to the appropriate coordinate system.

All drawings must include 3D structure data (rim elevations, invert elevations, drop structure details, etc.) and pipe data (size, elevation, flow direction, etc.) for the Municipality's use in updating their GIS database. The files must be prepared by the Consultant/Developer such that minimal to no work is required for integration.

2.6 LOT SERVICING

Services for individual residential lots shall be as follows:

a) Water services shall be installed on the centreline of single lots and 1.0m (3.0') to the right and left of centreline for semi-detached lots. Curbstop shall be provided at P/L.
b) Sanitary private drain connections (PDC) shall be installed 3.0m (10.0') right of centreline for single lots and 3.0m (10.0') right and left of centreline for semi-detached lots.
c) Telephone, Cable TV and electric services are to be installed in a common trench as noted in Appendix B.
d) Driveways shall be located on the opposite site of the lot to that of a pad mounted transformer, hydrant or street light pole where possible and shall be perpendicular to the road.
e) Each property shall be provided with a sanitary PDC of a minimum diameter of 125mm (5") having a minimum slope of 2%. Cleanout shall be provided at P/L.
f) For new construction each property shall be provided with a storm PDC to a minimum diameter of 100mm (4") having a minimum slope of 2%. Discharge shall be by sump pump only.
g) Roof water leaders and foundation weeping tile shall not be connected to the sanitary sewer.
h) Roof water leaders shall not be connected to the storm sewers and shall discharge at grade to the front or rear of the dwelling; foundation weeping tile shall not be directly connected to the storm sewers. All houses shall have a sump pump installed, discharging to a drainage swale which preferably drains to the rear of the lots.
i) No part of the driveway shall encroach upon the property boundaries when extended from the edge of the right-of-way to the roadway.
j) If a concrete driveway is installed, expansion joints are to be installed at both sides of the sidewalk and at the curb. A construction joint is also required at the property line.
k) Trees shall be installed 1.5m behind the property line, a minimum of 4m from

all other services.

SECTION 3.0 – STORM SEWERS

3.1 GENERAL

Storm sewers shall be provided to service all of the lands in the Plan of Subdivision or Development Plan and shall be located in the street right-of-way or in an approved easement. The storm sewer outlet must be carried to a sufficient outlet so that no damage is done to lands or roads because of the existence of said outlet. All lots and blocks in the plan must be connected to the storm sewer. Storm sewers shall be designed to accept all drainage from the contributing area, including upstream areas which shall be determined by the subdivider's Engineer and be subject to the approval of the Municipality's Engineer.

Ontario Provincial Standard Specifications (OPSS), Ontario Provincial Standard Drawings (OPSD) and Municipal Engineer's Association (MEA) guidelines shall govern, where applicable, in addition to any other applicable governing standards and guidelines.

In February 2015, the MECP issued an Interpretation Bulletin titled "*Interpretation Bulletin: Ontario Ministry of Environment and Climate Change Expectations Re: Stormwater Management*" which detailed what provincial expectations were. These expectations noted that "going forward, the Ministry expects that stormwater management plans… will employ Low Impact Development (LID) in order to maintain the natural hydrologic cycle to the greatest extent possible".

The primary goals of LID's are to better mimic the natural hydrologic cycle by infiltrating or filtrating stormwater runoff where it falls at the source, rather than sending all flows to one central location. The Municipality recognizes the importance of proper stormwater management that looks to assist with changing climate issues that includes increased storm activity and extreme weather events.

The Municipality standards includes guidance on best management practices associated with implementing LIDs and water balance where possible. In addition, the Ministry detailed requirements within the Municipalities Municipal Stormwater System Environmental Compliance Approval (ECA) #049-S701 by which newly proposed systems need to adhere to which can be found in Section 3.2.1.

3.2 STORM WATER MANAGEMENT (SWM)

3.2.1 Design Guidelines

Current Storm Water Management Design Standards, require restricting storm water flows outletting from a development to existing values. The impact of future flow on downstream facilities should be no greater than at present, and improved where possible.

On the other hand, current inadequate outlet facilities may have an impact on future upstream flooding. Any outlet deficiency should be corrected at or before the time of upstream development. Additional costs would be assessed to development subject to any cost sharing agreement negotiated with the Municipality.

A Stormwater Management Report setting out the existing and proposed drainage pattern shall be submitted to and approved by the Municipal Engineer, the local Conservation Authorities (the Municipality is divided between two Conservation Authorities, the governing Conservation Authorities are the Ausable Bayfield Conservation Authority and the St. Clair Region Conservation Authority) and the Ministry of the Environment, Conservation and Parks.

Should the development be of a size or location that the Conservation Authority has no requirement to regulate the stormwater management criteria, or in the event that specific design details are not provided by the Conservation Authority, the following general requirements shall apply:

- Quality and Quantity Control Targets – as dictated by the local Conservation Authority and/or the MECP in addition to the below.

  A 25mm volume capture target represents the first flush runoff event and generally 90% of storm events in Ontario. In accordance with Section 4.6 of the 2003 MOE manual, the water quality event is also identified by the Province to be a 25mm, 4-hour event. Development applications that are part of a subdivision or large site plan process are encouraged to capture the first 25mm of any rain event on-site within a contained stormwater management system where feasible to satisfy water balance and water quality criteria.

  Implementing infiltration or filtration measures for a volume representing the 25mm event will be accepted to meet the TSS reduction target requirements. Infiltration systems often require a water quality pre-treatment system to reduce sediment loading and prolong maintenance intervals.

  Where OGS units are proposed, the OGS must be sized to capture and treat a minimum of 90% volume of the annual runoff on a long-term average basis. The OGS quality target is the long-term average removal of the TSS reduction target on an annual loading basis from all run-off leaving the proposed site based on the post-development level of imperviousness.

  Overall quality control shall be to MECP enhanced protection level (80% of total suspended solids (TSS) over long term average).

Stormwater Management Control Hierarchy

As noted previously, to meet current water quantity and water quality

requirements, source controls should be included as part of the overall stormwater management strategy to complement traditional solutions or to stand alone as a complete solution.

When initiating a stormwater management design, Consultants are encouraged to use the following hierarchy to evaluate the types of SWM infrastructure to be designed:

- **Priority 1 (Infiltration – Retention by Native Soils):** infiltration to the extent possible, evapotranspiration, re-use to recharge shallow or deep groundwater, re-use collected rainwater for internal or external uses; generally applicable in highly favourable soil conditions without high groundwater.
    - *General Outcome: no discharge to the Municipality storm sewer systems; can partially or fully satisfy water quality and quantity requirements.*
- **Priority 2 (Filtration – Volume Capture and Release):** LID filtration technologies filter runoff and typically include a subdrain connected to the storm sewer or conveyance system; generally applicable to tighter soils.
    - *General Outcome: peak shaving/controlled discharge to the Municipality conveyance system; can partially or fully satisfy water quality and quantity requirements.*
- **Priority 3 (Other Volume Detention and Release):** filtration, hydrodynamic separation (ie. End-of-pipe facilities, oil grit separators, etc.) to detain and/or treat runoff; generally applicable to tight soils, high groundwater table or contaminated sites.
    - *General Outcome: attenuated discharge to the receiving watercourse or storm sewer; these systems can satisfy water quality but do not benefit quantity.*

Note:

Water quality requirements may be satisfied through implementing a combination of Priority 1, 2, or 3 stormwater management systems to manage the first 25mm of stormwater volume. However, water quantity can only be achieved through design and implementation of Priority 1 or Priority 2 stormwater management systems. Therefore, the Municipality strongly encourages the implementation of Priority 1 or 2 systems to satisfy both water quality and quantity requirements.

As part of complete development applications, Consultants should identify the type of systems being recommended as Priority 1, 2, or 3 and provide a brief rationale regarding the type of SWM that is being recommended and why including constraints.

- The design storm for the minor systems, at a minimum, shall be the five (5) year storm. In some areas of the Municipality a two (2) year storm may be used where

approved by the Municipality. The two (2) and five (5) year storm events must be contained and dealt with on-site where possible, including proof of exploration as such, before outletting to Municipality systems will be approved.

- The major system shall be designed to convey the Regional storm event.
- Sediment and erosion control measures associated with the stormwater management requirements shall be identified on the drawings for works to be included during the construction and for permanent measures. In cases where the stormwater management facility outlets to a ditch or storm sewer, a general erosion control storage of $40m^3/ha$ shall be applied (MOE, 2003). In cases where stormwater management facilities outlet to an open watercourse, specific erosion control requirements are to be used which may be further detailed in a Subwatershed Study or Municipal Class Environmental Assessment.

  Erosion control storage ($40m^3/ha$) is only typically applied to regional wet ponds with long extended detention drawdowns for larger developments and does not apply to smaller site projects unless specific by the Municipality Engineer.
- Design development to maximize the travel time of storm water over pervious, rough and/or fairly flat surfaces. Maximizing the use of rear lot drainage is one such technique.
- Use of shallow grassy swales for storm water conveyance is recommended. They can be used beside roadways in conjunction with curbs, as well as for rear lot drainage.
- Utilizing inlets for temporary ponding and buried perforated pipe covered with porous material (granular or topsoil material) for infiltration may also be considered.
- The impact of climate change should be considered in consultation with the Municipality and the Conservation Authority.
- Restoration of the SWM facilities should have regard for Landscape Ecology and is to be reviewed with the Municipality prior to plan finalization.
- The storm sewers shall be connected to the Municipal storm sewer system (where feasible) or discharged to a natural watercourse as approved by the Municipality, Conservation Authority, and the Ministry of the Environment, Conservation and Parks.
- The stormwater management system shall be designed by using MIDUSS (current version) or an alternate approved hydrologic model that might include SWMHYMO and Visual OTTHYMO, PCSWMM, SSA, etc. The Developer's Engineer shall consult the Conservation Authority as to the appropriate storm distribution and duration to be used. The Developer's Engineer shall advise the Municipal Engineer

in writing as to the Authority's requirements. The design of the stormwater management system shall be in accordance with the latest version of the "Stormwater Management Practices, Planning and Design Manual", as prepared by the Ministry of the Environment, Conservation and Parks.

The criteria listed within the following table applies to all drainage areas greater than 0.1 ha, with the construction erosion and sediment control criteria applying also to sites <0.1 ha, and, if some or all of the criteria listed have been assessed for and addressed in other adjacent developed lands to the project site through a subwatershed plan or equivalent study, then those criteria may not be applicable to the project site but must be confirmed with the Municipality.

Performance Criteria Table

Water Balance [1]	**FOR DEVELOPMENT SCENARIOS** [2] **Assessment Studies:** i) Control [3] as per the criteria identified in the water balance assessment completed in one or more of the following studies [15], if undertaken: a watershed/subwatershed plan; Source Protection Plan (Assessment Report component); Master Stormwater Management Plan, Master Environmental Servicing Plan; Class EA, or similar approach that transparently considers social, environmental and financial impacts; or local site study including natural heritage, Ecologically significant Groundwater Recharge Areas (EGRA), inflow and infiltration strategies. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; OR **IF Assessment Studies in i) NOT completed:** ii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iii) Control [3] the runoff from the 90th percentile storm event. **Lake Simcoe Watershed Municipalities:** iv) Control [3] as per the evaluation of anticipated changes in water balance between Pre-development and post-development assessed through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If it is demonstrated, using the approved water balance estimation methods [7], that the site's post to Pre-development water balance cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use Lake Simcoe and Region Conservation Authority's (LSRCA) Recharge Compensation Program [9].

	FOR RETROFIT SCENARIOS [10] **Assessment Studies:** i) Control as per criteria identified in the water balance assessment completed in one or more of the following studies: a watershed/subwatershed plan, Source Protection Plan (Assessment Report component), Master Stormwater Management Plan, Master Environmental Servicing Plan, Class EA, or local site study including natural heritage, EGRA, inflow and infiltration strategies, if undertaken. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; **OR** ii) If constraints [11] identified in i), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14]. **IF Assessment Studies in i) NOT completed:** iii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iv) Control [3] the runoff from the 90th percentile storm event.
Water Quality [1]	**FOR DEVELOPMENT SCENARIOS** [2] All of the following criteria must be met for development scenarios: **General:** i) Characterize the water quality to be protected and Stormwater Contaminants (e.g., suspended solids, nutrients, bacteria, water temperature) for potential impact on the Natural Environment, and control as necessary, **OR** ii) As per the watershed/subwatershed plan, similar area-wide Stormwater study, or Stormwater management plan to minimize, or where possible, prevent increases in Contaminant loads and impacts to receiving waters. **Suspended Solids:** i) Control [3] 90th percentile storm event and if conventional methods are necessary, then enhanced, normal, or basic levels of protection (80%, 70%, or 60% respectively) for suspended solids removal (based on the receiver). **Phosphorus:** i) Minimize existing phosphorus loadings to Lake Erie and its tributaries, as compared to 2018 or conditions prior to the proposed development, **OR** ii) Minimize phosphorus loadings to Lake Simcoe and its tributaries. Proponents with development sites located in the Lake Simcoe watershed shall evaluate anticipated changes in phosphorus loadings between Pre-development and post-development through a Stormwater management plan in

	support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If, using the approved phosphorus budget tool [12], it is demonstrated that the site's post to Pre-development phosphorus budget cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use LSRCA's Phosphorus Offsetting Policy [9]. **FOR RETROFIT SCENARIOS** [10] i) Improve the level of water quality control currently provided on site; **AND** ii) As per the 'Development' criteria for Suspended Solids, **OR** iii) **If 'Development' criteria for Suspended Solids cannot be met**, Works are designed as a multi-year retrofit project, in accordance with a rehabilitation study or similar area-wide Stormwater study, such that the completed treatment train will achieve the 'Development' criteria for Suspended Solids or local needs[14], within ten (10) years; **OR** iv) If constraints [11] identified in ii) and iii), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies.
Erosion Control (Watershed) [1]	**FOR DEVELOPMENT SCENARIOS** [8] i) As per erosion assessment completed in watershed/subwatershed plan, Master Stormwater Management Plan, Master Environmental Servicing Plan, Drainage Plan, Class EA, local site study, geomorphologic study, or erosion analysis; **OR** ii) As per the Detailed Design Approach or Simplified Design Approach methods described in the Stormwater Management Planning and Design Manual: a. The Detailed Design Approach may be selected by the proponent for any development regardless of size and location within the watershed provided technical specialists are available for the completion of the technical assessments; or considered more appropriate than the simplified approach given the size and location of the development within the watershed and the sensitivity of the receiving waters in terms of morphology and habitat function. b. The Simplified Design Approach may be adopted for watersheds whose development area is generally less than twenty hectares AND either one of the following two conditions apply: 1) The catchment area of the receiving channel at the point-of-entry of Stormwater drainage from the development is equal to or

	greater than twenty-five square kilometres; or 2) Meets the following conditions: • The channel bankfull depth is less than three quarters of a metre; • The channel is a headwater stream; • The receiving channel is not designated as an Environmentally Sensitive Area (ESA) or Area of Natural or Scientific Interest (ANSI) and does not provide habitat for a sensitive aquatic species; • The channel is stable to transitional; and • The channel is slightly entrenched; **OR** iii) In the absence of a guiding study, detain at minimum, the runoff volume generated from a 25 mm storm event over 24 to 48 hours. **FOR RETROFIT SCENARIOS** [10] i) If approaches i-iii) under 'Development Scenarios' are not feasible as per identified constraints [11], then improve the level of erosion control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14].
Water Quantity (Minor and Major System) [1]	**i)** As per municipal standards, Master Stormwater Management Plan, Class EA, Individual EA and/or ECA, as appropriate for the type of project [13]
Flood Control (Watershed Hydrology) [1]	**FOR DEVELOPMENT SCENARIOS** [2] i) Manage peak flow control as per watershed/subwatershed plans, municipal criteria being a minimum 100 year return storm (except for site-specific considerations and proximity to receiving water bodies), municipal guidelines and standards, Individual/Class EA, ECA, Master Plan, as appropriate for the type of project [13]. **FOR RETROFIT SCENARIOS** [10] i) If approaches i) under 'Development Scenarios' are not feasible as per identified constraints [11], then improve the level of flood control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies.
Construction Erosion and Sediment Control	i) Manage construction erosion and sediment control through development and implementation of an erosion and sediment control (ESC) plan. The ESC plan shall: a. Have regard to Canadian Standards Association (CSA) W202 Erosion and Sediment Control Inspection and Monitoring Standard (as amended); OR

	b. Have regard to Erosion and Sediment Control Guideline for Urban Construction 2019 by TRCA (as amended). ii) Be prepared by a QP for sites with drainage areas greater than 5 ha or if specified by the Owner for a drainage lower than 5 ha. iii) Installation and maintenance of the ESC measures specified in the ESC plan shall have regard to CSA W208:20 Erosion and Sediment Control Installation and Maintenance (as amended). iv) For sites with drainage areas greater than 5 ha, a QP shall inspect the construction ESC measures, as specified in the ESC plan.
Footnote	1. Where the opportunity exists on your project site or the same subwatershed, reallocation of development elements may be optimal for management as described in footnote [3]. 2. Development includes new development, redevelopment, infill development, or conversion of a rural cross-section into an urban cross-section. 3. Stormwater volumes generated from the geographically specific 90th percentile rainfall event on an annual average basis from all surfaces on the entire site are targeted for control. Control is in the following hierarchical order, with each step exhausted before proceeding to the next: 1) retention (infiltration, reuse, or evapotranspiration), 2) LID filtration, and 3) conventional Stormwater management. Step 3, conventional Stormwater management, should proceed only once Maximum Extent Possible [8] has been attained for Steps 1 and 2 for retention and filtration. 4. Recharge is the infiltration and movement of surface water into the soil, past the vegetation root zone, to the zone of saturation, or water table. 5. Pre-development is defined as the more stringent of the two following scenarios: 1) a site's existing condition, or 2) as defined by the local municipality. 6. Major Development has the same meaning as in the Lake Simcoe Protection Plan, 2009. 7. Currently, the approved tool by LSRCA for calculating the water balance is the Thornthwaite-Mather Method. Other tools agreed upon by relevant approval agencies (e.g., LSRCA, municipality, or Ministry) may also be acceptable, subject to written acceptance by the Director. 8. Maximum Extent Possible means maximum achievable Stormwater volume control through retention and LID filtration engineered/landscaped/technical Stormwater practices, given the site constraints [11]. 9. Information pertaining to LSRCA's Recharge Compensation Program and Phosphorus Offsetting Policy is available on

	LSRCA's website (lsrca.on.ca), or in "Water Balance Recharge Policy for the Lake Simcoe Protection Plan", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority and "Phosphorus Offsetting Policy", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority. 10. Retrofit means: 1) a modification to the management of the existing infrastructure, 2) changes to major and minor systems, or 3) adding Stormwater infrastructure, in an existing area on municipal right-of-way, municipal block, or easement. It does not include conversion of a rural cross-section into an urban cross-section. 11. Site constraints must be documented. A list of site constraints can be found in Table A2. 12. Tools for calculating phosphorus budgets may include the Ministry's Phosphorus Tool, the Low Impact Development Treatment Train Tool developed in partnership by TRCA, LSRCA, and Credit Valley Conservation (CVC), or other tools agreed upon by the LSRCA and other relevant approval agencies including the municipality. 13. Possible to look at combined grey infrastructure and LID system capacity jointly. 14. Local needs include requirements for water quality, erosion, and/or water balance retrofits identified by the owner through ongoing operation and maintenance of the stormwater system, including inspection of local receiving systems and the characterization of issues requiring remediation through retrofit controls. 15. All studies shall conform with Ministry policies. If any conclusions in the studies negate policy, then the project will require a direct submission to the Ministry for review through an application pertaining to a Schedule C Notice.

Stormwater Management Practices – Site Constraints

Site Constraints	
a)	Shallow bedrock [1], areas of blasted bedrock [2], and Karst;
a)	High groundwater [1] or areas where increased infiltration will result in elevated groundwater levels which can be shown through an appropriate area specific study to impact critical utilities or property (e.g., susceptible to flooding);
b)	Swelling clays [3] or unstable sub-soils;
c)	Contaminated soils (e.g., brownfields);
d)	High Risk Site Activities including spill prone areas;
e)	Prohibitions and or restrictions per the approved Source Protection Plans and where impacts to private drinking water wells and /or Vulnerable Domestic Well Supply Areas cannot be appropriately mitigated;
f)	Flood risk prone areas or structures and/ or areas of high inflow and infiltration (I/I)

	where wastewater systems (storm and sanitary) have been shown through technical studies to be sensitive to groundwater conditions that contribute to extraneous flow rates that cause property flooding / Sewer back-ups;
g)	For existing municipal rights-of-way infrastructure (e.g., roads, sidewalks, utility corridor, Sewers, LID, and trails) where reconstruction is proposed and where surface and subsurface areas are not available based on a site-specific assessment completed by a QP;
h)	For developments within partially separated wastewater systems where reconstruction is proposed and where, based on a site-specific assessment completed by a QP, can be shown to: i Increase private property flood risk liabilities that cannot be mitigated through design; ii Impact pumping and treatment cost that cannot be mitigated through design; or iii Increase risks of structural collapse of Sewer and ground systems due to infiltration and the loss of pipe and/or pavement support that cannot be mitigated through design.
i)	Surface water dominated or dependent features including but not limited to marshes and/or riparian forest wetlands which derive all or a majority of their water from surface water, including streams, runoff, and overbank flooding. Surface water dominated or dependent features which are identified through approved site specific hydrologic or hydrogeologic studies, and/or Environmental Impact Statements (EIS) may be considered for a reduced volume control target. Pre-consultation with the MECP and local agencies is encouraged;
j)	Existing urban areas where risk to water distribution systems has been identified through assessments to meet applicable drinking water requirements, including Procedures F-6 and F-6-1, and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
k)	Existing urban areas where risk to life, human health, property, or infrastructure has been is identified and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
l)	Water reuse feasibility study has been completed to determine non-potable reuse of Stormwater for onsite or shared use;
m)	Economic considerations set by infrastructure feasibility and prioritization studies undertaken at either the local/site or municipal/system level [4].
Footnote: 16. May limit infiltration capabilities if bedrock and groundwater is within 1m of the proposed Facility invert per Table 3.4.1 of the LID Stormwater Planning and Design Guide (2010, V1.0 or most recent by TRCA/CVC). Detailed assessment or studies are required to demonstrate infiltration effects and results may permit relaxation of the minimum 1m offset. 17. Where blasting is more localized, this constraint may not be an issue elsewhere on the property. While infiltration-based practices may be limited in blasted rock areas, other forms of LID, such as filtration, evapotranspiration, etc., are still	

viable options that should be pursued.
18. Swelling clays are clay soils that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content.
19. Infrastructure feasibility and prioritization studies should comprehensively assess Stormwater site opportunities and constraints to improve cost effectiveness, environmental performance, and overall benefit to the receivers and the community. The studies include assessing and prioritizing municipal infrastructure for upgrades in a prudent and economically feasible manner.

3.2.2 Drainage Policies

3.2.2.1 Application

These drainage policies will apply to all development or redevelopment requiring site plans or other planning approvals. Where the local Conservation Authority determines the development is in their regulated area or they have an interest in the development, their guidelines and policies shall apply.

3.2.2.2 Drainage Objectives

The Municipality has the following objectives for the management of storm drainage within its boundaries:

- Reduce to acceptable levels, the potential risk of health hazards, and loss of life and property damage from flooding.
- Reduce to acceptable levels, the incidence of inconvenience caused by surface ponding and flooding.
- Ensure that any development or redevelopment minimizes the impact of change to the groundwater regime; increased pollution; increased erosion or increased sediment transport, especially during construction; and impact to surrounding lands and areas of existing development.
- Maintain, where applicable, any natural stream channel geometry insofar as it is feasible while achieving the above objectives.
- Promote and support innovation in stormwater management practices.
- Ensure compliance with all applicable Municipality, Conservation Authority, Provincial, and Federal Legislation.

3.2.3 Attainment of Drainage Objectives

3.2.3.1 Major and Minor Systems

In general, the Municipality supports the concept of drainage having two separate and distinct components – the minor drainage system and the major drainage system. The minor system comprises swales, street gutters, ditches, catch basins and storm sewers. The major system comprises the natural streams and valleys and man-made channels,

roads, or other overland conveyance systems.

3.2.3.2 Run-off Quality Control

The Municipality requires developers, contractors and builders to plan and execute their operations so as to minimize sediment and debris pickup and transport to water bodies. The degree of control and methods used must meet the regulations and guidelines of the MECP, MNDMNRF, MTO, and local conservation authorities. The Municipality will expect all erosion control works to be properly maintained throughout the duration of the project.

3.2.3.3 Master Drainage Plans

The Municipality requires a Master Drainage Plan for all proposed urban developments. The primary purpose of the Master Drainage Plan is to define the effects of urban development and to determine the solution that is compatible with the objectives for the watershed.

3.2.3.4 Conservation Authority Criteria

In the design of new drainage systems within areas regulated by the local Conservation Authority, the developer's Consulting Engineer will be required to follow the most recent edition of the Authority's Stormwater Management Policies and Technical Guidelines.

3.2.4 Major System

3.2.4.1 Hazard Lands and Floodlines

The Municipality requires that Hazard Lands be clearly defined on all watersheds and that no development other than necessary access or services be located herein. The Municipality also requires that the floodplains that would result from the 1:100 and Regional storms be defined for predevelopment and post development conditions. Consultation with the local Conservation Authority will be necessary when dealing with Hazard Lands.

3.2.4.2 Detention Ponds

Detention Ponds shall be designed so as to minimize any adverse effects to the environment as well as ensuring the safety of local residents. Unless noted otherwise, detention ponds are to be designed in accordance with the Ministry of the Environment, Conservation and Parks Stormwater Management Planning and Design Manual (March 2003), or the latest edition.

3.2.5 Minor System

3.2.5.1 Watershed Area

The watershed area shall be determined from the contour plans and shall include all areas that naturally drain into the system. Fringe areas not accommodated in adjacent drainage systems, and any areas which may become tributary by reason of regrading.

3.2.5.2 Storm Drainage Plans

External Areas

A plan shall be prepared to a scale dependent on the size of the watershed area, to show the nature of the drainage of the lands surrounding the development site. The area to be developed and all existing contours used to justify the design shall be clearly shown. This plan shall be prepared and submitted to the Municipality's Engineer at the functional report stage.

Internal Drainage Plan

All internal drainage plans shall be prepared and shall include all streets, blocks, lots and easements. The proposed storm sewer system shall be shown on this plan with all Maintenance Holes and the area contributing to each structure shall be clearly outlined on the plan. The area in hectares and the run-off coefficient shall be shown within the contributing area.

In determining the contributing area to each storm sewer structure, the proposed lot grading must be considered to maintain consistency in the design.

The length, size, and grade of each section of the minor system shall also be shown on the storm drainage plan. Arrows should depict the overland flow route and the extent of flooding from the major storm.

Rainwater leaders shall not be connected directly to the storm sewer system.

3.2.6 Hydraulic Design

3.2.6.1 Design Levels

The system of street gutters, catch basins, storm sewers or open ditches, where permitted, shall be designed for the 1:5 year storm. Culverts or sewers crossing major County roads or Provincial highways shall be designed and approved in accordance with the requirements of the County Highways Department or the Ministry of Transportation, respectively.

3.2.6.2 Rational Method

In general, the Rational Method shall be used for the sizing of the minor sewer system at the final design stage. Calculations based on a hydrologic simulation model are required for systems serving large areas or involving treatment and/or storage systems.

3.2.6.3 Stormwater Management Report

Hydrologic studies should describe the model parameters and criteria for their selection as well as input and output data. The Consulting Engineer has the responsibility for the computations, and the Municipality's Engineer shall check the main assumptions and the input data. All information required for this verification shall be submitted with the hydrologic computations. Copies of the report, where required, shall be provided to the local Conservation Authority and MECP for approval purposes.

Each report shall include a section outlining the following:

- Quantity Control
  - Address the impact of the minor and major storm as required in these guidelines for both pre-development and post development regimes.
- Quality Control
  - Address best management practices proposed to achieve desired treatment.
  - Make reference to MECP Stormwater Management Planning and Design manual.
- Erosion and Sediment Control Plan
  - Provide comments and details on a Site Plan(s) or a separate plan(s) as part of the submission.
- Major System/Overland Flow Routes
  - Provide extent of flood for the Major Storm or Site Plan.
  - Show major storm route.
  - Comment on a right to access of major storm routes based on land ownership on adjacent lands.
- Maintenance Considerations
  - Address ownership and obligation for maintenance.
  - A maintenance manual outlining maintenance tasks and frequency of maintenance activities shall be provided as part of the Stormwater Management Report process.
- Facility Access
  - Access to all areas of any proposed facility needs to be detailed and commented on in the report.

3.3 DESIGN FLOWS

3.3.1 Runoff Computations

The Rational Formula is to be used to determine the quantity of storm runoff. The use of other empirical runoff formulae must be approved by the Municipality. The Rational Formula is:

$$Q = 2.78\ AIR$$

Where
- Q = Peak flow in L/s
- A = Area in hectares
- I = average rainfall intensity in millimetres per hour for a duration equal to the time of concentration for a particular storm frequency
- R = Runoff coefficient (see section 3.3.5)

3.3.2 Drainage Area

The drainage area to be used in the design of a storm sewer system must include all those areas which will reasonably or naturally drain to the system.

The area term in the Rational Formula represents the total area tributary to the point on the storm sewer under consideration.

3.3.3 Rainfall Intensity

The rainfall intensity I, shall be determined from Yarnell Precipitation Formula for Intensity-Duration-Frequency curves as follows, or current applicable Environment Canada rainfall intensity duration curves.

2 year storm $I = 25.7 \times t^{-0.66}$
5 year storm $I = 36.3 \times t^{-0.611}$
} Yarnell Formula

Where I = rainfall intensity (mm/hr)
t = duration time (hrs)

3.3.4 Design Storm Frequency

The design storm frequency shall be a five (5) year storm for new residential and industrial, or commercial lands.

3.3.5 Runoff Coefficients

The value of runoff coefficient R, is to be taken from the following:

Asphalt or Concrete Surfaces	0.90
Roof Areas	0.90

Single Family Residential	0.35 to 0.75
Semi-Detached Residential	0.40 to 0.75
Apartments	0.50 to 0.70
Light Industrial	0.50 to 0.80
Heavy Industrial	0.60 to 0.90
Neighbourhood Commercial	0.50 to 0.70
Playgrounds	0.20
Parks	0.20
Unimproved	0.20

3.3.6 Time of Concentration

The time of concentration is the time required for flow to reach a particular point in the sewer system from the most remote part of the drainage area. In includes not only the travel time in the sewers, but also the inlet time, or time required to flow overland into the sewer system. The initial inlet time shall be taken as 15 minutes unless calculations indicate a shorter or longer time is applicable. Supporting calculations shall be submitted to the Municipality's Engineer for review.

3.4 SEWER DESIGN

3.4.1 Flow Formula and Roughness Coefficient

The Manning Formula is to be used for calculating sewer capacity and selecting pipe sizes, and is as follows:

$$Q = \frac{7.855 \times 10^{-6}}{n} \times 2D \times R^{2/3} \times S^{1/2}$$

Where Q = flow capacity of sewer (L/s)
D = inside diameter of pipe (mm)
R = hydraulic radius of pipe (mm)
S = sewer slope (m/m)
n = Manning roughness factor

The Manning roughness coefficient shall be as follows:

smooth walled pipe	0.013

corrugated metal pipe	0.024
corrugated metal pipe with 25% paved inverts	0.020
corrugated metal pipe fully paved inverts	0.013

3.4.2 Allowable Flow Velocities

Minimum velocity = 0.90 m/s
Maximum velocity = 6.0 m/s

3.4.3 Minimum Pipe Sizes

A) Storm sewers - 300 mm
B) Catch basin leads
single - 250 mm
double - 300 mm
C) Connections - 100 mm

A decrease in pipe size from a large size upstream to a small size downstream will not be permitted regardless of grade increases.

3.4.4 Minimum Grades for Pipes

The minimum grades for storm sewers based on "n" = 0.013 are as follows:

250 mm	0.56%
300 mm	0.44%
375 mm	0.32%
450 mm	0.26%
525 mm	0.21%
600 mm	0.18%
675 mm	0.15%
750 mm & larger	0.13%
825mm	0.011%
900mm &larger	0.10%

≤150 mm connections	2.0%
200 mm leads	1.0%

3.4.5 Depth of Cover

The minimum cover over catchbasin leads shall be 1.25m based on proposed finished grade. Main storm sewers shall be installed with a minimum of 1.50 metres of cover.

3.4.6 Manhole Spacing

Manholes shall be placed at all changes in grade, changes in alignment (except for curvilinear sewers) and on straight runs at the following intervals:

A) Sewers 250 mm to 450 mm - 100 m
B) Sewers greater than 450mm - 120 m

3.4.7 Manhole Design

Manholes are to be designed in accordance with Ontario Provincial Standard Drawing and Specifications.

An appropriate "energy drop" is required at all manholes at which a change in direction of the sewer occurs. For bends of 45 degrees and 90 degrees, the minimum required drop of the inverts across the manhole is 0.03 m and 0.06 m respectively.

Manholes shall be installed via excavation to required grade, necessary backfill supplied, installed, and compacted, in accordance with OPSD and OPSS.

3.4.8 Separation of Sewers from Potable Water Lines

Storm sewers and watermains constructed parallel to each other should be constructed in separate trenches maintaining a minimum clear horizontal distance of 2.5 m (unless noted otherwise in the most current MECP design guidelines).

3.4.9 Catch Basins

A) Catch basins shall be installed with sumps.

B) Catch basins to be 1.5 m clear of any driveway curb depression.

C) With a normal 2% road cross fall either side of the centreline, the following maximum catch basin spacing will apply:

D) Double catch basins at all low points and/or curb inlet catch basin overflow plates should be considered on steep gradients (OPSD 400.090). Overflow plates require a modified catch basin precast unit (600mm x 840mm).

Road Gradient	Road Width	Maximum Spacing
0.35 to 0.5% *	8.5 m	45 m
	15.0 m	40 m
0.6 to 3.0%	8.5 m	90 m
	15.0 m	70 m
3.1 to 5%	8.5 m	75 m

	15.0 m	55 m
5.1 to 6%	8.5 m	60 m
	15.0 m	45 m

Where changes in gradient occur, the average gradient should determine the maximum spacing.

* 0.50% road gradient is the recommended minimum

3.4.10 Storm Sewer Gratings and Manhole Frames

Inlets and outlets of storm sewers which are accessible to the public shall be provided with projective rodent gratings, for pipe sizes 450 mm or greater.

Metal lift rings to adjust manhole cover to finished grade are not permitted. Curb inlets in drive over curb locations should be recessed into the curb with a curb setback formed as a barrier curb transition section to accommodate the overflow plate.

3.4.11 Sewer Separation at Crossings

A minimum 150 mm clearance is required between outside pipe barrels at all pipe crossings. Where storm sewer crosses sanitary sewer or watermain, separation requirements as per Ministry of Environment, Conservation and Parks Procedure F-6-1 shall apply.

3.4.12 Sewer Easements

All sewer easements must be a minimum of 6.0 m wide for one (1) sewer, 7.60 m wide for two (2) sewers in the same trench and 9.0 m wide for two (2) sewers in separate trenches.

3.4.13 Storm Sewer Outlets

Where approved by the Municipality, MECP, and Conservation Authority storm sewer outlets to existing or proposed trunk sewers, municipal drains or natural watercourses inside or outside the development will be installed by the developer. In no case will an outlet be allowed to a natural watercourse or municipal drain which does not have sufficient capacity for the proposed discharge. The developer will be required to ensure that development does not cause interference with the riparian rights of properties upstream or downstream from the development.

3.4.14 Private Drain Connections

Prior to connection a plan showing the location and invert elevation for all house connections at the street line shall be submitted to the Municipality for review. The minimum allowable slope shall be 2%. The maximum allowable slope shall be 8%. Where the depth of the sewer is excessive, a controlled settlement joint and riser may be used over the main sewers. All service connections to the sewer shall be connected to the main between springline and 45 degrees upward. Vertical connection the sewer main shall be prohibited.

All connections are to be made using an approved shop manufactured “Tee”. In instances where connection to an existing concrete sanitary main is required the Municipality may, at it’s sole discretion, permit the use of a core and tee system.

All house connections are to be 125mm in diameter and shall include a 100mm diameter “Wye” cleanout. The cleanout shall be positioned flush to finished grade and a shall be located minimum of 300mm from the lot line. Each cleanout shall received a bolted cap (Malcolm or approved equivalent). Cleanouts shall be required on all new service connections. Requirements for cleanouts on reconstruction work shall be reviewed on a project by project basis.

A PVC gasketed cap shall be installed on each service lateral termination at the street line and shall be made watertight. The location of all service ends shall be marked by a 50mm x 100mm (2”x4”) wooden post extending from the service to a minimum of 300mm above ground surface. The post shall be painted green.

All service connections to manholes shall enter the structure a maximum of 500mm above the lowest invert. Required connections at greater than 500mm height shall require a drop structure (except as otherwise approved by the Municipality.

3.5 MATERIALS FOR CONSTRUCTION

3.5.1 Storm Sewers

Pipe materials for storm sewers, catch basin leads and sewer connections shall be reinforced concrete or PVC and shall conform with OPSS. Alternative materials must be approved by the Municipality.

3.5.2 Manholes

Manholes are to be precast or cast-in-place concrete structures with cast iron frames and covers and shall be designed and constructed in accordance with OPSD and OPSS.

3.5.3 Catch Basins

Catch basins are to be precast or cast-in-place concrete structures with cast iron grates

and shall be designed and constructed in accordance with OPSD and OPSS.

3.5.4 Pipe Bedding and Cover Materials and Trench Backfill Materials

All bedding and cover material is to be Granular ‘A’ unless otherwise specified and accepted by the Municipality.

Should trench conditions be expected to exhibit seeping groundwater in silt or fine sand, the bedding for the pipe shall be specified to be 19mm crushed stone entirely surrounded by geotextile.

SECTION 4.0 – SANITARY SEWERS

4.1 GENERAL

Where sanitary sewer outlets are available to service the lands in the plan of subdivision, sanitary sewers shall be provided for all lands in the plan of subdivision and shall be located in the street right-of-way or in an approved easement. All lots and blocks in the plan of subdivision must be connected to the sanitary sewers.

Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD) and Ministry of the Environment, Conservation and Parks (MECP) guidelines shall govern where applicable.

4.2 HYDRAULIC DESIGN

4.2.1 Residential Flow

The following criteria shall be used in determining peak flows for municipal sewer design for residential areas, including single and multiple housing, mobile home parks, etc.

A) Design Population

For purposes of estimating future sewage flow rates, reference should be made to the Official Plan. The Official Plan will contain future population densities and land uses.

Unless otherwise stated, a population density of at least three (3) people per unit is to be used.

B) Average Daily Domestic Flow

Average daily domestic flow, exclusive of extraneous flows, shall be 400 L/cap.d.

C) Peak Rate of Flow

Peak domestic sewage flows to be calculated by the following equation:

$$Q(d) = \frac{PqM}{86.4} + IA$$

where $Q(d)$ = peak domestic flow L/s
P = design population in thousands
q = average daily per capita domestic flow in L/cap.d.
M = peaking factor derived from Harmon Formula

$$M = 1 + \frac{14}{4 + P^{1/2}}$$

The minimum peaking factor is three (3)

I = Unit peak extraneous flow in L/ha.s

A = Gross tributary area in hectares

4.2.2 Commercial and Institutional

Commercial and Institutional flows should be based on historical records when available. Where no records are available, the preliminary unit values below should be used, exclusive of extraneous flows. For tourist and commercial establishments, a minimum flow of 28 m^3/ha.d should be used in the absence of reliable flow data. Final unit flows will be negotiated with the Municipality on a project-by-project basis.

Facility	Sewage Flow
Shopping Centres	2500-5000 L/1000 m^2 day based on total floor area
Hospitals	900-1800 L/bed.day
Schools	70-140 L/student.day
Travel Trailer Park	340 L/space.day (minimum without water hook-ups) 800 L/space.day (minimum with indiv. water hookups)
Campgrounds	225-570 L/campsite.day
Mobile Home Parks	1000 L/space.day
Motels	150-200 L/bed space.day
Hotels	225 L/bed space.day

4.2.3 Industrial Flow

Peak sewage flow rates from industrial areas vary greatly with the extent, the type of industry, the provision of in-plant treatment or regulation of flows, and the presence of cooling waters in the discharge etc. In the absence of accurate flow data, the following preliminary sewage flow allowances may be used. Final unit flows will be negotiated with the Municipality on a project-by-project basis.

Light industry	35 m^3/ha.day
Heavy industry	55 m^3/ha.day

4.2.4 Infiltration

The infiltration rate into the sewers shall be taken as 0.20 litres/sec/hectare for residential, commercial and industrial lands.

4.3 SEWER DESIGN

4.3.1 Flow Formula and Roughness Coefficient

The Manning Formula is to be used for calculating sewer capacity and selecting pipe sizes, and the roughness coefficient (n) of not less than 0.013 is to be used for smooth-wall pipe materials.

The Manning formula is as follows:

$$Q = \frac{7.855 \times 10^{-6} \times D2 \times R^{2/3} \times S^{1/2}}{n}$$

where Q = Flow capacity of sewer (L/s)
D = Inside diameter of pipe (mm)
R = Hydraulic radius of pipe (mm)
S = Sewer Slope
n = Manning roughness coefficient

4.3.2 Allowable Flow Velocities

Minimum velocity = 0.6 m/s
Maximum velocity = 3.0 m/s

4.3.3 Minimum Pipe Sizes

A) Sanitary sewers - 200 mm
B) Connections - 125 mm

4.3.4 Minimum Slopes for Pipes

The minimum slopes for sewer are as follows:

200 mm	0.42%
250 mm	0.28%
300 mm	0.22%
375 mm	0.15%
450 mm	0.12%
525 mm	0.10%
600 mm	0.08%
675 mm	0.67%

750 mm	0.058%
≤125 mm connections	2.0%

4.3.5 Depth of Cover and Alignment

Sanitary sewers are to be located 1.5 m off centreline of street (i.e. 3 m offset from storm sewer) and are to be installed with a minimum depth of cover to the top of the sewer from the road surface of 2.5 metres.

4.3.6 Manhole Spacing

Manholes shall be placed at all changes in grade, align changes in alignment (except for curvilinear sewers) and on straight runs at the following intervals:

A)	Sewers 200 mm to 450 mm	-	100 m
B)	Sewers 525 mm or greater	-	125 m

4.3.7 Hydraulic Losses at Manholes

The following minimum allowances shall be made for hydraulic losses incurred at sewer manholes:

-	straight run	0.02 m min.
-	45 deg. turn	0.03 m
-	90 deg. turn	0.06 m

4.3.8 Separation of Sewers from Potable Water Lines

Storm sewers and watermains constructed parallel to each other shall be constructed in separate trenches maintaining a minimum clear horizontal distance of 2.5 m.

4.3.9 Sewer Easements

All sewer easements are to be a minimum of 6.0 m wide for one (1) sewer, 7.60 m wide for two (2) sewers in the same trench and 9.0 m wide for two (2) sewers in separate trenches.

4.3.10 Sewer Connection Cleanouts

Cleanouts are required for all new construction. For reconstruction, the requirement will be reviewed on a project-by-project basis.

4.3.11 Sewer Connection Types

Sewer connections shall be type I, II or III based on depth.

4.3.12 Private Drain Connections

Prior to connection a plan showing the location and invert elevation for all house connections at the street line shall be submitted to the Municipality for review. The minimum allowable slope shall be 2%. The maximum allowable slope shall be 8%. Where the depth of the sewer is excessive, a controlled settlement joint and riser may be used over the main sewers. All service connections to the sewer shall be connected to the main between springline and 45 degrees upward. Vertical connection the sewer main is prohibited.

All connections are to be made using an approved shop manufactured “Tee”. In instances where connection to an existing concrete sanitary main is required the Municipality may, at its sole discretion, permit the use of a “core-and-tee” system.

All house connections are to be 125mm in diameter and shall include a 100mm diameter “Wye” cleanout. The cleanout shall be positioned flush to finished grade and a shall be located minimum of 300mm from the lot line. Each cleanout shall received a bolted cap (Malcolm or approved equivalent). Cleanouts shall be required on all new service connections. Requirements for cleanouts on reconstruction work shall be reviewed on a project by project basis.

A PVC gasketed cap shall be installed on each service lateral termination at the street line and shall be made watertight. The location of all service ends shall be marked by a 50mm x 100mm (2”x4”) wooden post extending from the service to a minimum of 300mm above ground surface. The post shall be painted brown.

All service connections to manholes shall enter the structure a maximum of 500mm above the lowest invert. Required connections at greater than 500mm height shall require a drop structure (except as otherwise approved by the Municipality.

4.4 MATERIALS FOR CONSTRUCTION

4.4.1 Sanitary Sewers

Pipe materials for sanitary sewers and sewer connections shall be CSA approved PVC and shall conform to OPSS standards. Alternative materials must be approved by the Municipality.

4.4.2 Manholes

Manholes are to be precast or cast-in-place concrete structures with cast iron frames and covers and shall be designed in accordance with OPSD and OPSS. Metal lift rings to adjust manhole covers to finished grade are not permitted.

Manholes shall be installed via excavation to required grade, necessary backfill supplied, installed, and compacted, in accordance with OPSD and OPSS.

4.4.3 Pipe Bedding and Cover Materials and Trench Backfill Materials

All bedding and cover material is to be Granular 'A' unless otherwise specified and accepted by the Municipality.

Should trench conditions be expected to exhibit seeping groundwater in silt or fine sand, the bedding for the pipe shall be specified to be 19mm crushed stone entirely surrounded by geotextile.

4.5 SEWER TESTING FOR LEAKAGE

The complete sewer system, including house connections, shall be tested and flushed in accordance with the current OPSS procedure, including video inspection. The Developer shall arrange the tests for sections of sewer between Maintenance Holes and shall inform the Municipal Engineer when a section is on test and ready for inspection. Any sections of sewer which fail to meet the requirements of this section shall be repaired and retested.

Sanitary sewers shall not exceed the following permissible infiltration and exfiltration rates:

Exfiltration

(a) Up and including 900 mm diameter pipe

1.4 litres per 25 mm of conduit barrel internal diameter, per 30 metres of line length, per hour with a 0.6 metre head of water above the highest pipe. The above rate is to be increased by 10% for every additional 0.6 metre head.

(b) Greater than 900 mm diameter pipe

2.3 litres per 25 mm of conduit barrel internal diameter, per 30 metres of line length per hour with a 0.6 metre head of water above the highest pipe. The above rate is to be increased by 10% for every additional 0.6 metre head.

Infiltration

(a) Up to and including 900 mm diameter pipe

1.1 litres per 25 mm of conduit barrel internal diameter, per 30 metres of line length, per hour.

(b) Greater than 900 mm diameter pipe

2.3 litres per 25 mm of conduit barrel internal diameter, per 30 metres of line length, per hour.

The above requirements for pipe sizes up to and including 900 mm in diameter conform to the minimum requirements as set by the Ontario Ministry of the Environment, Conservation and Parks. The requirements for pipe sizes larger than 900 mm in diameter conform to the requirements of A.S.T.M. Designation C-443, latest edition.

SECTION 5.0 – WATERMAINS

5.1 GENERAL

Where a waterworks is available to lands to be subdivided, the subdivider shall construct a water distribution system as part of the servicing requirements.

Plans of the entire system shall be submitted to the Ministry of the Environment, Conservation and Parks and the Municipal Engineer for approval and prepared in accordance with the MECP Requirements and the Municipal Drinking Water Licensing Program (as applicable). This submission shall consist of an overall plan, a plan and profile of each watermain drawn to the same scale as the roads, together with typical details of house service connections, pipe bedding and other appurtenances. Approval for construction will not be given until all the requirements of the MECP and the Municipal Drinking Water Licensing Program are fulfilled and the necessary approvals received.

Ontario Provincial Standard Specifications (OPSS), Ontario Provincial Standard Drawings (OPSD), American Water Works Association (AWWA) and the MECP shall govern where applicable.

5.2 HYDRAULIC DESIGN

5.2.1 Design Water Demand

The water requirements in the design of the distribution system are to be based on the following four basic needs:

(a) Residential water demand
(b) Commercial and Institutional water demands
(c) Industrial water demands
(d) Fire demands

Water supply systems should be designed to satisfy the greater of either of the following demands:

(A) Maximum day plus fire flow
(B) Peak rate (maximum hourly demand)

The maximum day demand is the average usage rate on the maximum day. The fire flow demand will vary with the size of the area and density of development and shall comply with: “Water Supply for Public Fire Protection – A Guide to Recommended Practice (latest edition)” as issued by Fire Underwriters Survey and Insurance Bureau of Canada (c/o Insurers’ Advisory Organization – Toronto) and the MECP Design Guidelines. The peak rate demand is the short-term demand placed upon the system by usage other than firefighting. The peak rate demand is usually taken as the average water usage over the maximum hour.

5.2.2 Unit Consumption Rates

a) Residential Water Demands

For the purposes of design, the average daily per capita water demands shall be 400 L/cap.d.

Peak usage rates for residential purposes will vary in accordance with the guidelines published by the MECP.

b) Commercial and Institutional Water Demands

Commercial and Institutional flows should be based on historical records when available. Where no records are available, the preliminary unit values below should be used. For tourist and commercial establishments, a minimum flow of 28 m^3/ha.d. should be used in the absence of reliable flow data. Final unit values will be negotiated with the Municipality on a project-by-project basis.

Facility	Water Usage (av.daily)
Shopping Centres	2500-5000 L/1000 m^2 day based on total floor area
Hospitals	900-1800 L/bed.day
Schools	70-140 L/student.day
Travel Trailer Parks	340 L/space.day (minimum without water hookups) 800 L/space.day (minimum with indiv. water hookups)
Campgrounds	225-570 L/space.day
Mobile Home Parks	1000 L/space.day
Motels	150-200 L/bed space.day
Hotels	225 L/bed space.day

For estimation of peak demand rates, an assessment of the water using fixtures is generally necessary and a fixture-unit approach is required. A peak rate factor of four (4) will apply to campground areas.

c) Industrial Water Demands

Peak water demand from industrial areas vary generally with the extent, the type of industry. In the absence of accurate flow data, the following preliminary flow allowances may be used. Peak usage rates will generally be 2 to 7 times the average usage rate. Final unit rates will be negotiated with the municipality on a project-by-project basis.

Light industry	35 m^3/ha. day
Heavy industry	55 m^3/ha.day

d) Fire Demands

The minimum fire flow shall be determined on a project-by-project basis. The system must be simultaneously capable of satisfying the maximum day demand.

5.3 SYSTEM PRESSURE

5.3.1 Minimum Operating Pressures

The distribution system shall be sized so that under maximum hourly demand, the pressures are not less than 275 kPa (39.8 PSI). Under conditions of simultaneous maximum day and fire flow demands, the pressure should not be less than 140 kPa (20.3 PSI).

5.3.2 Transient Pressures

The distribution piping system shall be designed to withstand the maximum operating pressure plus the transient pressures to which it will be subjected. Transient pressures are caused by rapid valve operation, pump start-up and shut-down, power failures, etc.

As a minimum allowance in the distribution system, the pipe and joint strength shall be such that it can withstand the maximum operating pressure plus the pressure surge that would be created by instantaneous stoppage of a water column moving at 0.6 m/s.

5.4 FRICTION FACTORS

The Hazen-Williams Formula is to be used in the design of water distribution systems. The following Hazen-Williams "C" values shall be used for the design of water distribution systems, regardless of materials:

Diameter	C-Factor
150 mm	100
200 mm/250 mm	110
300 mm/600 mm	120
Over 600 mm	130

5.5 MINIMUM PIPE SIZES

5.5.1 Watermains

The minimum size of watermain shall be 200 mm except for the following cases:

(A) Watermains in systems not required to carry fire flows;
(B) Beyond the last hydrant on cul-de-sacs; and
(C) Modelling (using Watercad software) has been completed to show otherwise. Watermain sizes less than 150 mm shall not be considered even with acceptable modelling results.

5.5.2 Water Services

The minimum pipe size for water service connections is 20 mm (internal diameter).

5.6 SYSTEM LAYOUT

5.6.1 Grid Design

The water distribution system shall be designed to eliminate dead-end sections. Where dead-end mains cannot be avoided, the section shall be provided with a fire hydrant or blow-off.

5.6.2 Valve Placement

Shut-off valves shall be placed as follows:

At "T" intersections	at least 3
at cross intersections	at least 4
on straight runs	intervals not greater than 250 m

5.6.3 Hydrant Requirements

In residential areas, the line spacing for hydrants shall be not greater than 150 m. For areas other than residential, consult the appropriate water commissions.

Fire hydrants must be installed only on watermains capable of supplying fire flow requirements. The hydrant leads shall be 150 mm diameter pipe. Location and number of hydrants is subject to the approval of the Fire Chief.

5.6.4 Depth of Cover

The minimum depth of cover over watermains and service connections shall be 1.7 m. Variations in depth of up to 2.2 m may be permitted in order to address variations in topography and to avoid conflicts with other utilities.

Where in open ditch and non-urbanized roads, minimum depth shall be laid 2.2 m below road grade or 1.2 m below the bottom of the ditch, whichever is greater. Consultants should review vertical alignments of roads so that, where possible, future road improvements and potential urbanization will not result in unacceptable watermain depth.

Where joint deflections or offsets require the pipe to be laid at less than 1.7 m of cover, insulation shall be placed to prevent freezing. Where storm drains or culverts cross over or under a watermain, insulation is required unless there is a minimum of 1.7 m separation. Insulation must be a minimum of 50mm in thickness and be installed a minimum of 0.15 m above the watermain and must be DOW Styrofoam Highload 100 extruded polystyrene

insulation (or approved equivalent). Installed insulation is to be centred on the watermain and be a minimum of 1.8m wide.

5.6.5 Cross-Connection Control

No connection shall be made between a potable public water system and any well or private water system.

If, in the opinion of the Municipality's Engineer or of the respective Commissions, a hazard could exist in a proposed water service, a backflow preventer shall be installed in such water service line.

5.7 WATERMAIN MATERIALS

No substitutes without the approval of the Operating Authority and the Municipality of Lambton Shores are permitted.

5.7.1 Watermain

Watermain material shall be Polyvinyl Chloride PVC-C-900 Class 150 (DR18) confirming with AWWA C900 / CC905 or biaxially molecularly oriented Polyvinyl Chloride (PVCO) C-909 (235psi) pipe confirming with AWWA C909 and CSA B137.3.1. Only one class of watermain is to be utilized per new installation, and it shall be clearly labelled on As Built drawings which class was installed. Midline repairs to water mains shall be of the same class of pipe as the existing line (i.e. a repair on a PVC-C-900 pipe shall be repaired with PVC-C-900 pipe).

Pipe joints shall be bell and spigot with rubber gaskets. All watermain material shall be Cast Iron Outside Diameter (CIOD).

5.7.2 Gate Valves and Boxes

Valves shall be resilient-seated, wedge gate valves of the Darling 50 line by Mueller Canada Valve or approved equivalent. Main line valves to be #55 MJ type with standard operating nut. Hydrant valves to be #525 MJ to FL gate valve with standard operating nut and resilient seal. (Valves to be attached to the FL boot of hydrant with suitable gasket installed).

All valves to be supplied with "O" ring packing for water use and **open counter-clockwise**.

Valve boxes to be slide or sliding type valve box 113 mm with guide plate.

Tapping valves and sleeves must meet with approval of the Operating Authority.

Resilient-seated gate valves shall be in accordance with AWWA C509.

5.7.3 Fittings

Fittings shall be ductile iron mechanical joint type with adaptors to suit other materials, where necessary, or Tyton joint suitable for PVC pipe or PVC-C-900 push on fittings. Fittings must be restrained with approved restraining glands.

Ductile iron fittings shall be in accordance with AWWA C110 and rubber gasketed joints for D.I. fittings to be in accordance with AWWA C111.

PVC fittings shall be in accordance with AWWA C900.

5.7.4 Hydrants

Fire hydrants shall be Mueller Canada Valve “Century” type c/w flanged boot. Hydrant specifications as follows:

- 3 way with steamer port STORZ connector
- Hydrants shall open **counter clockwise**
- Colour shall be **yellow**
- Operating nut shall be a #1 nut
- Hydrant length shall be such that the bottom of the upper barrel shall be 150 mm above finished grade.

Dry barrel hydrants shall be in accordance with AWWA C502.

5.7.5 Thrust Restraints

OPSS 701.07.23 is amended to the following insert:

General

All thrust restraint shall be designed to adequately provide the minimum amount of pipe/joint restraint required by mechanical joint restraint device alone. Concrete thrust blocks is the preferred method of thrust restraint in the Municipality except for connections to an existing main as directed by the Operating Authority.

Restrained lengths for watermain 100 mm to 300 mm shall be in accordance with the requirements outlined below. Restrained length calculations for watermains 400 mm and greater shall be supplied by the pipe manufacturer using the design criteria set out below.

Thrust restraint shall be provided at all fittings, bends, tees, valves, hydrants, crosses,

reducers, and plugged or capped dead ends.

For PVC pipe refer to UNI-BELL and AWWA M-23. Where connecting to DI pipe, refer to AWWA C600 – Section 3.8.

Hydrants shall be restrained with mechanical thrust restraints.

Design Criteria

All inline valves up to 300 mm in size shall be mechanically restrained and as well one (1) full pipe length (6m) on each side of the restrained valve must be mechanically restrained with a minimum of two (2) steel rods to be used on the restraints.

All bends up to 200 mm in size must be mechanically restrained and as well one (1) full pipe length (6m) on each side of the restrained bend must be mechanically restrained with a minimum of two (2) steel rods to be used on the restraint.

All bends from 250 mm to 300 mm in size shall be mechanically restrained and as well two (2) full pipe lengths (12m) on each side of the restrained bend must be mechanically restrained with a minimum of four (4) steel rods to be used on the restraints.

All dead ended watermains up to 200 mm in size cap and or plug shall be mechanically restrained and three (3) full pipe lengths (18m) must be restrained prior to the end of that watermain with a minimum of two (2) steel rods to be used on the restraints.

All dead ended watermains 250 and 300 mm in size cap and or plug shall be mechanically restrained and as well five (5) full pipe lengths (30m) must be restrained prior to the end of that watermain with a minimum of four (4) steel rods to be used on the restraints.

All fittings, which would include tees, fire hydrants, reducers and crosses up to 300 mm in size, shall be restrained and as well two (2) full pipe length (12m) on each side of the fitting and must be mechanically restrained with a minimum of two (2) steel rods to be used on the restraints.

All branch valves shall be treated as dead end watermains and shall be restrained according to the above mentioned dead end watermain criteria.

NOTE: If any joint is encountered in the above restrained lengths it must also be restrained.

5.7.6 Services – Min. 20 mm, Max. 50 mm

- Corporation Stops – C.C. thread inlet/compression outlet. Screw connection to be

provided for attachment of anode wire.

- Curb Stop – Mueller or equivalent full port ball valve, with compression joint inlet to compression joint outlet.
- Service Pipe - Type “K” copper tubing to ASTM B88
  - Cross linked polyethylene (PEX) conforming to AWWA C904
- Curb box - Concord Clow or Mueller equivalent service box and stem 1.4 m to 1.7 m with 25 mm steel upper section with stainless steel stem.
- Service saddles – Model No. 2616 by Robar Industries Inc., stainless steel, double bolted, wide band (18 gauge min.).

Underground service line valves and fittings shall be in accordance with AWWA C800.

Model numbers shall be stamped on all valves and materials.

5.7.5 Cathodic Protection

Polyvinyl Chloride (PVC) or Polyethylene (PE) Mainline Piping as per OPSD 1109.011.

Appurtenance		**Method of Protection**
i)	Piping	Not required
ii)	Hydrants	One anode per each (see hydrant standard drawing OPSD 1105.010)
iii)	Services • Each copper service	One anode per each service
iv)	Valves	Sacrificial zinc nuts / anode
v)	Fittings	One anode per each or sacrificial zinc nuts

- Anode sizes shall be 5.5 kg for watermain appurtenances up to and including 300 mm diameter and 11.0 kg for watermain appurtenances greater than 300 mm.
- Anodes for steel pipe encasement shall be 11.0 kg for all sizes.
- Sacrificial zinc nuts shall be of the protecto-cap type and installed on each bolt.

5.7.6 Water Meter Pit

Water meter pits shall, at a minimum, comply with OPSD 1108.101, or any modified or current version thereof. The requirements of OPSD 1108.101

shall be in addition to any requirements for the supply and installation of a backflow device for the purpose of compliance with applicable Municipal By-Laws. Proposals for deviation from the sizing requirements specified in OPSD 1108.101 must be reviewed and approved by the Municipality prior to construction.

5.9 ACCEPTANCE OF WORK

5.9.1 Flushing, Testing, and Disinfection

All watermain shall be tested, flushed, swabbed and disinfected. Such procedures shall be in accordance with OPSS 701 for pressure testing and AWWA C651-99 for disinfection and connection to the waterworks system. The Developer shall inform the Municipal Engineer when the watermain is to be tested and disinfected. Bacteriological testing will be completed by the municipal operating authority. The Developer will be billed for any testing or retesting required. Any failure of the testing and disinfecting shall require the Developer to reflush, retest and/or redisinfect the watermain until the watermain has met the requirements of the Ontario Provincial Standard Specifications and the MECP, to the satisfaction of the Municipality.

Minimum requirements for bacteriological testing are:

- E. coli (fecal coliforms) – not detectable
- Total coliforms – not detectable
- Heterotrophic Plate Count (HPC) – operational tool for monitoring general bacteriological water quality, increases in HPC concentrations above baseline levels are considered undesirable.

All chemicals and materials used in the disinfecting of the drinking water system shall conform to the following standards:

- AWWA B300 for Hypochlorites
- AWWA B301 for Liquid Chlorine
- NSF/ANSI 60, Drinking Water Treatment Chemicals – Health Effects
- NSF/ANSI 61, Drinking Water System Components – Health Effects

The distribution system and services shall be back flow protected and pressure-tested to 1050 kPa (152 PSI) for a period not less than two (2) hours. All leaking joints, fittings or appurtenances shall be tightened and all defective materials shall be removed and replaced. The maximum allowable leakage is 1.85 litres per day per mm of diameter per Km of length and all necessary steps to reduce the leakage to the allowable amount shall be taken.

When the installation is completed and the leakage test and pressure test results are

satisfactory, the system shall be thoroughly swabbed and flushed to remove all debris and unwanted material. The system shall be disinfected using a chlorine solution maintained at a minimum concentration of 50 mg/l throughout the length of the pipeline. The residual concentration at the end of 24 hours shall be at least 25 mg/l. If tests of the solution are satisfactory, the contents of the pipeline shall be flushed out completely and recharged by normal municipal water. Samples of the recharge water in the system shall be analysed for contamination and the system shall not be put into operation until test results indicate no contamination. Disinfection procedures shall be repeated as necessary.

All testing and disinfection shall be carried out by the developer in the presence of the Municipality's representative. The complete water distribution system installation must be approved by the Municipality prior to the issuance of building permits for the subdivision.

5.9.2 Valve Boxes and Curb Boxes

The top of all valve boxes and curb boxes must be set to finished grade. Curb boxes must be set plumb and be 150 mm to 300 mm from the street line toward the centreline of the road.

5.9.3 Hydrants

Hydrants are to be set plumb, with nozzles parallel to edge of pavement or curb line, and pump connection facing pavement.

Flange at base of hydrant is to be set at finished grade to 100 mm above finished grade.

SECTION 6.0 – ROADS

6.1 GENERAL

Paved roads and concrete curbs and gutters shall be provided in the Plan of Subdivision. Existing street allowances, which provide access to the subdivision shall be constructed or improved as determined by the Municipality's Engineer.

Ontario Provincial Standard Specifications (OPSS), Ontario Provincial Standard Drawings (OPSD), Municipal Engineer's Association (MEA) guidelines, geometric Design Standards, Transportation Association of Canada and Ministry of Transportation guidelines shall govern where applicable.

6.2 DESIGN

In general, the following design criteria shall be adhered to unless otherwise approved by the Municipality's Engineer.

6.2.1 Pavement Widths and Right-of-Way Widths

The following information outlines right-of-way widths, pavement widths (face to face of curb) for the various street classifications:

Type	Lane Width	Parking Lane	Min Total Width	Right-of-Way
Local Residential	3.0 m	2.5 m	8.5 m	20 m
Industrial Commercial	3.5 m	2.5 m	9.5 m	20 m to 26 m

The street classification will be determined by the Municipality.

6.2.2 Minimum Road Gradients

The minimum allowable road gradient is 0.5% and maximum is 5% (8% absolute). In the case of curves, the minimum gradient applies to the longest gutter (min. grade at intersection curb radii 0.8%). Vertical curves are required where the algebraic difference in grades is greater than 1.0%. Minimum length of vertical curve shall not be less than 45m.

6.2.3 Standard Geometrics

	Minor Local	Local
No. of Units	<25	<100
Traffic Volume (AADT)	<200	<1000
Min Boulevard Width	3.15 m	3.15 m
Min Cul-de-Sac Pavement Radius (residential)	15.0 m	15.0 m
Min Cul-de-Sac Radius at property line (residential)	19.0 m	19.0 m
Min Stopping Sight Dist.	60.0 m	60.0 m
Pavement Cross fall	2.0%	2.0%
Pavement Thickness *		
Hot Mix Asphalt	75 mm	80 mm
Granular "A"	150 mm	150 mm
Granular "B"	300 mm	400 mm
Maximum allowable beam deflection (Benkleman)	2.5 mm	1.8 mm

* Minimum requirements in the absence of a Geotechnical Engineer's report.

Off – site road improvements (existing street widenings, turning lanes, tapers, traffic island, signals, sidewalks … etc. including traffic studies … etc.) will be determined on a project-by-project basis. Refer to typical sections for additional information.

6.2.4 Intersection Radii

The minimum % radii at edge of pavement required at intersections are as follows:

Street Classification	R.O.W. Widths	Minimum Radius
Local to local	20 m	9.0 m residential
	20 m	13.0 m industrial
Local to collector	20 m	9.0 m residential
	20 m	13.0 m industrial

6.2.5 Street Patterns

Where possible:

- intersecting streets at right angles
- no jogged intersections
- intersections not closer than 60m (200ft)
- avoid long cul-de-sacs
- minimize through traffic

6.2.6 Curb and Gutter

Concrete curb and gutter is required on all streets. Alternative curb types will be considered by the Municipality. A roll type curb may be installed on cul-de-sacs with approved transitions. All curbs shall be in accordance with OPSS and OPSD Specifications. All curb cuts shall be installed at the time of construction and locations shall be in accordance with zoning by-law side yard setbacks for interior and exterior yards.

6.2.7 Pavement Markings

Permanent pavement markings shall be designed in accordance with the Ontario Traffic Manual – Book 11. Proposed designs both temporary and permanent shall be submitted to the Municipality for approval, prior to application.

6.2.8 Entrance Configurations

Entrances related to new proposed developments shall be in compliance with OPSD 350.010. No catchbasins, existing or proposed, shall be located within the limits of any entrances.

Entrances related to proposed residential shall generally follow the following where “A” represents the width beyond the curb cut and throat radius section of the entrance, and ‘B” represents the width at the curb cut section of the entrance.

Driveway Entrance Type	Dimensions (min/m)			
	A	B	Radii	
Single Family (Local & Collector)	6.0	7.0	Left Side – 0.5	Right Side – 0.5
Single Family (Other ROW)	6.0	8.0	Left Side – 0.5	Right Side 1.5
Multi-Family	6.7	12.7	Left Side – 3.0	Right Side – 3.0

Entrances related to agricultural properties shall be in compliance with OPSD 301.010, OPSD 301.020, OPSD 301.030, and any other applicable standards.

6.3 MATERIALS FOR CONSTRUCTION

6.3.1 Concrete

Unless noted otherwise in OPSS, the concrete curb and gutter is to be placed on a Granular "A" base of not less than 150 mm thick. Concrete is to be 25 MPa at 28 days and air entrainment capabilities of 6%+/-1%. Contraction joints are to be provided every three (3) meters. Expansion joints every nine (9) meters; on both sides of catch basins; and, at the beginning and end of circular curves. The use of asphaltic concrete curb will not be permitted.

General specifications for concrete shall be according to OPSS. A mix design shall be submitted to the Municipality's Engineer for approval.

6.3.2 Asphalt

General Specifications for asphalt shall be OPSS. The top course of asphalt shall be 35/40 mm of HL3 and the base course shall be HL8 as per the typical cross section unless otherwise recommended by a geotechnical engineering report and accepted by the Municipality. Asphalt shall be compacted to 97% of the Marshall density of the mix design. Granulars used in asphalt shall conform to OPSS. Superpave equivalents may be utilized if approved by the Municipality and must conform to all applicable standards and guidelines.

6.3.3 Granular "A"

Granular "A" shall conform to OPSS. Granular "A" shall be compacted in roadways to 100% Standard Proctor maximum Dry Density. Sieve analysis shall be performed on the proposed material to ensure conformance with the specification before the material is placed on the roadway.

6.3.4 Granular "B"

Granular "B" shall conform to OPSS. Granular "B" shall be compacted in roadways to 100% Standard Proctor Dry Density. Sieve analysis shall be performed on the proposed material to ensure conformance with the specification before the material is placed on the roadway.

6.4 CONSTRUCTION

6.4.1 Trench Compaction and Subgrade Compaction

All sewer and water trenches and utility trenches within the roadway shall be compacted to at least 95% Standard Proctor Dry Density up to 1 metre below first road grade and 98% up to subgrade level.

The subgrade shall be proof rolled and compacted to at least 98% Standard Proctor Dry Density. Imported materials for subgrade shall be compacted to at least 98% Standard Proctor Dry Density.

All topsoil shall be removed under roadways and curb and gutters. All subgrade to be approved by a Geotechnical Engineer.

6.4.2 Boulevard Grading

All boulevards between the curb and street line shall be fine graded. The slopes on boulevards shall be not less than 2% and not greater than 5%. All debris, rubbish and junk shall be removed from the street right-of-way before final acceptance of the subdivision.

6.5 STREET NAME SIGNS

Street identification signs shall be as noted herein:

Street name signs are to be located on the southwest corner of all street intersections unless otherwise specified. Street signs shall be mounted on separate poles from regulatory signs. The street sign poles shall generally be on the opposite side of the street from regulatory signs. At “Tee” intersections, where it is not possible to locate a street sign on the southwest corner, the street sign poles shall generally be located across the intersection opposite the centreline of the intersecting street.

Regulatory sign posts shall be hot dipped galvanized steel “U-Flange” sign posts. Street sign posts shall be 60mm (2 3/8”) diameter minimum, galvanized steel posts approximately

3.4 metres (11') long or longer if required. Posts shall be embedded in concrete or driven into the ground to a depth of at least 1.0m (3.3'). Regulatory signs, post locations and sign mounting heights shall be in accordance with the Highway Traffic Act and Regulations (latest version) Metal posts, regulatory traffic signs and street signs shall be as supplied by Owl Light Trillium, Clemmer Industries Ltd., Fortran Traffic Systems Limited or approved equal. In general, street signs shall be centre-mounted on top of posts. However, at major intersections the Municipality of Lambton Shores may require street signs to be mounted on street light poles (see below). In general, the mounting height of street signs (from ground to bottom of sign) shall be 2.3 to 3.3 metres (7.5' to 10.8').

Except as noted below, street name plates shall be extruded aluminium blades with heat activated application of "engineering grade" reflective vinyl to the blank. Lettering shall be reflective white on a reflective green background with lettering on both sides of the sign.

At intersections with traffic islands and/or signalised intersections, the Municipality of Lambton Shores may require street signs to be installed at more than one corner of the intersection and/or at traffic islands/medians. In these situations, the Municipality may require street signs to be mounted on street light poles. These signs shall be fabricated from flat, heavy gauge (0.8") aluminium sign blanks with reflective white lettering on a reflective green background on one side of the sign and shall be mounted to light poles with two centre hole brackets and 3/4" x 0.02" thick stainless steel strapping.

Lettering shall be done by the heat application of die cut letters, or by the heat-fixed screening process where the quantity of signs having the same name exceeds five, subject to the approval of the Public Works Superintendent. Lettering shall be upper case standard block condensed style. Lettering size and sign blank height shall be as follows:

Local / collector streets
150mm (6") high sign blank
- 75mm (3") high street name
- 50mm (2") high ST., AVE., etc.

Street name signs and traffic signs satisfying the requirements of the Municipality and Ministry of Transportation shall be located in accordance with MTO criteria.

6.6 SIDEWALKS

The Municipality will determine where sidewalks are required to be installed at the Developer's expense.

At a minimum, sidewalk shall be required as follows.

a) on both sides of all collector streets;

b) on both sides of any street on which a school property fronts;
c) on one side of local residential streets, except cul-de-sacs and crescents which contain less than 20 residential units may not require sidewalks;
d) both sides of streets abutting parkland may require sidewalk on both sides: each situation to be considered on a case-by-case basis

Sidewalks and curbs shall be depressed at street intersections to permit easy passage of wheelchairs, etc. complete with directional lines, etc. Sidewalks shall be installed in conjunction with curb installation and prior to driveway construction, final lot grading and boulevard restoration.

Minimum sidewalk width shall be 1.5m. On a project-by-project basis, the Proponent must explore sidewalk width opportunities with the Municipality to determine what is appropriate.

6.7 ACCEPTANCE OF WORK

6.7.1 Concrete

The Subdivider shall provide compressive cylinder test results, from a Geotechnical Engineer, for concrete used in the work. Such testing shall be performed by a recognized testing company. Visual inspection and impact hammer tests may be made on the concrete by the Geotechnical Engineer.

The Municipality's Engineer may also require tests by coring and taking compressive, petrographic and entrained air tests on the cores obtained. Provided that no defective work is indicated by such inspections, the whole cost of coring and testing shall be borne by the Municipality. If defective work is indicated by such inspections, the subdivider shall bear the total cost of the inspections and testing.

6.7.2 Pavements - Evaluation of Pavements

All asphalt that is intended to be assumed by the Municipality shall be tested for conformance by a Geotechnical Engineer and those tests shall be provided to the Municipality. The geotechnical testing shall be performed by a recognized testing company recognized by the Canadian Council of Independent Laboratories (CCIL) and which has a current CCIL Type B Certification or AMRL equivalent certification. Testing shall include on-site compaction testing and laboratory based quality control / assurance as noted in OPSS.MUNI 310.

All costs associated with the testing and evaluation of pavement that is to be assumed by

the Municipality shall be borne in their entirety by the subdivider and all test results shall be submitted to the Municipality's Engineer for approval and acceptance.

6.8 CONSTRUCTION SIGNAGE

6.8.1 General

All construction signage shall comply with the Ontario Traffic Manual – Book 7

6.8.2 Traffic Management Plans

The Traffic Management Plan (TMP) is a construction tool that assists with harmonizing the construction requirements with operational Municipality requirements, and the transportation needs of the road users.

The Ministry of Labour and Ontario Traffic Manual – Book 7 lay out the requirements for Traffic Control Plans (TCP) and Traffic Protection Plans (TPP) which are different than TMP requirements. The TMP is high level plan that details construction methodology's that will ensure traffic, utility services, pedestrian & cyclist, and vehicular access to adjacent areas will be maintained. TCP's and TPP's focus in greater detail and list specific signage and barricades to be installed.

For basic, straightforward projects, the Municipality will receive a TCP/TPP for approval prior to work commencing. For all development related projects, a TMP is required for Municipality approval prior to work commencing with potential supporting TCP's depending on the intricacies of the work.

6.9 PARKING

6.9.1 General

Parking shall be in compliance with the Municipality of Lambton Shores "Comprehensive Zoning By-Law" that details general requirements for design related to parking. Accessible parking shall be in compliance with all applicable Accessibility in Ontario guidelines and standards.

SECTION 7.0 – LOT GRADING

7.1 GENERAL

Subdivisions and/or developments shall be graded in accordance with the following specifications. Lot grading plans shall be prepared by the developer and approved by the municipality along with the subdivision servicing drawings.

7.2 LOT GRADING DETAILS

1. Yard surfaces shall have a minimum of 2%.
2. Drainage flows shall be directed away from houses.
3. Drainage flows which are carried around houses are to be confined in defined swales located as far from the house as possible.
4. Desirable swale depth to be 225 mm. Minimum swale depth to be 150 mm. Maximum swale depth to be variable, but dependent on location and safety considerations. Swale width: 1.8 m. (1.0 m from property line).
5. Grades
   a) Minor swales (providing drainage for up to four (4) lots) minimum grade shall be 2%
   b) Major swales (providing drainage for more than four (4) lots) minimum grade shall be 1%.
6. The maximum flow allowable in a side yard swale shall be that from four (4) backyards.
7. The maximum flow in rear yard swales shall be that from 10 to 15 backyards deepening on lot size and grade. The maximum length of a rear yard swale without outlet shall be 90 metres. The maximum area contributing to the rear yard swale shall be 0.5 hectare. The maximum flow in rear yard swales which may be discharged onto the road allowance, is that from six (6) backyards.
8. Front yard catchbasin shall not be permitted 9. Driveways:
   optimum grade: 3 – 4%
   maximum grade: 10%
   Walks: optimum cross slope: 2%
10. Maximum slope ratio for all terraces and banks shall be 3:1 (3 horizontally to 1 vertically).

All other site areas: optimum gradient: 4%
minimum gradient: 1%

11. Where retaining walls are required, they shall be placed on private property unless otherwise approved by the Municipality.

12. The minimum height of basement openings (i.e. basement window sills) shall be 300 mm minimum above finished road centreline elevation unless otherwise approved by the Municipality (such as with rear yard “walk-out” basements).

Reference should be made to the “Typical Site Plan Drawing” detail provided in Appendix C.

As a condition of obtaining building permits, builders shall be required to submit site plans with sufficient detail and elevations in accordance with the requirements of Figure 1 “Subdivision Requirements Checklist” and in accordance with the approved subdivision grading plan. Further, builders will be required to submit to the Municipality lot grading certificates signed and sealed by a Professional Engineer/Ontario Land Surveyor at two (2) stages of construction:

a) top of footing or top of foundation; and
b) finish grading.

Where requested by the Municipality, the builder will be required to complete an interim lot grading certificate to confirm lot subgrade and rough grading elevations.

Each certificate shall provide certification that the appropriate stage has been constructed in accordance with the approved plans, prior to construction proceeding to the next stage.

Lot grading plans on infill lots may be prepared by a Professional Engineer or an Ontario Land Surveyor.

Reference should be made to the “Typical Lot Grading Plan” detail provided in Appendix C.

All lot grading certificates shall show sufficient detail to understand existing and/or proposed drainage on all adjoining lots.

SECTION 8.0 – PARKLAND / LANDSCAPING

8.1 GENERAL

When open space or parkland dedication is required pursuant to the Planning Act or the Subdivision Agreement, the areas so designated shall be identified on the Subdivision plans with sufficient details, notes and typical sections as may be required to identify lot grading, drainage, landscaping, access and other details as may be required. The Subdivider shall grade, topsoil, seed, landscape and otherwise prepare the parkland and open space areas to a condition which is acceptable to the Municipality for assumption and as per the approved drawings. Access for maintenance must be incorporated into the layout.

8.2 PASSIVE AND ACTIVE RECREATIONAL USES

The design and site preparation of the parkland and open space shall take into account the intended and future passive and/or active recreational uses in accordance with the Municipality's requirements. Where possible, natural features including topography, vegetation and trees, soil conditions, watercourses, drainage, and orientation to sun and wind, should be carefully considered in the design and layout of the parkland areas.
The shape of the site must be suitable for the future layout of official sized sports fields if active usage is required. Narrow strips and triangular pieces of land are generally not acceptable. Natural wooded areas, stream and creeks will be considered on an individual basis and may be desirable where organized recreation uses are not suitable. Boggy lands are generally not acceptable for park purposes except where the area can be defined as a conservation type park area subject to the approval of the Municipality. Open water courses are generally not acceptable for proposed active playground areas.

8.3 SITE CLEARING AND SECURITY

No topsoil shall be removed from the site. The parkland and open space areas shall be fenced or otherwise made secure during land development and house construction activities to prohibit the removal of topsoil and the dumping of debris and unauthorized fill.

All rubbish, rocks, boulders, tree stumps and other debris shall be removed from the site. The burning or burying of such materials on the site shall be permitted only if approved by the municipality. Dead trees shall be cut and stumps removed. Trees which are to remain shall be adequately protected during land development.

All earthworks works must comply with Excess Soil Regulations.

8.4 SITE GRADING / DRAINAGE

Park drainage and grading plans shall be submitted to the Municipality at the same time as the servicing drawings and shall meet the following minimum standards.

DRAINAGE:

a. Drainage of Parkland dedications shall be self-contained such that areas drain to channels or swales which outlet to catch basins and storm sewers or other suitable outlet, so that park drainage does not adversely affect other properties.

b. Swales should have gently sloping sides and should be used wherever possible rather than steep sided ditches. The minimum slope of channel and swale inverts shall be 1.5%. Maximum side slope permitted is 4:1.

c. Maximum depth to bottom of channel shall be 1 metre. Minimum depth of swale shall be 200 mm.

d. Except for natural watercourses, in general, catch basins shall be provided in open channels and swales at maximum intervals of 100 metres.

e. Swales or open ditching shall not cross the entrance way into the park area.

f. Natural wetland areas may require special attention and preservation.

GRADING:

a. In general, the minimum grade for grassed areas shall be 2%. However, areas to be developed for future soccer or baseball facilities may have grades less than 2%. Subsurface drainage may be required.

b. Grassed slopes shall not have gradients steeper than 4:1 so as to allow safe use of moving equipment.

c. All lands must be satisfactorily graded before the lands will be accepted by the Municipality for park purposes.

d. Grading or natural contours which result in undrained areas are not acceptable. If overland drainage cannot be modified, catch basins and pipe will be required.

e. The Developer shall do all rough grading and filling where required, under all landscaped areas, to establish the sub-grade parallel to the

finished grades indicated on the grading plans, to allow sufficient topsoil depth. All soft and unstable areas below sub-grade shall be excavated and filled with compacted select fill material.

f. All areas shall have uniform slopes between points for which finished grades are indicated on the plans or between such points and existing grades. Grades shall be smoothly rounded at top and toe of slopes.

g. Sub-grade shall be scarified to minimum depth of 75 mm to produce an even, loose textured surface free of all stones, roots, branches, etc. larger than 50 mm in diameter.

h. Topsoil shall be loose textured and free of all stones, roots, branches, etc. larger than 50 mm in diameter.

i. The minimum depth of topsoil under seeded areas shall be 150 mm. When additional topsoil exists on site, it shall not be removed from site, but shall be used to increase overall finished topsoil depth, or to construct other landscaping features proposed.

8.5 SEEDING

Prior to seeding, a formulation of appropriate fertilizer shall be applied at the manufacturers recommended rate to initiate leaf growth and root development. Grass seed shall be a certified seed, meeting the requirements of The Seeds Act for Canada No. 1 Seed. It shall be a mixture which is suitable for the soil conditions, etc. of the site. The seeding periods, in order of preference are:

i) August 15 to September 15
ii) Early Spring to May 30

At the time of inspection for acceptance, grass shall be well established and in vigorous growing condition. Unacceptable areas shall be reseeded by the Developer. The Developer shall regularly mow the grass after good growth has been established and shall control weeds as required, prior to assumption of the site by the Municipality.

8.6 WALKWAYS

Where walkways are required through parklands, they shall be 1.5 m wide and constructed of a 150 mm depth of well-compacted chip and dust over geotextile fabric unless otherwise specified.

8.7 FENCING

Where permanent fencing is required within or along parkland boundaries, it shall be 1.8 meters high and shall meet the material specifications as outlined in the easement details (Appendix B).

8.8 TREE PLANTING

Where possible, mature healthy trees should be preserved. The subdivision plans and park land plans should clearly indicate existing wooded areas and/or single trees where appropriate and shall indicate those trees/areas to be preserved.

If required by the Subdivision Agreement, the Developer shall plant trees at the standard location 1.5 m behind property line, on private property, at an approximate spacing of 20 metres (one (1) tree per residential lot). In lieu of tree planting, the Subdivider may make a cash-in-lieu payment to the Municipality, based on a rate of $10.00 per meter of frontage and flankage.

If required by the Subdivision Agreement, the Subdivider shall establish a buffer zone of trees to abut a road allowance to separate and screen non-compatible land uses. Such buffer zones in road allowances, shall consist of a continuous row of trees in a location specified by the Municipality of Lambton Shores.

In all cases where tree planting is required, the Subdivision plans shall clearly indicate on the park land plans or separate landscaping plans, the tree type, size, spacing, location etc.

Planting, staking, watering, pruning and maintenance of new plant stock shall be the responsibility of the Subdivider until such time as the Subdivision is assumed by the Municipality.

New plant stock shall satisfy the following minimum standards:

a)	Deciduous trees:	- 2.5 to 3.0 m (8 to 10 ft) in height - 50 mm in calliper (measured at 300 mm above the ground - well branched
b)	Coniferous trees:	- 1.0 to 1.5 m (3 to 5 ft) in height
c)	Shrubs:	- 1.0 m at time of planting - closely spaced (when used for screening)

Plant stock shall be carefully planted in accordance with standard nursery practice and the detail and drawings included with the approved subdivision plans. Plantings shall be done during periods suitable with respect to local weather conditions and established horticultural practice.

SECTION 9.0 – TRAFFIC SIGNALS & STREET LIGHTING

9.1 TRAFFIC SIGNALS

Traffic signals shall be considered warranted if:

a) Intersection conditions meet or exceed the warrant requirements of Section 4.3 of the Ontario Traffic Manual – Book 12;
b) Approval is granted by the Municipality; and
c) Approval is granted by Council.

Intersection pedestrian signals (IPS) shall be considered warranted if:

a) Conditions meet or exceed the warrant requirements of Section 4.8 of the Ontario Traffic Manual – Book 12;
b) Approval is granted by the Municipality; and
c) Approval is granted by Council.

The design of Traffic Signals, Temporary Traffic Signals, and the Relocation of Existing Traffic Signals must be completed, signed and sealed by a fully qualified Professional Electrical Engineer. Designs must be submitted to the Municipality for review and acceptance prior to any construction work being undertaken.

Design and material selection for traffic signals shall be in conformance with the requirements of all applicable Ontario Traffic Manual's, Ontario Electrical Safety Code, Ontario Highway Traffic Act, OPSD and OPSS, Canadian Standards Association (CSA), and Institute of Transportation Engineers (ITE), and another applicable standards and guidelines.

9.2 STREET LIGHTING GENERAL

All subdivisions shall be provided with streetlights as required by this section. Lighting systems shall be designed in accordance with the "Guide for the Design of Roadway Lighting" as published by the Roads and Transportation Association of Canada and the "Design Manual for Highway Illumination" as published by the Ministry of Transportation.

9.3 GENERAL STREET LIGHTING REQUIREMENTS

In general, street lighting shall be high performance Light Emitting Diode Type (L.E.D.) luminaries with posts located opposite the lot lines perpendicular to the street, where possible. The first light poles should be installed to a maximum of 10 metres (33') from the curb of the intersecting streets. The CCT of fixtures within subdivisions and/or developments and/or walkways shall be 3,000 +/- 500K.

Poles may be base mounted or direct burial type. The Developer's Engineer shall be required to provide details, specifications of the proposed lighting system and materials including Engineer's detail drawings of concrete bases and/or pole embedment for review and approval by the Municipality. Where direct buried poles are approved for use, the Municipality may require concrete embedment to ensure that poles are securely installed. See OPSD for concrete footing and "direct buried" details.

Underground wiring for street lighting shall be used.

All light fixtures must comply with the Municipality's Dark Sky bylaw. Fixtures must be directed to ground surface and be dark sky compliant.

The following are recommended general lighting requirements and are to be read in conjunction with the Typical Cross-Sections in Appendix B for road width and pole location:

a) Residential
- mounting height: 5.5 metres (18.0')
- lamp: equivalent to 100 Watt HPS
- pole spacing: 30 metres (100')

b) Commercial
- mounting height: 8-10 metres (25' – 33')
- lamp: equivalent to 100 Watt HPS

c) Industrial
- mounting height: 12 metres (40')
- lamp: equivalent to 150 Watt HPS
- pole spacing: 50 metres (165')

9.4 DESIGN CRITERIA

The design of streetlights for subdivisions must be designed, signed and sealed by a Professional Engineer. The design of streetlights on all other roads must be designed, signed and sealed by a Professional Electrical Engineer.

The design of street illumination shall conform to the requirements set out by American National Standard Practice for Roadway Lighting (ANSI/IESNA RP-8-14).

The following are recommended standards. Pole spacing, mounting height, etc. may vary with such conditions as staggered pole arrangements, intersections, cross walks, turning lanes and median mounting.

The following illumination criteria in Table 2 should also be considered in conjunction with averaging factors, extent of lighting coverage, luminance levels, glare, etc. The Subdivider's Engineer may be required to submit photometric data for lighting system design for review by the Municipality, particularly for collector and arterial streets. Detailed photometric designs shall be submitted for all other roads, intersections, and sidewalks demonstrating how the RP-8-14 standards have been satisfied without excessive over lighting. Illumination at intersections may require a higher wattage fixture than the remainder of the road. Photometric design, in addition to the drawings, must be displayed in a table similar to the following:

	Lavg	Lavg/Lmin	Lmax/Lmin	Lmax/Lavg
Major Road with Medium Pedestrian Conflict				
Luminaire name	**RESULTS**	**RESULTS**	**RESULTS**	**RESULTS**
	Eh (lux/fc)	Evmin (lux/fc)	Eavg/Emin	
Sidewalk with Medium Pedestrian Conflict	5.0/0.5	2.0/0.2	4.0	
Luminaire name (near side)	**RESULTS**	**RESULTS**	**RESULTS**	
Luminaire name (far side)	**RESULTS**	**RESULTS**	**RESULTS**	

Streetlights shall be located such that current and future tree canopies do not interfere with the distribution of the light, nor any other proposed landscaping features.

The drawings shall show the location of the streetlights, streetlight conductors, the location of transformers and the location of the power disconnects. The drawings shall specify the

type of pole, fixture, conduit, fixture wattage, conductor and breakers being used. Existing streetlights (if any) must also be shown.

The maximum number of lights that can be attached to a single circuit is 10 unless voltage drop calculations are provided that demonstrate the circuit can accommodate the load.

All streetlight wire road crossings shall be placed in a 50 mm RPVC duct with handholes at either end of the road crossing.

Designers should be aware of driveway and living room window locations when determining the location of lights.

In the legend beside the streetlight symbol, it should show Manufacture Wattage Model Information (e.g., Eaton 52W MSA-EO2-LED-E1-SL3-AP-PER7-7030- DIM-HSS).

TABLE 2

ROADWAY / AREA CLASS	ILLUMINANCE CRITERIA			
	AVG. ILLUMINANCE		UNIFORMITY RATIO	
	Foot Candle (fc)	Eav (lux)	Maximum Avg. / Min.	Maximum Max./Min.
Local:				
Residential	0.6	6	6:1	12:1
Commercial	0.9	10	3:1	6:1
Industrial	0.6	6	6:1	12:1
Collector:				
Residential	0.9	10	3:1	6:1
Commercial	1.2	13	3:1	6:1
Industrial	0.6	6	3:1	6:1
Arterial:				
Residential	1.1	12	3:1	6:1
Commercial	1.5	17	3:1	6:1
Industrial	0.8	9	3:1	6:1

9.4 DECORATIVE STREET LIGHTING

For subdivision areas exceeding 20 hectares (50 acres), decorative streetlights and poles may be used. Where decorative street lighting is used, the subdivider shall provide the Municipality with additional fixtures and poles for stockpiling purposes, at the rate of 5% of the number used in the subdivision.

Decorative streetlights shall be L.E.D. equivalent to 100 Watt HPS bulbs for local residential and commercial applications. Luminaire housings and poles shall be finished black or nostalgia bronze. Mounting height shall be 4.5 metres for local residential applications.

a) Luminaires shall be post top mounted:
   - In areas where a more decorative model is deemed appropriate, the Villa Maria VMAT4A from Cyclone, or approved equivalent, shall be utilized.

b) Poles shall be:
   - Model to be coordinated with Municipality

9.5 LOCAL RESIDENTIAL STREET LIGHTING

For local residential street lighting where nostalgia type streetlights are not used, street lighting shall be as follows or approved equal:

a) Post top luminaries shall be:
   - Cree current model.

b) Poles hall be:
   - Model to be coordinated with Municipality.

All installations must be inspected by the Electrical Safety Association (ESA) prior to Hydro power connection. The Contractor is responsible for arranging inspection with ESA.

9.6 COLLECTOR, COMMERCIAL, INDUSTRIAL LIGHTING

All street lighting other than local residential and nostalgia style commercial street lighting, shall be cobra-head style luminaries mounted on tapered elliptical arms with 1.8 m (6') reach for local and 2.4 m (8') reach for collector streets and arterial streets.

a) Luminaires shall be as follows or approved equal:
   - In areas where a more decorative model is deemed appropriate, the Villa Maria VMAT4A from Cyclone, or approved equivalent, shall be utilized.
   - In areas where a less decorative model is deemed appropriate, the Levanto CLE17T4A from Cyclone, or approved equivalent, shall be utilized.

b) Pole types for all other 8 m, 10 m, 12 m mounting heights shall be as follows or approved equal, and shall satisfy OPSS/OPSD requirements:
   i) aluminium poles (round tapered aluminium, aluminium finish, direct buried or base mounted):
      - Model to be coordinated with Municipality.
   ii) steel poles (solid shaft, round or octagonal, tapered, galvanized steel, base mounted):
      - Model to be coordinated with Municipality.

iii) spun concrete (round cross-section with natural smooth concrete finish, direct buried):

- Model to be coordinated with Municipality.

SECTION 10 – UTILITY LOCATION

10.1 GENERAL

The "Municipal Works Design Manual" will serve as a guide in establishing utility locations within the street right-of-way. The following offsets will apply for the storm and sanitary sewers and watermains.

10.2 STORM SEWERS

Storm sewers to be located 1.5 m off centreline of street, 3 m offset from the sanitary sewer alignment.

10.3 SANITARY SEWERS

Sanitary sewers to be located 1.5 m off centreline of street, 3 m offset from the storm sewer.

10.4 WATERMAINS

Watermains to be located 4.7 m from property line in boulevard.

10.5 OTHER UTILITIES

Location of all other utilities, i.e.) telephone, gas, cable etc. Shall be in accordance with typical cross section drawings as shown in Appendix B. It is incumbent on the Proponent to confirm with each individual Utility if that specific running line will work, if offset or design requirements have changed, etc. on a project-by-project basis.

SECTION 11.0 – DRAFTING AND DESIGN REQUIREMENTS

11.1 GENERAL

Except where noted herein, all drafting and design projects shall follow these standards.

11.1.1 Basic Drawing Requirements

Drawings, at a minimum, are to contain the following details:

a) A list of "Construction Notes for Engineering Drawings". Note, all required and supporting reports as per Council conditions, Approval Authority Conditions, Permit details, and potential Ontario Municipal Boards Conditions are to be listed on the drawings;
b) A list of all applicable standards (OPSS MUNI, OPSS PROV, etc.); and
c) A typical road and sewer trench cross-section detail identifying road, boulevard, sidewalk, curb & gutter, subdrain(s), watermain(s), forcemain sanitary & storm sewers, trench zones/slopes, bedding details, including all necessary dimensions and construction notes.

11.1.2 Transportation Related Drawing Requirements

a) Road Plan & Profiles

Road plan & profiles are required for all roads constructed or reconstructed. As well, additional road profiles are required as follows:

120m Road Plan & Profile of Adjoining Future Streets

To ensure proper drainage is maintained and/or evaluated a profile extending into the existing subdivision/side street is required.

60m Road Plan & Profile of Adjoining Existing Streets

To review future alignment extensions including existing ground and proposed finish ground details.

b) Typical Road Cross-section Detail

A typical road cross-section detail, identifying recommended pavement structure and subgrade information (minimum to meet Municipality standards, and as recommended by a Geotechnical Engineer and supporting report) is required in conjunction with the typical sewer trench cross-section detail. Curb & gutter cross-sections to be

incorporated into the typical combined road and sewer trench cross-section detail.

c) Driveway Locations & Details

All driveway locations are to be identified under existing and proposed conditions, where non-standard, and where curves and cul-de-sacs in roads are designed, adjacent to walkways, CICBs and the last lot on dead end streets. All existing and proposed driveways that form part of the project require an individual cross-section to ensure proper grading is achieved.

d) Cul-de-sac Roads (Subdivision Specific)

- General: Minimum curb & gutter road grades around a cul-de-sac is 0.5%, and maximum is 3%.

e) Ultimate Road Profile

To achieve proper road design parameters on future/proposed road networks, limitations and designs are to be reviewed and accepted by the Municipality.

11.1.3 Sewer Related Drawing Requirements

a) Connections to Future Subdivisions

Sanitary and Storm sewers are to be extended to the edge of the subdivision limit for future service connections.

NOTE: All active sewers/stubs require a maintenance hole. If sewer/stub is not active, then maintenance hole is not required.

b) Plan & Profile Details

A plan & profile drawing is required for all sewer designs. A typical sewer trench cross-section and details are also required. This may be done in conjunction with the road cross-section, if applicable.

- For poured maintenance holes.
- Unusual benching configurations within the maintenance holes.

NOTE: Trench construction to be in accordance with the latest specifications regarding trench widths (Occupational Health and Safety Act – Regulation 213/91).

c) Steep Grades of Sewers

NOTE: Anchoring or concrete encased sewers are required for steep grades and/or velocities.

d) Consultants shall provide a table demonstrating adequate crossing clearances between services (sanitary/storm/water/utilities) on the engineering drawings. All crossing clearances shall be in accordance with Municipality and industry standards. The table shall generally be presented and conform to the following example.

Sewer Crossing Chart						
CID	Pipe Under	Elev.	Pipe Over	Elev.	Clearance required (m)	Clearance provided (m)
C1	300 STM	xxx.xxx	50 WM	xxx.xxx	0.XX	0.XX
C2	300 SAN	xxx.xxx	200 STM	xxx.xxx	0.XX	0.XX
C3	100 WM	xxx.xxx	600 STM	xxx.xxx	0.XX	0.XX

11.1.4 General

All capital and development drawings and calculations are to be completed in metric units and shall adhere to the Municipality Engineering Record Drawings – Drafting Standards and templates (including title block, font size, and linetypes, etc.).

a) Layout Information

For all fire hydrants, maintenance holes, catch basins, etc., layout information is required or alternatively a note indicating the use of UTM Coordinates.

b) Temporary Measures

Temporary measures (ie. DICB, ditches, maintenance holes, turning circles, grading, barricades, easements, etc.) may apply to some designs depending on the planning and future connections of the development or project, and where applicable, these guidelines are to be adhered to, unless approved by the Municipality.

c) Drawing Template

Refer to the attached drawing template included in Appendix C and accompanying details that are a visual representation of what expectations are for presentation, layout, format, expected drawings, etc.

All sewers and watermain are to be presented in colour, watermain and appurtenances detailed in blue, storm sewers and appurtenances detailed in green, and sanitary sewers and appurtenances detailed in red. All sewers must also be presented in the

actual size they represent (outside diameter).

APPENDIX A

DEVELOPMENT PROCEDURE AND CHECKLIST

INDEX – APPENDIX A

Document Name

Subdivision Requirements Checklist
General Procedural Guidelines for Subdivision Development

Subdivision Requirements Checklist

This checklist of items to be shown on the plans for subdivisions and/or individual site developments is intended as a minimum guide only. The degree of detail and exclusion of one or more items from the list will vary with the nature and complexity of each development and at the discretion of the Municipality. The Municipality also reserves the right to add additional requirements.

1. legal survey information including lot dimensions, lot line bearings, legal description of property, abutting road allowance widths, easements, lot numbers, street names;_____
   _____
2. north arrow; (required on all plans) _____
3. locations, orientations, massing and uses of all buildings and structures, proposed and existing on the site (proposed buildings may not be required on subdivision plans);
   _____
   _____
4. locations, of municipal services abutting this property (eg. in the road allowance) including, sidewalks, curbs, gutters, watermains, storm sewers, catch basins, manholes, sanitary sewers, hydro poles, telephone poles, light standards, buried cables, utility pedestals, fire hydrants, gas mains, hydro transformers; _____
   _____
   _____
5. location of all existing trees on the side of the road allowance abutting the property;
   _____
6. access ramps, driveway locations, widths, the surfacing of such areas (eg. asphalt), and curbing; _____
7. on-site vehicular loading and parking facilities, the surfacing of such areas, and curbing;
   _____
8. on-site sidewalk and walkway, ramp areas, including the surfacing of such areas; _____
   _____
   _____
9. lighting, floodlighting facilities; _____
   _____
10. retaining walls, walls, fences, hedges, trees, shrubs and other landscaping areas, including all planting strips as are required by the zoning by-law (less detail may be required on subdivision plans); _____

_____

11. vaults, central storage, collection areas and enclosures for storage of garbage; _____
_____

12. site grading including original ground elevations and/or contours and sufficient proposed finished elevations on site to adequately illustrate the finished site elevations in relation to abutting properties and roads, and to adequately illustrate existing and finished lot drainage and grading; (This will require elevations on adjacent properties and road allowance.) This includes final elevations at lot corners, swales, at the front and rear of buildings where applicable, and at the centreline of roads. Proposed underside of footing, top of foundation, basement window sill and basement walk-out elevations shall be shown. Direction of surface flows and swales shall be shown by arrows._____
_____
_____

13. storm water drainage areas and facilities including private storm sewers, catch basins, catch basin leads, manholes, ditches, watercourses, culverts, rainwater leaders, Agreement Drains, Municipal Drains, Storm Water Management Facilities, etc.; _____
_____
_____
_____

14. erosion and sedimentation control details; _____
_____

15. sanitary sewage drainage areas and facilities including private sanitary sewers, manholes, storage tanks, treatment facilities, sanitary private drain connections;
_____
_____

16. sign locations and details, including entrance and exit signs; (This may be more applicable to individual site plan developments.) _____
_____

17. others including any sewer, road works or other facilities which the municipality may require to be; _____

ADDITIONAL COMMENTS:

_____

_____

_____

APPENDIX B

TYPICAL ROAD CROSS SECTIONS

INDEX – APPENDIX B

APPENDIX C

SAMPLE DRAWINGS AND DETAILS

INDEX – APPENDIX C