



# **Engineering Design Standards & Specifications Manual**

June, 2022

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# 1 General Information and Subdivision Design Submissions

## 1.1 INTRODUCTION

The **Township of Essa Engineering Design Standards and Specifications Manual**, including the **Essa Standard Drawings** (“the Manual with Standard Drawings”) is intended as a guideline to:

- i. provide a good engineering basis for subdivision design;
- ii. establish a uniform criterion of minimum standards; and
- iii. improve processing of subdivision plans and agreements in the Township of Essa.

Technological or economical changes which improve or maintain the quality of the design will be considered at the Township’s discretion.

The Manual with Standard Drawings is considered a living document subject to regular review such that revisions and updates will be made from time to time at the Township’s discretion. It is the responsibility of the Developer and / or Consulting Engineer to obtain and use the latest version available at the time of subdivision design.

It is understood that the Manual with Standard Drawings may be referred to as a schedule in a subdivision agreement and that the current revision of the standards are then considered to be part of the agreement.

## 1.2 CONSULTANT / DESIGN ENGINEER’S ROLE

The design and all required engineering drawings and associated reports must be signed and sealed by a suitably qualified Professional Engineer, licensed to practice in the Province of Ontario.

## 1.3 SUPPORTING STUDIES AND REPORTS

The following studies and reports may be required to support the subdivision application prior to draft plan approval. It should be noted that the information provided is the minimum requirement and the studies and reports may need to include further details depending upon site specific conditions. Additional reports or studies may be required at the discretion of the Township.

### 1.3.1 Functional Servicing Report

A Functional Servicing Report (FSR) shall be prepared in support of the subdivision development application for draft plan approval which addresses preliminary servicing requirements sufficient to confirm the viability of servicing the development and includes, at a minimum, the following:

- i. Confirmation of adequate municipal system wastewater and water treatment capacities. Refer to Sections 11.2 and 12.3 regarding sewer and water modelling requirements, respectively;
- ii. Proposed storm sewer, sanitary sewer and watermain pipe network sizing calculations and plan layout or services internal to the subdivision, showing all proposed connections to the municipal system.

### 1.3.2 Geotechnical Report

The Geotechnical Report shall examine and confirm subsurface conditions including soil type(s) and stratification, groundwater levels, depth to bedrock, soil bearing capacity, permeability, conductivity, and presence of any contaminants.

The report shall:

- i. Address the adequacy of the Township's standard minimum pavement structure and sub-drainage system or recommend a higher standard of design if conditions warrant;
- ii. Assess the suitability of native soils for trench backfill and building foundation construction. It shall also address requirements for imported fill as well as construction methods for the use of both native and imported materials;
- iii. Discuss the requirements for pipe bedding as well as engineered fill where necessary for building construction;
- iv. Be accompanied by a scaled drawing showing test pit and/or borehole locations complete with a detailed test pit and/or borehole log;
- v. Be signed and sealed by a Professional Engineer licensed to practice in the Province of Ontario.

### 1.3.3 Hydrogeological Assessment

Hydrogeological studies for proposed projects must be conducted by a qualified Professional Engineer and/or Geoscientist to characterize the groundwater regime from a site specific and regional perspective in order to address issues related to the following aspects (as applicable):

- i. Impacts to existing well water supplies within the project influence area;

- ii. Soil permeability and associated properties where the design of septic systems are concerned;
- iii. Water balance;
- iv. Groundwater impact assessment to area aquifers from construction activities and/or discharge of waste or wastewater;
- v. Test wells and associated testing in accordance with MECP D-5-5 guidelines to address water taking impact sustainability;
- vi. Impacts to nearby surface water bodies; and
- vii. Specific technical review of well field or wellhead protection areas.

For general road and servicing construction, the report should consider depth of services and identify likely areas where dewatering will be required, the rate of dewatering, requirements for dewatering, permits and the strategy to achieve the required groundwater levels. If dewatering is necessary, the report should contain sufficient data on groundwater quality and temperature of the receiving watercourse.

#### **1.3.4 Stormwater Management Report**

The Stormwater Management Report is to provide details and supporting calculations associated with the design of the minor and major drainage systems as well as the required stormwater management measures in accordance with criteria of MECP, the Conservation Authority and this document.

At a minimum, the following details must be included in the Report:

- i. Background Information;
- ii. Stormwater Management criteria to be met;
- iii. Stormwater Management Strategy including a review of feasible Low Impact Development measures;
- iv. Pre-Development and Post-Development Drainage Areas;
- v. Storm Drainage System Design - major and minor conveyance systems;
- vi. Design of End of Pipe Controls;
- vii. Erosion and Sediment Control;
- viii. Inspection and Maintenance Requirements;
- ix. Operation Manual outline; and

- x. Calculations, Tables, Figures, Modeling, and Drawings.

### **1.3.5 Traffic Impact Assessment**

Traffic Impact Assessment Guidelines are included in Appendix C of this document which provide a consistent approach to be followed by applicants for the preparation of a Traffic Impact Assessment (TIA) in the context of a development application. In part, these guidelines include thresholds based on predicted traffic volumes which identify the need for a TIA in general and also as to when a Traffic Impact Study is required versus a Traffic Impact Brief.

The scope of work for each type of study is identified in the TIA guidelines in accordance with MTO, TAC and ITE guidelines and criteria as applicable.

In general, a TIA shall consider and review existing and projected traffic levels under the horizon years in the TIA Guidelines to determine requirements for traffic control devices and intersection improvements, including storage length requirements for turning lanes, based on peak traffic flows that have been generated. In addition to vehicular traffic, the report shall identify how cyclist and pedestrian needs are satisfied, including those with barrier free requirements.

The area of influence of a development should include major intersections which may not be directly adjacent to the development.

The report shall include a summary of sight lines and a comparison of existing and proposed road geometry with the MTO Geometric Design Guidelines for Ontario Roadways. For the reconstruction of existing roadways, the report should include a "Roadside Safety Review" identifying any deficiencies in road geometry, sight lines, clear zones, and roadside protection needs.

The traffic study should provide a summary of existing and proposed roadway cross-sections.

All new residential developments require provisions for off-street visitor parking facilities. The traffic study shall identify suitable locations and number of spaces required.

The traffic study should include considerations for municipal by-laws as well as the requirements of other road authorities such as the County of Simcoe and the MTO, where applicable.

### **1.3.6 Noise and Vibration Study**

The Noise and Vibration Study shall review all potential noise and vibration sources and evaluate mitigation requirements to achieve compliance with MECP guidelines, the Township's Noise By-Law and this document.

Where noise attenuation fences and / or berms are proposed, the report should detail the locations and height required to attain acceptable noise levels, including details which address grading and drainage impacts.

For railway traffic, the report should also identify foundation requirements to attenuate vibration.

The report should consider the construction activities typically expected and provide guidance on development of a pre-construction survey of adjacent buildings and structures.

A post construction survey or report may be required by the Township to confirm that acceptable noise levels have been achieved.

### **1.3.7 Environmental Impact Study**

The Environmental Impact Study shall be prepared by a qualified professional and will assess any potential impact of the proposed project upon the natural environment including, but not limited to wetlands, woodlots and natural habitats for threatened and/or endangered species. The report shall also characterize the impact and make recommendations for mitigation, if necessary. Additional details and requirements can be found in the Township's Official Plan.

### **1.3.8 Environmental Site Assessment (ESA)**

For any lands that are to be dedicated to, or purchased by the Township, an Environmental Site Assessment may need to be completed.

If required, a Phase I ESA shall be undertaken by a "qualified person" as defined in O. Reg. 153/04 (or the latest revision thereof) and a report shall be completed in accordance with the requirements set out in the same regulation as well as the guidelines published by the Canadian Standards Association (CSA).

The report shall include, but not be limited to:

- i. Confirmation of Insurance coverage;
- ii. Certification that the person undertaking the assessment and completing the report is a "qualified person";
- iii. The "qualified person's" opinion as to whether a Phase II ESA is warranted based on the findings of the Phase I ESA;
- iv. If the "qualified person's" opinion is that a Phase II ESA is not required, the report shall expressly include a statement that "in his/her opinion and based on the findings of the Phase I ESA, a Phase II ESA is not necessary"; and

- v. Confirmation that the report may be relied upon by the Township in making the decision to accept ownership of the property.

### **1.3.9 Archaeological Report**

The Archaeological Report shall assess any significant historical features on the site and recommend a mitigation plan if necessary. The study shall follow the Ontario Ministry of Culture guidelines for determining the archaeological potential of the area impacted by construction. As a minimum, the report shall follow the requirements of a Phase 1 Archaeological survey and proceed with Phase 2 and 3, if necessary.

The Archaeological Report shall also consider “Built Heritage” and provide an inventory of any historically or culturally significant structures within the affected area. The Essa Historical Society shall be contacted during the preparation of the report and the report shall include any comments they may have on the affected area.

### **1.3.10 Barrier Free Considerations**

All design projects including new or replacement sidewalks, paths, trails, parks etc. throughout the Township of Essa must comply with the Accessibility for Ontarians with Disabilities Act and must incorporate ways to remove barriers for the public.

## **1.4 ENGINEERING SUBMISSIONS**

### **1.4.1 Engineering Drawings - General**

In general, a complete engineering drawing set shall contain, as a minimum, the following drawings plus any others that may be necessary to address Conditions of Draft Plan Approval.

- i. Cover Sheet including key plan;
- ii. Legal and Reference Plan of Subdivision;
- iii. General Servicing Plans showing all structures, underground and aboveground services and utilities;
- iv. Detail Grading Plans;
- v. General Phasing Plan;
- vi. Sediment and Erosion Control Plans;
- vii. Storm Drainage Area Plans;
- viii. Sanitary Sewer Drainage Area Plans;
- ix. Stormwater Management Pond Detail Plans;

- x. Park Development Plan;
- xi. Traffic Calming Management Plan;
- xii. Swept Path Width Analysis for fire truck access (B-12 Design Vehicle or approved equivalent, required for any site plan development);
- xiii. Sidewalk and Pedestrian Pathway (where applicable) Circulation Plan;
- xiv. Street Plan and Profile Drawings;
- xv. Landscape Planting Drawings;
- xvi. Tree Preservation Plan;
- xvii. Street Light Illumination Drawing and Electrical Design;
- xviii. Composite Utility Drawings;
- xix. Detail drawings including pertinent standards and special details.

**NOTE:** All drawings are to be provided with a Title Block, revision summary, benchmark, scale, legend, north arrow, "Accepted for Construction" signing blocks for Township and Township Engineer and Block for the stamp of the design engineer.

All drawings to be standard A-1 size sheets (594mm x 841mm).

All plans to include a Key Plan in top right corner indicating the location of the street within the plan of subdivision.

#### 1.4.2 Engineering Submission Requirements

##### First Submission

Two complete paper sets of the following plans and documents are required for the first submission:

- i. Proposed final plan for registration;
- ii. General services plan showing aboveground and underground works;
- iii. Plan and profile drawings for watermain, sanitary sewer and roadworks;
- iv. Sanitary drainage area plan and design sheets, including external areas and contours;
- v. Storm drainage area plan and design sheets, including external areas and contours;
- vi. External watermain layout plan illustrating the existing distribution system;
- vii. Miscellaneous and special details pertaining to storm sewer, sanitary sewer or watermain design;

- viii. Grading plans;
- ix. Traffic signal drawings or drawings indicating underground works (conduits, maintenance holes, hand wells, etc.) for future traffic signal installation;
- x. Pavement marking and signing;
- xi. Cross-section drawings where roads are being widened or extended;
- xii. Storm Water Management report;
- xiii. Sewer pipe strength and bedding requirements are to be provided;
- xiv. Geotechnical report.

When these drawings, documents and calculation sheets are reviewed, comments will be returned to the consultant for revisions as necessary.

#### Second Submission

Provided all First Submission comments have been satisfactorily addressed as confirmed by the Township, the Applicant may submit two (2) complete ECA application packages to the for review and processing.

An electronic copy (i.e. on USB drive) of the design drawings and two complete paper sets of the following plans and documents are required for the second submission and must be sealed by a professional engineer, as follows:

- i. All drawings referred to in First Submission section, incorporating all changes required from review comments;
- ii. Letter describing changes and updates;
- iii. All revised calculation sheets, if required;
- iv. Cost estimate of Township services;
- v. Draft R-Plans and easement documents;
- vi. Submit applications, fees and documentation to respective agencies and inform the Township of any other approvals required, e.g. MTO, pipelines; NVCA; MNRF; County of Simcoe;
- vii. Landscape drawings.

Interim Submission

- i. Submit two copies of only those documents, drawings, schedules and calculations that required correction. The revised documents are to be stamped and sealed by a professional engineer;
- ii. Letter describing changes and updates;
- iii. Utility coordination plans.

Final Submission / Servicing Preparations

Three complete sets of construction plans and documents are required for the final submission and are to be sealed by a professional engineer, including the following:

- i. All drawings incorporating all changes as referred to in the first, second and interim submissions;
- ii. All drawings in PDF format;
- iii. Completed Form 1 document with description of proposed watermain works and specific design drawing reference, signed by design engineer of record;
- iv. Final sewer design calculation sheets;
- v. Final cost estimate of services.

**1.4.3 Construction Commencement Requirements**

Prior to the commencement of construction, the Township requires confirmation that:

- i. All applicable Township securities have been paid;
- ii. Acceptable insurance is in place. All Contractors working within the right-of-way must provide proof of liability insurance, minimum \$5.0 million limit, naming the Township of Essa as additional insured;
- iii. All easement documents and deeds have been received;
- iv. All external easements have been registered prior to any work outside the limits of the development;
- v. The development agreement is executed by the Applicant and returned to the Township, together with all financial securities and any other deliverables defined in the agreement.

The Consultant shall:

- i. Provide notification to the Township a minimum of 5 days prior to the commencement of construction;

- ii. Arrange a pre-construction meeting with the contractor, consultant and Township. This meeting is required to determine schedule, approvals, main service connections and testing methods. The name and contact information of the Consultant's full-time Inspector are to be provided to the Township at the pre-construction meeting;
- iii. Supply full time inspection required to ensure that the work is performed as specified. Any changes or deviation from the plans and specifications will require clearance from the Township and/or other agencies if required;
- iv. Where concrete pressure pipe (CPP) watermains are proposed, shop drawings reviewed and signed off by the Applicant's engineer shall be supplied to the Township for review and approval prior to construction;
- v. Ensure all "As-Built" drawings and service record sheets are completed and submitted to the Township including all service ties as required;

In general, the Applicant's consultant shall be responsible to ensure the requirements in the development agreement and in this manual are carried out.

#### Road Occupancy Permit

All work carried out within the Township's right-of-way is subject to a Township Road Occupancy Permit. The Applicant or his contractor must complete this permit application, including 2 sets of folded approved plans and the application fee as per the latest Township Fee By-Law. All works conducted within the Township right of way must be done so in accordance with Ontario Traffic Manual Book 7, Temporary Conditions. In addition, the operation of Township roads must be maintained at all times and all cost associated with traffic control shall be at the sole expense of the Applicant.

#### **1.4.4 "As-Built" Drawings**

Upon completion of the installation of underground services, the Township shall require "as-built drawings" before issuance of the Certificate of Substantial Completion and Acceptance for any of the works as defined in the Town's standard subdivision agreement, as well as a digital copy of the plans in PDF and AutoCAD formats.

Upon completion of the maintenance period and before issuing the Certificate of Maintenance and Final Acceptance as defined in the Town's standard subdivision agreement, two full sets of "as-built" engineering drawings are to be forwarded to the Township Engineer for review and comments. Revisions must have been made to the drawings to reflect any changes to the line and/or grade of the roadways and services, and to incorporate all the grading modifications resulting from final lot grading. All water and sewer valves, hydrants, curb stops and service connections shall be properly tied into fixed reference points.

If any revisions are required, one set of red lined drawings will be returned to the Developer's Engineer.

When all revisions and/or corrections have been made a complete set of "as-built" hard copies shall be submitted to the Township Engineers as well as digital PDF and AutoCAD drawings.

The "as-built" drawings shall include the following information:

#### Road System

- i. Elevation of centreline of roadway every 20 metres;
- ii. Revised horizontal and vertical curve information;
- iii. Any additional information that has been required for construction after approval of engineering drawings;
- iv. Revised benchmarks located in a permanent location throughout the new development at sufficient intervals such as on fire hydrants and/or other permanent structures.

#### Storm System

- i. Invert elevations of all storm sewers;
- ii. Invert elevations of all storm manholes;
- iii. Revised percentages of all storm sewers along with "as-built" distances between manholes;
- iv. Revised storm sewer design sheets;
- v. Location measurements to all storm sewer connections to each individual lot. These should have swing ties from property corners or other fixed structures such as fire hydrants and manholes;
- vi. As-built elevations of road cross culvert inverts;
- vii. Any additional information that has been required for construction after approval of engineering drawings.

#### Sanitary System

- i. Invert elevations of all sanitary sewers;
- ii. Revised percentages of all sanitary sewers along with "as-built" distances between manholes;
- iii. Revised sanitary sewer design sheets;

- iv. Location measurements to all sanitary sewer connections (or pressure sewer valves where applicable) to each individual lot. These should have swing ties from property corners or other fixed structures such as fire hydrants and manholes;
- v. Any additional information that has been required for construction after approval of the engineering drawing.

#### Water System

- i. Elevations of top of watermain every 30 metres;
- ii. Location measurements to all water service boxes for each individual lot. These should have swing ties from property corners, buildings or other fixed structures such as fire hydrants and manholes;
- iii. Location by measurement of tees, bends, valves and dead ends;
- iv. Any additional information that has been required for construction after approval of the engineering drawing.

#### Lot Grading

- i. Any major revisions to the approved lots;
- ii. Invert elevations of all swales, sufficient to confirm intermittent swale grades;
- iii. Invert elevations of all culverts;
- iv. Invert elevations of all ditches at 20 metre intervals.

## 2 Drafting Requirements

### 2.1 FORMAT AND QUALITY

All drawings are to be prepared in digital AutoCAD format, geo referenced to UTM NAD 1983, Zone 17N.

All original drawings and prints shall be neat and legible and shall be corrected for “As-Built” in the same manner. All information shall be reproducible by a white-printing or photocopy machine.

### 2.2 DRAWING SHEET SIZES

Drawings shall be of a consistent size of 594mm by 841mm (metric size A1).

#### 2.2.1 Scales

Standard metric scales to be used are 1:100, 1:200, 1:250, 1:500, 1:1000 and their factors of 10. Scales shall be as follows and shown on the drawings:

- i. the key plan shall be shown on the cover sheet at a scale of 1:5000;
- ii. the General Service Plan and the Sanitary and Storm Sewer Plans shall be 1:1000;
- iii. the Lot Grading Plan and the Park Development Plan shall be 1:500, or 1:250 if required;
- iv. Plan and Profile Drawings shall be 1:500 (Horizontal) and 1:50 (Vertical).

### 2.3 BASIC INFORMATION

The following standards shall apply in preparation of the drawings:

- i. All plans shall include a north arrow in the upper right-hand quadrant. All east-west streets shall generally be drawn with the north arrow pointing to the top, all north-south streets with the north arrow generally pointing to the right, and all cul-de-sacs or other roads where this does not apply shall be drawn with the stations numbered from left to right.
- ii. All elevation data shall be referred to geodetic datum and at least one benchmark shall be shown on each plan indicating a proposed elevation.
- iii. In general, east-west streets shall have zero chainage at their westerly limits and north-south streets shall have zero chainage at their southerly limits. Chainages on a plan-profile shall increase from left to right.

- iv. All existing utilities, structures and other features such as trees and hedges shall be shown and identified using a broken line.
- v. The beginnings and ends of curves must be shown on plan and profile with the radius of curvature shown on the plan. Chainages of points of curvature shall be calculated from the final plan. The chainage elevations and names of intersecting streets shall be shown in plan and profile.
- vi. Street names shall be kept clear of the road allowance.
- vii. The drawings shall show any required off-street drainage and separate profiles shall be prepared for drainage easements.
- viii. The drawings shall clearly show the proposed profiles, road widths and cross-sections, ditches, ditch gradients, curb and gutter gradients, culvert sizes / gauges and gradients, existing and proposed services and limits of the proposed work. All detail for intersecting streets including grades must be shown for a minimum distance of 30 metres from the intersection of the intersecting street. All street lines and easements for drainage or services shall be shown. Larger scale detail may be required for congested bends and/or cul-de-sacs.
- ix. The drawings shall show the lot frontage distances and dimensions of easements and land to be dedicated to the Township.
- x. The Township's Consulting Engineer shall be consulted as to the manner of showing information not set out in these requirements.

### **2.3.1 Sewer Details**

The standard abbreviations, sewer diameter, sewer pipe material, length, grade, manholes, inlets and connections to the sewer shall be shown on appropriate General Plans. This information plus sewer bedding, type and class of sewer pipe, manhole numbers, diameters and inverts, flow direction, grate elevations and drop structures shall be shown on Plan and Profile Drawings. Chainage of manhole locations shall be shown in profile. Service locations to be shown on plan drawing.

### **2.3.2 Watermain Details**

The standard abbreviations, watermain diameter, length, type and class of pipe, and the valves, services, hydrants, bends and connections to the watermain shall be shown on appropriate General Plans and on Plan and Profile Drawings.

### 2.3.3 Road Details

Horizontal control data (beginning and end of curve, radius, length, etc.) shall be shown on appropriate General Plans and on Plan and Profile drawings.

Vertical control data (proposed road grade, length of run and percent slope, beginning and end of vertical curves, high and low point) shall be shown on Lot Grading Plans and on Plan and Profile drawings. Existing and proposed centreline road elevations shall be shown every 20 metres with stations shown measured in metres with kilometres separated by a + sign on long runs (e.g. - STA 0+000, STA 0+020, STA 0+040...STA 1+020). Stations of interest (curve stations, intersections, end stations, etc.) shall be shown calculated to the nearest millimetre (e.g. -BVC STA 0+041.169, EVC STA 0+066.169, END STA 0+069.124).

### 2.3.4 Lot Grading Plans

Lot grading plans shall be prepared at a scale of 1:500 and show the information indicated on Township standard drawing ESD-200.01.

The design for individual lot grades shall be in accordance with Township standard drawings 201.01 and 201.02.

The plans must show overall lot fabric with lot and block numbers, street names, right-of-way limits, road curb and gutters, catchbasins, sidewalks, all aboveground street furniture and driveway locations. All easements and blocks for walkways or maintenance access shall be indicated on the plan complete with dimensions. The plans shall show existing topographic information, including existing contours and contour labels at an interval of 0.50 m and shall extend 30 m beyond the limits of the project.

Road grades shall be shown at 20 m intervals and at all changes in grade. Directional arrows shall be provided indicating the overland flow route.

Existing and proposed retaining walls, including top and bottom elevation, and existing and proposed embankments including slope label and associated elevations shall be shown.

Any lots requiring more than 1.2 metres of fill shall be indicated with an asterisk (\*) beside the lot number to show that either engineered fill or extended footings may be required.

Any existing structures shall be shown with notes clearly identifying whether they are to be retained or demolished/decommissioned.

### 2.3.5 Stormwater Management Pond Facilities

Drawings for SWM pond facilities shall be at a scale which is suitable to clearly illustrate the required details, such as 1:500 (minimum), 1:300, 1:250.

Information to be shown on the SWM pond drawing includes:

- i. Permanent pool volume;
- ii. Forebay volume;
- iii. Active storage volume;
- iv. Location and height of berms;
- v. Location, invert elevations and size of pipes, inlets and orifices for the outfall;
- vi. Maintenance access;
- vii. Sediment drying area;
- viii. Contours with storm storage level elevations;
- ix. Cross sections across pond and longitudinally through invert, forebay, pond bottom, outlet control structure and discharge pipe;
- x. Perimeter ground elevations demonstrating compatibility with adjacent properties.

The minimum details to be shown include that for spillway, outlet control structure, control orifice and maintenance access.

### **2.3.6 Miscellaneous Details**

Other details shall be according to the Township Standard Drawings where applicable or if a Township Standard Drawing is not available in accordance with Ontario Provincial Standards. Township Standards take precedence when available. All necessary details shall be included on sheets similar to other drawings sheets, if not on relevant drawings. Township Standard Drawings may be printed on these detail sheets directly.

# 3 Roadways

## 3.1 GENERAL

OPSS and OPSD shall apply together with these Township Standards. Where there are any apparent conflicts or discrepancies, the Township Engineering Standards and Standard Drawings shall take precedence.

- i. All roads to be constructed in serviced areas in the Township of Essa shall be designed to urban standards complete with a sanitary sewer system, water distribution system, storm sewer system, curb and gutter, concrete sidewalk and an asphalt surfaced road structure unless specific approval from the Township is received prior to the development receiving draft plan approval.
- ii. Roads shall be classified as local, collector or arterial in accordance with the Township Official Plan.
- iii. Right-of-ways shall be a minimum of 20 m wide for local streets, 26 m for collector roads and 30 m for arterial roadways.
- iv. Where a development adjoins or incorporates an existing County Road or Township arterial roadway as per the Township's Official Plan, the Developer shall deed to the County or the Township the required property widenings.
- v. The minimum longitudinal grade on any roadway shall be 0.5 percent and the maximum grade shall be as per Section 3.4, Table No. 2.
- vi. Property daylighting corners at intersections of Township roads and County or Provincial Roads shall be in accordance with Section 3.5.3, Table 3.
- vii. The edge of the roadway pavement surface shall have a minimum radius at intersections as per Section 3.4.3, Table No. 3.
- viii. Finished roadways shall have a crossfall of 2 percent conforming to OPSS geometric design standards.
- ix. 150mm diameter perforated road subdrains complete with filter sock are required full length under curb lines as part of the road structure design.
- x. Where a development road terminates adjacent to a future development phase or stage, a temporary turn around will be required conforming to Township standard ESD-103.02.
- xi. The road design for industrial and/or commercial developments shall take into account the type of traffic anticipated on the development. Granular base thicknesses, asphalt type and

thickness, shoulder width and cul-de-sac radii shall be designed specifically for the development utilizing these standards as minimum requirements.

- xii. Where new roads are to connect to existing roads, the design shall extend along the existing road for a sufficient length to provide a satisfactory transition.
- xiii. All roads are to be extended to the limit of the subdivision boundary and shall terminate at a cul-de-sac conforming to Township standard ESD 102.01 when not connecting to an existing road.
- xiv. Provisions shall be included in the road design for communal mailboxes. The Developer will be responsible for providing parking areas, structural concrete foundations, electrical supply, etc., all as required by the Township and Canada Post Corporation for communal mailboxes in locations designated by the Township and Canada Post.
- xv. All new residential developments require provisions for off-street visitor parking facilities, the location and size of which will be determined in conjunction with Township staff at the time of development application.
- xvi. The minimum lane width in any development is to be 7.5 metres, from face of curb to curb.

### **3.2 TRAFFIC CALMING**

The Township requires the implementation of traffic calming measures in a development which are deemed appropriate for the neighbourhood, the roadway classification and in accordance with the Township's Transportation Master Plan (TMP) guidelines for suitable traffic calming measure designs and implementation. The TMP should be referred to for approved measures and design requirements.

### **3.3 PAVEMENT DESIGN**

For all development proposals, a geotechnical investigation and report must be prepared by a qualified engineering consultant which recommends pavement designs for each pertinent class of roadway.

For reference, the minimum pavement structure to be met for each classification of Township road is provided in the table below:

**Table 1: Minimum Pavement Structure**

ROAD CLASS	SURFACE ASPHALT	BINDER ASPHALT	BASE COURSE	SUB-BASE COURSE
Local	40 mm HL3	50 mm HL4	150 mm Granular 'A'	300 mm Granular 'B'
Collector	50 mm HL3	90 mm HL4	150 mm Granular 'A'	450 mm Granular 'B'
Arterial	50 mm HL3	90 mm HL4	150 mm Granular 'A'	450 mm Granular 'B'
Industrial	50 mm HL3	50 mm HL4	150 mm Granular 'A'	300 mm or thicker depending on Geotechnical Recommendation

The use of Superpave may be permitted for any road class; however, a recommendation must be made by the geotechnical consultant and must be approved by the Township.

The pavement structures identified above are a minimum and the actual pavement structure may need to increase as a result of the following:

- i. Local conditions such as soil type or water table;
- ii. Anticipated traffic loading;
- iii. To ensure that there will be no half load restrictions on collector, arterial, or industrial roadways; and
- iv. Any other requirements identified in the geotechnical report.

All asphalt materials and work shall conform with OPSS 1150.

### 3.4 GEOMETRIC ELEMENTS

The following geometric standards shall be applied:

**Table 2: Geometric Standards for Road Design**

ROAD CLASS (CROSS - SECTION)	ROW (M)	DESIGN SPEED (KM/H)	PAVEMENT WIDTH <sup>1</sup> (M)	MIN./MAX. GRAD (%)	MIN. HORIZONTAL C/L CURVATURE (M)	VERTICAL CURVATURE MIN. 'K' VALUE <sup>2</sup>		MIN. TANGENT BETWEEN HORIZONTAL CURVES (M)
						CREST (M)	SAG (M)	
Urban								
Arterial	30	80	14.0	0.5/5.0	340	26	30	120
Collector	26	70	14.0	0.5/6.0	190	17	23	80
Local	20	60	8.5	0.5/6.0	20	11	18	50
Industrial	26	60	10.0	0.5/6.0	40 <sup>3</sup>	11	18	50
Semi-Urban / Rural								
Local	20	60	7.5	0.5/6.0 <sub>4</sub>	30	11	18	50
Industrial	26	60	8.0	0.5/6.0 <sub>4</sub>	40 <sup>3</sup>	11	18	50

<sup>1</sup> "Sawtooth" of a roadway is not preferable and will require Township approval on a case by case basis.

<sup>2</sup> K values less than those listed above may be considered at stop approaches.

<sup>3</sup> Pavement widening required on horizontal curves as per TAC Geometric Design Guide for Canadian Roads.

<sup>4</sup> On rural roads, the cross-section will include curb & gutter where centreline grades are equal to or greater than 5%.

### 3.5 OTHER DESIGN ELEMENTS

#### 3.5.1 Vertical Curves

For local streets, all changes in grade of 2.0% or more shall be accommodated through the use of a vertical curve.

For all other road classifications, a change in grade of 1.0% or more shall be accommodated through the use of a vertical curve.

#### 3.5.2 Crossfall

Finished roadways shall have a minimum crossfall of two percent (2%). Super-elevated road platforms shall be considered subject to site specific conditions.

### 3.5.3 Curb Radii and Daylighting Requirements

The curb return radii measured from edge of pavement, and daylighting requirements at intersections shall be in accordance with the table below:

**Table 3: Minimum Curb Radii and Daylighting Requirements**

ROAD CLASS	INTERSECTING ROAD CLASS	MIN. CURB RADII (M)	DAYLIGHTING (M)
Local	Local	9	3x3
	Collector	9	5x5
	Arterial <sup>1</sup>	9	10x10
Collector	Local	9	5x5
	Collector	12	10x10
	Arterial <sup>1</sup>	15	10x10
Arterial	Local	9	10x10
	Collector	15	10x10
	Arterial <sup>1</sup>	<sup>2</sup> (see below)	15x15
Industrial	Any Other Class	18	15x15

<sup>1</sup>If the intersecting arterial road is a County Road, County of Simcoe design requirements will govern.

<sup>2</sup> A compound curve shall be provided in accordance with M.T.O. Geometric Design Standards for Ontario Highways to accommodate a Wb-15 vehicle.

### 3.5.4 Cul-de-Sacs

Cul-de-sacs are to be provided at all dead ends, where there is no proposed connection to an existing street, in accordance with Township standard ESD-102.01.

### 3.5.5 Community Mailboxes

Provisions shall be included in the design for community mailboxes. While the final locations are subject to approval by the Township and Canada Post, the designer must propose locations that are conducive to the pedestrian and vehicular movements anticipated in the area. As a result, placement on collector or arterial roads should be avoided. Further, mailboxes are to be located a minimum of 30 m from any intersection, preferably on a lot line and giving consideration to other aboveground features such as streetlights, fire hydrants, transformers, etc. Community

mailboxes must have direct sidewalk access wherever possible and are to face the sidewalk (if present).

### **3.5.6 Transitions**

Where a new street is to connect to an existing street, whether the design includes an extension of the existing street or connects at an intersection, the design shall extend along all existing streets for a sufficient length to provide a satisfactory transition. In the case of an intersection, the distance must be equal to the greater of the required stopping sight distance or the turning lane development lengths, if applicable, for all legs of the intersection.

### **3.5.7 Road Base Construction and Sub-Drains**

The sub-grade shall be excavated or filled to the required grade for the required width of road surface plus shoulders or curbs plus 0.6 metre or the additional width necessary for the required depth of granular road base. Where earth fill is required, it shall be placed in lifts not exceeding 150mm in depth and each lift shall be thoroughly consolidated to the required density and approved by a qualified geotechnical consultant.

All vegetation, boulders over 150mm in diameter, topsoil and organic or frost-heave susceptible materials shall be removed from the road-base to a depth of 1.0m below finished grade and replaced with suitable granular fill material. In swamp or other areas where the depth of unsuitable material exceeds 1.0m below finished grade, the soils report shall make specific recommendations for consideration by the Township Engineer.

All unsuitable excavated material shall be removed entirely clear of the road allowance. The deposition of any fill type material within the Township is to be in compliance with the Township's cut and fill by-law requirements.

The sub-grade shall be shaped to conform to the required longitudinal grade and cross-section and shall have a cross-fall of 3 percent from the centreline of roadway to each side. If considered necessary by the Geotechnical Consultant, the sub-grade shall be compacted with suitable mechanical compaction equipment as required to produce a solid base for the road gravel. All structurally weak sub-grade soils shall be excavated and backfilled with granular base material or in accordance with the recommendations of a geotechnical consultant and approved by the Township's engineer. The granular base shall be laid on dry, smooth, properly graded sub-grade and shall be spread for the required width of surface plus shoulders and tapered at the edges to meet the edge of sub-grade.

The granular materials shall be spread in layers of 150mm maximum compacted depths, or at lesser depths if recommended by the Soil Report, and each layer shall be thoroughly compacted to specifications.

Recycled concrete will not be permitted as granular road base.

No granular base or surface material shall be placed until the grade on which it is to be laid has been subjected to a proof role and approved by the geotechnical consultant and Township Engineer.

During and between construction seasons, the granular base shall be maintained suitable for vehicular and pedestrian traffic including dust control to the satisfaction of the Township Engineer.

Following the placement of base course asphalt, the Developer shall be responsible for weekly power washing and sweeping the road surface until such time as the boulevards are stabilized to the satisfaction of the Township.

Continuous sub-drains, full length beneath curbs, shall be provided for all road designs on both sides of the road base and shall consist of 150mm diameter (minimum) perforated, corrugated polyethylene piping with a geotextile filter fabric. Sub-drains shall be bedded in a 300mm x300mm trench below and at each edge of the sub-grade and shall conform to O.P.S.S. Sub-drains are to be connected to catchbasins. When a sub-drain is extended to drain above grade, it shall be provided with a 3m section corrugated pipe end section and rodent grate.

### **3.5.8 Curb and Gutter**

For all new developments concrete curb and gutter is to conform to OPSD 600.070 (two-stage).

Concrete curb and gutter shall be in accordance with OPSS 353, with the exception that all concrete shall be supplied in accordance with the "Performance Specification Alternative" of OPSS.MUNI 1350 and shall meet the requirements of CSA A23.1, Exposure Class C-2, with a minimum compressive strength of 32 MPa at 28 days.

Prior to the placement of the top stage curb, the base curb is to be completely cleaned and reviewed by the Township Engineer. Any found defects are to be corrected to the satisfaction of the Township. The developer shall make every effort to protect the curb and gutter during the maintenance period. Prior to the placement of top asphalt, the curb and gutter is again to be reviewed by the Township Engineer. Any curb and gutter found to be cracked, chipped, or deficient in any way is to be removed and replaced all at the developer's expense.

Curb and sidewalk shall be extended across commercial and industrial entrances and according to OPSD 350.010 unless the entrance is signalized or is aligned with a municipal street on the opposite side of the street.

Treatment at residential entrances shall be according to OPSD 351.010.

### **3.5.9 Grading within Right-of-Way**

The boulevard area between the curb and the street property line shall be graded to provide positive drainage toward the roadway at a minimum 2% grade.

For roads having a rural design section, the area between the edge of the road shoulder and the street property line shall be graded and the ditches cut with slopes of 3m horizontal to 1m vertical from the edge of the shoulder to the bottom of the ditch and from the bottom of the ditch to the original ground. In fills over 1.5m measured vertically from the edge of shoulder to the toe of slope, the fill slope shall not be steeper than 2:1. The ditch shall be located at the toe of the fill slope. On fills higher than 3.0 metres measured vertically from the edge of boulevard to the toe of slope, steel beam guide rails shall be installed conforming to the Ontario Provincial Standard Drawings and Ministry of Transportation protection warrants.

All side slopes, ditches and boulevards to the street line shall be provided with a minimum 100mm of topsoil and nursery sod. Hydraulic seeding of ditches and boulevards will be accepted for the issuance of the Certificate of Substantial Completion within estate residential developments. Prior to the issuance of the Certificate of Final Completion, the ditches and boulevards must have an established growth of sod subject to the satisfaction of the Township.

### **3.5.10 Road Crossing and Entrance Culverts**

The minimum sizes for driveway entrance culverts and road crossing culverts are 400 mm.

The capacity of the culvert must be sufficient to ensure a conveyance of 1:5 year for driveway culverts and 1:25 year for road crossing culverts. Where the conveyance capacity of the minimum size culvert is not sufficient, a larger diameter culvert is to be sized using the cross-sectional end area calculated by the rational design method. Road crossing culverts are to be sized in accordance with MTO drainage Design Standards, WC-1 Design (Bridges and Culverts). Detail drawings and calculations shall be submitted for approval by the Township.

## 4 Builder's Road

A "builder's road" must be constructed prior to issuance of a building permit. A road will be classified as a "builder's road" when the granular bases and sub-drains, curb and gutter, base course asphalt and rough grading of the boulevards, including street name signs and traffic signs, has been certified complete by the Developer's Engineer and acceptable to the Township Engineer.

# 5 Driveway and Entrance Design

## 5.1 DRIVEWAY CULVERTS

The minimum length of culvert shall be that which is required to extend under the driveway with matching slopes from top of culvert to driveway edge not exceeding 3:1.

The minimum depth of cover for all culverts is 300 mm unless otherwise indicated by the Township.

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

Culverts 600 mm and smaller in diameter shall be HDPE. Larger than 600 mm diameter are to be CSP.

## 5.2 GRADES

The maximum grade for driveways and entrances shall be 7% except in site specific cases that receive written approval from the Township. This maximum grade is not recommended and should be employed only in exceptional cases where conditions prohibit the use of lesser grades. The minimum grade permitted is 2%. Maximum grade change shall be 4% at curb or sidewalk and 1% per 2.0 metres average.

## 5.3 LOCATION

### 5.3.1 Sight Distance Requirements

New accesses on Township roads must meet the following minimum sight distance requirements, which are consistent with those provided in the TAC Geometric Design Guide for Canadian Roads.

**Table 4: Sight Distance Requirements**

DESIGN SPEED (KM/H)	MINIMUM STOPPING SIGHT DISTANCE (M)	INTERSECTION SIGHT DISTANCE (M)	
		RIGHT TURN FROM STOP/ CROSSING MANEUVER	LEFT TURN FROM STOP
50	65	95	105
60	85	110	130
70	105	130	150
80	130	145	170

### 5.3.2 Clearances

All access driveways shall be located with a minimum clearance of 1.5 metres to utility poles, hydro transformers, hydrants, telecom junction boxes, side lot lines and other driveways. Water service valve boxes are not permitted in driveways and shall be installed a minimum of 1.0m from the edge of the driveway. On roadway bends and in cul-de-sacs, the extensions of the property line to curb line are to be at least 1.0m offset from edge of driveway. Where frontage limitations interfere with standard locations, site specific solutions shall be detailed with the Plan and Profile and Lot Grading Plans. On corner lots, the edge of driveway is to be a minimum of 4.5 metres from the daylight triangle corner.

### 5.4 WIDTH

The width of a typical residential driveway shall be the lesser of half the width of the lot to a maximum driveway width of 6 metres. For lots less than 9m the maximum driveway width shall be 3.5m.

A secondary driveway entrance will only be permitted for estate residential lots with frontages exceeding 30 metres with the provision that the total driveway width of both driveways does not exceed 30% of the total lot frontage.

Deviations from the standard driveway widths may be considered subject to the following site considerations:

- i. width of road and grade;
- ii. end slope on entrance;
- iii. depth of ditch;

- iv. turning radius;
- v. sight lines visibility;
- vi. proximity to existing entrances;
- vii. total road frontage;
- viii. volume and types of traffic;
- ix. divided access lanes;
- x. number of lanes of traffic.

## **5.5 RADIUS**

For non-residential entrances, the minimum driveway curb radius is 9.0 m but may be greater to accommodate truck traffic depending on the intended site use. The end of the curb radius at street line should not extend beyond property line.

## **5.6 GRANULAR BASE AND ASPHALT**

For residential driveways, between the back of curb and property line, the driveway entrance shall have a minimum of 150mm of Granular 'A' and 50mm HL3 surface asphalt, or other hard surface as approved by the Township.

For non-residential entrances, the minimum pavement structure shall be 300mm of Granular 'B', 150mm of Granular 'A', 50 mm HL4, and 40mm HL3. This minimum pavement structure shall also apply for the entire fire route.

The foregoing are minimum requirements, and a more stringent pavement structure may be required and must be confirmed by the Geotechnical Engineer.

## 6 Sidewalks

A 1.8m metre wide concrete sidewalk shall be placed in locations approved by the Township. In general sidewalk will be required on one side only for local roads and on both sides for collector and arterial roads. Except for collector road where sidewalks are set 1.0 m from property line, the standard location is to set the edge of sidewalk 0.5 m from property line. The closest edge of sidewalk location to edge of pavement in Township standards is 3.45m.

All sidewalks shall be constructed on a properly constructed foundation of a minimum of 150mm of compacted Granular "A". The sidewalk shall be 150mm thick except at commercial and industrial entrances where it is to be 180mm thick. All concrete materials and work shall conform to OPSS 351. Concrete shall be 32 MPa, Class C2 in accordance with CSA A23.1-04.

Tactile walking surface plates shall be inserted in the sidewalk at street intersections in accordance the requirements of the Accessibility for Ontarians with Disabilities Act (AODA). Tactile walking surface plates are to be subject to Township approval.

Concrete sidewalk and sidewalk joints are to be installed as per OPSD 310.010.

Prior to the issuance of the Certificate of Final Completion and Final Acceptance the sidewalk is to be reviewed by the Township Engineer. Any sidewalk found to be cracked, chipped, heaved, defaced or deficient in any way, is to be removed and replaced all at the developer's expense.

# 7 Walkways and Fencing

## 7.1 WALKWAYS

The following identifies general requirements for typical walkways. It is recommended that discussion with the Township be carried out in the planning stages to determine walkway requirements. All walkways are to be provided with 1.5 meter high chain link fence unless they are adjacent to a school or storm water management facility. All pedestrian walkways are to be provided with signs indicating, “No Winter Maintenance” and “No Motorized Vehicles”.

Walkways may be curbed or have swale drainage, at the Township’s discretion, suitable for the circumstances. Refer to standard drawings ESD-600.01 and 600.02 and the following sections.

### 7.1.1 Pedestrian Walkway

Where the walkway block serves only pedestrians, the walkway block is to be 5 metres wide with 3 metre walkway and chain link fence on either side. The walkway shall be asphalt or concrete at the Township’s discretion depending on the location and walkway purpose. In general, the sidewalk standards will be applied to the asphalt or concrete structure. Pedestrian entrance gates may be required or removable bollard(s) at the Township’s discretion.

### 7.1.2 Pedestrian/Lawn Maintenance Pathway

If the pathway is to be used as an entrance to an Open Space Block or Park Area and it will be used by lawn maintenance equipment, then a 6 metre wide block shall be provided with 4 metre walkway and chain link fence along each side. At the Township’s discretion, a pedestrian entrance gate or removable bollard(s) may be required at street line.

### 7.1.3 Walkway/Utility Corridor

Where the walkway block includes trunk services for watermain, sanitary or storm sewer services, the block shall be a minimum of 6 metres wide with a 4 metre wide asphalt walkway. At the Township’s discretion, a pedestrian entrance gate or removable bollard(s) may be required at street line.

The spacing, depth and size of the trunk services shall also be considered and, if necessary, the walkway block is to be widened. The horizontal separation of services is to meet the recommendations of the MECP and the centreline of the service must not be closer than 1.5 metres from the limit of the walkway block.

## **7.2 FENCING**

### **7.2.1 General**

The requirements for fencing shall be determined during the drawing review process and consider safety and privacy requirements. In general, a 1.5m high standard galvanized chain link fence will be constructed with a top and bottom rail and 38mm wire mesh consisting of 9-gauge (3.4mm) steel. Galvanized chain link fence shall be placed at locations along all walkways, open spaces, parks, and steep slopes, adjacent to commercial properties and as required by the Township. In some instances, a 1.8-metre-high wood privacy fence may be required between the new and existing development or between residential and commercial properties or between commercial and institutional properties. When abutting Township property, privacy fence shall be installed on the private property side of the property line.

### **7.2.2 Acoustical Fencing**

Where required, the location and extent of acoustical fence shall be defined in the noise and vibration study prepared for the development. Various types of acoustical fence will be considered during the review process. Acoustical fence shall be installed on the private property side of property line.

### **7.2.3 Open Space Blocks**

Where an Open Space Block is adjacent to a municipal road allowance, a fence will not be required unless necessary as part of a Park Plan or to provide a barrier from steep grades.

### **7.2.4 Storm Water Management Facilities**

Fencing of storm water management facilities will be at the Township's discretion. In general, storm water management facilities are to be designed with maximum slopes of 5:1 in order to avoid fencing requirements.

### **7.2.5 Pools**

The designer is referred to the Township Fence By-Law and Pool Permit requirements for fencing type, height and location requirements regarding private outdoor inground and above-ground pools.

In new developments, final lot grading is to be achieved before pool installation. Pool installation shall have regard for final lot grading and not block or interfere with swales or drainage patterns according to approved drainage plans for the development.

# 8 Utilities, Streetlighting, and Traffic Signals

## 8.1 GENERAL

The location of all utilities including communications, cable, gas, streetlight and hydro must be installed in a common utility trench, in accordance with the locations as detailed on the typical cross section.

Anyone intending to occupy or perform work on Township of Essa property must first apply to the Public Works Department for a Road Occupancy Permit. Approval must be obtained from the Manager, or his/her designate, prior to the commencement of work. Full restoration requirements for road cuts and boulevard repairs following utility installations in Township property shall be in accordance with Conditions of Approval in the Township's Road Occupancy Permit Application Form.

## 8.2 STREETLIGHTING

All streetlight lamps to be light emitting diode (LED).

Streetlights shall be installed throughout the subdivision and may also be required on roadways bordering the development if deemed necessary by the Township. A qualified engineering consultant shall prepare the streetlight design and provide a photometric plan for the proposed layout. All streetlight design must conform to the requirements of the Illumination Engineering Society of North America Design Guidelines (or any successor body).

The installation of the street lighting system shall be in compliance with ESA, CSA, Hydro One requirements, the Township's standards and specifications and manufacturer's specifications.

Poles must be installed on projections of lot lines. In urban subdivisions, all wiring is to be in underground ducts.

The location of the streetlights should generally be on the south and east side of the road, opposite the watermain. The poles shall be installed to the outside of road curves.

Streetlight poles, luminaires and arms shall be in accordance with the Approved Products List in Appendix B. Product substitutions must receive prior approval from the Township.

Streetlight types will be either Standard Street Lighting (Cobra Head on arm) for urban residential developments or Decorative Street Lighting (side mount coach style luminaire) for estate residential developments.

General streetlight product requirements and principles are as follows:

- 8.2.1** Standard streetlighting pole and arm – poles to be direct buried Class “B” pre-stressed round concrete with provisions for electrical ground. The streetlight arm shall be tapered elliptical aluminum bracket.
- 8.2.2** Decorative streetlighting pole and arm – poles to be direct buried octagonal spun concrete with polished black finish and anti-graffiti coating or approved equivalent. The streetlight arm shall be aluminum, black polished finish.
- 8.2.3** Luminaires - only full cut off and International Dark Sky Association (IDA) compliant fixtures shall be accepted.

The individual LEDs shall be connected such that a loss or a failure of one LED will not result in the loss of the entire luminaire.

Each luminaire shall have the manufacturer’s name, trademark, model number, serial number, date of manufacture (month-year), rated voltage in watts, and lot number as identification permanently marked on the back of the module. Each streetlight shall be provided with an identification number as provided by the Township.

A photoelectric unit shall be supplied for each luminaire. The design of the photoelectric unit must include features to ensure that the device remains insect free.

Light fixtures should be positioned across a site so as to give a uniform distribution of light across the relevant area to assist in the avoidance of the creation of “hot spots,” being areas of over-illumination that make adjacent areas seem darker.

Fixtures shall be positioned such that they focus light down, preventing light from emitting above the horizontal plane (90-degree position relative to the ground) and preventing light trespass.

Lamps shall be located in such a way to direct light away from neighbouring properties.

Streetlight power distribution pedestals - heavy gauge galvanized steel with powder coated paint finish and concealed ventilation.

Ducts - shall be solvent welded together in trenches with minimum cover of 600mm. Ducts shall be surrounded by 80mm of brick sand and warning tape to cover width of trench.

Road crossings of existing roads are to be carried out by directional bore method with a minimum depth of cover of 750mm using thickwall PVC duct.

Where open-cut road crossings are necessary, ducts shall be installed as per OPSD 2100.06 and OPSS 603.

### **8.3 TRAFFIC SIGNALS**

#### **8.3.1 General**

Traffic signal design is to be prepared by a qualified engineering consultant in accordance with the Ontario Traffic Manual Book 12 and the appropriate electrical design codes. All work shall be performed in accordance with the current edition of the Ontario Electrical Code, including all appending bulletins issued by the Electrical Safety Authority which are applicable to the work. All work shall be governed by Federal, Provincial and Local laws and by-laws pertaining to the work, as well as by the latest issue of CSA Standards pertinent to the work. All electrical work is subject to inspection by the Electrical Safety Authority. In the event of a conflict between regulations, the strictest regulation shall apply.

In addition to accommodation of traffic flow, the signalized intersection design shall include pedestrian requirements and accessibility features. All signalized crossings must be designed in accordance with the TAC "Guidelines for the Understanding, Use, and Implementation of Accessible Pedestrian Signals". Accessibility features must include gentle grades for sidewalks, drop curbs and directional lines in the sidewalk to provide guidance for the visually impaired. Pedestrian crosswalk features shall include single head "walk/don't walk" heads, countdown heads, and audible pedestrian heads with tactile push button.

## 9 Signs and Pavement Markings

### 9.1 STREET NAME SIGNS

The Developer will be responsible for coordinating the supply of the street name signs with the Township. All costs associated with the supply and installation of the signs will be borne by the developer. Street name signs of an approved design in green colour shall be erected on approved metal posts (U-Channel galvanized), complete with break-away flange, 3.6m long and embedded 1.2m in the ground. Street name signs are not to be mounted on stop signposts and are to be installed on the opposite side of the road as the stop signs.

### 9.2 TRAFFIC SIGNS

Signs of the standard type conforming to the Ontario Traffic Manual Book 2 shall be mounted on 3.6 m (1.2 m lower channel and 2.4 m upper channel), double-slide, and “U-Channel” galvanized steel posts, embedded 0.9 m in the ground. The signs shall be located as required by the Township after a By-law is passed for their installation.

### 9.3 PAVEMENT MARKINGS

Upon completion of the final asphalt and upon notification by the Township, pavement markings shall be painted conforming with the Standards of the Ontario Traffic Manual, Book 11 (Pavement, Hazard and Delineation Markings) at all intersections, school crossings, walkways and railway crossings to clearly indicate the proper traffic zones, lanes and stop lines.

Lane markings are to be organic solvent based or water borne traffic paint complete with glass beads. All lane marking applications to new asphalt require two applications of paint. The second application shall not be applied until the first is tack free. Pavement markings are to conform with OPSS 532 and OPSS 1712.

Traffic lane symbols, stop bars and pedestrian crosswalks are to be durable pavement markings or field reacted polymeric pavement markings in accordance with OPSS 532, OPSS 1713 AND OPSS 1714.

All pavement marking removal required to prepare the area for final pavement marking shall be done by abrasion.

Local streets do not require centreline pavement marking, but stop bars are required with a minimum of 15 metres centreline marking.

#### **9.4 SEASONAL ACTIVE TRANSPORTATION LANES**

The requirements for Seasonal Active Transportation Lanes are to be discussed at the planning stage and within the Traffic Impact Study.

For collector or arterial streets, the Township may require the provision of a Seasonal Active Transportation lane in accordance with the Township's Transportation Master Plan.

Dedicated Seasonal Active Transportation lanes are generally not required on local streets.

The design for the Seasonal Active Transportation lanes shall be in accordance with the Transportation Association of Canada (TAC) Urban Supplement to the Geometric Design Guide for Canadian Roads and the Bikeway Traffic Control Guidelines of Canada.

The designer shall confirm with the Township if there will be any requirements for the provision of Seasonal Active Transportation Lanes prior to the commencement of the engineering design.

# 10 Storm Drainage and Stormwater Management

## 10.1 GENERAL

This section outlines the policies, design criteria and applicable parameters for the design and implementation of storm drainage facilities within the Township. These policies are to be adhered to in the design of all stormwater management facilities, including sewers, surface drainage and related environmental facilities.

In particular, the principles and design criteria in this section are intended to be consistent with and augment the guidelines, policies, and standards established in the latest version of each of the following:

- Ministry of Transportation Drainage Management Manual (1997);
- Ministry of the Environment Stormwater Management Practices Planning and Design Manual (2003);
- Nottawasaga Valley Conservation Authority Development Review Guidelines (2006);
- Ministry of the Environment Phosphorous Reduction Strategy (2010).

Accordingly, the following objectives are to be observed and achieved for drainage management within Township boundaries:

- i. Prevent loss of life and minimize property damage and health hazards;
- ii. Minimize inconvenience from surface ponding and flooding;
- iii. Minimize adverse impacts on the local groundwater systems and base flows in receiving watercourses;
- iv. Mitigate downstream flooding and erosion;
- v. Minimize pollution discharges to watercourses;
- vi. Minimize soil losses and sediments to sewer systems and water bodies from construction activity;
- vii. Minimize impairment of aquatic life and habitat;
- viii. Promote orderly development in a cost-effective manner.

In the planning and design of stormwater management facilities, the designer is to have full regard for the riparian rights of all surrounding, upstream and downstream landowners.

Consideration of the surrounding topography, land uses, environment and integration of the facility into all such elements is essential.

## **10.2 MINOR SYSTEM**

Generally, storm drainage shall be accommodated by a system of curb and gutters as well as storm sewers, with the exception of rural roadways or estate residential subdivisions where an open ditch system may be permitted according to conditions and subject to prior approval from the Township.

Storm sewers are to be designed to convey a minimum of the 1:5 year storm without surcharge. However, when the major storm drainage system is inadequate the Township may require a storm sewer system designed to carry additional flows.

### **10.2.1 Service Area**

The storm drainage system shall be designed to accommodate all on-site drainage areas as well as all external tributary areas to their maximum future development capacity in accordance with the Township's Official Plan, as determined by the delineation of appropriate topographic mapping and preparation of drainage plans.

### **10.2.2 Design Flow**

Storm sewer systems with a drainage area  $\leq 40$  ha shall be designed to convey the 1:5 year (minimum) design storm using the Rational Method and the Township's IDF regression equation for rainfall intensity unless otherwise approved or directed by the Township. Storm sewer systems with a drainage area  $> 40$  ha shall be designed using an approved computer program and verified with the Rational Method. The storm sewer design shall be based on the larger of the two flows calculated using the computer model and the Rational Method. Under no circumstances shall the storm system be designed in a surcharged condition.

Storm sewer design sheets shall be included with the design submission. The designer may use their own standard design spreadsheet which includes the pipe size calculation information defined in this section and the following sections. In addition, the following information is to be included in the design sheet:

- IDF formula and curve coefficients;
- actual pipe velocity;
- percentage of full flow capacity.

All storm sewers shall be designed according to the **Rational Formula** where:

$$Q = \frac{(C)(i)(A)}{360}$$

Where: Q = design flow (m<sup>3</sup>/s)  
C = the site specific runoff coefficient  
I = average rainfall intensity (mm/hr)  
A = drainage area (ha)

#### Average Rainfall Intensity, I

The average rainfall intensity shall be calculated in accordance with the following table and equation:

**Table 5: Rainfall Intensity Return Periods**

PARAMETER	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
A	678.085	853.608	975.865	1146.275	1236.152	1426.408
B	4.699	4.699	4.699	4.922	4.699	5.273
C	0.781	0.766	0.760	0.757	0.751	0.759

Parameters based on rain gauge data for the period 1979 - 2003 for the Barrie WPCC Station #6110557.

The IDF intensity values for Barrie WPCC Station were increased by 15% before calculating a, b, c values to account for climate change.

#### **Rainfall Intensity Calculation**

$$I = A/(t+B)^C$$

Where: I = intensity (mm/hr)  
t = storm duration (minutes)  
A, B, C = a function of the local intensity-duration data

The storm duration is set to the time of concentration (i.e. the sewer inlet time plus the time of travel in the pipe or channel) for the total cumulative drainage area to the node of interest. The maximum inlet time for the first pipe of a storm sewer system is 10 minutes.

This shall apply where the upstream drainage area does not include large open space areas. Where peak flows from external areas enter a subdivision sewer system, the more critical case based on either the time of concentration including the external area or the time of concentration

excluding the external area shall be used. Actual velocities of computed peak flows shall be used to estimate time of concentration.

#### Time of Concentration, $T_c$

The initial time of concentration, to be used to determine total time of concentration, should be calculated using the following methods, according to the run-off coefficient as indicated:

METHOD	CONDITION
Airport Method	$C \leq 0.4$
Bramsbey-Williams	$C > 0.4$

#### **Airport Method**

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

Where:

$T_c$  = Time of Concentration (minutes)

$C$  = Runoff coefficient

$L$  = Length (m)

$S$  = Slope (%)

#### **Bramsbey Williams Method**

$$T_c = \frac{0.057L}{S_w^{0.2} A^{0.1}}$$

Where:

$T_c$  = Time of Concentration (minutes)

$L$  = Length (m)

$S$  = Slope (%)

$A$  = Area (ha)

Typical initial  $T_c$  value for urban areas is 10 minutes and should be used as the minimum value.

#### Runoff Coefficient, $C$

An arithmetic weighted  $C$  is used where there are different land uses and soil types to obtain a composite runoff coefficient. as shown below:

$$C = \frac{(A_1C_1) + (A_2C_2) + \dots}{A}$$

At

Where: C = composite runoff coefficient (dimensionless)  
 A<sub>1,2...</sub> = area corresponding to specific land use or soils type (ha)  
 C<sub>1,2...</sub> = runoff coefficient corresponding to A<sub>1,2...</sub> (dimensionless)  
 A<sub>t</sub> = total drainage area (ha)

Source: adapted from the Ministry of Transportation Drainage Management Manual, 1997, Equation 8.10.

The minimum site-specific runoff coefficients for 5-yr to 10-yr events to be used for the proposed development land uses are per the following table:

LAND USE	C
Residential, single family detached	0.50
Residential semi-detached	0.60
Residential townhouse	0.70
Commercial	0.90
Industrial	0.75
Grassed park, unimproved (buffer) areas	0.25

For estimating flows from storms larger than the 5-year event, the runoff coefficients should be increased to account for the increase in runoff due to saturation of the soil, with the estimate becoming less accurate for larger storms. Coefficients for the larger storms can be derived as follows:

Return Period	Runoff Coefficient "C"
25 years	$C_{25} = 1.1 * C_5$
50 years	$C_{50} = 1.2 * C_5$
100 years	$C_{100} = 1.25 * C_5$

### 10.2.3 Pipe Capacity

Manning's Formula is to be used in calculating the full flow capacity of the storm sewer.

The roughness coefficients to be used in the calculation are as follows:

- Concrete pipe,  $n = 0.013$
- PVC and Smooth walled PE pipe,  $n = 0.013$

- Corrugated pipe (for culvert use only),  $n = 0.024$

#### **10.2.4 Velocities**

The minimum velocity in the pipe under full flow conditions is 0.6 m/s for the 5-year return storm.

The maximum velocity in the pipe under full flow conditions is 4.5 m/s for the 5-year return storm.

#### **10.2.5 Minimum and Maximum Pipe Slopes**

The minimum pipe slope shall be that which is required to meet the minimum velocity but shall not be less than 0.25%.

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

#### **10.2.6 Minimum Pipe Sizes**

The minimum pipe size is 300 mm.

#### **10.2.7 Minimum Depth of Cover**

The minimum depth of cover to be provided shall be 1.2 m to the obvert of the sewer provided there are no conflicts with utility crossings. Insulation to address shallower installations will be considered only on a localized basis when necessary to address a constraint and is subject to prior Township approval.

#### **10.2.8 Bedding and Backfill**

All storm sewers are to be installed with bedding and pipe cover (well graded OPSS Granular 'A' or as recommended and approved by the Geotechnical Engineer and the Township) and backfill in accordance with OPSD 802.010 or 802.030 to 802.032 as applicable. Compaction is to be a minimum of 95% SPD or as indicated in the approved Geotechnical Report.

In soft or wet conditions, additional Geotechnical Investigation may be necessary to determine the appropriate bedding and backfill measures.

#### **10.2.9 Pipe Clearances**

Minimum clearances shall be provided in accordance with MECP guidelines.

#### **10.2.10 Sewer Layout**

Storm sewers shall generally be located as per the typical road cross-sections.

Where storm sewers mains are located in easements, the easement width shall be a minimum of 6.0m.

### 10.2.11 Maintenance Holes

Maintenance holes shall be as per OPSD 701 series and shall be placed at the beginning and end of each sewer line, at changes in pipe size and/or material, and at all designed changes in grade and/or alignment. Radius pipe for large diameter sewers may be permitted where it is beneficial to certain circumstances, subject to prior written approval from the Township.

Blind main line sewer connections are not permitted.

All maintenance holes up to and including 1200 mm diameter are to be pre-benched to spring-line by the supplier. All maintenance holes larger than 1200 mm diameter are to be benched to spring-line on-site after installation.

Frost straps are required in accordance with OPSD 701.100.

The maximum spacing between maintenance holes shall generally be according to the following:

- 300 to 900 mm diameter            110 metres
- Greater than 900 mm diameter    150 metres

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

CHANGE IN DIRECTION	MINIMUM DROP
Straight run (0°)	0.03 m
1 - 45°	0.05 m
> 45°	0.08 m

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

Drop structures shall be provided when the difference in the inlet and outlet inverts is equal to or greater than 0.9 m that cannot be eliminated by changing sewer grades. Internal drop structures are not permitted.

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

Obverts of inlet pipes shall not be lower than obverts of outlet pipes. Where maintenance holes are located in areas to be flooded by the major storm design and surcharged sewer design is not used, maintenance hole covers shall be of the sealed variety. Where maintenance holes are located where the surcharged sewer design hydraulic grade line is higher than the rim elevation,

maintenance hole covers shall be of the bolted variety. In all other areas, standard maintenance hole covers shall be used.

Except for special cases as pre-approved by the Township, the downstream pipe diameter shall always be greater than or equal to the upstream pipe diameter.

### 10.2.12 Catchbasins

Catchbasins shall be located upstream of pedestrian crossings and not within 1.0 m of any curb depressions or in driveways. Preferably, catchbasins will be installed on projections of lot lines. Double catchbasins shall be located where flows are being received from more than one direction, such as at low points.

The maximum allowable spacing shall be in accordance with the following:

PAVEMENT WIDTH (M)	MAXIMUM SPACING (M)	
	Slop $\leq$ 4.5%	Slope $>$ 4.5%
8.5	90	60
14.0	60	40

Catchbasin capacities shall be determined in conjunction with the overall stormwater management system. On roadways, catchbasins shall have a minimum capacity to pass the runoff from the 5-year return frequency storm. Where the pipe system is required to convey flows in excess of the 5-year return frequency storm, sufficient catchbasin capacity shall be provided to permit the design flows to enter the sewer system. Inlet control devices may be used where the hydraulic grade line needs to be strictly controlled to prevent surcharging of the sewer line and to allow storm sewer house connections.

Where catchbasins are used as inlet controls, spacing shall be determined by design and must be approved by the Township.

Leads shall be minimum 250 mm at 0.7% grade for single catchbasins and 300 mm at 0.7% grade for double catchbasins.

Leads shall connect to maintenance holes where possible and shall have a minimum depth of cover of 1.2 m to the obvert.

### 10.2.13 Foundation Drainage System

In order to minimize the flow rate from foundation drains, a minimum distance of 0.5 m shall be provided between the underside of the basement floor slab and the measured seasonal high groundwater table. Subdivision applications shall clearly include this difference of elevation at the time of the “Draft Plan Application” and shall be updated during the detailed design process.

A foundation drainage system is to be provided for each residential lot. The designer has three options to choose from:

- i. A sump pump discharging to an underground storm sewer service connection as per Essa Standard Drawing ESD-202.01 Sump pump discharge is not permitted over sidewalks.
- ii. A gravity connection to the storm sewer, provided the 100-year hydraulic grade line is minimum of 0.5 m below the finished basement floor elevation of the dwelling.
- iii. A sump pump, or gravity connection to a third pipe foundation drain collection (FDC) system, that is separate from the storm sewer system and which discharges to a sufficient approved outlet. The need and suitability of a FDC system shall be addressed in the geotechnical report for the development.

### 10.2.14 Storm Service Connections

Single connections for residential lots shall be constructed in accordance with Essa Standard Drawing ESD-1000.02 for each type of residential lot. Connections for commercial, institutional or multiple uses will be considered on an individual basis.

The minimum depth of cover is 1.5 m and the minimum slope is 2.0%. Utility duct trench depths must be considered in setting the depth of service connections.

Where a sump pump discharges to a storm service connection, a 25mm air gap shall be provided at the building such that there is no direct connection between the building sump pump outlet and the storm service.

Where it can be shown to the satisfaction of the Township that groundwater conditions at footing level are unlikely to require more than 2 sump basins and pumps for an entire Townhouse block, storm service connections to the internal units in a Townhouse block may be eliminated. However, storm service connections must be installed to the end units.

Single residential storm connections shall be 100mm diameter with a 100mm x 100mm test fitting plugged and braced at the property line.

For new developments, the service shall be extended 2.0 m beyond property line, complete with a temporary, plug, brace, and marker.

Roof leaders shall **not** be connected to the storm sewer system. Roof leaders are to be discharged to the ground surface onto splash blocks, and flows shall be directed away from the building and into the surface drainage / swale system in such a way as to prevent ponding or seepage into the foundation weeping system. Notwithstanding, the use of inground infiltration pits may be considered subject to supporting geotechnical and engineering considerations.

Where flat roofs are used, as in commercial or industrial sites, detention roof hoppers requiring smaller or fewer roof leaders may be used as part of the stormwater management design. No connections are to be installed directly to storm sewers.

#### **10.2.15 Testing**

The following testing requirements apply to all new storm sewers. Any sections of sewer or service connections which fail to meet the requirements shall be repaired or replaced at the direction of the Township.

#### **10.2.16 Deflection Testing**

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

Deflection testing is not required for concrete storm sewers.

#### **10.2.17 CCTV Inspection**

A CCTV Inspection of the storm sewer shall be completed prior to substantial completion and final assumption. CCTV inspection is to be completed in accordance with OPSS 409, including flushing and cleaning.

#### **10.2.18 Visual Inspection**

All maintenance holes shall be visually inspected by the Township for deficiencies prior to substantial completion and prior to final assumption.

### **10.3 MAJOR SYSTEM**

Runoff rates in excess of the design capacity of the minor system shall be conveyed via roadways, swales, walkways, drainage easements, and in special circumstances the storm sewer system, to a sufficient outlet. The combination of the overland flow system and the minor system shall be designed for a minimum 25-year return frequency storm, to prevent flooding of private property with maximum level of road flooding and surface detention as defined in the table below.

It shall also be demonstrated that overland flow conditions resulting from the 100-year return frequency storm will not cause unacceptable flooding damage to private property with a

maximum level of road flooding and surface detention as outlined in the table below. A continuous overland flow route is to be identified on the Engineering Drainage Plans.

In new subdivisions the limit of overland flow route floodlines shall not extend onto private property unless protected by a drainage easement. Development of the site must not increase flood levels upstream or downstream of the development.

For all classes of road, the product of depth of flow at the gutter (m) times the flow velocity (m/sec) shall not exceed 0.65m<sup>2</sup>/sec.

Street grading must provide a continuous gradient to direct street flows to a safe outlet at low points. Outlets can be walkways or open sections of roadways leading to parks, open spaces or river valleys.

**Table 6: Maximum Allowable Flow Depths**

LOCATION	STORM RETURN FREQUENCY (YEARS)		
	5	25	100
Walkways	minor surface	as required	as required
Open Spaces	flow up to 25mm on walkways	for overland flow outlets	for overland flow outlets
Collector and Industrial Roads	1.0m wide in gutter or 0.10m deep at low point catchbasins	up to crown	0.10m above crown
Local Roads	Not applicable	as required	0.3m above crown
Arterial Roads	1.0m wide in gutter or 0.10m deep at low point catchbasins	1 lane clear	up to crown
Private Property	minor ponding in swales	no structural damage, ponding in yard areas below building openings - no basement flooding	no structural damage from overland flow
Public Property	minor ponding in swales or ditches	no structural damage, ponding in flat areas, no erosion	no structural damage, ponding in flat areas, some erosion

Pre-development peak flows shall be computed by an approved hydrologic model. Watershed definition and pre-development flows must be approved by the Township.

Preliminary estimates of post-development flow rates may be computed using the Rational Method.

For all systems and for the design of surcharged sewers and detention facilities, the latest version of the computer model OTTHYMO is recommended. Other hydrograph methods may be considered if it is demonstrated that the results are comparable to those from OTTHYMO. Post-development design flows may be determined using the Rational Method only where the design area is less than 40 hectares and runoff control facilities are not considered. The Modified Rational method may be used to model runoff control facilities provided the tributary area to the facility is 2 ha or less.

### **10.3.1 Open Ditches**

In rural areas, industrial areas, or estate residential subdivisions, open ditches may be permitted by the Township. Ditches shall be constructed a maximum of 0.5m and a minimum of 0.15m below the sub-grade of the roadway. Where this cannot be achieved, a sub-drain may be provided under the invert of the ditch and day-lighted once the minimum depth can be attained.

The minimum ditch grade shall be 0.5% and the maximum 5%. In exceptional cases and where ditches are on easements off the Road Allowance, ditches with grades greater than 6% may be allowed by the Township; but these shall be suitably protected against erosion to the satisfaction of the Township. Where ditch grades exceed 5%, the Township may require that an urban cross-section be applied for that road segment.

The minimum ditch protection on all ditches shall be 100mm of topsoil and staked sod on the side slopes and bottom of the ditch regardless of the ditch gradient.

### **10.3.2 Open Channels**

Open channels are to be designed as follows:

- For the Regional Storm where the upstream watershed area exceeds 1 square kilometre;
- For a minimum 25-year return frequency storm with protection from erosion damage for larger storms if required by the Township;
- To maintain the natural storage characteristics of the watercourse;
- To maintain a natural appearance as far as possible; and
- To meet specific requirements of the Conservation Authority in each case.

### **10.3.3 Sufficient Outlet**

All developments must demonstrate that the stormwater generated onsite is directed to a sufficient outlet.

A sufficient outlet typically constitutes a lake or permanently flowing watercourse. Sufficient outlet may also include public right-of-way provided that written permission is obtained from the Township. In the case where the discharge is directed over private land, the developer must obtain a legal right of discharge registered on title. Copies of all written documentation such as a legal right of discharge registered on title and/or written permissions from the Township must accompany the design submission.

The designer shall provide calculations for the conveyance capacity of the downstream conveyance routes to demonstrate that upstream, downstream and adjacent landowners do not incur significant adverse impacts, including increased runoff volumes, and that the flow is conveyed in a safe manner.

## **10.4 STORMWATER MANAGEMENT FACILITIES**

All stormwater management facilities are to be designed to ensure that post-development peak flows do not exceed pre-development levels for storm events up to and including the 1:100-year event. All new stormwater management facilities are required to provide an Enhanced level of water quality protection.

The Township supports the design of stormwater management facilities using hydrologic computer programs including VISUAL OTTHYMO, PCSWMM and SWMHYMO.

All stormwater management facilities are to be designed in accordance with the preferred criteria listed in the Ministry of Environment, Conservation and Parks (MECP) "Stormwater Management Planning and Design Manual and relevant requirements of the Nottawasaga Valley Conservation Authority (NVCA)". The information provided below is intended to supplement that manual.

### **10.4.1 Maintenance Access**

A gravel surface maintenance access is required to the inlet and outlet structures, forebays, sediment drying areas, and emergency spillways. The maintenance access should be looped to provide two access points to all key features. When this is not possible, dead-end access may be provided with a hammerhead turning area of 4m by 17m with a 12m centreline turning radius. The maintenance access must descend to the forebay bottom. Access paths shall not be less than 4m wide and shall be set a minimum of 0.3m above the maximum pond water level.

At locations where overland inlet flow routes or the emergency spillway cross the maintenance access, reinforcing measures shall be incorporated to strengthen the access route.

#### **10.4.2 Emergency Spillway**

All stormwater management facilities shall be provided with an emergency spillway designed to convey the greater of the 1:100 year or regional storm event without failure. The spillway is to be designed with suitable erosion protection given the velocities associated with the uncontrolled flow.

#### **10.4.3 Side Slopes**

Stormwater management facilities shall be designed with a minimum side slope of 5:1 above and below the safety shelf.

A safety shelf shall be provided with a slope of 7:1 extending 3m horizontally above and below the normal water level.

#### **10.4.4 Sediment Forebay Bottom**

The sediment forebay bottom is to be lined with a hard surface material (with consideration of “green” materials) to assist in the maintenance operations of the facility. A Geotechnical Engineer must certify that the forebay bottom design has sufficient bearing capacity to support maintenance equipment assuming the forebay has been drained.

#### **10.4.5 Sediment Drying Areas**

Sediment drying areas are to be incorporated into the design of the stormwater management facility such that water from the sediment drains back into the sediment forebay with a slope of 2% to 4%. The sediment drying area shall be designed to accommodate 30% of the forebay volume with a maximum sediment stockpile depth of 1m and maximum side slopes of 4:1.

Sediment drying areas should be located in areas that avoid high public visibility, are accessible from the maintenance access road, and are above the 5-year water level.

#### **10.4.6 Signage**

Township Standard warning signs shall be provided in clearly visible locations, as approved by the Township.

#### **10.4.7 Landscaping**

In cases where there are residential lot(s) adjacent to a stormwater management facility, a minimum 6-meter-wide landscaping buffer with a maximum slope of 5:1 will be required between the maintenance access route and the residential lot(s) to provide separation between the stormwater management facility and private property. This buffer can be included within the stormwater management block.

Refer to Section 14 for additional guidelines related to planting and landscaping for stormwater management facilities.

#### **10.4.8 Operations and Maintenance Manual**

A detailed operations and maintenance manual will be required as part of the design of each facility, including inspection checklists, maintenance descriptions and projected frequency, as well as recommendations for facility cleanup.

The certification of a storm water management facility by the developer's engineer will be a requirement of the Certificate of Final Assumption.

### **10.5 WATER QUALITY TREATMENT UNITS**

Where a stormwater management pond is not feasible due to spatial, topographical or drainage outlet constraints, consideration will be given to the use of oil/grit separators or stormwater quality treatment units. The units must be designed to provide 80% TSS removal for 90% of the annual runoff volume for the site using a fine particle size distribution. Oil/grit separators and other stormwater quality treatment units should be used in conjunction with additional quality control measures to provide a treatment train approach.

Supporting calculations and anticipated maintenance requirements shall be provided to the Township along with certification of the design by a Professional Engineer.

Additional documentation may be required on a case-by-case basis.

### **10.6 EROSION AND SEDIMENT CONTROL**

This section presents the minimum criteria to achieve by implementing the design of some commonly used erosion and sediment controls. For specific control measures and/or information on control options that have not been included in this section, other reference resources include the latest revision of the Ministry of Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual; the Nottawasaga Valley Conservation Authority Development Review Guidelines; the Lake Simcoe Region Conservation Authority Watershed Development Policies; and the Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Control Guidelines for Urban Construction.

Every control measure and all control plans must meet or exceed the specifications set out in this document and must be designed to achieve satisfactory performance at all times.

The controls should be designed using a phased approach whenever feasible to minimize the exposed area of the site at any given time. There must also be a contingency plan for repair which includes regular inspection and maintenance provisions, particularly following rain events,

for the replacement and upgrading of control measures as required to achieve satisfactory performance at all times.

#### **10.6.1 Runoff Control**

The development of the control plan shall examine concentrated runoff from adjacent areas that will pass through the site and shall provide for the diversion of the runoff around disturbed areas, in general. If this is not possible, the runoff shall be directed into armoured channels flanked by silt fencing with appropriate low point protection and shall outlet into a capture and treatment facility prior to discharge.

For sites where sediment control ponds are not being proposed, sediment control fences and cut off swales/channels or equivalent control measures shall be placed along all down gradient boundaries of the site.

For sites adjacent to existing residential areas, a cut-off swale/channel shall generally be placed around the entire perimeter of the site to prevent drainage onto private lands. A 3 m wide buffer strip and/or sediment control fence shall be provided along the perimeter of the down gradient boundaries of the site.

#### **10.6.2 Temporary Sediment Control Ponds**

Temporary sediment control ponds are generally required for any project that has a construction area greater than 5 hectares, however, may also be appropriate to implement on smaller sites.

The location of the pond(s) shall be that required to intercept runoff from the entire disturbed area unless other controls are implemented in conjunction with the pond, to ensure that satisfactory performance is achieved for the entire area.

In general, a pond shall consist of:

- i. A permanent pool to contain accumulated sediment and post-storm waters;
- ii. A water quality treatment volume that allows for settlement of suspended sediment from storms; and
- iii. A forebay to quiet incoming flow if the construction project is anticipated to take place over more than one year.

The required active storage volume shall be designed with a minimum of 125 m<sup>3</sup>/hectare of contributing area.

The required permanent pool volume shall be designed with a minimum of 125 m<sup>3</sup>/hectare of contributing area.

The draw down time shall be a minimum of 24 hours, or as required by the governing Conservation Authority.

The outlet works shall consist of a perforated riser system, with a minimum orifice diameter of 75 mm.

The forebay shall be designed with a minimum depth of 1 m, a maximum volume of 20% of the permanent pool, have a stable bottom to allow mechanical clean out, and incorporate sediment depth indicators.

The overall pond shall be designed with a minimum depth of 1.0 m, a maximum depth of 2.5 m, maximum side slopes of 5:1, and an emergency spillway sized to safely convey the 1:100-year storm event from the contributing area.

### **10.6.3 Silt Fences**

Silt fence is to be installed on the perimeter and on the up-gradient side of sensitive areas, streams and rivers, at the base of slopes including those of temporary earth stockpiles. It should not be used in areas of high flows.

When silt fence is proposed, it shall be:

- i. Aligned with site contours.
- ii. A minimum above grade height of 900 mm with a minimum of 300 mm of the fabric toed into the ground.
- iii. Constructed of suitable woven UV stabilized fabric (with a weave density of 270 R or greater) fastened with wire fasteners to 150 mm gauge wire fencing or acceptable equivalent.
- iv. Supported by steel T bar fence posts with a separation distance of no more than 2.5 m.
- v. Accompanied by a vegetative buffer strip on the down gradient side.

### **10.6.4 Vegetative Buffer Strips**

Vegetative Buffer Strips shall be provided between the site alteration area and every down-gradient protected area. They shall be protected from up-gradient erosion by silt fences and shall consist of established vegetation that is growing, whenever possible, on undisturbed soil. They are to be a minimum of 3 m wide between the perimeter of the property and a disturbed area and a minimum of 15 m wide between surface water and a disturbed area. Additional width may be required if the adjacent surface water is classified as a source for cold water fisheries.

### 10.6.5 Non-Vegetative Buffer Strips

Non-Vegetative Buffer Strips shall be installed where there is not a minimum undisturbed area of established vegetation down gradient of the site alteration area. They shall be a minimum of 2 m wide between the perimeter of the property and a disturbed area and a minimum of 15 m wide between surface water and a disturbed area.

A second silt fence must be installed no closer than 1 m to the primary silt fence and there must be space provided for access to clean out trapped sediment and complete any repairs to the fence.

### 10.6.6 Channel Low Point Protection (Stone Silt Traps)

Channel Low Point Protection Devices shall be constructed in channels and ditches that will contain concentrated flows to reduce the velocity; thereby reducing erosion of the sides and invert. They shall be designed as follows:

- i. so that the crest of the downstream device is at the same elevation as the downstream base of the device further upstream;
- ii. with 100 mm to 150 mm diameter rip rap, wrapped in geotextile fabric, from the invert of the channel or ditch to a maximum of 250 mm below the top of the channel or ditch;
- iii. with a downstream slope not to exceed 1 vertical in 4 horizontal and an upstream slope not to exceed 1 vertical in 1.5 horizontal; and
- iv. with a 2.5-metre-long excavated sediment trap approximately 600 mm in depth at the upstream face.

### 10.6.7 Construction Access Mats

Construction Access Mats shall be installed at all exits from the site and shall be designed and maintained to remove most of the sediment accumulated on vehicle tires. They shall be designed as follows:

- i. With 300 mm of 100 mm to 200 mm quarry stone placed on a geotextile fabric suitable for allowing ex-filtration of water and preventing the quarry stone from becoming contaminated with the substrate soil.
- ii. To be a minimum of 8 m in width and extend a minimum of 30 m onto the site.
- iii. To be flanked by silt fences and vegetative buffers from the property line to the start of any on-site roadways.

#### **10.6.8 Topsoil and Spoil Pile Management**

Topsoil and spoil piles shall be designed such that they are not in low areas of a site where water may accumulate, and they must be surrounded by one or more silt fences.

Any piles containing more than 100 m<sup>3</sup> of material shall be a minimum of 15 metres from a roadway or channel.

If topsoil or spoil piles are to be left in place for more than 45 days, they shall be stabilized by mulching, vegetative cover, tarps or other equivalent means.

Stockpiles of any materials are to have a maximum slope of 2:1.

#### **10.6.9 Drain Inlet and Catchbasin Protection**

Protection of all potentially affected storm drain inlets and catchbasins shall be accounted for in the design.

Filter cloth protection may be used over the catchbasin inlet where ponding of water will not occur and where traffic will not affect the filter cloth. In all other cases, catchbasin inserts shall be used constructed of filter cloth with a metal support structure.

#### **10.6.10 Site Dewatering**

Effluent from site dewatering operations must not discharge directly into receiving bodies of water or streams.

Water pumped from the site shall be treated by control devices such as a sediment control pond, grit chambers, sand filters, pea gravel bags, upflow chambers, swirl concentrators or other appropriate controls, and must not contain particles more than 40 microns in size, or more than 100 mg/L of suspended solids.

# 11 Sanitary Sewer System

## 11.1 GENERAL

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

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

## 11.2 CONFIRMATION OF AVAILABLE CAPACITY

The Township maintains a "SewerGEMS"® model of its sanitary sewer systems. Prior to the commencement of any design, the developer and/or designer must contact the Township and confirm that there is adequate capacity to accommodate the proposed project. A sanitary model update will be required for each new development. To facilitate this exercise, the designer shall prepare and provide the proposed development design flows to the Township based on the criteria in this section. The designer shall confirm with the Township whether the sanitary model update will be performed by the Township or is to be done by the designer.

## 11.3 SERVICE AREA

The system shall be designed to accommodate all on-site drainage areas as well as all external areas to their maximum future development capacity in accordance with the Township's Official Plan.

## 11.4 DESIGN FLOWS

All sewers shall be sized for peak design flows, including an allowance for infiltration based on the criteria in this section.

Sanitary sewer design sheets shall be included with the design submission. The designer may use their own standard design spreadsheet which includes the pipe size calculation information defined in the following sections. In addition, the following information is to be included in the design sheet:

- development type;
- average flows per development type;
- density / persons per unit (residential);
- actual pipe velocity;

- percentage of full flow capacity.

#### 11.4.1 RESIDENTIAL

##### Design Population

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

When details regarding the proposed land uses are known, the actual number of units shall be used and the design population estimated using the following occupancy values (persons per unit):

Detached, semi-detached = 3.25 ppu

Townhouses, apartments = 2.5 ppu

##### Average Daily Flow

Average Daily Domestic Flow = 450 L/person/day (excluding extraneous / infiltration flows).

##### Extraneous Flows

An allowance should be made for the infiltration of groundwater into the sewers and sanitary service connections (infiltration) and for other extraneous water entering the sewers from sources such as maintenance hole covers (inflow). The amount of groundwater leakage into the sewer system will vary with the quality of construction, type of joints, ground conditions, and level of groundwater in relation to pipe. While infiltration can be reduced by proper design, construction, and maintenance, it cannot be completely eliminated, and an allowance should be made in the design sewage flows to incorporate this flow component.

A **peak extraneous flow rate of 0.23 L/s/ha** shall be used for sanitary sewer design. This rate assumes strict adherence to construction standards in the installation of sanitary sewers and building connections and does not account for any other extraneous flows such as: foundation drain connections; excessive flooding through maintenance hole covers; significant groundwater problems; etc. Where collection system infrastructure is being designed to convey flows from existing developed areas, the extraneous flow allowance used may be increased based on flow monitoring data and/or system modelling as directed by the Township.

Where a sewer is located within the floodplain of a watercourse, maintenance hole covers are to be raised above the maximum flood elevations, or watertight maintenance hole covers with associated air vents may be required as directed by the Township.

##### Peak Domestic Flow

Peak domestic flow is to be calculated using the following formula:

$$Q_p = (P \times q \times M) / 86.4 + I \times A$$

where;

$Q_p$  = Peak residential sanitary sewage flow, including peak extraneous flows (L/s)

$P$  = Design population in thousands

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

$M$  = Peaking factor

$I$  = Peak extraneous flow (L/s/ha)

$A$  = Tributary area (ha)

Peak design flows shall be determined by applying a peaking factor,  $M$ , to the average daily flows, based on the Harmon Formula, as follows:

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

where;  $M$  = Harmon Peaking Factor  
 $p$  = Population (in thousands)

#### 11.4.2 Commercial, Industrial, and Institutional

Equivalent domestic flows for land uses other than residential shall be calculated on an area basis utilizing historical records where possible and / or MECP criteria. Such flows are to be approved in advance by the Township.

#### 11.5 PIPE CAPACITY

The pipe capacity under full flow conditions is to be calculated using Manning's formula, below, and a roughness coefficient of  $n = 0.013$ . Sanitary sewers shall be upsized when calculated flows exceed 85% of full flow under future peak flow conditions during inflow and infiltration.

$$Q = 1/n (A) (R^{2/3}) (S^{1/2})$$

where;

$Q$  = Flow capacity of sewer ( $m^3/s$ )

$R$  = Hydraulic radius of pipe (m)

$S$  = Sewer slope (m/m)

$n$  = Manning roughness coefficient (unitless)

$A$  = Area ( $m^2$ )

**11.6 VELOCITIES**

The minimum velocity in the pipe under full flow conditions is 0.6 m/s.

The maximum velocity in the pipe under full flow conditions is 4.0 m/s.

**11.7 PIPE SLOPES**

The minimum pipe slope shall not be less than 0.5% or that which is required to meet the minimum velocity.

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

The maximum pipe slope shall be that which is required to not exceed the maximum velocity.

**11.8 MINIMUM PIPE SIZE**

The minimum pipe size is 200 mm.

**11.9 DEPTH OF COVER**

A minimum depth of cover of 2.8 metres below the centreline road elevation shall be provided or sufficient depth for basement floor drains and frost cover, as approved by the Township. Where sewers are located within an easement, a minimum frost cover of 1.5 metres may be used, provided that such sewers cross below watermains.

Where sufficient cover does not exist, the Township may consider shallower insulated sewers on an individual and exceptional basis only.

The maximum height of fill is not to exceed OPSD standards unless satisfactory pipe strength design calculations are provided for approval by the Township.

**11.10 BEDDING AND BACKFILL**

All sanitary sewers are to be installed with bedding and pipe cover (well graded OPSS Granular 'A' or as recommended and approved by the Geotechnical Engineer and the Township) and backfill in accordance with OPSD 802.010 or 802.030 to 802.032, as applicable. Compaction is to be a minimum of 95% SPD or as indicated in the approved Geotechnical Report.

In soft or wet conditions, additional Geotechnical investigation may be necessary to determine the appropriate bedding and backfill measures.

**11.11 PIPE CLEARANCES**

Minimum horizontal and vertical clearances shall be provided in accordance with MECF guidelines.

**11.12 SEWER LAYOUT**

Sanitary sewers shall generally be located along the centre of the right-of-way.

Where sanitary sewers are located in easements, the easement width shall be a minimum of 6.0 m.

**11.13 MAINTENANCE HOLES**

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

All maintenance holes shall be pre-benched up to or above springline to the satisfaction of the Township.

The maximum spacing between maintenance holes shall be 110 metres for all pipe sizes.

A sufficient drop shall be provided across each maintenance hole to offset any hydraulic losses and in accordance with the following:

CHANGE IN DIRECTION	MINIMUM DROP
Straight run (0°)	0.03 m
1 - 45°	0.05 m
> 45°	0.08 m

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

Drop structures shall be provided when the difference in the inlet and outlet inverts is equal to or greater than 0.9 m that cannot be eliminated by changing sewer grades. Internal drop structures are not permitted.

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

Frost straps are required in accordance with OPSD 701.100.

Obverts of inlet pipes shall not be lower than obverts of outlet pipes. Where maintenance holes are located in areas to be flooded by the major storm design, maintenance hole covers shall be of the sealed variety and properly vented. In all other areas, standard maintenance hole covers shall be used and labelled "Sanitary".

Except for special cases, the downstream pipe diameter shall always be greater than or equal to the upstream pipe diameter. A maintenance hole will be required on the private property side for sanitary services to commercial, industrial, and institutional properties.

Foundation drains shall not be connected to the sanitary sewer.

#### **11.14 SANITARY SERVICE CONNECTIONS**

Single connections for residential and industrial use shall be located in accordance with Essa Standard Drawing ESD-1000.02 for each type of residential lot.

Single residential sanitary connections shall be 125mm diameter with a 125mm x 100mm test fitting at property line. For new developments, the service shall be extended 2.0 m beyond property line.

Connections for commercial, industrial and institutional will be considered on an individual basis but will generally be 150mm diameter with a maintenance hole on private property just beyond property line.

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

Service connections to the sewer main shall be accomplished with a manufactured Tee. Tees shall be installed at a 45° angle to the main, where possible, such that the invert of the tee is at the springline of the main.

Where sanitary main is deeper than 5 m, the use of a sanitary riser is required. The maximum height of riser section should not exceed 5 m.

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

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

#### **11.15 TESTING**

The following testing requirements apply to all new sanitary sewers. Any sections of sewer or service connections which fail to meet the requirements shall be repaired or replaced at the direction of the Township.

##### **Deflection Testing**

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

**Low Air Pressure Testing**

All newly installed sanitary sewers shall be subjected to low air pressure testing in accordance with OPSS 410.

**CCTV Inspection**

All newly installed sanitary sewers shall be subjected to a CCTV Inspection. The sewer and sewer service laterals are again to be subjected to a CCTV inspection prior to final assumption.

**Visual Inspection**

All maintenance holes shall be visually inspected by the Township for deficiencies.

**11.16 PIPE MATERIAL**

Refer to Appendix B for a list of approved materials.

# 12 Water Supply and Distribution System

## 12.1 GENERAL

The water distribution system is to be designed as a network system to meet the water demand for each area or development under consideration. Long dead-end mains and single supply systems are to be avoided. In order to ensure reliability, a looped system must be provided to the satisfaction of the Township.

All water distribution system components and lubricants are to be as stated on the Township's Approved Products List and must meet the Township's Drinking Water License requirements, applicable AWWA Standards, NSF/ANSI 60 and 61 Standards, and other appropriate standards for approved materials, coatings or linings for distribution system components or chemicals that come into contact with potable water.

Shop Drawings shall be submitted for review and approval by the Township prior to construction for all watermains made of concrete pressure pipe and all chambers, valves, hydrants and other fittings and appurtenances as requested by the Township.

## 12.2 SERVICE AREA

The system shall be designed to service all areas within the development to their maximum future capacity in accordance with the Township's Official Plan. Allowance shall be made for connection to appropriate watermains in adjacent developments or areas. The exact location for these connections shall be approved by the Township.

## 12.3 CONFIRMATION OF AVAILABLE CAPACITY

The Township maintains a "WaterGEMS"© model of its water supply and distribution systems. Prior to the commencement of any design, the developer and/or designer must contact the Township and confirm that there is adequate capacity to accommodate the proposed project. A water model update will be required for each new development. To facilitate this exercise, the designer shall prepare and provide the proposed development design flows to the Township based on the criteria in this section. The designer shall confirm with the Township whether the water model update will be performed by the Township or is to be done by the designer.

## 12.4 DESIGN FLOWS

Watermains shall be designed to meet the greater of the maximum day demand plus fire flows, or peak hour flow, in accordance with the criteria below.

The estimated populations and areas shall be in accordance with the Official Plan.

In general, Fire flows are to be determined based on the most recent publication of the Fire Underwriters Survey of the Insurance Bureau of Canada (FUS) or AWWA Manual M31 - Distribution System Requirements for Fire Protection, but in any case the designer shall satisfy the following at a minimum.

Minimum fire flow: Residential detached - 100 L/s;  
 Residential townhouse - 150 L/s;  
 Industrial and commercial areas - to be determined by the designer in accordance with FUS and / or AWWA requirements and submit for Township approval.

Average daily demand: 450 litres/capita/day

Maximum daily demand factor: determined from the current MECP design guidelines, minimum 1.8 to be used.

Pressure reducing valves will be required where water pressures exceed 552 kPa.

## 12.5 WATERMAIN SIZING

The Hazen-Williams formula shall be used for computing friction losses and subsequently sizing the watermains.

For new mains the Hazen-Williams factor, "C", shall be as follows:

Watermain Pipe C-Factors

Pipe Diameter (mm)	"C" Factor
150	100
200-250	110
300-600	120
Over 600	130

The minimum size of watermain in residential developments shall be 150mm diameter except for 50mm diameter looped systems in residential cul-de-sacs in accordance with Township standards.

The minimum size of watermain in industrial developments shall be 200mm diameter.

**12.6 WATERMAIN PRESSURE**

Watermain supply systems are to be designed to achieve the following minimum pressures under the noted demand scenario:

<u>Demand Scenario</u>	<u>Minimum Acceptable Pressure Range</u>	
	<u>kPa (PSI)</u>	
	<u>Preferred</u>	<u>Accepted</u>
Maximum Day Demand .....	345 – 485 (50 – 70)	275 – 550 (40 – 80)
Maximum Day + Fire .....	> 140 (20)	> 140 (20)
Peak Hour Demand .....	345 – 485 (50 – 70)	275 – 550 (40 – 80)
Average Day Demand .....	345 – 485 (50 – 70)	275 – 550 (40 – 80)
Min Hour Demand .....	345 – 485 (50 – 70)	275 – 550 (40 – 80)

The minimum pressure during the peak hourly demand shall be 275 kPa (40psi).

The maximum pressure under static load or during the minimum hourly demand shall be 550 kPa (80psi).

The minimum pressure when the system is tested under fire flow conditions in conjunction with the design maximum daily demand shall be 140 kPa.

Where water pressure exceeds 620 kPa (90psi), a pressure reducing valve will be required.

**12.7 OVERSIZING**

Oversizing of watermains will be provided as required to provide for adjacent areas where service is expected to be extended, and to provide fire flow requirements including oversizing of hydrants, openings and leads as required in accordance with modelling results.

**12.8 WATERMAIN LAYOUT**

Watermains shall generally be located as per the typical road cross-section. Refer to Appendix D, Standard Drawings.

When watermains are located in easements, the easement width shall be 6.0m minimum.

**12.9 MINIMUM DEPTH OF COVER**

A minimum depth of cover of 1.7 metres from finished ground surface to top of watermain is required.

The maximum height of fill is not to exceed OPSD unless pipe strength design calculations are provided for approval by the Township.

**12.10 PIPE CLEARANCE**

Minimum clearances between other types of underground services shall be provided in accordance with MECP guidelines.

**12.11 BEDDING AND BACKFILL**

All watermain and appurtenances are to be installed with bedding and backfill in accordance with OPSD to suit applicable pipe material and ground conditions accordingly. Compaction shall be to a minimum of 95% SPD or as indicated in the approved Geotechnical Report.

In soft or wet conditions, additional Geotechnical investigation may be necessary to determine the appropriate bedding and backfill measures.

**12.12 RESTRAINING**

All joints are to be mechanically restrained in fill areas, as per the manufacturer's recommendations.

Concrete thrust blocks are not permitted. Restrained joints shall be installed at all tees, bends, hydrants, end of mains and connections for all mains. Calculations will be required from the designer in accordance with Township standards and manufacturer's specifications to determine the number of joints to be restrained beyond the bend, fitting, tee etc.

**12.13 DEFLECTION OF WATERMAIN**

If it is necessary to deflect a watermain to avoid a conflict with other infrastructure, the designer will be required to provide detailed drawings and calculations for approval by the Township.

Joint deflection to enable bends in the watermain is not permitted. All pipe bends or deflections shall be accomplished using manufactured bends.

**12.14 SUPPORTING OF WATERMAIN**

Where crossing an existing watermain, if more than 0.9 m of the watermain will be exposed, the designer will be required to provide detailed drawings showing how the watermain will be supported during construction for approval by the Township.

**12.15 FIRE HYDRANTS**

Hydrants shall be installed in accordance with OPSD 1105.010, complete with thrust blocks and mechanical restrainers.

Hydrants shall be located as per the typical road cross-section and generally on projections of lot lines, at the end of all cul-de-sacs, and at dead ends. On rural cross-sections, hydrant access complete with culvert is to be provided.

On busy and wide roadways, hydrants may be required on both sides where it may be impractical to run hose lines across traffic.

The maximum spacing for hydrants shall be a 150 m for low density residential areas and 90 m for high density residential areas, industrial, commercial and institutional land uses or as required by the Township.

Hydrant flanges shall be set such that the final elevation is between 100 mm and 150 mm above finished grade.

In areas where the water table is known to be high, the Township may request that the drain holes of the hydrant be internally plugged.

All hydrants are to be fixed with hydrant markers.

Hydrants are to be flow tested, by an organization approved by the Township, to determine performance while maintaining a minimum residual system pressure of 138 kPa, in accordance with NFPA Standard 291. All hydrants shall be painted yellow with the top and nozzle caps to be provided with two (2) reflective hose connection markers based on the results of the flow testing as follows:

CLASS	CAPACITY	COLOUR
Class AA	> 5680 L/min	Light Blue
Class A	3785 L/min to 5675 L/min	Green
Class B	1900 L/min to 3780 L/min	Orange
Class C	< 1900 L/min	Red

Hydrant numbers will be stencilled on the top of all hydrants by the Township.

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

## 12.16 VALVES

The size of main line valves shall be equivalent to the size of the watermain.

Valves shall be located as required to meet spacing and intersection requirements described below, or as required by the Township.

Generally, four valves shall be placed at cross-intersections and three valves at tee intersections, such that sections can be isolated without jeopardizing flow to other sections.

Valves shall be spaced such that no more than 40 dwelling units are isolated at one time. In addition, the maximum permissible spacing between valves shall be 150 metres for distribution watermains and 400 metres for trunk supply watermains.

All valves 450 mm diameter or greater shall be installed in a waterproof, precast concrete valve chamber. Valves in chambers to have flanged ends and couplings to permit removal. Chambers shall be cored and a valve box shall be installed over the centre of the valve operating nut. All chambers are to have the tracer wire extend from the valve along the bottom of the chamber up the backside of the steps along the chamber wall and securely fastened to the top rung with fibreglass tape. The chamber size shall be designed adequately to accommodate access and working height should be a minimum 1.7 m from floor to ceiling of chamber. Working distance around outside surface of flanges to the inside wall shall be a minimum 500 mm. Clear access must be provided for entry of workers wearing Self Contained Breathing Apparatus (SCBA) and for removal of the equipment from the chamber.

Air release valves shall be provided at high points of all trunk watermains and, where possible, installed together with valves in valve chambers. Further, where possible, fire hydrants shall be located at all highpoints to minimize the requirements for air release valves.

Drain valves shall be provided at low points of all trunk watermains and, where possible, installed together with valves in valve chambers. All drain valves must have a positive outlet.

The use of pressure reducing valves must be approved by the Township and are to be installed in concrete valve chambers.

## **12.17 WATER SERVICES**

Single 25 mm diameter water services with a curb stop at the property line are to be installed to each residential property. Tracer wire must be installed with and along the pipe and brought to the surface at each service box.

Water services to commercial, industrial, institutional, and multiple-use shall be sized for the specific land use and approved by the Township.

If requested by the Township, a 25mm water service shall be provided to park areas with a non-freeze post hydrant.

Single services for a residential lot shall be located in accordance with Essa Standard Drawing ESD-1000.02. The location of a water service for commercial, institutional, or industrial use will be considered on an individual basis.

Water services shall be located at a minimum depth of cover of 1.7 metres.

Water sampling stations shall be provided where directed by the Township. In general, one sampling station is required for every 300 residential lots. Additional water sampling stations may be required at the Township's discretion.

Fire connections may be required for industrial, commercial or institutional developments.

#### **12.18 WATER METERS**

A water meter is required for each water service. The water meter will be sized by the Township using the peak instantaneous flow provided by the designer.

#### **12.19 TRACER WIRE**

Where non-metallic pipe (e.g., PVC, PE, concrete pressure pipe) is installed, continuous tracer wire with no joints must be installed with and along the pipe and brought to the surface at each valve box/chamber and hydrant (around port). Where the ends of rolls must be connected, tracer wire connections are to be achieved with a waterproof and corrosion proof connector designed for the purpose and in accordance with the Approved Products List in Appendix \_\_\_\_. Tracer wire is to be attached to the pipe and outside of each valve box by means of tape. See Township standard drawings for additional details.

A low frequency continuity test of the tracer wire is to be completed to ensure that the tracer wire has been installed without breaks.

Tracer wire is also being provided with each individual water service in accordance with the Water Services section.

#### **12.20 CATHODIC PROTECTION**

Sacrificial caps are to be provided on every bolt of all mechanical joints and restrainers. The bolt lengths shall be sufficient to accommodate the caps.

At their discretion, the Township may also require zinc anodes or other corrosion protection measures.

All new metallic watermain fittings, valves, joint restraints, etc. shall be epoxy coated or stainless steel.

All existing metallic fittings, valves and joint restraints must be wrapped end to end with an approved corrosion protection system that includes petrolatum primer (paste), petrolatum moulding mastic, and low temperature petrolatum tape.

#### **12.21 SWABBING**

All water servicing greater than 50mm diameter shall be swabbed. Swabs shall be supplied by the Contractor. A swabbing plan and schedule indicating the installation and removal location of the swabs is to be provided to the Township Engineer. Hand swabbing is permitted for small repair sections of watermain.

Swabbing must be completed in the presence of the Township Engineer. All swabs are to be accounted for. The developer/contractor will be responsible to locate any swabs not accounted for.

#### **12.22 TESTING AND DISINFECTION**

The following testing requirements apply to all new sections of watermain. Any sections which fail to meet the requirements shall be repaired or replaced at the direction of the Township.

A temporary bypass connection is to be installed to permit testing of the system.

##### **12.22.1 Hydrostatic Testing**

The contractor/ developer shall supply all materials, labour and equipment necessary to complete a hydrostatic leakage test.

All hydrostatic leakage testing procedures are to be witnessed by the Township Engineer.

Pressure and leakage test shall be performed on the completed distribution system. The distribution system shall be tested in accordance with AWWA specification C600-93 or the latest revision thereof. Test sections are not to exceed 500m in length unless approved by the Township Engineer.

##### **12.22.2 Disinfection**

The contractor/ developer shall not operate any main valves, blow-offs, by passes during the period of chlorination. All testing procedures must be completed in the presence of the Township Engineer.

All chlorinating procedures are to be completed in accordance with the Watermain Disinfection Procedure - August 1, 2020 from the Ministry of the Environment, Conservation and Parks and AWWA standard C651-14 or the latest revisions thereof, as applicable. A minimum initial chlorine concentration of 50 mg/l shall be provided to the system and checked by the Township Engineer.

Following a minimum 24 hours, the system is to be tested for residual chlorine prior to flushing. Prior to flushing the system, the discharged chlorinated water must be dechlorinated utilizing a neutralizing chemical. Flushing of the watermain is not to proceed until all safety precautions have been completed to the satisfaction of the Township Engineer.

### **12.22.3 Bacteriological Testing**

Sampling of the water system is to be completed by the Township Engineers and the Township's operating authority. 25mm tails at locations acceptable to the Township Engineer, are to be installed by the developer/contractor for the purpose of sampling. The new water system shall be deemed acceptable for consumption following two (2) consecutive acceptable potability test results in accordance with AWWA C651-14. For a test result to be deemed acceptable, the bacterial analysis of the sampled water must indicate a Total Coliform count of 0 CPU's per 100ml, an E.Coli count of 0 CPU's per 100ml and Background count of 0 CPU's per 100ml.

Should the results of the Bacterial Analysis of Water be deemed unacceptable, additional swabbing, chlorinating and flushing and sampling will be required.

Following the confirmation of acceptable sampling results, valves are to be checked for operation by the Township's operating authority and service connecting curb stops shall be checked for operation by the developer's engineer.

### **12.22.4 Continuity Testing**

A continuity test of the tracer wire shall be completed utilizing low frequency testing methodology with point-to-point readings recorded and approved by the Township.

### **12.22.5 Final Connection**

The final connection shall not be made until all of the above testing has been satisfactorily completed and the Township has provided written notification to proceed.

The length of pipe required to connect the new water system to the existing distribution system shall not exceed 5.5 metres and shall be disinfected prior to installation in accordance with AWWA C651.

The completion of the final connection to the existing water system may only proceed upon written direction from the Township Engineer.

## **12.23 MATERIALS**

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

# 13 Grading and Drainage

## 13.1 GENERAL GRADING

For residential lots, it is preferable to have one consistent slope of between 2% - 5% for the entire rear yard area; however, where this is not possible, lots are to be provided with a rear yard amenity area in which a slope of between 2 - 5% is provided for a minimum of 5 m or 75% of the average rear yard length, whichever is greater. Slopes from the end of the rear yard amenity area to the rear lot line shall not exceed 3:1. All exceptions must receive written approval from the Township.

All other areas shall have a minimum slope of 2% and a maximum slope of 3:1, to a maximum vertical difference of 1.0 m. Where the vertical difference is greater than 1.0 m, a retaining wall system shall be implemented.

Any lot with a 10% average grade may require a split-level dwelling and cross sections may be required.

## 13.2 SWALES

All standard yard drainage swales are to be designed with a minimum slope of 2%, a maximum slope of 5%, and a maximum side slope of 3:1.

An exception to the minimum slope criteria may be where enhanced drainage swales have been designed in accordance with a storm water management plan for the subdivision which has received prior approval from the Township.

All standard yard drainage swales shall have a minimum depth of 0.15 m. The maximum depth for side yard and rear yard swales shall be 0.3 m and 0.4 m respectively.

The maximum contributing area to a side yard swale shall be 500 m<sup>2</sup>. For rear yard swales, the maximum contributing area shall be 1000 m<sup>2</sup> and the maximum length shall be 60 m. The flows from the contributing areas should be calculated and the capacity of the swale confirmed to ensure adequate conveyance.

## 13.3 REAR YARD CATCHBASINS

The use of rear yard catchbasins (RYCB's) are highly discouraged and the designer should design the overall subdivision grading in order to avoid their use. Designs using RYCB's require special approval from the Township and will only be considered where there is no feasible alternative. If RYCB's are proven to be necessary, overland grading shall be designed such that all structures,

dwelling and ancillary, are protected from flooding if the inlet is blocked or surcharged by a major storm event.

Where a RYCB lead extends between houses, the RYCB shall be placed equally between adjacent lots, straddling the shared lot line, and within a minimum 6.0 m wide easement which extends from the rear lot line to the fronting street property line. The 6.0 m wide easement shall be conveyed to the Township. The catchbasin lateral shall be placed such that the center is 0.5 metres off of the common lot line. The catchbasin shall be placed such that the center is 1.5 m offset from the rear lot line unless rear yard sloping requires a greater offset. The maximum contributing area to the inlet shall be 2,500m<sup>2</sup>.

Storm sewers located in side-yard easements shall be offset from property line as required to avoid damage to storm pipe during the installation of lot line fencing. Storm sewers shall be designed and installed to achieve minimum 1.2 m cover and to ensure adjacent house footings will have no influence loading upon the storm sewer. The designer may be requested to demonstrate the influence of footing loading with appropriate cross-sections.

Where the RYCB lead extends across the rear yard of a corner lot, the RYCB shall be placed on a minimum 6.0 m wide easement with the catchbasin placed such that the center is 1.5 m offset from the rear lot line. The maximum contributing area to the inlet shall be 2,500 m<sup>2</sup>.

All RYCB leads are to be concrete and a minimum of 300 mm in diameter.

#### **13.4 DRIVEWAYS**

The minimum slope on any driveway shall be 2%. For residential lots, this minimum shall be measured from the garage sill to the property line, as well as on the driveway apron, being the area within the municipal road allowance. The preferred maximum slope for any driveway is 5%, however an absolute maximum of 7% may be permitted where necessary.

# 14 Streetscape / Parkland Trees

## 14.1 TREE PRESERVATION

This section provides policies, general standards and guidelines for the protection of existing trees during construction and for the planting of new trees. The section outlines tree inventory, preservation and protection requirements to ensure existing vegetation is retained where possible, and measures to ensure damage to existing vegetation is minimized.

### 14.1.1 Tree Inventory Requirements

For the entire property to be developed, the Proponent shall submit a tree inventory drawing for all trees on the subject property as well as for any trees on adjacent property whose critical root zones extend onto the property to be developed.

Where there is more than one tree to be removed, the trees must be numbered. These numbers must correspond to an arborist report and the Tree Protection plan as outlined below.

A report prepared by an arborist or landscape architect which details specific and accurate information about trees that may be impacted by the development initiative and identifies the nature of the work to be undertaken and appropriate protection measures. Information on the report may include location, species, size, condition, structural integrity, disease, infestations and vigour. This report helps Township Staff to determine the legitimacy of tree removal requests by summarizing the actions necessary, and results in the efficient processing of inspection requests and applications. Arborists undertaking reports must be certified with the International Society of Arboriculture (I.S.A.).

As required to control the proliferation of the Emerald Ash Borer, ash trees will not be permitted as nursery tree plantings.

A Tree Protection Plan shall be submitted, designating trees to be preserved and trees to be removed on the subject and adjacent property. Replacement trees for those removed should also be indicated and clearly summarized in a tabular chart directly on the Plan.

### 14.1.2 Tree Protection Measures and Techniques

Tree protection fencing shall be erected at the critical root zone or beyond, prior to commencement of any clearing, grading or other construction activity.

Tree protection shall not be removed until completion of all construction activity.

The minimum required distances for determining a Tree Protection Zone (TPZ) is as per the following Table. Some trees depending on health, the uniqueness of the species, soil type and competition from other trees may require larger TPZ at the discretion of the Township.

**Table 7: Tree Protection Distances**

TRUNK DIAMETER (DBH)* (CM)	MINIMUM PROTECTION DISTANCES REQUIRED (M)**
<10	1.8
11-40	2.4
41-50	3.0
51-60	3.6
61-70	4.2
71-80	4.8
81-90	5.4
91-100	6.0

\* Diameter at breast height (DBH) measurement of tree trunk taken at 1.4 metres above the ground.

\*\* Tree Protection Zone distances are to be measured from the outside edge of the tree base.

### 14.1.3 Tree Protection Barriers

Tree protection barriers, erected for trees and tree groupings situated on the Township road allowance, parkland, and open spaces must be maintained. Tree protection barriers are to be constructed of steel T-bar posts (50 mm x 100 mm x 1.8 m) spaced 3 m, and spray painted with fluorescent orange paint. Livestock fencing and filter fabric is to be attached to the posts.

All supports and bracing used to secure the barrier should be located outside the Tree Protection Zone (TPZ) to minimize damage to roots.

Where protection barrier is on slopes greater than 4%, provide a ditch on the elevated side of the fence, lined with filter fabric and backfill to prevent erosion.

## 14.2 LANDSCAPE REQUIREMENTS

This section provides guidelines, policies of procedure and practice that are to be adopted by the proponent. Specific guidelines are included for plant materials, including nursery grown trees, topsoil, shrubs, groundcovers, sod and seed mixtures.

### 14.2.1 Species and Size of Plant Materials

Suitable trees, varieties, and cultivars to be planted in Essa are to be approved by the Township.

Caliper size shall be determined in accordance with the Canadian Standards for Nursery Stock and measured at 150 mm above grade for trees 40 - 100 mm caliper and at 300 mm above grade for trees larger than 100 mm caliper.

The minimum size for trees and shrubs shall be as follows:

Deciduous trees	50mm caliper
Coniferous trees	1.5m height (min.)
Deciduous shrubs	60cm in height
Evergreen shrubs (non-columnar)	60cm in spread
Columnar evergreen shrubs	100-120cm in height

### 14.2.2 Diversity

The Township does not support the planting of monocultures (the predominance of one tree species). This section supports our commitment to maintain tree health and bio-diversity, and recognizes the importance of a proactive integrated pest management approach to street tree planting.

As such, individual species should not occur in like rows in excess of 3 trees. The Township encourages a randomized approach to sequencing of tree species. This allows flexibility in terms of soil types and adjacent urban design.

### 14.2.3 Topsoil & Seed Requirements

#### 14.2.3.1 Topsoil

The stockpiled topsoil shall be spread over the sub-grade to a minimum depth of 200mm. It shall be free of stones and roots over 25mm in diameter and other extraneous matter. All topsoil may be subjected to a physical and chemical analysis by a qualified laboratory to determine its suitability for the intended purpose.

Where the developer is required to supply additional topsoil to meet minimum requirements, it shall be fertile, friable natural light organic loam and shall be approved by the Township before placement.

The developer must supply all necessary fertilizers to eliminate any chemical deficiencies as indicated by a soil analysis conducted by the developer.

Such an analysis shall be completed by a recognized laboratory specializing in soil analysis and all associated cost shall be at the expense of the developer.

#### **14.2.3.2 Native Topsoil**

Use native topsoil, stripped and stockpiled, provided it meets specified requirements.

If native topsoil is inadequate in quantity, quality or both, use imported topsoil meeting specified requirements for balance of topsoil required.

#### **14.2.3.3 Topsoil Stockpiles**

Control and eliminate perennial grass and noxious weeds including their root systems until stockpile topsoil is required for landscape use. Stockpile topsoil shall be reasonably free of all weed growth before placement on site.

Perform weed control, when necessary, in accordance with relevant government chemical pesticide application legislation.

Screen stockpiled topsoil, as necessary. Use a screener having a wire mesh screen size opening of minimum 25mm and maximum 50mm to remove stones, soil lumps, foreign material, debris, undesirable plants and roots.

Topsoil Stockpiles are not to be located in open space or park areas.

#### **14.2.3.4 Preparation of Subgrade**

Loosen subgrade by scarifying or tilling using discs, harrows or other suitable equipment to a depth 75-100mm immediately before placing any topsoil. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted topsoil.

#### **14.2.3.5 Preparation of Final Grade**

Rake, chain drag and lightly roll top soiled areas, remove all ridges and fill all depressions. On larger areas, use hydraulic power box rake or similar mechanical equipment to: remove soil lumps, rocks and debris; fill and level low areas; and correct other grades deficiencies in preparation of seed or sod bed.

### **14.2.4 Plant Material Considerations**

#### **14.2.4.1 Stock**

High quality nursery stock is a prerequisite to ensuring the survival of trees. As such, all trees shall conform to the Canadian Standards for Nursery Stock and be of standards quality, true to name and type, and a first-class representative of their species or variety.

Balled and burlap wrapped 50-mm caliper stock is the Township of Essa's minimum requirement standard.

Whips (bare-root stocks measuring 1-1.5m in height) may be planted in low-profile, rural areas, and stormwater management facilities and seedlings or whips may be used for naturalization or restoration areas.

#### **14.2.4.2 Form Vigour of Trees**

All trees shall be true to type, structurally sound with no evidence of dead branches, sun scald, frost cracks, abraded or broken bark, and be free of insect or disease infestation.

All trees shall have a full, well-developed crown with one distinctive vertical leader, and a root system typical of the species. All parts shall be moist and show active green cambium when cut.

All trees must meet these specifications at the time of planting and final inspection by the Township's designate. Trees that are rejected will be replaced at the Proponent's expense.

#### **14.2.4.3 Planting Holes, Drainage and Root Pruning - Balled and Burlapped ("B&B") Trees**

Planting in linear trenches (min. 1.2 width) along street boulevards is strongly encouraged.

Where planting in trenches is not feasible, the planting hole must be at 400cm greater than the diameter of the rootball; the depth of the hole will be the same as the depth of the ball.

#### **14.2.4.4 Backfilling**

Backfill is to be placed in layers approximately 15cm in depth, and firmly tamped in place in such a manner that the tree retains its vertical position without support. Particular care is to be taken to ensure that no air pockets remain under or around roots and that damage does not occur to the root system. The fill shall be thoroughly watered immediately after planting.

At grade, a ridge of soil located at the edge of planting hole shall be formed to a height of 10cm, to act as a catch basin for any subsequent watering and to retain mulch.

B&B trees shall have the burlap cut and rolled back from the ball and buried under least 10cm of soil. All wire, rope, burlap and twine from around the top 1/3 of the root ball shall be cut and removed.

All excess fill removed from the planting holes, which does not meet planting specifications, shall be removed by the Proponent, along with all branches, roots from pruning, leftover wire and plastic shields from staking. Any damage done to this surrounding site shall be repaired by the Proponent at their own cost.

#### **14.2.4.5 Bed Preparation**

Within 48 hours of planting, a circular (or other such suitable shape as may fit the site) area around the root ball shall be cultivated to improve future root growth.

The area shall extend to a minimum of 1m from the trunk of the tree in all directions; all sod shall be removed from the area, and the soil shall be broken up and cultivated to a depth of at least 15cm within the 1m radius.

#### **14.2.4.6 Pruning**

The crown of the tree shall be pruned from the bottom up at the time of planting to remove all dead and damaged branches. Branches with included bark should be pruned from the tree.

The terminal or leader is not to be pruned unless broken. All cuts shall be collar cut as per ISA standards.

On all cuts over 2cm in diameter and bruises or scars on the bark, the injured cambium shall be cut back to living tissue and removed. Wounds shall be smoothed and shaped so as not to retain water. Large wounds produced by any means other than branch pruning may render the tree unacceptable, requiring replacement.

#### **14.2.4.7 Staking**

Where staking is required, B&B trees shall be supported by two (2) steel t-bars (50 mm x 100 mm x 2.4m in length) driven outside the ball in line with the direction of the prevailing wind. The stake must be driven at least 90cm below grade line, leaving at least 5cm between the top of the stakes and the first branch. Stake replacement shall be such that no main roots are severed by the stake being driven into the ground.

Within storm water facilities, staking is not required. However, should any trees move in either direction 10% or more from the vertical plane, the Proponent is responsible for straightening and staking the trees within one week of notification from the Township.

The Proponent will be responsible for the removal of stakes prior to final inspection.

#### **14.2.4.8 Tree Ties**

Ties shall be made from burlap ranging in width from 25 - 50 mm, which must completely encircle the trunk. Plastic hoses and rubber ties are not accepted.

For B&B trees where the two stakes are driven into the ground outside the root ball, the tie tension must be such that the tree is firmly, but not too tightly, supported and remaining in a vertical position.

On final inspection of the guarantee (after spring flush), the Proponent will be responsible for the removal of the ties.

#### **14.2.4.9 Mulching**

Within 48 hours of planting, a mulch comprised of wood chips or shredded bark, shall be spread over the entire planting pit and the bed preparation to a surface diameter of 2m.

All shrub planting beds are to be mulched to the same depth of 75mm after settlement.

Mulching is to be topped up prior to final inspection.

#### **14.2.4.10 Minimum Root Ball Diameter**

The minimum acceptable root ball diameter for B&B trees shall be:

- 55cm for 40mm caliper trees
- 65cm for 50mm caliper trees
- 85cm for 75mm caliper trees
- 100cm for 100mm caliper trees
- 165cm for 150mm caliper trees

#### **14.2.4.11 Watering**

The Proponent shall apply water at low pressure underground. The amount of water per tree shall be 40 litres or until excess water runs off. Watering should be applied directly after planting. The initial application of water should be included in the planting price.

After the initial application of water, the watering and maintenance plan should be followed to ensure the health of the tree.

#### **14.2.4.12 Rodent Guards**

In some locations, such as naturalized areas where grass is permitted to grow quite long, rodent guards may be required to protect the trees from girdling by rodents.

Rodent guards shall consist of plastic spiral wrap wound around the base of trunk, up to a height of 60cm. These guards must be installed after planting and inspection and then removed after two (2) years of growth.

### **14.2.5 Acceptance and Warranty**

All plant materials shall be maintained by the Proponent, from the time of planting until acceptance by the Township.

A maintenance regime shall consist of proper cultivation, weeding, watering and pruning to establish and maintain plant material in a healthy growing condition.

The Proponent shall arrange a time to have the plant material accepted following the guarantee period. At the time of inspection, all beds and tree pits shall be freshly cultivated, weeded and in a tidy condition, with all rubbish, leaves and dead plant debris removed.

### **14.3 DESIGN CONSIDERATIONS**

In this section the requirements relative to acceptable tree species and related landscaping components with respect to specific applications are provided.

#### **14.3.1 Acceptable Trees**

Proposed tree species are to be provided to the Township for approval.

In selecting trees for specific applications, consider the following factors are to be considered:

- i. Assess conflicts with power lines, sidewalks and underground utilities.
- ii. Select of large trees where space is available to maximize planting effect.
- iii. Encourage diversity of species to reduce susceptibility to disease.
- iv. Utilize native species as much as possible.
- v. Consider long-term maintenance pruning requirements of trees.
- vi. Select species with respect to soil microclimate requirements.
- vii. Select species with respect to salt tolerance and specific moisture requirements.

#### **14.3.2 Mixture and Proportion of Species**

The planting of monocultures (dependence on one plant species) within the streetscape is detrimental to the maintenance of tree health and increases a tree's overall susceptibility to pests and diseases.

Accordingly, the Township of Essa encourages biodiversity in the streetscape by the following measures:

- i. The random sequencing of tree species is encouraged within a planting scheme.
- ii. The planting of any one individual species is limited to eight (3) consecutive trees in any given planting scheme.
- iii. To ensure diversity, the amount of one tree genus shall not exceed more than 20% of all plantings, and the amount of one tree species shall not exceed more than 10% of all plantings.

### **14.3.3 Tree Siting and Setback Requirements**

A minimum of one (1) tree, planted in the boulevard, is required per residential lot unless determined otherwise. The minimum spacing of trees along the lot flankage on a side street shall be 12m. When planting near utilities, the location and species of the plant material must be coordinated with mechanical and electrical site plans to ensure the non-obstruction of storm and sanitary sewers, water service, hydro, telephone, gas lines and other services. All utilities must be demarcated by the Proponent prior to any excavation.

In order to reduce conflicts with utilities, driveways, curbs, sidewalks and other trees, the following setbacks shall be incorporated:

- i. Large crown trees are to be planted at intervals ranging from 15 to 18 metres apart. Small crown trees are to be planted between 6 to 8 metres apart.
- ii. In single family detached residential developments as well as multi-unit developments, a minimum of one (1) shade tree per lot is required.
- iii. The minimum spacing for trees along a lot flankage on a side street is to be 12m.

### **14.3.4 Park and Playground Requirements**

#### **14.3.4.1 Minimum Park Requirements for Residential Developments**

Components of Parkland, and other Open Space considerations are as follows:

- i. The Township may require services to parkland parcels, as follows: 25mm water service, 125 mm sanitary sewer service, 250mm storm sewer service and a hydro service as minimum requirements.
- ii. Park grading: minimum slopes of 1.5 - 2% graded to a manner to maintain proper drainage.
- iii. Park fencing: 1.5 m high chain link fence.
- iv. Park turf: The minimum requirement for park turf may be established utilizing a seed mix conforming to the landscape architect's specifications. Once established, the turf must have a consistent sod like appearance.
- v. Development construction: undeveloped, disturbed blocks shall be graded, seeded, and maintained by the Proponent until construction commences thereon.

#### **14.3.4.2 Development Adjacent to Park Property**

Where development abuts a Park or Open Space, runoff from the development property shall not drain into the Park or Open Space. A rear lot catch basin may be required.

#### 14.3.4.3 Park and Open Space Features

Required park and open space features include:

- i. Chain link fence (1.5m) to Township standards where Park property is adjacent to private lots. No gates into parks, open spaces, or stormwater management facilities are permitted from private property. Park frontage on streets is not fenced.
- ii. Park walkways that are to be maintained in the winter must be 3m width, asphalt surfaced. Otherwise, park walkway material is stone dust.
- iii. Playgrounds must conform to the latest Canadian Standards Association (CSA) standards for play spaces and equipment.
- iv. At least one (1) light standard must be provided at playgrounds for security.
- v. Playgrounds and walkways must conform to AODA standards in addition to CSA standards.
- vi. A park sign indicating the name of the park is to be provided by and installed by the developer at a location approved by the Township. Specifications for the park signs are to be submitted, reviewed and approved by the Township.

#### 14.3.4.4 Parking Supply Standards

Parking lots may be required for Neighbourhood Parks at the discretion of the Township.

Parking space requirements for Community or Township parks will be determined on a case-by-case basis.

#### 14.3.4.5 Park Development Standards

All Parks and Open Space developed in the Township of Essa shall comply with the following standards:

Can/CSA Standard Z614 - Children's Playspaces and Equipment (latest edition).

Accessibility for Ontarians with Disabilities Act (AODA), including all associated Regulations. Refer to US Guide to ADA Guidelines for Accessible Play Areas for clarification and requirements of "accessible" play features.

## **Appendix A: Revision Information**

## **Appendix B: Approved Products List**

**Appendix C:  
Traffic Impact Assessment  
Guidelines**



## **TRAFFIC IMPACT ASSESSMENT GUIDELINES DOCUMENT**

**June 2022**

### **Introduction**

The intent of these guidelines is to provide a clear and consistent approach to be applied by Township staff and followed by developers with respect to traffic impact assessment requirements within the context of the site plan application process.

It is typical that a traffic impact study be required when:

- the proposed development will generate 100 or more vehicle trips during the peak hour (peak hour of the road or peak hour of the development); or
- the proposed development will generate less than 100 vehicle trips during the peak hour, however, the site or study area characteristics are such that traffic or other transportation issues or concerns may have to be addressed to accommodate the development.

As stated by ITE<sup>1</sup>: This site trip generation threshold is appropriate for the following reasons:

- an additional 100 vehicles per hour can change the level of service or appreciably increase the volume-to-capacity ratio of an intersection approach; and
- left or right-turn lanes may be needed to satisfactorily accommodate site traffic without adversely impacting through (non-site) traffic.

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<sup>1</sup> *Transportation Impact Analyses for Site Development, An ITE Proposed Recommended Practice*. ITE, 2005.

## Traffic Impact Assessment Guidelines

For smaller scale developments (i.e. less than 100 trips during the peak hours) where little or no impact to the external road system is anticipated, a traffic study of reduced scope is typically accepted.

### **Terminology**

There are several names given to studies that assess the potential traffic impacts of future development (i.e. traffic impact assessment, traffic impact study, traffic review, traffic brief, traffic statement, etc.). For the purpose of clarity, the following terminology has been considered in developing the traffic impact assessment guidelines for the Township:

<b>Traffic Impact Assessment</b>	Refers to the generic requirement that an assessment be completed to address the potential traffic impacts of a proposed development on the adjacent road network. The traffic impact assessment will be in the form of a <i>Traffic Impact Brief</i> or <i>Traffic Impact Study</i> , whichever is deemed appropriate based on the thresholds contained herein and in consultation with Township staff. The Traffic Impact Assessment Guidelines, as recommended in this review, are intended to provide guidance to the Township and developer with respect to establishing the appropriate scope of traffic impact assessment required (i.e. Traffic Impact Brief or Traffic Impact Study).
<b>Traffic Impact Brief</b>	This is a reduced scope traffic impact assessment, usually required for small scale developments where little or no impact to the adjacent road network is anticipated.
<b>Traffic Impact Study</b>	This is a comprehensive traffic impact assessment, usually required for medium and large scale development where greater impacts to the adjacent road network are anticipated.

The thresholds and content requirements for a Traffic Impact Brief and Traffic Impact Study are detailed in the Traffic Impact Assessment Guidelines provided herein.

### **MTO and/or Municipal Requirements**

Should a development have frontage and/or access to a Provincial highway or County road, or be considered a major traffic generator in close proximity to a Provincial highway, consultation with the Ministry of Transportation of Ontario and/or the County is recommended to confirm their requirements with respect to a Traffic Impact Assessment. While the Township's Traffic Impact Assessment Guidelines are generally consistent with the requirements of MTO, the applicant must confirm the requirement of all relevant road authorities. Regardless, it is expected that developments impacting Township's roads will submit a Traffic Impact Assessment that satisfies the requirements noted herein.

# Traffic Impact Assessment Guidelines

## **Purpose of a Traffic Impact Assessment**

The purpose of a Traffic Impact Assessment, regardless of scope, is to examine and document the potential impact of traffic generated by a new use, and to identify any mitigating measures/improvements that may be required to accommodate the additional traffic volumes. Depending on the required scope, the assessment may be limited to the proposed access, or expanded to include impacts at nearby intersections, interchanges and adjacent road sections. The type of Traffic Impact Assessment required, be it a Traffic Impact Brief or Traffic Impact Study, and content to be included shall be determined based on the thresholds noted below and in consultation with Township staff.

## **Traffic Impact Assessment Thresholds**

The following thresholds are to be considered by applicants as a general rule. Prior to undertaking a Traffic Impact Assessment, the applicant must confirm the appropriate level of assessment through consultation with Township staff.

**Traffic Impact Brief** For developments expected to generate less than 100 vehicle trips during the peak hours (total of inbound and outbound trips), a Traffic Impact Brief may be considered, *provided that* the site or study area characteristics are not such that would otherwise indicate that traffic or other transportation issues/concerns are likely to arise given the proposed development.

**Traffic Impact Study** For developments expected to generate 100 or more vehicle trips during the peak hours (total of inbound and outbound trips), a Traffic Impact Study is required for review and approval by the Township.

A Traffic Impact Study may also be required for a development that will generate less than 100 vehicle trips during the peak hour, if the site or study area characteristics are such that traffic or other transportation issues or concerns may have to be addressed to accommodate the development.

## **Traffic Impact Brief - Scope of Work**

A Traffic Impact Brief has a reduced scope in context of the anticipated trip generation of the development, and hence reduced potential for impacts that may result. A Traffic Impact Brief should address the following:

1. Study Area: Inventory the existing road system to which the development fronts and/or in the immediate area of the development. This should include the number of lanes, speed limits, urban/rural cross-sections, sidewalk locations, pedestrian crossings, etc. The study area is to be confirmed with the Township prior to commencing the assessment.

## **Traffic Impact Assessment Guidelines**

2. Proposed Development: Detail the proposed land use and phasing/completion year. Provide an overall plan illustrating the proposed access locations, the internal road network, building locations, parking, etc. as applicable.
3. Site Traffic: Based on the land uses, determine trip estimates for the most appropriate peak hours. Typically, these will be the weekday AM and PM peak hours of the adjacent road, although for commercial, entertainment, religious, institutional or sport facility uses, a weekend peak may be more appropriate. For uses that are expected to experience seasonal variations, the peak seasonal conditions should be considered. The trip estimates should be based on published trip rates, data from other representative sites, or based on sound engineering (“First Principles”).
4. Site Access Assessment: The site access should be reviewed in consideration of the volume and type of vehicles to be generated by the site, and the proposed access location and configuration. The site access assessment should consider the Township’s standards as outlined in Township of Essa Engineering Design Standards and Specifications Manual.
5. Sight Line Assessment: At each access point, the sight distance requirements should be determined based on the Township’s guidelines (as detailed in By-Law No. 2015-11 regulating entrances to Township roads), and the availability of appropriate sight lines determined from actual field measurements or engineering plans.
6. Site Plan Review: On-site circulation should be reviewed in context of the volume and type of vehicles to be served (including emergency vehicles, garbage collection or other appropriate design vehicles) and the ability of the site to accommodate site traffic without impact to the adjacent road system. Circulation of pedestrians and cyclists should also be considered as well the potential impact the development may have on existing pedestrian/cycling facilities. Queuing assessments may be required for land uses that induce on-site queues (i.e. restaurants with drive thru facilities, gas stations, drive-thru bank machines, car washes, etc.) The intent of a queueing assessment is to ensure that on-site queues can be accommodated wholly within the site without causing disruption to the operations of the adjacent road system (i.e. queue lengths that block access points or spill back onto the adjacent road).
7. Documentation: A report should be prepared to detail the findings related to the above. Relevant maps, graphs, tables and figures should be provided. The Traffic Impact Brief should be able to provide a conclusive statement that the proposed development will not adversely affect the operations or the safety of the adjacent road system (or conversely, identify any improvements that may be required to accommodate the development), and that the development plan (including the access, parking area and internal circulatory system) is adequate to suit the site traffic.

## **Traffic Impact Assessment Guidelines**

### **Traffic Impact Study - Scope of Work**

A Traffic Impact Study should address the following:

1. **Study Area:** The study area should extend far enough, within reason, to contain all municipal and provincial roads that will be noticeably affected by the traffic volumes to be generated by the proposed development. The study area is to be confirmed with the Township prior to commencing the assessment. The Township reserves the right to establish the study area as may be deemed necessary.

A description of the existing transportation system in the study area, using a combination of maps and other documentation, should identify relevant information, such as:

- existing roads, number of lanes, on-street bike lanes, posted speed limits, sidewalk locations, pedestrian crossings;
  - the lane configurations and control of the key intersections/roundabouts to be considered in the study;
  - the provision of on-street parking in the vicinity of the development site and the potential for this to impact key intersections being analyzed;
  - other traffic controls and transportation facilities; and
  - other features of interest such as designated trails, walkways, etc.
2. **Horizon Years & Periods of Analysis:** The horizon years should coincide to the anticipated full build-out of the site, in addition to 5 and 10 years beyond full build-out. Interim horizon years must also be considered as necessary for the staged implementation of the identified road system improvements.

Typically, the weekday AM and PM peak hours of the adjacent street will constitute the peak hours to be addressed. However, in the case of commercial, entertainment, religious, institutional or sport facility use, the weekend peak hours may be more appropriate. During the initial consultation process with the Township, the Consultant should determine the selected peak periods for analysis and identify an appropriate method for considering peak seasonal conditions.

3. **Existing Traffic Volumes:** Figures illustrating the existing traffic volumes and turning movements for the study area roads and intersections are required. Traffic volumes may be acquired from the Township, County, MTO, from other transportation studies in the area, or through new traffic counts. To ensure representation of existing conditions, traffic count data should be no more than 3 years old. Ideally, traffic counts will be conducted so as to capture peak seasonal conditions; however, where such data capture is not feasible due to timing constraints, a reasonable adjustment to account for peak seasonal variations should be established and verified by the Township and applied to the existing traffic volumes.

## Traffic Impact Assessment Guidelines

4. Future Road Network & Background Volumes: Future transportation improvements to the study area road network that are currently being considered should be identified. These improvements should be described to a level of detail sufficient to assess their implications for travel to/from the development site. In each case, identify the status and anticipated date of implementation for consideration in the Future Background and Future Total traffic conditions.

Future traffic volumes should be prepared for each horizon year, with consideration for annual growth rates to reflect general growth in traffic in addition to the growth specific to new development.

General growth can be estimated based on historic growth in area traffic volumes, and/or future projections of area population and employment. Consideration can also be given to other area transportation studies.

All significant developments under construction, approved or in the approval process and that are likely to contribute additional traffic volumes to the study area within the study horizon period, should be identified. The trips that are expected to be generated by these developments should be included in the future background volumes (trips can be established from a corresponding Traffic Impact Study or based on the land uses and published trip generation rates).

5. Proposed Development: The Traffic Impact Study should provide a full description of the proposed development, including the following as applicable:
  - municipal address;
  - existing and proposed land uses;
  - total development area and summary by use (e.g. type and number of residential units, commercial gross floor area, etc.);
  - anticipated tenants;
  - planned phasing and build-out period.

A site plan, concept plan, or similar, is to be included in the Traffic Impact Study document. If the proposed development is to be constructed in phases, describe each phase and the proposed implementation timing for each.

6. Site Traffic - Trip Generation: Trip generation estimates are to be based on the proposed land uses, size of development and trip generation data from:
  - the *ITE Trip Generation Manual* (most recent edition);
  - trip generation surveys conducted at similar developments/proxy sites; or
  - “First Principles” calculations of anticipated trips to/from the site.

## **Traffic Impact Assessment Guidelines**

Where appropriate, it may be justified to reduce the base trip generation estimates to account for pass-by trips and/or internal/shared trips (in the case of a multi-use development). The resulting estimates are referred to as “new” vehicle trips. All trip generation assumptions employed in the calculation of the “new” vehicle trips should be supported and well documented.

Sensitivity analysis should be undertaken where trip generation parameters have the potential to vary considerably and most probable values cannot be readily identified (i.e. the exact tenant or use of commercial space is not known). A trip generation table should be provided in the report to summarize the land uses and sizes, with the corresponding trip generation rates and the resulting number of trips. For large developments that will be phased in over time, the table should identify each significant phase separately.

7. **Site Traffic - Trip Distribution & Assignment:** Trip distribution assumptions should be supported by an adequate assessment of surrounding development, proximity to major trip generators, likely origin/destinations and existing/anticipated travel patterns. Sound engineering judgement should be utilized when establishing trip distribution.

Trip assignments should consider logical routings, available and projected road capacities, and travel times. Trip assignments may be estimated using a transportation demand model or “hand assignment” based on knowledge of the proposed/future road network in the study area. The trip assignment should also take into consideration varying assignments for pass-by trips, link-diverted trips and internal trips.

8. **Future Total Traffic Volumes:** Future total traffic volumes are to be presented, representing the culmination of the future background traffic volumes and the site generated traffic volumes for each horizon year.
9. **Traffic Impacts:** An evaluation of the key signalized and unsignalized intersections within the study area for all relevant peak periods for the existing and future planning horizons (both with and without the subject development traffic) is required and summaries are to be provided in a tabular format (e.g. level of service, volume to capacity ratio and delay). The intersection capacity/operational analysis should be completed using Synchro/Sim Traffic Simulation Software or the like. The objective should be to ensure that no new problem movements are created by the proposed development and that existing problem movements are not worsened to an unacceptable level with the addition of site generated traffic. Where intersections are closely located, queueing assessments should be included with respect to appropriate storage, queue encroachment, back to back left turns, etc.

Should operational issues result, means of mitigation and the operations with consideration for such, are to be presented (e.g. introduction of traffic signals, additional through lanes, turn lanes, etc.) Appropriate warrants for improvements and associated operational review worksheets should be appended to the report.

## **Traffic Impact Assessment Guidelines**

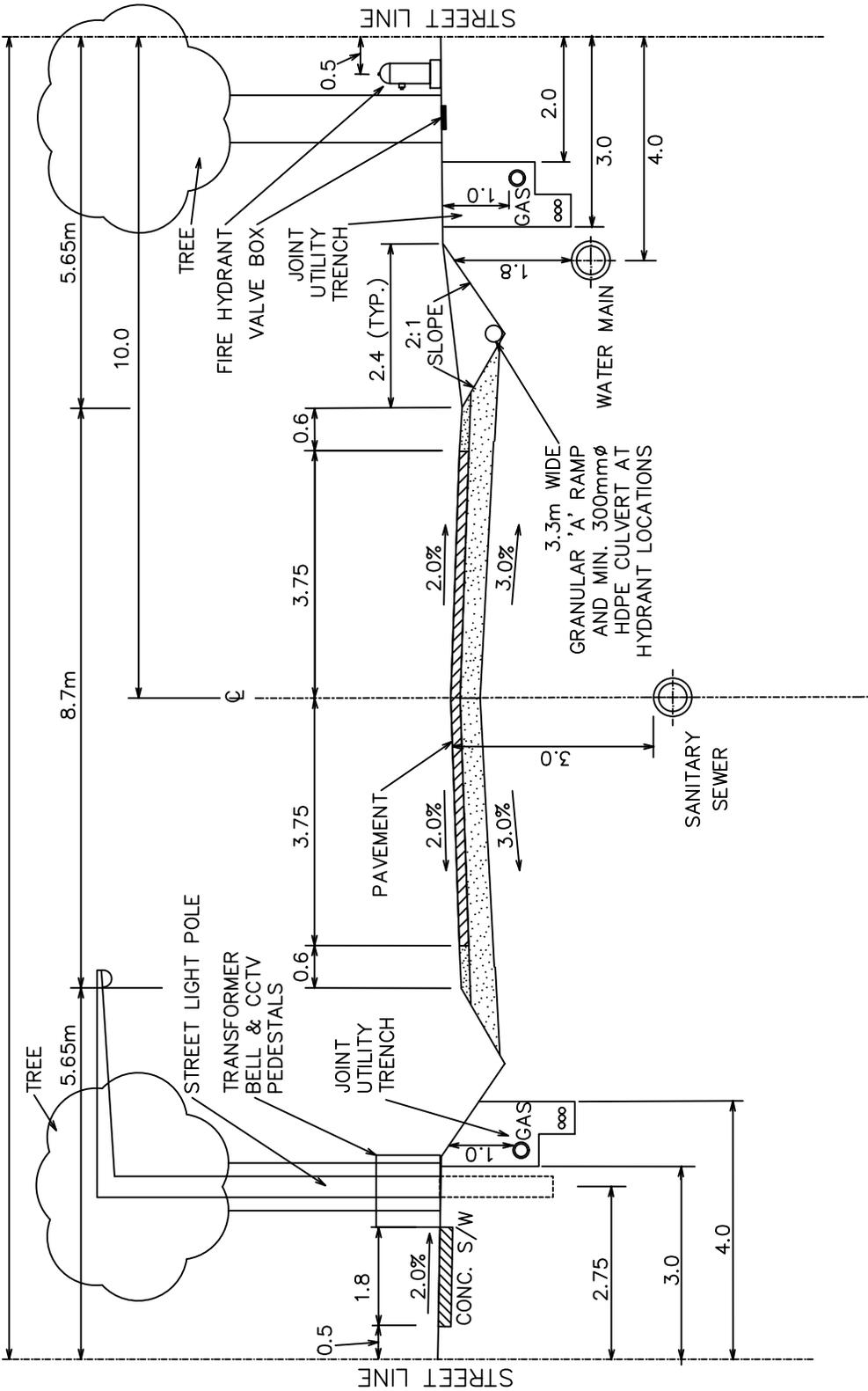
10. **Site Access Assessment:** The site access should be reviewed in consideration of the volume and type of vehicles to be generated by the site, and the proposed access location and configuration. The site access assessment should consider the Township's standards as outlined in *Township of Essa Engineering Design Standards and Specifications Manual*. Access points should be evaluated in terms of capacity, safety and adequacy of queue storage capacity.

Should operational issues result at the site access, means of mitigation and the operations with consideration for such, are to be presented (e.g. introduction of traffic signals, additional through lanes, turn lanes, etc.). Appropriate warrants for improvements and associated operational review worksheets should be appended to the report.

11. **Sight Line Assessment:** At each access point, the sight distance requirements should be determined based on the Township's guidelines (as detailed in *By-Law No. 2015-11* regulating entrances to Township roads), and the availability of appropriate sight lines determined from actual field measurements or engineering plans.
12. **Site Plan Review:** On-site circulation should be reviewed in context of the volume and type of vehicles to be served (including emergency vehicles, garbage collection or other appropriate design vehicles) and the ability of the site to accommodate site traffic without impact to the adjacent road system. Circulation of pedestrians and cyclists should also be considered as well the potential impact the development may have on existing pedestrian/cycling facilities. Queuing assessments may be required for land uses that induce on-site queues (i.e. restaurants with drive thru facilities, gas stations, drive-thru bank machines, car washes, etc.) The intent of a queueing assessment is to ensure that on-site queues can be accommodated wholly within the site without causing disruption to the operations of the adjacent road system (i.e. queue lengths that block access points or spill back onto the adjacent road).
13. **Documentation:** The structure and format of the Traffic Impact Study should follow the guidelines outlined in this document as applicable. This format will facilitate review, discussion and communication. Relevant maps, graphs, tables and figures should be provided.

## **Appendix D: Standard Drawings**

20.0m - R.O.W.



NOTES:

1. GAS, WATER MAIN, & FIRE HYDRANT TO BE LOCATED ON OPPOSITE SIDE OF ROADWAY TO SIDEWALK, TRANSFORMERS AND STREET LIGHTS WHERE POSSIBLE.
2. TOWNSHIP TO CONFIRM REQUIREMENTS FOR SIDEWALK.
3. ALL DIMENSIONS ARE IN METRES.



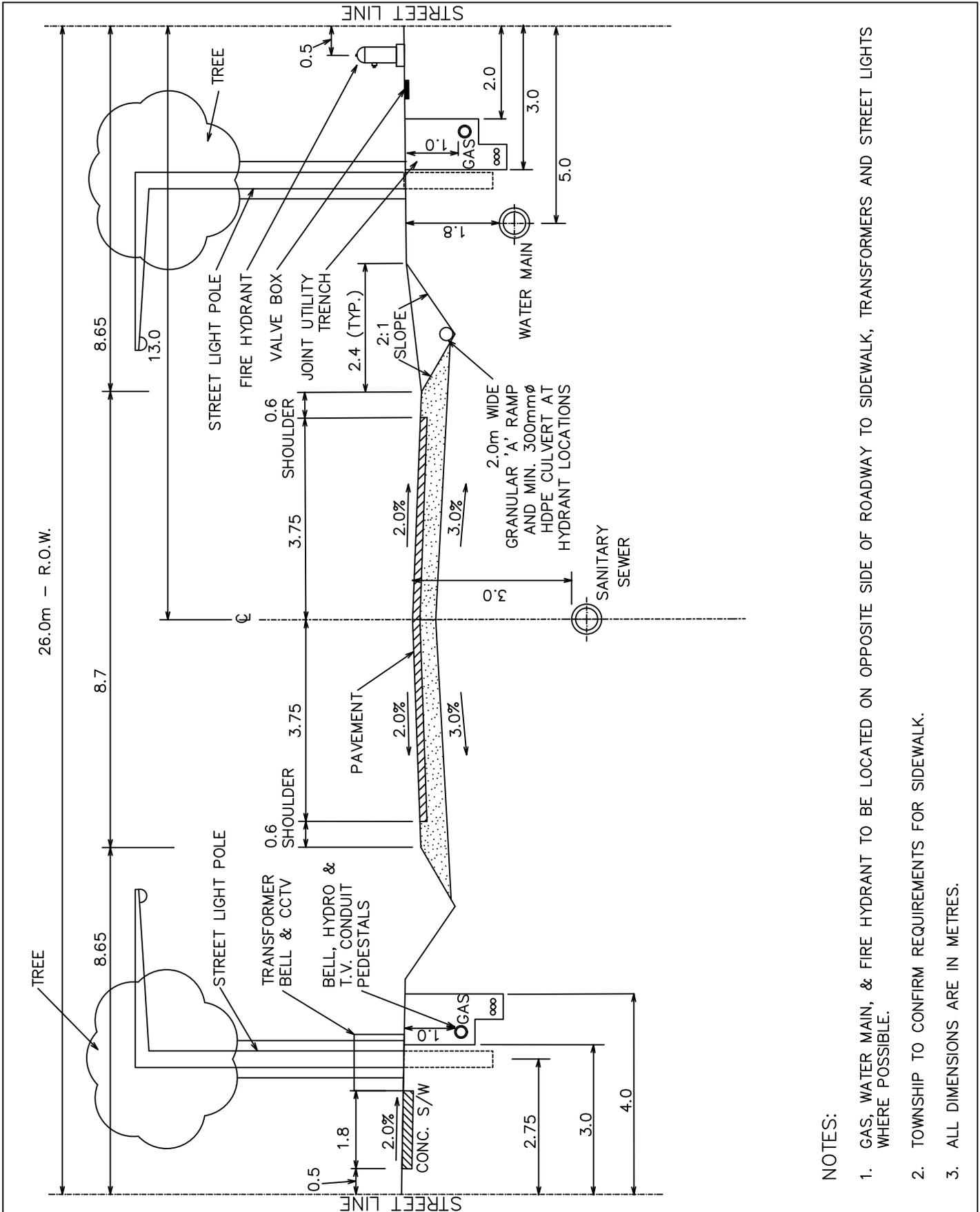
ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**SEMI-URBAN LOCAL ROAD  
7.5m PAVEMENT  
20.0m - R.O.W.**

NOT TO SCALE

DATE: JUNE 2022

**ESD-100.01**



NOTES:

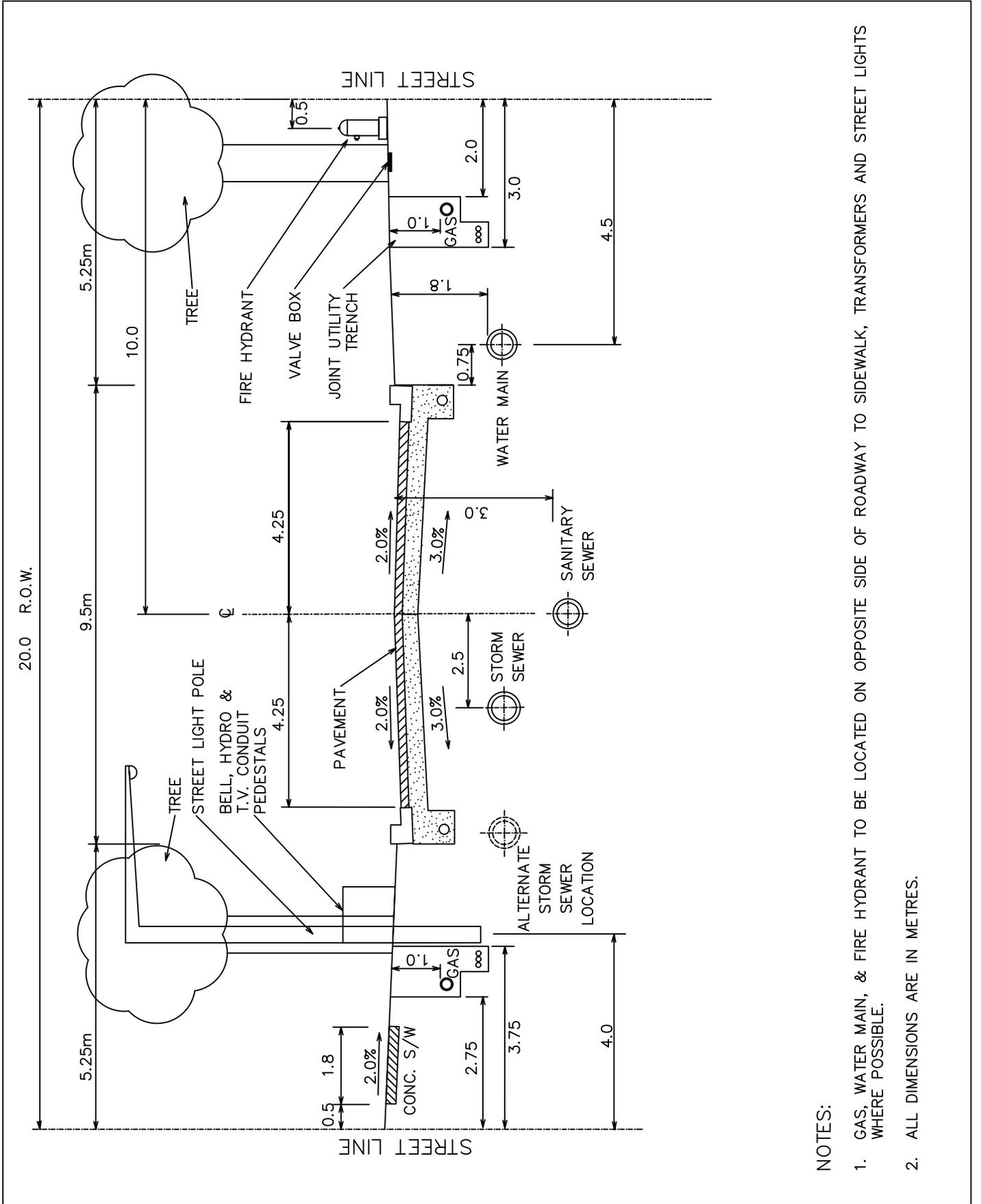
1. GAS, WATER MAIN, & FIRE HYDRANT TO BE LOCATED ON OPPOSITE SIDE OF ROADWAY TO SIDEWALK, TRANSFORMERS AND STREET LIGHTS WHERE POSSIBLE.
2. TOWNSHIP TO CONFIRM REQUIREMENTS FOR SIDEWALK.
3. ALL DIMENSIONS ARE IN METRES.



ENGINEERING AND PUBLIC WORKS DEPARTMENT

**SEMI-URBAN / INDUSTRIAL ROAD**  
**8.0m PAVEMENT**  
**26.0m - R.O.W.**

NOT TO SCALE	
DATE:	JUNE 2022
<b>ESD-100.02</b>	



NOTES:

1. GAS, WATER MAIN, & FIRE HYDRANT TO BE LOCATED ON OPPOSITE SIDE OF ROADWAY TO SIDEWALK, TRANSFORMERS AND STREET LIGHTS WHERE POSSIBLE.
2. ALL DIMENSIONS ARE IN METRES.



ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

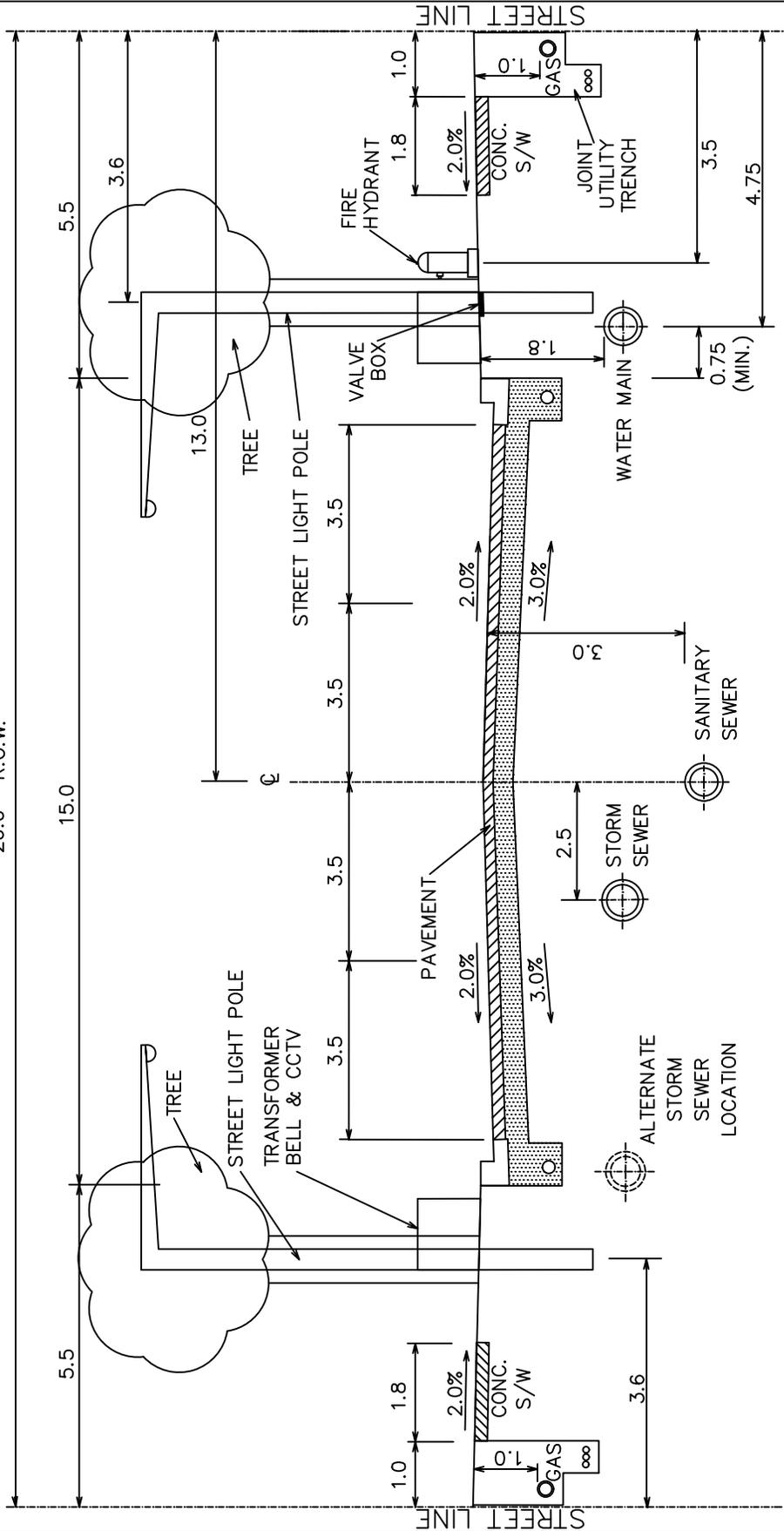
**URBAN LOCAL ROAD  
8.5m PAVEMENT  
20.0m - R.O.W.**

NOT TO SCALE

DATE: JUNE 2022

**ESD-101.01**

26.0 R.O.W.



NOTES:

1. GAS, WATER MAIN, & FIRE HYDRANT TO BE LOCATED ON OPPOSITE SIDE OF ROADWAY TO SIDEWALK, TRANSFORMERS AND STREET LIGHTS WHERE POSSIBLE.
2. ALL DIMENSIONS ARE IN METRES.

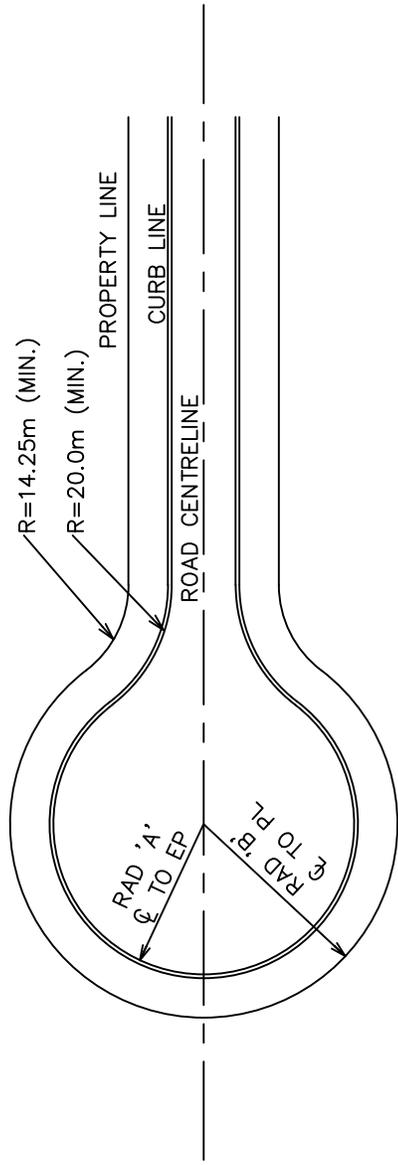


ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**URBAN COLLECTOR ROAD**  
**14.0m PAVEMENT**  
**26.0m - R.O.W.**

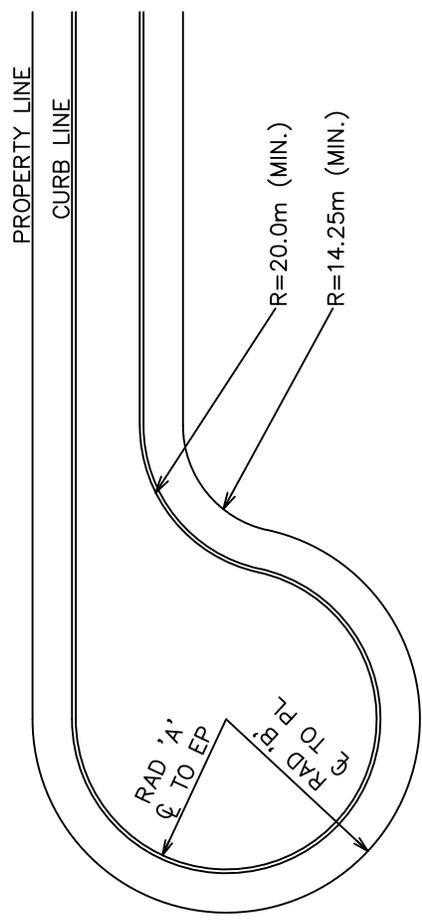
NOT TO SCALE  
DATE: JUNE 2022

**ESD-101.02**



TYPE 'A'

		MINIMUM RADIUS	
		A	B
RESIDENTIAL		20.0m	25.75m
INDUSTRIAL		20.0m	25.75m



TYPE 'B'

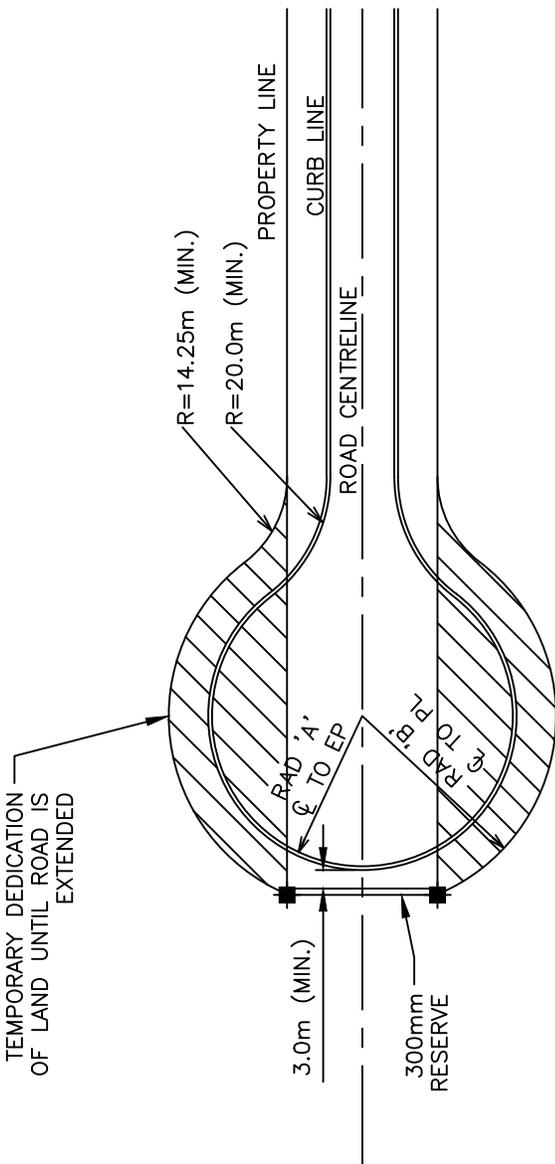


ENGINEERING AND PUBLIC WORKS DEPARTMENT

PERMANENT CUL-DE-SAC

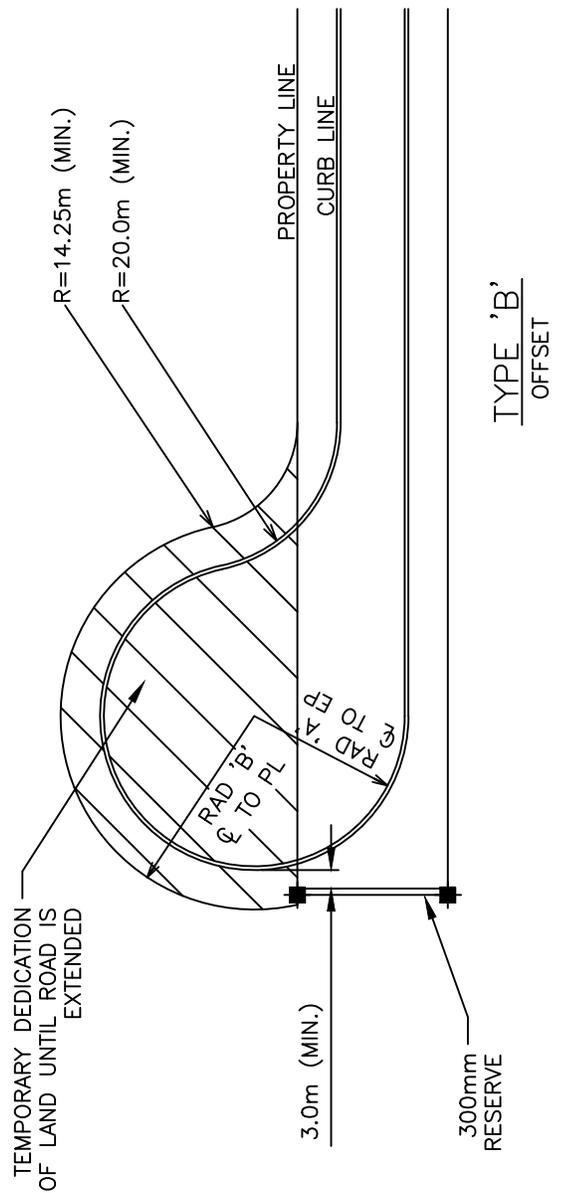
NOT TO SCALE  
DATE: JUNE 2022

ESD-103.01



TYPE 'A'

MINIMUM RADIUS		
A	B	
RESIDENTIAL	20.0m	25.75m
INDUSTRIAL	20.0m	25.75m



TYPE 'B'  
OFFSET

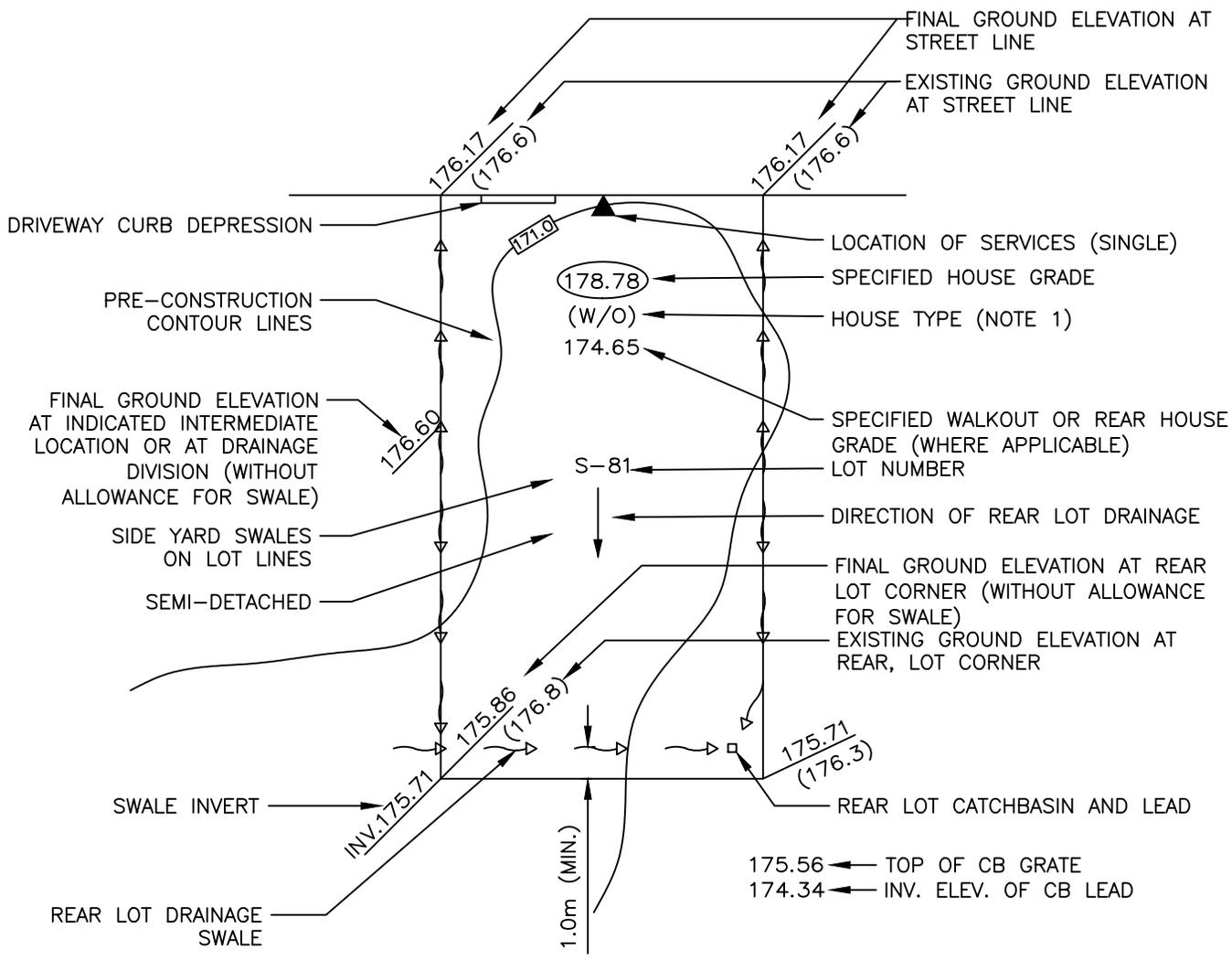


ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

## TEMPORARY CUL-DE-SAC

NOT TO SCALE  
DATE: JUNE 2022

ESD-103.02



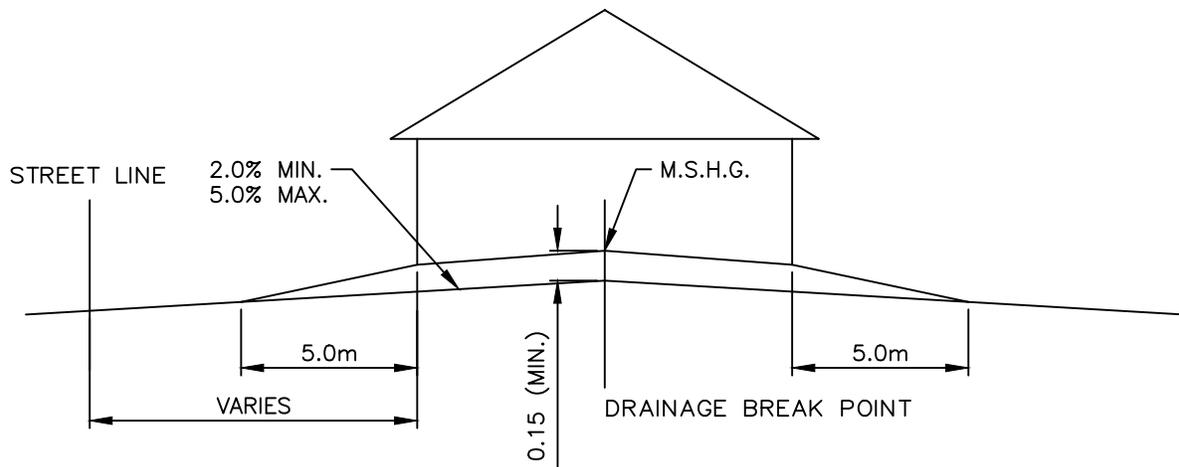
NOTE 1) WHERE HOUSE SYTLE IS RESTRICTED TO MEET THE LOT GRADING REQUIREMENTS, THE ACCEPTED HOUSE STYLES AREA TO BE INDICATED:  
(W.O.) = REAR WALKOUT BASEMENT TYPE  
(F.W.O.) = FRONT WALKOUT BASEMENT TYPE  
(B.S.) = BACK SPLIT  
(F.S.) = FRONT SPLIT  
(S.S.) = SIDE SPLIT



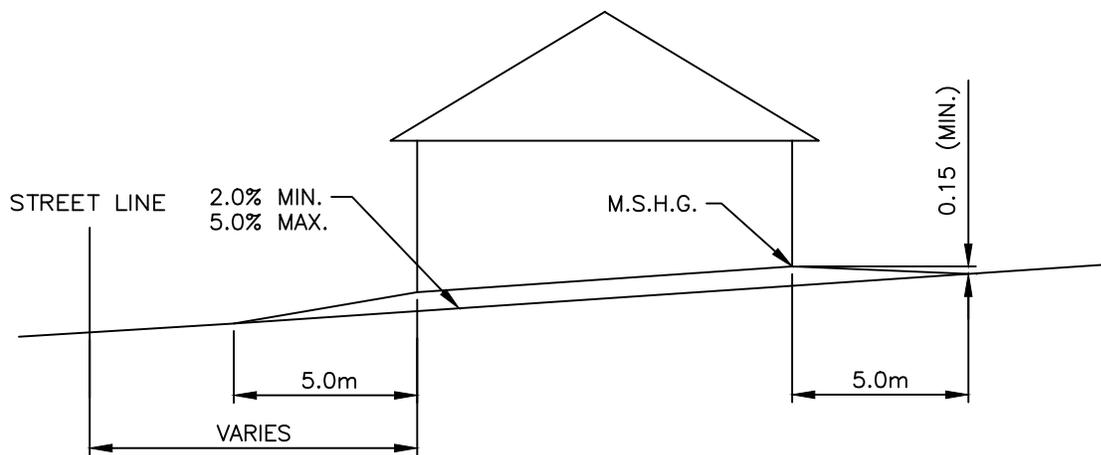
ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**MINIMUM REQUIREMENTS  
FOR  
LOT GRADING PLAN**

NOT TO SCALE  
DATE: JUNE 2022  
**ESD-200.01**



TYPICAL SECTION – SPLIT LOT DRAINAGE



TYPICAL SECTION – BACK TO FRONT LOT DRAINAGE

NOTE 1) THE MINIMUM SPECIFIED HOUSE GRADES (M.S.H.G.) ARE TO BE DETERMINED BY:

- a) SPLIT DRAINING LOT  
THE HIGHEST SPLIT POINT ELEVATION FOR EACH INDIVIDUAL LOT PLUS 0.15m APRON.
- b) FRONT DRAINING LOT  
FROM THE HIGHEST FRONT LOT CORNER OF EACH INDIVIDUAL LOT DETERMINE THE ELEVATION AT 5.0m PAST THE REAR OF THE HOUSE AND ADD 0.15m APRON (0.75m MIN.)

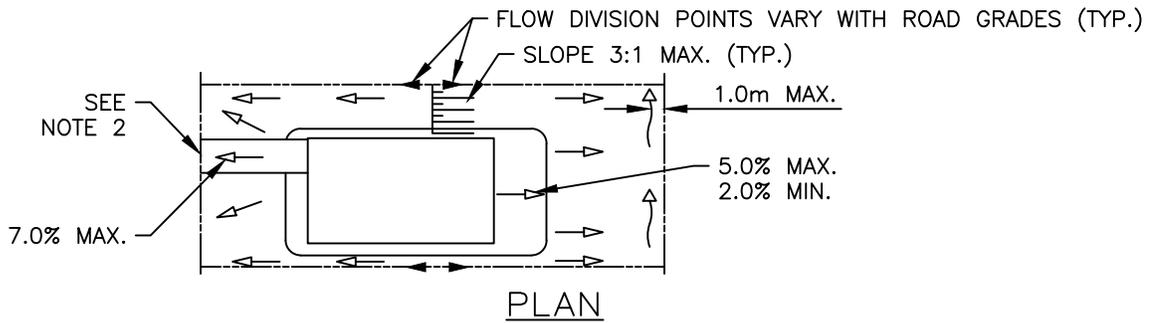
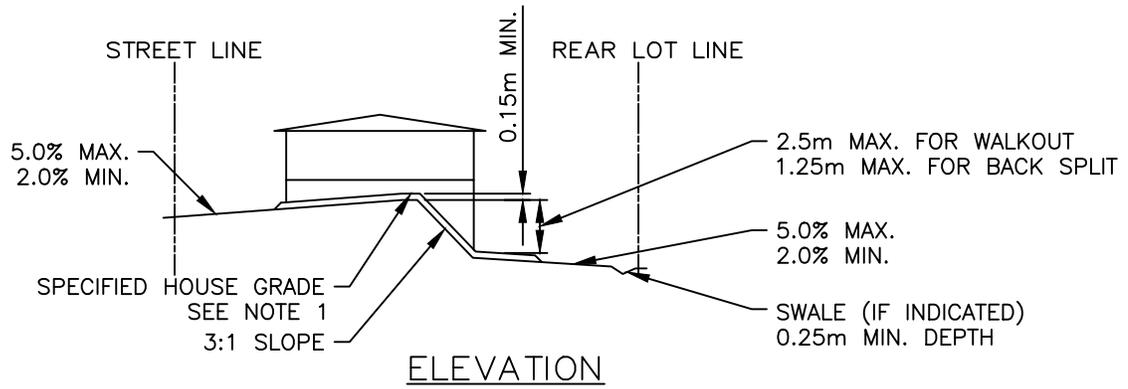


ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

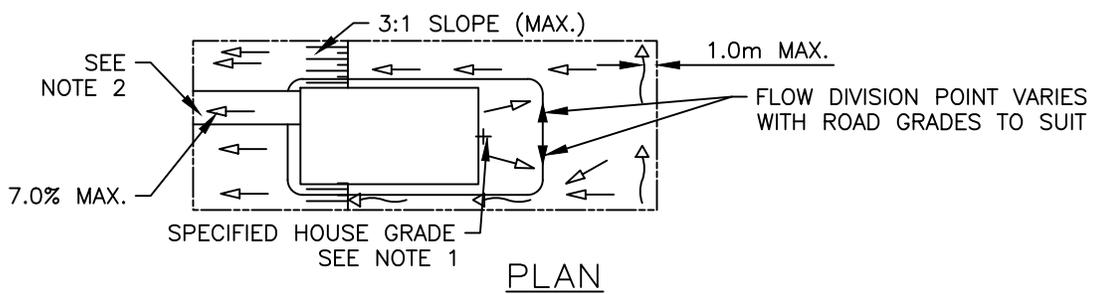
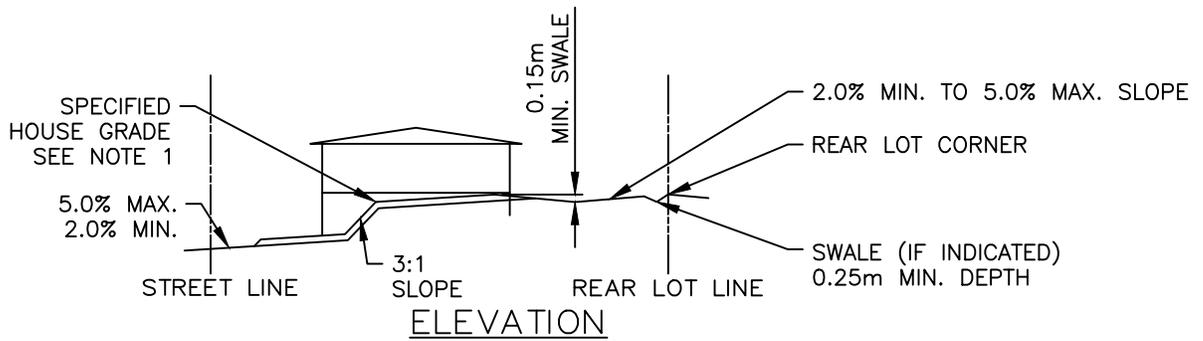
**TYPICAL GRADING SECTIONS**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-201.01**



**TYPICAL SPLIT LOT DRAINAGE WALKOUT (W.O.)  
OR BACK SPLIT (B.S.) TYPE**



**TYPICAL SPLIT LOT DRAINAGE FRONT SPLIT (F.S.) TYPE**

- NOTE 1) SPECIFIED HOUSE GRADE REFERS TO GROUND ELEVATION OPPOSITE FLOW DIVISION POINTS. MIN. 0.15m FROM HIGHEST SPLIT POINT ELEVATION.
- NOTE 2) DRIVEWAY LOCATION CAN VARY WITH HOUSE TYPE AND ROAD GRADE.
- NOTE 3) SIDES SWALE TO BE LOCATED AT THE PROPERTY LINE.

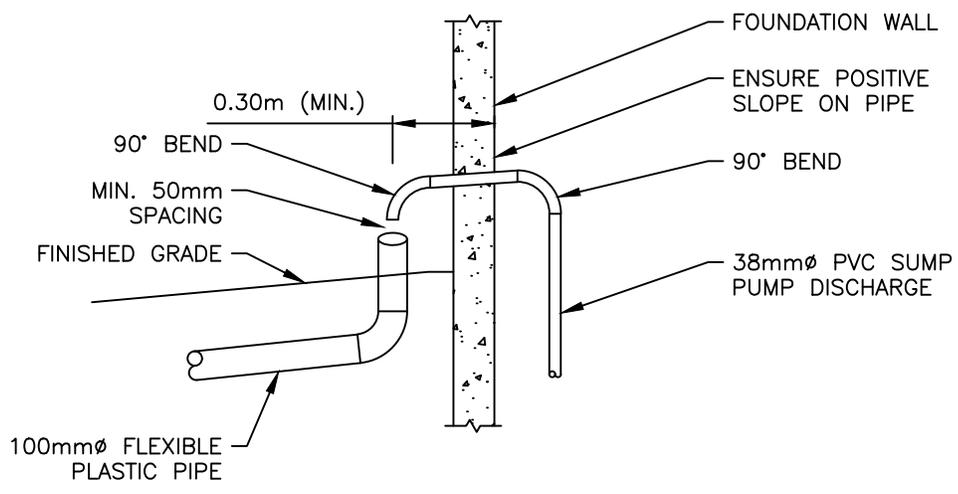
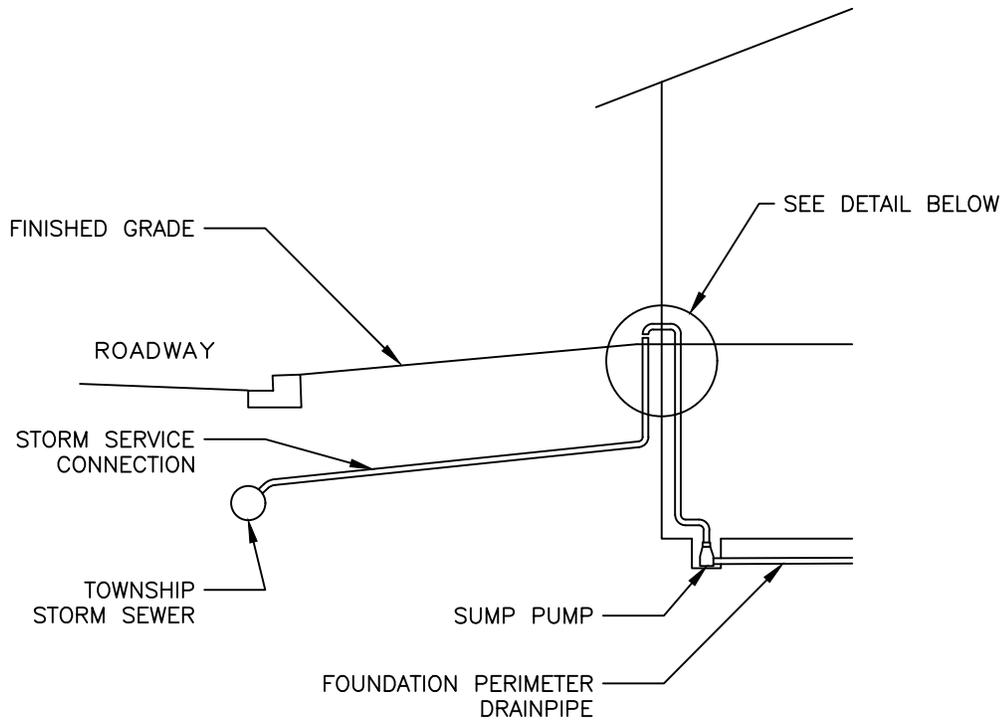


ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**LOT DRAINAGE  
AND  
GRADING**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-201.02**



NOTES

1. OPENING OF DRAINAGE PIPE SHALL BE PROTECTED BY A SCREEN OR FUNNEL TO PREVENT ENTRY OF FOREIGN MATERIAL.

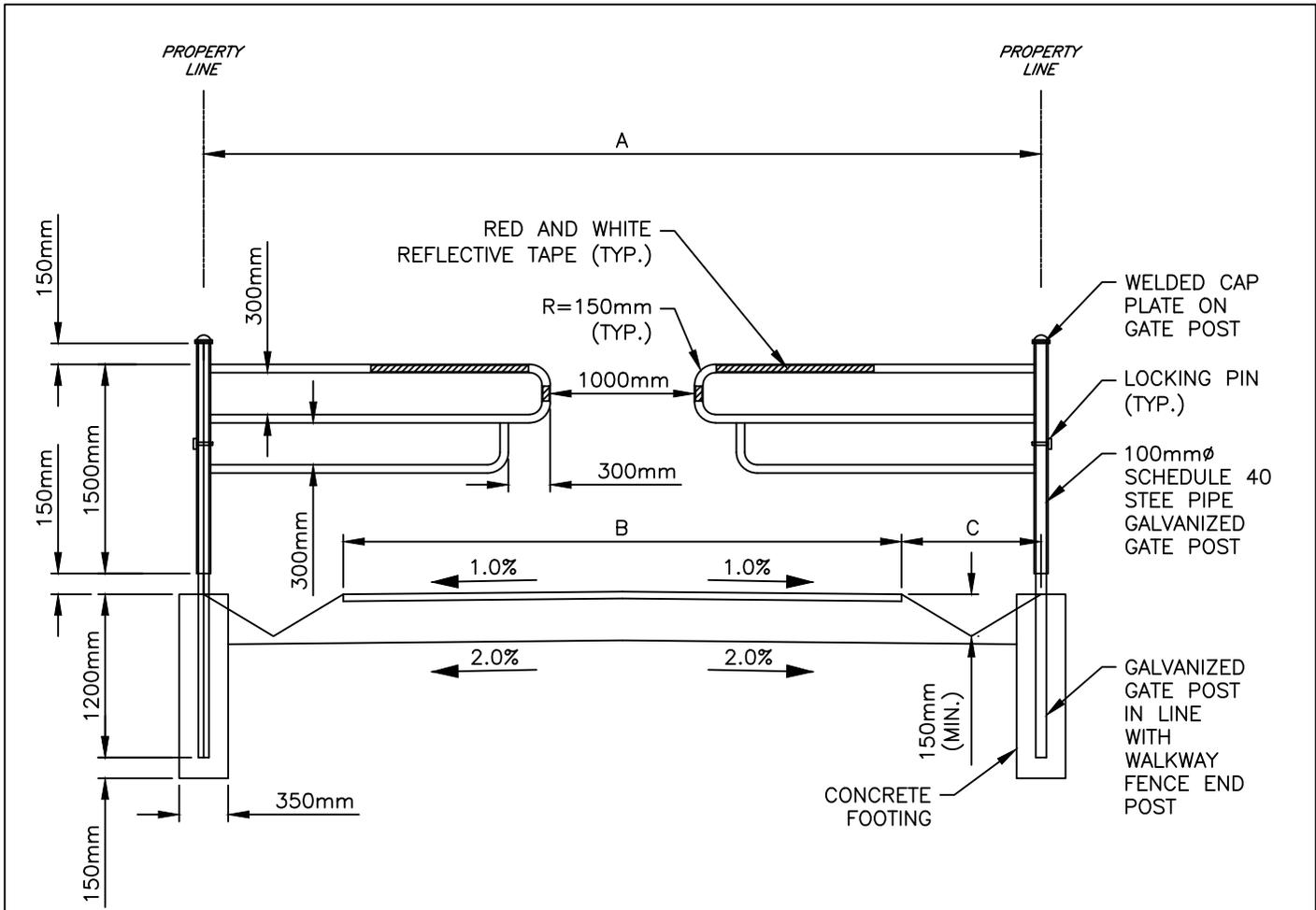


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DEPARTMENT

**HOUSE SUMP PUMP  
CONNECTION**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-202.01**



USE	TOTAL WIDTH "A"	TOTAL WIDTH "B"	LANDSCAPE STRIP / SWALE "C"	SURFACE TREATMENT & BASE
PEDESTRIAN ACCESS	5.0m	3.0m	1.0m	50mm HL-4 OR 32 MPa CLASS C-2 CONCRETE 150mm GRANULAR 'A'
MAINTENANCE ACCESS / SERVICE CORRIDOR	6.0m	4.0m	1.0m	50mm HL-4 300mm GRANULAR 'A'

**NOTES**

1. INSTALL GATES WHEN REQUIRED BY TOWNSHIP.
2. GATES AND POSTS TO BE PREMANUFACTURED AND HOT DIPPED GALVANIZED. GATES SHALL ALSO BE PAINTED SAFETY YELLOW FOLLOWING GALVANIZING AND PROPER SURFACE TREATMENT TO ENSURE ADHESION OF PAINT TO GALVANIZING.
3. INSTALL REMOVABLE BOLLARDS IN LIEU OF GATES WHEN DIRECTED BY TOWNSHIP.
4. 1.5m HIGH CHAIN LINK FENCE TO BE INSTALLED ALONG WALKWAY PROPERTY LINES WHEN DIRECTED BY TOWNSHIP.

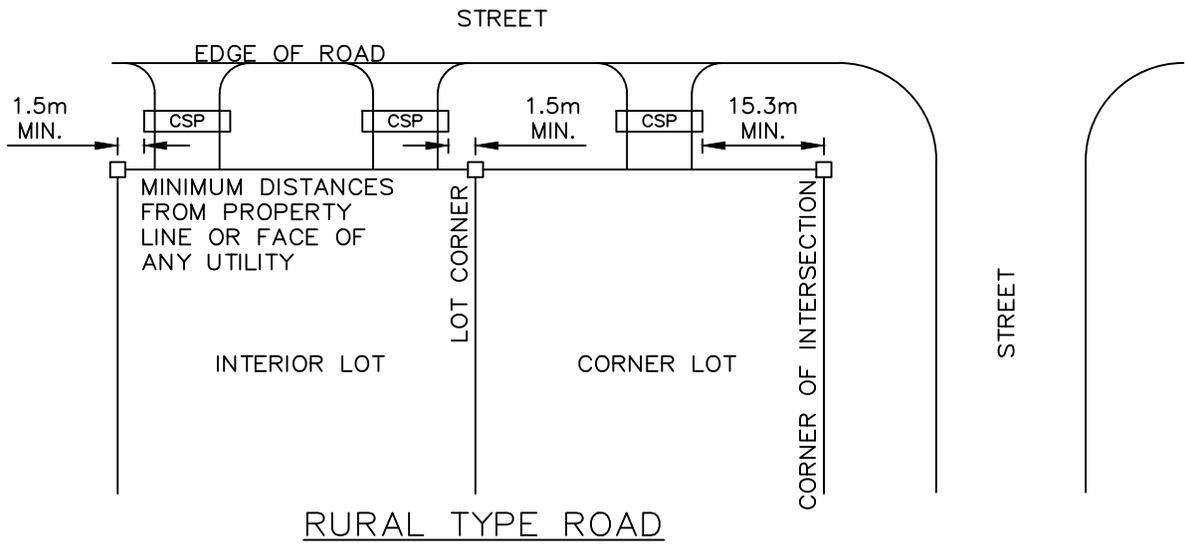


ENGINEERING AND PUBLIC WORKS DEPARTMENT

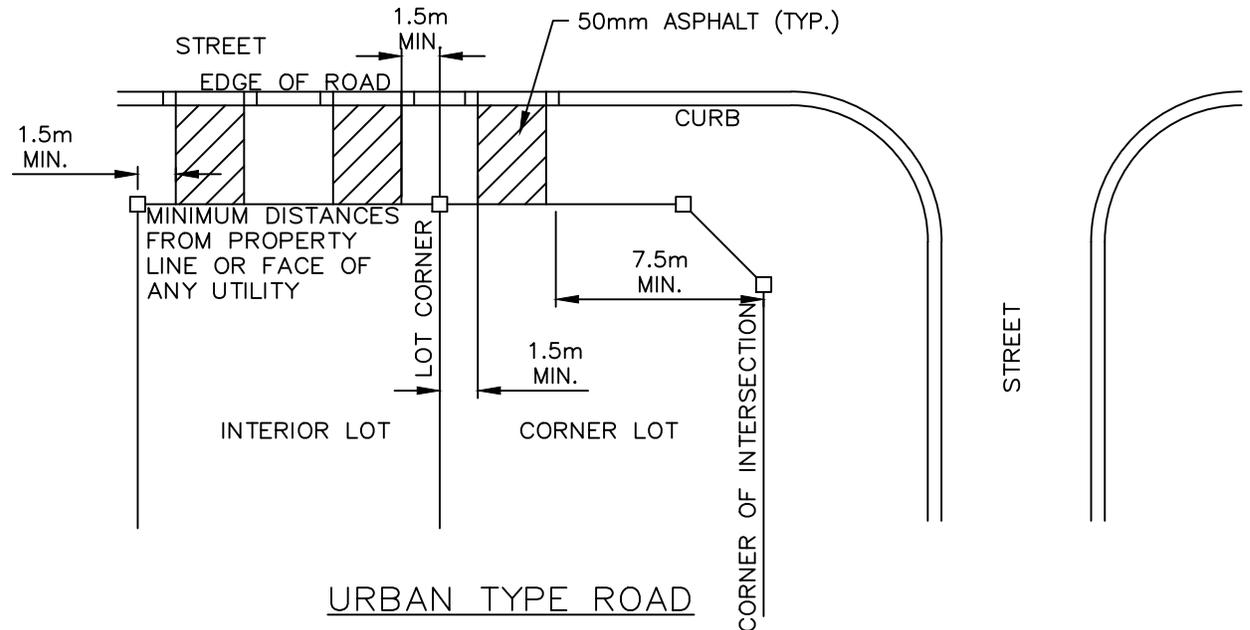
**TYPICAL WALKWAY / TRAIL SECTIONS AND ACCESS GATE - WITH SWALES**

NOT TO SCALE	
DATE:	JUNE 2022
<b>ESD-600.01</b>	





RURAL TYPE ROAD



URBAN TYPE ROAD



CURB CUT FOR URBAN DRIVEWAYS

NOTE 1) URBAN TYPE DRIVEWAY APRONS MUST BE PAVED WITH A MINIMUM OF 50mm ASPHALT FROM BACK OF CURB TO PROPERTY LINE.

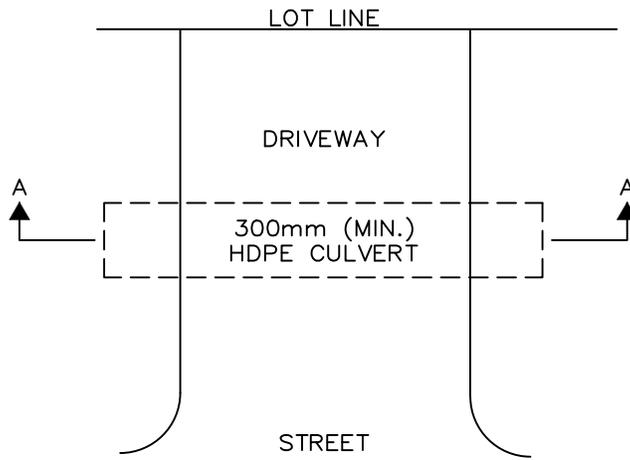


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DEPARTMENT

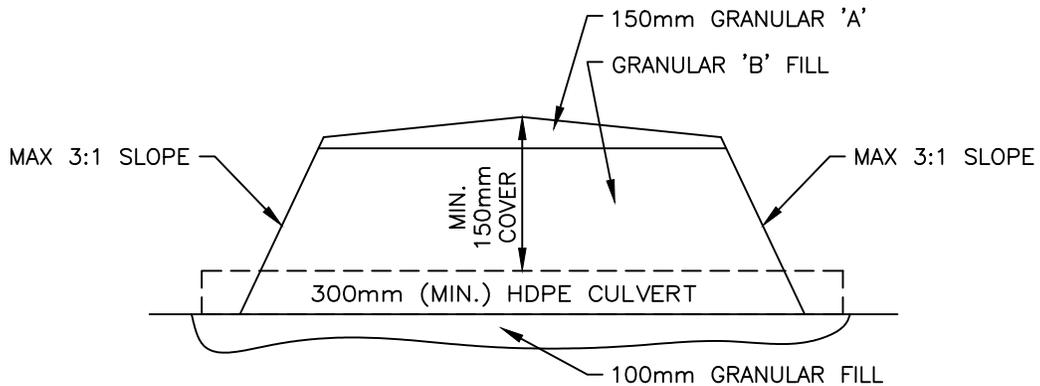
**TYPICAL ENTRANCE  
LOCATION**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-700.01**



TOP VIEW



SECTION A-A



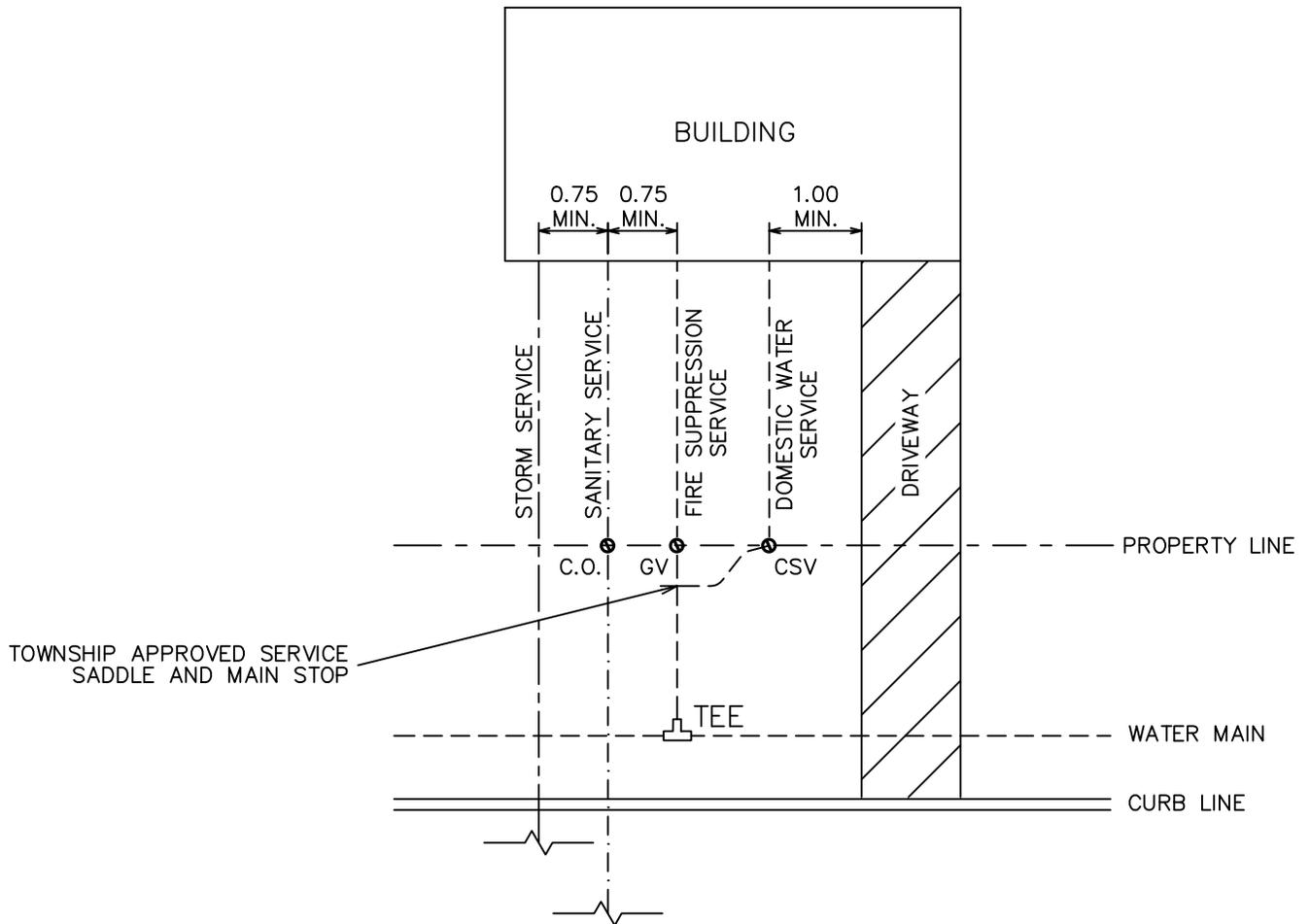
ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**TYPICAL CULVERT  
ENTRANCE DETAIL**

NOT TO SCALE

DATE: JUNE 2022

**ESD-701.01**



NOTES:

1. CURB STOPS AND CLEANOUTS TO BE LOCATED OUT OF DRIVEWAY, AT PROPERTY LINE.
2. WATER AND SANITARY SERVICE TO BE ON SIDE OF LOT OPPOSITE TO DRIVEWAY, WATER SERVICE NEAREST TO DRIVEWAY.

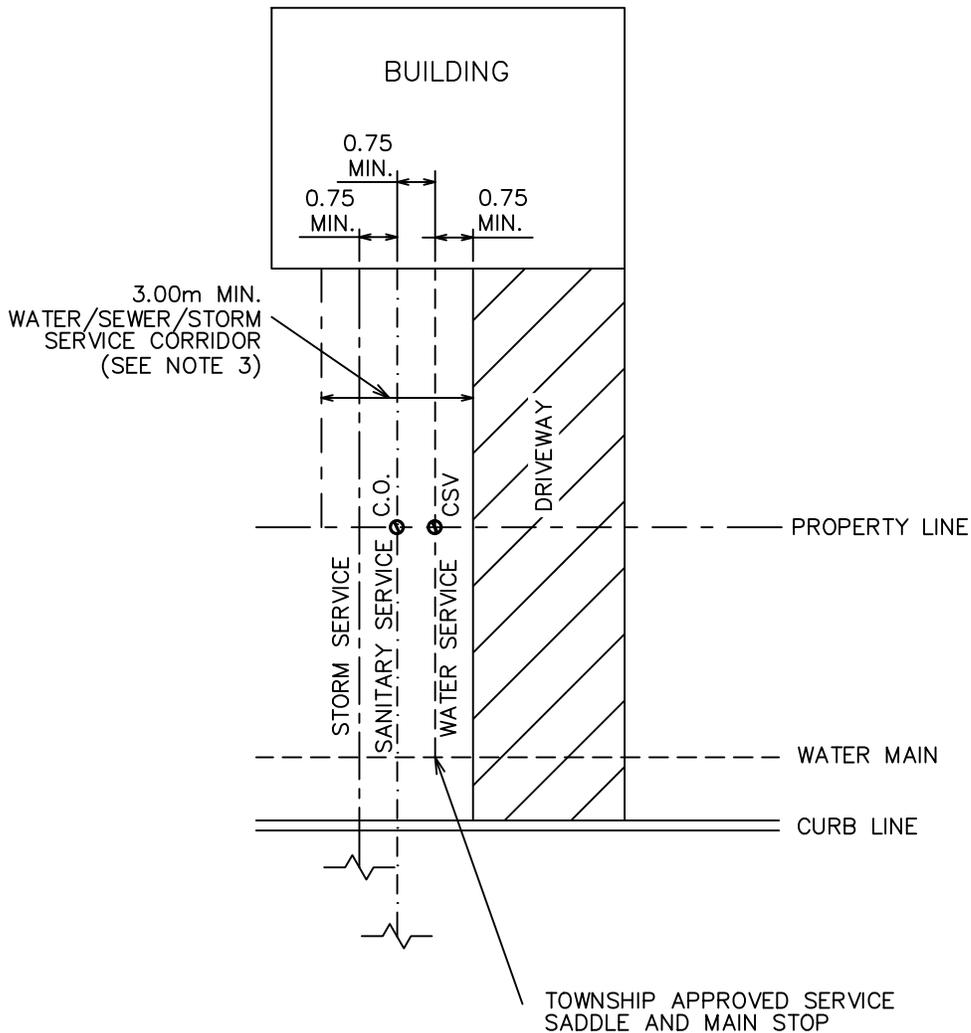


ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**LOT SERVICE LOCATIONS**  
**MULTI-UNIT RESIDENTIAL OR**  
**COMMERCIAL BUILDING**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-1000.01**



NOTES:

1. CURB STOPS AND CLEANOUTS TO BE LOCATED OUT OF DRIVEWAY, AT PROPERTY LINE.
2. WATER AND SEWER SERVICES TO BE ON SIDE OF LOT OPPOSITE TO DRIVEWAY, WATER SERVICE NEAREST TO DRIVEWAY.
3. NO UTILITIES IN SERVICE CORRIDOR.



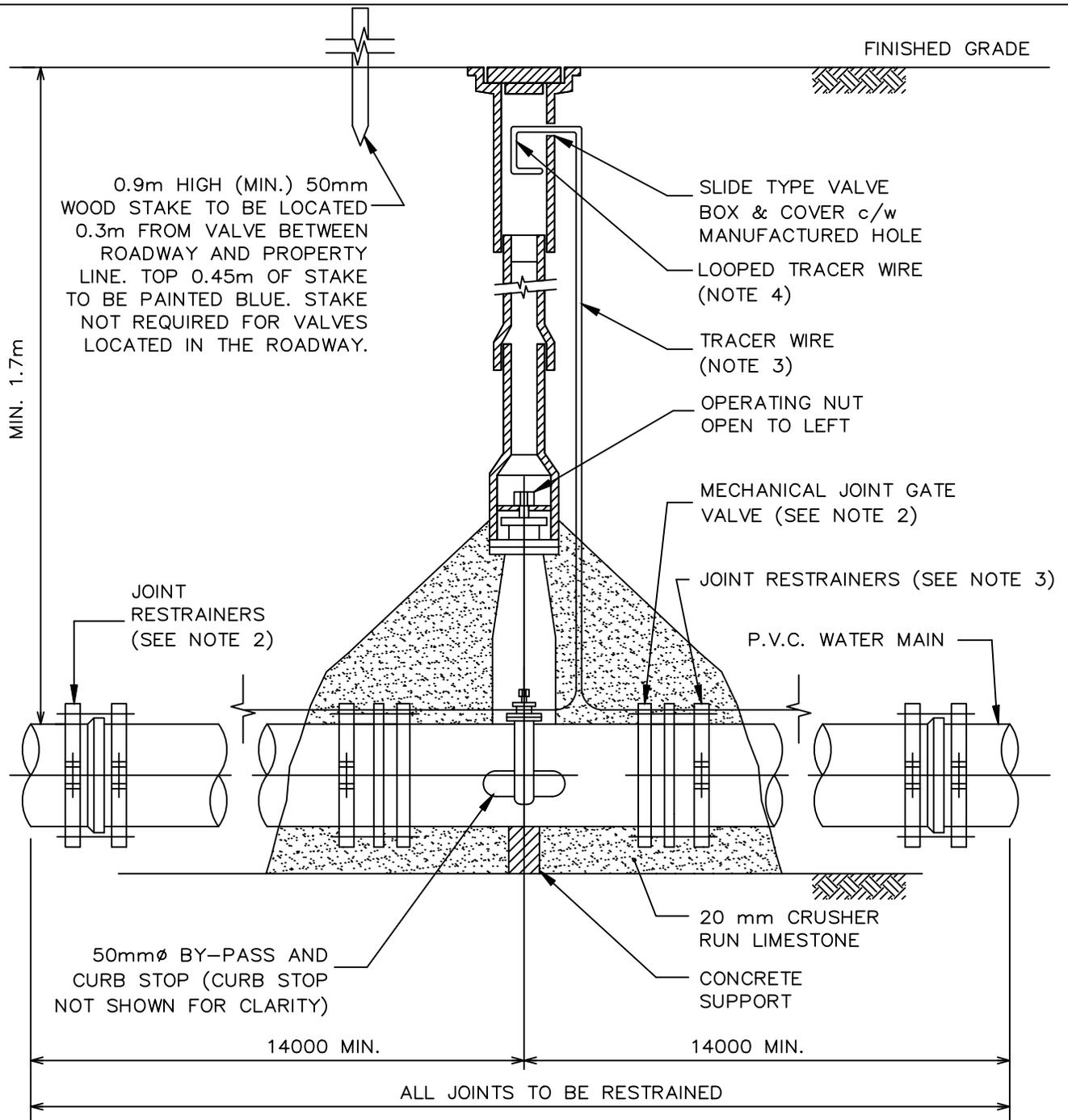
ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**LOT SERVICE LOCATIONS**

**SINGLE FAMILY AND  
TOWNHOUSE RESIDENTIAL**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-1000.02**



NOTES:

1. VALVES 450mm AND LARGER TO BE IN PRECAST CONCRETE CHAMBER.
2. DUCTILE IRON VALVE & FITTINGS TO BE EPOXY COATED.
3. JOINT RESTRAINERS AND VALVES TO BE PER APPROVED PRODUCT LIST.
4. TRACER WIRE - #12 A.W.G. , TYPE T.W.U. 75-660 VOLT INSULATED STRANDED COPPER.
5. TRACER WIRE TO BE INSTALLED OUTSIDE OF VALVE BOX AND BE BROUGHT INTO TOP OF UPPER SECTION THROUGH HOLE AND LOOPED. LENGTH OF LOOP TO BE MIN. 450mm.
6. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

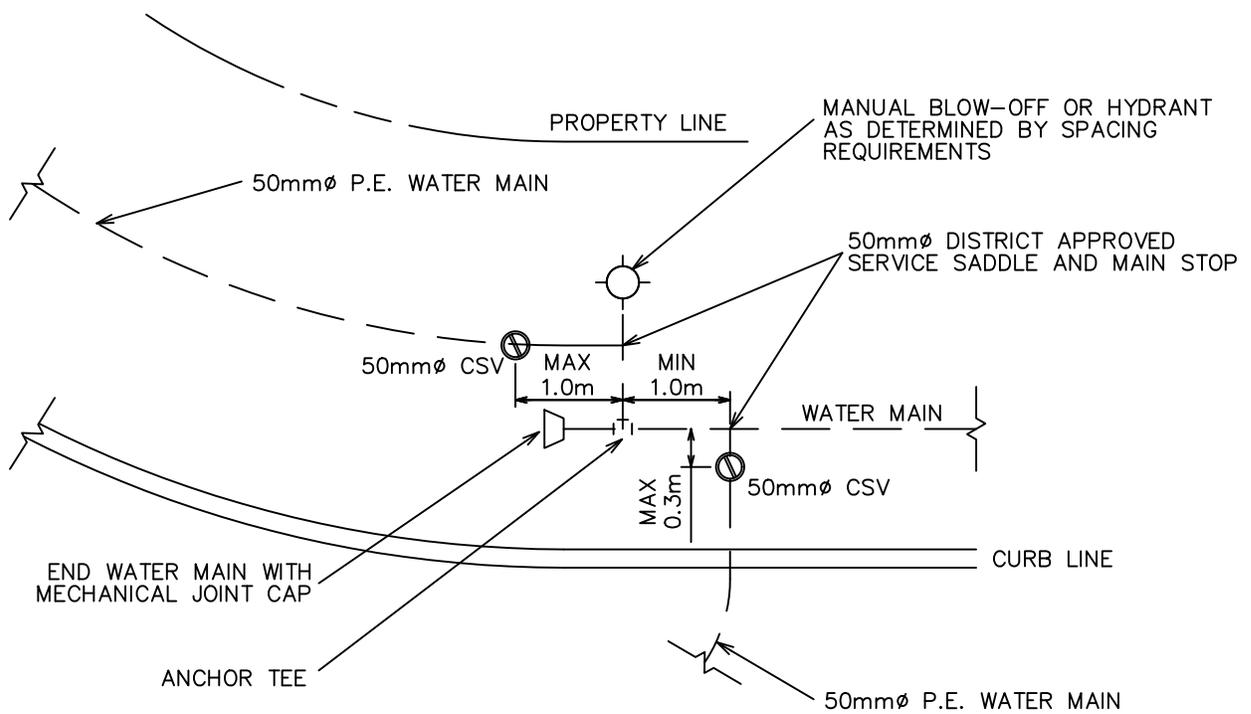
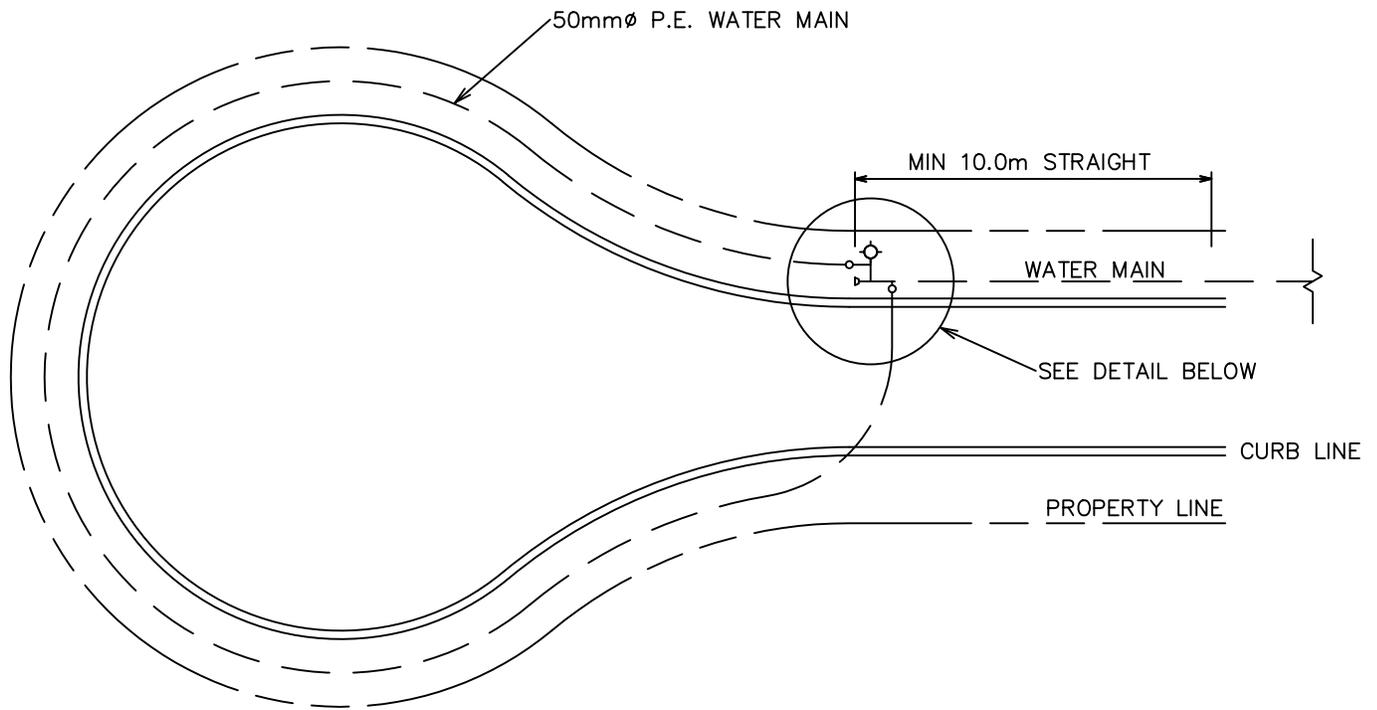


ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

**400mm GATE VALVE AND  
SMALLER AND VALVE BOX ON  
PVC WATER MAINS**

NOT TO SCALE  
DATE: JUNE 2022

**ESD-1100.01**



ENGINEERING AND  
PUBLIC WORKS  
DEPARTMENT

## TYPICAL CUL-DE-SAC WATER MAIN DESIGN

### 50mmØ P.E. LOOPING

NOT TO SCALE

DATE: JUNE 2022

**ESD-1102.02**

# MINIMUM RESTRAINING LENGTH ON EACH SIDE OF FITTING PVC DR 18 WATERMAIN

## BENDS

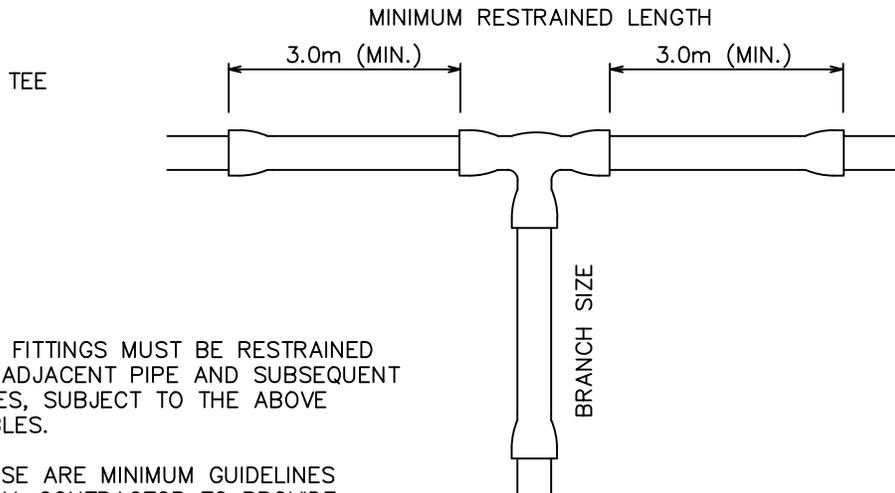
HORIZONTAL BENDS, DEAD ENDS AND INLINE VALVES	150mm $\phi$ PIPE SIZE (m)	200mm $\phi$ PIPE SIZE (m)	250mm $\phi$ PIPE SIZE (m)	300mm $\phi$ PIPE SIZE (m)
11.25°	0.6	0.6	0.6	0.9
22.5°	0.9	1.2	1.5	1.5
45°	1.80	2.4	2.7	3.4
90°	4.27	5.5	6.7	7.9
VALVES OR END CAPS	9.1	12.2	14.4	17.0

## REDUCERS

	150mm $\phi$ PIPE SIZE (m)	200mm $\phi$ PIPE SIZE (m)	250mm $\phi$ PIPE SIZE (m)	300mm $\phi$ PIPE SIZE (m)
ONE PIPE SIZE SMALLER	6.7 (100x150mm)	6.4 (150x200mm)	5.7 (200x250mm)	5.7 (250x300mm)

## TEES (RUN SIZE)

BRANCH SIZE	150mm $\phi$ PIPE SIZE (m)	200mm $\phi$ PIPE SIZE (m)	250mm $\phi$ PIPE SIZE (m)	300mm $\phi$ PIPE SIZE (m)
150mm	0.3	0.3	0.3	0.3
200mm	3.6	0.9	0.3	0.3
250mm	7.6	5.8	3.4	1.2
300mm	11.5	9.8	7.9	6.1



**NOTE:**

- ALL FITTINGS MUST BE RESTRAINED TO ADJACENT PIPE AND SUBSEQUENT PIPES, SUBJECT TO THE ABOVE TABLES.
- THESE ARE MINIMUM GUIDELINES ONLY. CONTRACTOR TO PROVIDE RESTRAINT PLAN BASED ON SITE CONDITIONS AND MANUFACTURER'S SPECIFICATIONS .



ENGINEERING AND  
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## WATER MAIN THRUST RESTRAINT AT FITTINGS

NOT TO SCALE  
DATE: JUNE 2022

**ESD-1106.01**