



DESIGN GUIDELINES MANUAL

2019 Edition

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1. INTRODUCTION

1.0. About the City of St. Thomas

St. Thomas is a single tier City and, as such, is the operating authority for all roadways, storm sewers, sanitary sewers and watermains that are to be installed within all road allowances and registered easements within St. Thomas. The City is also responsible for all parks and open space on municipally owned lands.

It is the City's objective to work collaboratively with developers on site plans and subdivisions towards the end goal of creating great private and public infrastructure and neighbourhoods.

1.1. Purpose of Design Criteria

The purpose of this document is to provide a clear and concise description of the City Engineering review processes and Engineering design standards. All development-related Engineering design proposals are to be prepared in a manner that conforms to the design guidelines contained in this document. This document will be periodically updated to include revisions where required. All submissions will be required to conform to the latest revision.

NOTE: Additional Items may be required to address specifics for any given development. Each property is looked at its own merit and may require items over and above the zoning By-Law and design guidelines requirements depending upon the site and the nature of the development.

Where it is deemed appropriate or necessary the Drainage Act legislation and procedures therein shall be utilized to service the development.

1.2. Submissions

Submission and circulation of engineering drawings related to Planning Approvals is co-ordinated through the City's Planning and Building Services Department. Through the City's planning by-laws, the developer is required to make the contact with the Planning and Building Services Department for a consultation meeting to understand the necessary requirements and documentation needed for their development.

Approval of engineering drawings must be obtained from the Environmental Services Department, Development and Compliance Service Area prior to commencement of any and all development works.

2. GENERAL INFORMATION

2.0. List of Contacts

See the City's website at <http://www.stthomas.ca/content/contact-us> for a complete listing of the City's various departments and their associated contact information.

Please contact the Customer Service at the City of St. Thomas at (519) 631-1680, extension '0', for any inquiries.

2.1. Definitions

Applicant	A person or party in the process of completing a development application.
Apartment	Means a dwelling unit in a multi-housing structure of two or more dwelling units.
Building	Means a building as defined in subsection 1.(1) of the Building Code Act which for the purposes of the City's Building By-law and Building Code Act includes plumbing and the various structures designated in the Ontario Building Code.
Developer	Means the Owner, or party specifically named in a Development Agreement (ie. Site Plan Agreement or Subdivision Agreement).
Dwelling Unit	Means a room or suite of rooms used or intended to be used for residential occupancy and usually containing cooking, eating, living, sleeping, and sanitary facilities and a private entrance from outside the building or from a common hallway inside the building.
Engineer	Means the City Engineer or designate.
Fire Service	Means a water service to either sprinklers or standpipes for fire protection. A fire service may in some cases be combined with a domestic service.
Inspector	Means the person(s) authorized by the City to see that the installation is executed according to the specifications and the approved plan(s) in a good workmanlike manner.
Main or	Means every water pipe, except services and portions of private

Watermain	watermains as herein defined, installed on the public road allowance or on any other land for which the City has obtained easements.
Private Hydrant	Means a hydrant connected to a watermain and installed on private property. (Fire Department has full rights of connection.)
Private Watermain	Means a pipe connected to a watermain and installed on private property and from which more than one service and/or hydrant lateral are connected
Service	Means every water pipe installed from a connection on a watermain or private watermain to the meter location or, for a fire service, to the inside of the exterior wall of a structure.
Service Extension	Means the portion of a service from the property line to the meter location, or for a fire service to the inside of the exterior wall of a structure. (i.e.; an extension of a service stub)
Service Stub	Means the portion of a service from a watermain to the property line which will always include one control valve.
Structure	Means a building of any kind, including but not restricted to, apartments, condominiums, single-family homes, town housing, row housing, industrial, commercial, and institutional.
Subdivider	Means the Developer, Owner, or party specifically named in a Subdivision Agreement.
Owner	Means the registered owner of a property and also includes a lessee of, a mortgagee in possession of, or a party acting as an authorized agent in lawful control of a property.
Substantial Completion	When the works within the ROW of a new subdivision development has been completed, which triggers the start of the assumption process.
Water Distribution System	Means watermain with connection to feeder mains, feeder mains within subdivision lands, private watermains, services, fire hydrants, and shut-off valves and all other appurtenances thereto.
Low Maintenance	Means pruning of vegetation for safety, management of non frangible vegetation, noxious weed control, rubbish removal, fungal and insect attack.
H.O.V.	High Occupancy Vehicles.

Complete Streets	Complete Streets are transportation facilities that are designed for all ages, abilities, and modes of travel. On Complete Streets, safe and comfortable access for pedestrians, bicycles, transit users and the mobility-impaired is not an afterthought, but an integral planning feature. See <i>Complete Streets St. Thomas Guide</i> on creating attractive and livable streets.
ROW	Right-of-way; the width of a road from property line to property line.
Street Line	Limit of the right-of-way; property line.
TAC	Transportation Association of Canada.
Tactile	Describes an object that can be perceived using the sense of touch.
PDC	Means a private drain connection.
Luminaire	The lighting luminaire itself
Lumens	Measure of total amount of light emitted by a light source, known as luminous flux.
Illuminance	The intensity of light falling on a surface, measured in lux.
Luminance	The light that the eye sees, measured in Candelas per square metre (cd/m ²)
Veiling Illuminance	The veiling, adverse effect or glare produced by bright sources in the visual field that results in decreased visual performance
Pole Height	Height of a light pole above ground level.
Mounting Height	Height of luminaire above the ground level.
IESNA RP-8-14	Illumination Engineering Society of North America Recommended Practice for Roadway Lighting (most recent version).

3. ENGINEERING REVIEW FOR DEVELOPMENT

3.0. Consultation Process

An applicant for a new development shall arrange for a consultation meeting with City Staff to discuss a development or planning application, as per the City's by-laws. The applicant shall contact the City's Planning and Building Services Department

Plans are circulated to City staff involved with the new development for review prior to the consultation.

Meetings are held at City Hall. The setting is informal and open dialogue with the applicant/agent is encouraged.

City staff comments on the proposed development, and can inform the applicant what reports or studies will be required for the specific development application.

The applicant will then provide the applicable studies, reports, drawings, and other submission requirements as deemed necessary by City staff to support their development application.

3.1. Subdivisions

Subdivision submissions, including reports and engineering drawings that are prepared by the developer's consulting engineer, are administered by the City's Planning and Building Services Department. Submissions are typically reviewed by the Development and Compliance Division of the City's Environmental Services Department and the Planning and Building Services Department.

This section describes the content of which the submissions to the City should contain. Incomplete submissions which do not attempt to address all aspects of the draft conditions or engineering criteria may be returned with a request for complete documentation unless acceptable arrangements have first been made with the City Engineer.

3.1.1. Design Submissions

Design submissions are to be accompanied by any supporting documentation required for the completeness of the design of the subdivision development. Such documentation may include, but may not be limited to copies of the following reports:

- Geotechnical (soils) Report
- Traffic Impact Assessment Report
- Environmental Assessment
- Copies of reports submitted to the Conservation Authority
- Storm Water Management Report
- Noise Report
- Functional Servicing Report

- Vibration Report
- Archeological Report

3.1.2. Drawing Standards

The following AutoCAD Drawing Standards shall be used in new development submissions.

- The drawing scale for plan and profile drawings shall be in metric, using a scale of 1:500 horizontally and 1:50 vertically. A scale of 1:250 horizontally should be used in congested areas.
- Drawings shall be oriented such that North points up and/or to the right (or left if required).
- Dimensions and elevations shall be provided in metric units.
- Existing conditions should appear faded in comparison to the proposed work, and use a text size of 1.6mm of the final hard copy.
- The various utility lines should be identified and appear slightly darker than existing topography.
- Proposed work should appear heavier than existing conditions, and use a text size of 2.0mm for notes, elevations and dimensions.
- All linework and text should be drawn using a bylayer colour and linetype to facilitate easy modifications.

3.1.3. Engineering Drawings

A complete set of Engineering Drawings, in addition to the requirements in Section 3.1.2 shall be comprised of the following:

- The approved draft plan
- The proposed plan for registration showing all lot and block numbering and dimensioning
- Cover Sheet
- General Plan of Services
- Plan and Profile Drawings
- Area and Lot Grading Plan
- Sediment & Erosion Control Plan
- Storm Drainage Plan
- Storm Sewer Design Sheets
- Storm Water Management Report
- Sanitary Drainage Plan (including all existing servicing in the area)
- Sanitary Sewer Design Sheets
- Water Distribution Plan (including all existing servicing in the area)
- Landscaping plan
- Park Grading Plan, if necessary
- Composite Utility Plan (including Hydro Distribution System and Street Lighting)
- Street Signage and Traffic Control Plan
- All detail drawings other than the O.P.S. Detail Drawings
- All drawings pertinent to the design
- All other calculations necessary to check the design; and
- A copy of a Geotechnical Investigation report prepared by a qualified Soils Consulting Engineer

The required drawings listed above may have several drawings incorporated into one drawing as long as the drawings are neat and legible (i.e. Area/Lot grading Plan combined with Sediment and Erosion Control Plans).

Some of the drawings listed above have been further explained and expanded upon in the subsections below.

3.1.4. Cover Sheet

A cover sheet shall be provided and include the name of the development or project, the owner/developer's name, consultant's name, drawing index and a key plan showing the site location.

3.1.5. General Plan of Services

The General Plan of Services will indicate the general overall scope of the project and the geographic relationship to surrounding lands.

- A General Plan of Services drawing shall be prepared for all developments at a scale of no greater than 1:2000.
- When more than one General Plan of Services drawing is required for any development then the division of drawings shall reflect the limits of the Registered Plans as closely as possible.
- The reference Geodetic Bench Mark and the Site Bench Marks to be used for construction shall be identified on the General Plan of Services. Iron property bars are not acceptable construction benchmarks.
- A drawing index shall be shown on all General Plan of Services and the area covered by each drawing shall be clearly identified.
- Road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as the Registered Plan.
- Existing services, utilities and abutting properties are to be shown, if possible.
- All proposed services to be constructed are to be shown.
- All sewers are to be shown and labeled with length, size, material and flow directions.
- Sewer manholes and catchbasins will be shown and are to be numbered in accordance with the design drawings.
- All watermains, valves, hydrants, reducers, tees and blow-offs are to be shown. Watermains are to be identified by size and material.
- All curb and sidewalks to be shown.
- All fencing to be indicated by the height and type of fence.
- All street light poles and transformers are to be shown.
- Dimensioning of utilities and roadways is not a requirement on the General Plan of Services.
- Registered Plan number must be shown on the As-Constructed General Plan of Services.
- All site information for parks, schools, churches, commercial and industrial development must be shown.
- If a subdivision encroaches on an existing floodplain, the approved fill lines and restrictions must be shown, as specified by the conservation authority.

3.1.6. Plan And Profile Drawings

Plan and Profile Drawings will provide the detailed information required for construction of roads and municipal services.

- Scale shall be 1:500 or 1:250 horizontal; 1:50 vertical
- Plan and Profile drawings are required for all roadways, blocks and easements within the development, for all outfalls beyond the development to the permanent outlet, for all boundary roadways abutting the development and for other areas where utilities are being installed below grade. Plan and profile drawings are not required for rear yard catchbasin leads, but rather a cross section of the proposed work.
- Geodetic benchmark monument location and information.
- All existing or future services, utilities and abutting properties are to be shown.
- All proposed services to be constructed are to be shown.
- The profile portion of the drawing shall be a vertical projection of the plan portion whenever possible.
- All road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as the Registered Plan. Lot and block frontages are to be shown.
- All curb and gutter and sidewalks shall be shown and dimensioned on the plan portion of the drawing.
- All storm and sanitary sewers and watermains shall be shown and dimensioned on the plan and shall also be plotted on the profile of the drawings. The sewers shall have a complete description on the plan and/or profile portion of the drawing including length, grade, material, class of pipe, and bedding requirements. The size of the pipe shall be plotted to full scale on the profile.
- All sewer manholes shall be shown on the plan and on the profile portions of the drawing. The manholes shall be identified number on the plan and on the profile portion of the drawing. All invert elevations shall be shown on the profile with each having reference to the north arrow.
- All catchbasins and catchbasin connections shall be shown. Catchbasins are to be identified by number.
- All rim and invert elevations for manholes are to be shown. Catchbasins shall have rim elevations only.
- All sewer manholes which have safety platforms are to be noted.
- All drop connections are to be noted and referred to the applicable O.P.S. specification, drawing or detail sheet.
- All watermains, hydrants, valves, blow-offs, etc. shall be shown, described and dimensioned on the plan portion of the drawing. In addition, the watermain shall be plotted to true scale size on the profile portion of the drawing and labelled with the pipe size, material and depth of cover.
- The location of all storm, water and sanitary service connections shall be shown on the plan portion of the drawing using different symbols, and line types for each service type. The connections to all blocks in the development shall be fully described and dimensioned (size, length, grade, invert elevations, material, class of pipe, bedding, etc.).
- The centreline of construction with 20 metre stations noted by a point or small cross shall be shown on the plan portion of the drawing.

- The original ground at centreline and the proposed centreline road grade shall be plotted on the profile. The proposed centreline and centreline grades shall be fully labeled including length, grade, P.I. stations and elevations, vertical and horizontal curve data, etc.
- Details of the gutter grades around all 90 degree bends, crescents and cul-de-sacs shall be provided on the plan portion of the drawing.
- Special notes necessary to detail construction procedures or requirements are to be shown.
- Chainages for the centreline of construction are to be shown on the profile portion of the drawing. The P.I., B.H.C., E.H.C., B.V.C., and, E.V.C. chainages shall also be noted.
- Any test pit or borehole locations and soil profile information shall be shown.
- The basement elevation of all existing dwellings on the streets where sewers are to be constructed shall be noted.
- All of the proposed services and features are to be shown on the plan portion of the drawing. Those services below grade that are critical to the new construction shall also be shown in the profile. Test holes may be required to determine actual elevation of these services.
- The curb radii at all intersections shall be shown on the plan portion of the drawing.
- Profiles of roadways shall be produced sufficiently beyond the limits of the proposed roads, to confirm the feasibility of possible future extensions.
- The location of all streetlights and transformers shall be clearly shown on the plan portion of the drawings.

3.1.7. Area and Lot Grading Plans

The Lot Grading Plan shall establish the final grade control for all lots and blocks within the development in accordance with City's current lot grading By-Law and with the criteria given within the Lot Grading Sections 11 of this Design Criteria.

- The Lot Grading Plan shall be prepared at a scale of 1:500 for single family, semi-detached areas and for multi-family areas.
- All lots and blocks within the subdivision are to be shown and are to be identified in the same manner as the Registered Plan.
- Geodetic benchmark monument location and information.
- Existing contours are to be shown at maximum 0.5 m intervals within the subdivision limits and 30 metres beyond the subdivision limits.
- Proposed centreline road elevations are to be shown at 20 m stations along all roads within and abutting the subdivision. Elevations are to be shown for the 20 m stations in accordance with the chainage on the profile drawings.
- Proposed elevations are to be shown for all lot corners and intermediate points of grade change. On larger blocks, a proposed elevation is to be shown at 15 m intervals along the frontage of the block and at reasonable intervals along the sides and rear of the block to clearly illustrate the grading of the block in relation to the surrounding lands and house type.
- The specified lot grade shall be shown at a location 6.0 m minimum from the street line. For "split" type drainage patterns, the specified rear house grade shall be shown. The specified minimum top of foundation elevation for each lot shall also be shown.
- The direction of the surface water runoff from the rear of all the lots shall be indicated by means of an arrow pointing in the direction of the runoff.

- All swales, other than the normal side yard swales, are to be shown along with the invert elevation of the swale at regular intervals (i.e. centreline of each lot for rear yard swales).
- All rear yard catchbasins shall be shown along with the rim elevation of the catchbasin grate and the invert elevation of the outlet pipe.
- All curbs, sidewalks, catchbasins, valves, hydrants, streetlight poles, transformers, Canada Post community mailbox locations and easements shall be shown on the lot grading plans. Driveways must have a minimum 1 m clearance to these utilities.
- All 3:1 slopes (terracing) required shall be shown with the intermediate grades specified.
- Existing elevations are to be shown on adjacent lands approximately 30 metres from the subdivision limit to enable assessment of the grading between the subdivision and the adjacent areas. The interval of those elevations shall be dependent upon the degree of development of the adjoining lands with the developed areas requiring the most information.
- For all design lots, the top of foundation wall shall be shown and labeled on the approved grading plan.
- For all design lots, the underside of footing shall be shown (if required).
- The grading along the limit of the subdivision shall be carefully controlled to avoid disturbance to the adjoining areas.
- Temporary silt fencing shall be installed along the limit of subdivision and maintained for the duration of the contract until such time as seeding or sodding takes place. This fencing shall be noted on the grading plan.
- All semi-detached lots shall be indicated with SD on all drawings.
- The lot grading plans shall show proposed locations for building envelopes, enveloped for private sewage disposal systems and private water supply systems for rural estate developments.
- All culverts shall be designed and shown on the lot grading plans identifying culvert diameter, gauge, minimum length and type.
- All typical grading details and specifications shall be shown on the Lot Grading Plan.
- Masked imaging of the Storm Drainage Areas shall be shown.

3.1.8. Detail Plan

A Detail Plan will be required when there is not sufficient space on the Plan and Profile Drawings or other drawings to fully describe the necessary works.

- A Typical road cross section shall be shown on the Detail Plan, illustrating R.O.W. dimensions, pavement structure, sewer and watermain locations, curb and sidewalk locations, and proposed utility locations.
- Details of special chambers, such as metering chambers shall be shown.
- Details of special structures, such as storm sewer inlets and outlets or retaining walls shall be shown.
- Details of special drainage features, including stormwater retention/detention ponds shall be shown.
- Pumping station details shall be shown.
- Any other details or notes as required shall be shown, such as drop structures in manholes.

3.1.9. Storm And Sanitary Drainage Plans

A separate drainage area plan for storm and sanitary drainage shall be prepared.

- Scale to suit drawings, but needs to be legible.
- The street and lot layout of the subdivision, street names and property descriptions shall be shown on the Drainage Plans.
- All existing and proposed sewers, manholes, catchbasins shall be shown and labeled with identifying numbers, sizes, lengths, grades and direction of flow.
- All external areas shall be shown on the Drainage Plans. If the external areas are too large to be accommodated, a separate drawing for the external storm areas shall be included in the set.
- Storm drainage areas shall be delineated on an actual contributing drainage area and manhole to manhole basis.
- Sanitary drainage areas shall be delineated on a lotline by lotline and manhole to manhole basis.
- All drainage areas shall be numbered and shall include area in hectares, run-off coefficients for storm or population densities for sanitary.
- The design sheet shall be shown on the Drainage Plans. If the design sheet cannot be accommodated on the area plan, the design sheets can be shown on their own drawing.

3.1.10. Utility Plan

The Consultant will compile the Utility Plan for utilities other than water and sewer from the requirements of the various public and private utility agencies. The Utility Plan shall also detail the layout for street lighting.

- Maximum drawing scale of 1:750.
- A legend using standard symbols shall be shown on the Utility Plan.
- The location of all existing and proposed utilities (Hydro, Telephone, Cable TV, Gas, Streetlight), including those in common trenches, shall be shown on the Utility Plan.
- The location of all existing and proposed utility structures and pedestals, including Canada Post community mailboxes shall be shown and labeled.
- Typical utility trench details and duct locations shall be shown.
- Any specific duct and trenches cross section details for road crossing shall be shown.
- Any other utility details or notes shall be shown on the Utility Plan.

3.1.11. Landscape Plan

All landscaping plans shall be prepared in accordance with the criteria given within Sections 13 and/or 11 of this Design Guidelines Manual and in accordance with the Ontario Landscape Contractors Standard.

3.1.12. Functional Servicing Report

Generally a functional servicing report (feasibility study) is required as background information for Draft Approval for a Plan of Subdivision. A functional report may also be required, for other mid to large-scale developments potentially having an impact on servicing, grading and drainage, water quality or quantity, and traffic, at the discretion of the Manager of Development and Compliance.

Prior to the commencement of the design and the functional report, the Developer's Engineer shall meet with the Manager of Development and Compliance or designate to discuss the City's requirements. It is suggested that, when possible, this be a joint pre consultation meeting with other affected departments and agencies. The functional report shall provide all details, calculations, costs, alternatives and recommendations necessary to facilitate logical and appropriate decision-making.

The report should provide all relevant background information with respect to Site Constraints / Existing Conditions such as:

- Topography and drainage
- All pipelines (Trans Canada, Union Gas etc.)
- Hydro easements / corridors
- Trunk sewers and watermains
- Utilities
- Environmental features (protected watercourses, terrestrials)
- Traffic impact studies

The functional report shall include, but will not necessarily be limited to the following considerations:

- Concept Plan
- Contour Plan
- General Plan of Services
- Drainage Plan
- Geotechnical Investigation
- Major roadway alignments, cross-sections and intersections;
- Roadway structures;
- Watercourse improvement and channelization;
- Railway crossings;
- Parkland development
- Major trunk sewers, storm and sanitary;
- Stormwater management strategy for the development, using ponds or low impact development practices.
- Storm drainage systems, including overland flow routes and outlets;
- Sanitary drainage systems, including capacity analysis of the receiving system;
- Water distribution systems, including independent pressure and flow testing of the existing systems and network modelling;
- Lot grading design;
- Pumping station locations;
- Electrical distribution
- Traffic Impact Study

3.1.13. Construction Inspection

Periodic construction inspection will be carried out by the City of St. Thomas, Development and Compliance Division. The subdivider's consulting engineer shall be conducting full time site inspection services for new subdivision developments and be available for consultation during the entire construction period.

3.2. Site Plan Control

To initiate the process for site plan approval, the applicant must contact the City's Planning and Building Services Department to arrange for a consultation meeting to discuss the site and submission requirements of the City.

Site plan submissions, including reports and site plan drawings that are prepared by the developer's consultant(s), are administered by the City's Planning and Building Services Department. Submissions are typically reviewed by the Development and Compliance Service Area of City's Environmental Services Department and the Planning and Building Services Department.

This section describes the content of which the submissions to the City should contain. Incomplete submissions which do not attempt to address all aspects of the consultation or agreed upon terms of the site plan application may be returned with a request for complete documentation unless acceptable arrangements have first been made.

3.2.1. Design Submissions

Design submissions are to be accompanied by any supporting documentation required for the completeness of the application. Such documentation may include, but may not be limited to copies of the following reports:

- Geotechnical (soils) Report
- Traffic Impact Assessment Report
- Environmental Assessment
- Copies of reports submitted to the Conservation Authority
- Storm Water Management Report
- Noise Report
- Functional Servicing Report
- Vibration Report
- Archeological Report

3.2.2. Site Plan Drawings

A complete set of engineering and/or architectural drawings will be required for the site plan application submission. Engineering drawings typically required for site plan developments shall include, but not be limited to:

- Site Plan Drawing (general layout with site data chart)
- Site Grading and Drainage Plan (including sediment and erosion control)
- Site Services Plan and Profile
- Landscaping Plan
- Electrical Services and Utilities Plan
- Lighting Layout and Distribution Plan
- Building Elevations Plans
- Any servicing external to the site that may be required.

3.3. Approval Agencies

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

The Department of Fisheries and Oceans (DFO)
The Ministry of Environment, Conservation and Parks (MECP)
The Ministry of Natural Resources (MNR)
The Ministry of Transportation (MTO)
The Ministry of Municipal Affairs and Housing (MMAH)
The Ministry of Tourism, Culture and Sport (MTC)
The City of St. Thomas Planning and Building Services
The City of St. Thomas Parks and Recreation Department
The City of St. Thomas Fire Department
Kettle Creek Conservation Authority
Catfish Creek Conservation Authority

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

The development will be subject to the requirements of all by-laws within the City.

The developer shall be required to enter into a Development Agreement (i.e. Subdivision Agreement or Site Plan Agreement) with the City and pay fees to the City such as application fees for zoning and administration fees applicable to the development application.

Please contact the City's Planning and Building Services Department at (519) 631-1680, extension 4186, for further information.

3.4. Site Alteration Permit

As per City By-law 161-2010, property owners must file for a site alteration permit with City staff in Environmental Services Department when one of the following works take place:

- Removal of topsoil
- Alteration of the grade of land
- Temporary or permanent placing, dumping, or removal of any fill originating on the site or elsewhere
- The temporary or permanent placement , construction or alteration of structures on or under the land which will affect established drainage patterns
- The changing of surface cover affecting drainage or erosion risk, including paving or removal of plants, vegetation or trees.

More information on the process and requirements can be found at the following website (www.stthomas.ca/content/site-alteration-law), or by calling (519) 631-1680, extensions 4228 or 4259.

4. CAD STANDARDS

4.0. Civil 3D

Computer-Aided Design (CAD) shall be used to generate all engineering drawings. Vector format “DWGS” files with no X-Refs shall be supplied to the City. This data shall be supplied when “as-builts” are submitted for assumption. Storm sewer, sanitary sewer and watermain information must be on a separate layer.

AutoCAD 2016 is the most recent version used by City. All as-built CAD drawings must be submitted in this version.

For further information of CAD standards and layering for City submissions, please contact the City’s Environmental Services Department.

4.1. Georeferencing

Digital files must be referenced to the City of St. Thomas’ geographic reference system which is the NAD’83 (CSRS v6-2010) datum, 6 degree UTM projection expressed in meters. The digital file shall include at minimum two (2) redundant ties to the City of St. Thomas’ horizontal control network. The digital file must be submitted scaled to grid (i.e. the UTM projection). All dimensions shall be shown as ground level distances.

4.2. Presented Information

- Plan and Profile
 - horizontal metric scale shall be 1:250 for reconstructed or congested areas, 1:500 for new development drawings.
 - vertical metric scale shall be 1:50
- Plan and Profile drawings will not be required for Site Plan submissions, but rather topographic plans or Site Plans are only required.
- Metric scale for general plans shall be a minimum of 1:750
- All drawings shall be neat, legible and completed in ink;
- All engineering drawings **must contain** the City standard title block, a key plan, north arrow, current revision status, and be stamped by a Professional Engineer licensed to practice in the Province of Ontario;
- All sewers, watermains, maintenance holes, maintenance hole numbers, pipe diameter, direction of flow, pipe class and bedding, and service connection shall be shown on all drawings;

- Where plans require more than one drawing, match lines shall be provided, showing both reference drawing numbers, preceding and following, plus station, or an overlap between drawings of 10 metres minimum;
- Servicing drawings must clearly label existing services distinctly from proposed services by label and by line type.
- In Site Plan submissions all existing infrastructure and existing structures shall be shown in greyscale and opaque. All proposed works and construction shall be solid and shown darker than existing to proposed works to stand out from existing.
- Upon submission of the subdivision design drawings the Consultant shall provide and submit the location of all new private drain connections.
- Invert and top of manhole elevations as constructed.

Where a development has been phased, a set of as-built drawings shall be submitted at the completion of each phase. Title sheet, index pages shall be adjusted to clearly identify the location of the work. Any portion of the drawing not related to the current construction shall be indicated in a light lineweight and clearly identified "NOT IN CONTRACT".

4.3. Drawing Sizes

Full sized drawings to be ANSI D 22" x 34" (559mm x 864mm). Reduced drawings are to be 11" x 17" (279mm x 432mm).

4.4. GIS/Asset Management Requirements

4.4.1. Inventory Data

The use of a geographical information system (GIS) database management system for the capture, storage, retrieval, analysis and display of objects and/or events should be populated and maintained by the Capital Works Service Area of the Environmental Services Department.

The Final Submission Requirements shall consist of one (1) CD or USB stick of digital submission (Preferred format is AutoCAD .dwg file, which may include Civil 3D)

The following information should be included in the GIS data base:

- Road Section Number
- Street Name
- Road Surface Length (m)
- Road Surface Width (m)
- Asphalt Type Base
- Asphalt Type Topcoat
- Asphalt Base Depth (mm)
- Asphalt Depth Topcoat (mm)
- Road Surface Condition
- Road Surface Useful Life

- Year Constructed
- Cost of Initial Pavement
- Year of Maintenance
- Cost of Preservation (Betterment)
- Type of Maintenance
- Traffic Counts
- Design Mixes
- Soils Reports
- Traffic Signal (Pole and Fixture)
- Street Light (Pole and Fixture)
- Sidewalks
- Traffic Signs
- Transit Stops

4.5. As-Built/Record Drawing Requirements

4.5.1. Final Submission

Prior to assumption the applicant is required to provide a complete project package to the City. This package includes the following:

- Digital "As Constructed Drawing Set" in an Adobe format (.pdf file), (complete with all required signatures);
- Digital "As Constructed Drawing Set" in AutoCAD format (.dwg file, which may include LDD or Civil 3D)
 - provide all Paper Space Title Blocks and Plot Style Tables
 - all existing survey points are to be contained in the drawing
 - all proposed TIN's, grading models and/or contour lines are to be contained in the drawing
 - all line work must be in Model Space at 1:1 scale and unrotated in a World Coordinate System (WCS)
 - drawing units are to be in metric
 - purge all old or extra drawing layers
 - bind all XRef files (no external attachments upon submission)
 - georeferenced plans are preferred, but not mandatory for submission
- All digital "Project" support files which do not reside in AutoCAD such as stormwater calculations, technical reports, etc.
- The digital formats may be from industry standard software including Microsoft Office, Adobe, Synchro Traffic, etc

4.5.2. Recording of PDC Services

Once the PDC have been placed, a record of its location must be produced for As-Constructed drawings and provided digitally to the City of St. Thomas. Water, Sanitary and Storm laterals are to be located on these drawings by showing proper plan view location which includes any bends and sweeps between the tee and the R.O.W. tie-in or stub. Also required on the drawing is the pipes invert elevation at the property line. See Section 15 (Standard Drawings) for a sample Building Services Report for PDC's.

5. TRANSPORTATION

5.0. Roadway Design

5.0.1. General

The following factors shall be considered in the design of all transportation systems in the City of St. Thomas:

- Number and types of vehicles using the roadway;
- Accessibility of an area to emergency services;
- Spacing, type, intersecting angle and location of intersections and crosswalks;
- Sight distance (decision, stopping, intersection, etc.);
- Level of access from adjacent properties;
- Traffic calming requirements;
- Playground and school zone locations;
- Complete Streets, including
 - Neighbourhood/Pedestrian/Cycling Connectivity;
 - Tree protection and Improved Planting Zones;
 - Placemaking – Community Enhancement Features
 - Pedestrian facilities;
 - Cycling facilities;
- Intersection offsets;
- Intersection control (uncontrolled, Yield, Stop, roundabout or traffic signal);
- Channelization requirements,
- Median treatment; and
- Traffic control device warrants.
- Requirements identified by the Ontario Building Code
- Avoidance of Noise Barrier Walls due to numerous uninterrupted back yards along arterial roads
- Public Transit requirements

Pedestrian, cyclist and vehicular safety shall be held paramount and integral in the design of any transportation system.

5.0.2. Reference Standards and Guidelines

Road design shall be in accordance with the following standards and guidelines, as amended or expanded upon within the City of St. Thomas Design Guidelines:

City of St. Thomas Complete Streets Guide

City of St. Thomas Standard Contract Documents

- Supplemental Specifications - Roads

Transportation Association of Canada (TAC)

- Geometric Design Guide for Canadian Roads (TAC Standards)
- Manual of Uniform Traffic Control Devices for Canada (MUTCD)
- Guide for the Design of Roadway Lighting
- Pedestrian Crossing Control Manual
- Canadian Guide to Neighborhood Traffic Calming

Ministry of Transportation

- Geometric Design Standards for Ontario Highways, 1985 (latest revision)
- Ontario Traffic Manual (OTM) (latest edition)
- OTM Book 12 – Traffic Signal Design
- Ontario Provincial Standards (OPS) (latest edition)

Institute of Transportation Engineers (ITE)

- Trip Generation Manual
- Transportation and Land Development
- Traffic Access and Impact Studies for Site Development - Recommended Practice

5.0.3. Road Classification

Functional classification of roads in the City of St. Thomas shall be in accordance with the City of St. Thomas Official Plan.

Through the City of St. Thomas Official Plan, the following hierarchy of roads and streets have been established:

Road Type	General Function	Typical Right-of-Way Width	Intersection & Access
Expressway	King's Highway #3 (under MTO's jurisdiction)	N/A	Under jurisdiction of MTO.
Highway	Large to moderate volumes of all types of traffic city-wide	29 m +	Intersection with arterial and collector roads. Direct access may be permitted, pending approval.
Arterial (Major and Minor)	Large to moderate volumes of all types of traffic city-wide	29 m	Intersection with arterial and collector roads. Direct access may be permitted, pending approval.
Collector (Major and Minor)	Moderate volumes of traffic primarily moving between points of origin and arterial roads.	26 m 23 m (minor collector)	Intersection with arterial, collector and local roads. Direct access permitted.
Local	Light volumes of traffic moving between points of origin and collector roads.	Urban – 20 m - 18 m only allowed on Cul-de-sacs (where permitted)	Intersection with collector and local roads. Direct access permitted. Intersection with arterial roads to be discouraged.

Roadway classification and right-of-way width will be confirmed at the draft plan approval stage.

Standard road cross sections adopted by the City of St. Thomas can be found in Section 15 (Standard Drawings). Any deviation from these road cross sections shall be reviewed and approved by the Environmental Services Department.

Highway # 3 Expressway is the responsibility of the Ministry of Transportation of Ontario and as such is deemed to be a special category roadway not included within the scope of these standards.

5.0.4. Design Speed

The designer shall ensure that the roadway functions at the desired operating speed reflecting the function of the roadway and the surrounding context. To ensure a strong relationship between the

desired operating speed and the posted speed limit, the design speed limit should be reflective of the desired operating speed.

- For roadways with a desired operating speed of less than 60 km/h the desired operating speed should equal the design speed and the posted speed limit.
- For roadways with a desired operating speed between 60 km/h and 90 km/h, the design speed should be 10 km/h over the desired operating speed, and the posted speed should be equal to the desired operating speed.
- For roadways with a desired operating speed of 90 km/h or greater, the design speed should be 20 km/h over the desired operating speed, and the posted speed should be equal to the desired operating speed.

In cases where future development will lead to a lowered posted speed, it may be possible to use the future reduced posted speed in consultation with the City Engineer.

5.0.5. Design Vehicle

All roadways within the City of St. Thomas shall be designed to accommodate a WB-20 Tractor Semitrailer as per TAC.

5.0.6. Minimum Pavement Design

Minimum pavement design shall follow details provided under each of the City's standard ROW cross-sections. Deviations from these minimum standards shall be based on the recommendation from a geotechnical report by a professional engineer.

5.0.7. Concrete Curb and Gutter

Concrete curb and gutter used in the City of St. Thomas shall be OPSD 600.010 or 600.040 for Local and Collector roads, OPSD 600.010 only for Arterial roads, which is shown on the City's standard ROW cross-sections. Any deviation from this standard shall be approved by the City Engineer.

5.0.8. Concrete Sidewalk

Concrete sidewalk in the City of St. Thomas shall be 1.5 metre minimum width at a thickness of 125 mm. Concrete sidewalk adjacent to curb shall be 1.8 metre minimum width.

Thickness of concrete sidewalk at residential driveways shall be at 150 mm and commercial driveways shall be 200 mm.

5.0.9. Horizontal Alignment

Centerline Radii shall be in accordance with TAC Design Guidelines. Bends of 90 degrees are only permitted on local streets.

For reconstruction of existing roads, the centreline horizontal alignments shall be reviewed by the City Staff on a site specific basis.

5.0.10. Vertical Alignment

Sag and crest curves shall be in accordance with TAC Guidelines. Curves shall be required when change in grade is greater than 1% as per equation below:

$$\Delta\% = S_1 - S_2 > 1\%$$

Where: S_1 = Slope 1

S_2 = Slope 2

5.0.11. Location Of Utilities

The location of all utilities within the road allowance shall be as detailed on the typical cross-section. Utility drawings shall be submitted to the City Engineer or designate for approval. All new development utilities are to be constructed underground. Hydro transformers are to be housed in suitable enclosures and mounted on transformer pads installed at the final ground elevation. Bell telephone junction boxes may be mounted at the surface in approved standard enclosures.

5.0.12. Cul-de-Sacs and Bulbs

Subdivision street pattern designs shall avoid the use of cul-de-sacs in order to promote connectivity with streets in a new development.

5.0.13. Signage Posts

Regulatory sign posts shall be 100 mm x 100 mm (4"x4") minimum pressure treated sign posts or steel U-channel posts, pending on the size and location of the signage.

5.0.14. Sight Triangles

Local streets with bends of approximately 90 degrees are to have a minimum inside street-line radius of 10 metres or a 6.0 metre by 6.0 metre sight triangle. See City zoning by-laws for further information.

5.0.15. Daylight Corners

The design of a daylight corner is a function of road width of major street, design speed of the major street, the minor street design vehicle length and stop block set-back distance on minor street. Sizes of typical daylight corners used in the City of St. Thomas shall be as per the zoning by-laws depending on location and road classification.

5.0.16. Road Sub-Drains

Sub-drains will be required on all developments within The City of St. Thomas.

5.0.17. Snow Clearing/Snow Storage

Snow clearing operations will be carried out by the City after the roads have been paved.

For site plan control applications, snow storage areas shall be shown on all drawings. Snow clearing for private developments are to be carried out by the developer's contractor.

5.0.18. Right of Way Occupancy Permit

Any work required by a developer, utility company, or contractor working for a property owner/developer within the City's right-of-way is subject to obtaining a Right-of-Way Occupancy Permit from the City's Environmental Services Department. Please contact the City at (519) 631-1680 ext. 4161 for more information.

Permission is required from the City for any proposed detours and road closures. Details and/or road closures need to be submitted and reviewed by the City prior to approval. Where the proposed route utilizes roads that are not part of the City's road system, approval from the appropriate road authority will also be necessary. In all cases a road closure notification shall be circulated to emergency services and other affected agencies a minimum of 48 hours prior to the road closure.

All work will be done in accordance with ordinances, by-laws of The City of St. Thomas and in accordance with OTM Book 7.

All disturbed areas shall be restored to its original conditions or better, including but not limited to roadway, sidewalks, traffic loops, etc.

5.0.19. Mailboxes

Community mailbox (CMB) locations will be the responsibilities of Canada Post. The consulting engineer for the developer is to ensure that no utility conflicts exist with the proposed CMB locations. Locations of community mailboxes shall be reviewed and approved by the City.

5.1. Intersection Design

5.1.1. Intersection Geometrics

Intersection geometrics shall accommodate the design vehicle. The following chart illustrates the minimum radii, measured at the edge of pavement.

To:			
From:	Arterial	Collector	Local
Arterial	13.5m	12m	10m
Collector	12m	7.5m	6.0m
Local	7.5m	6.0m	6.0m

To minimize the intersection dimensions and prevent oversized curb radii, the designer should consider the use of two-centered or three-centered curves where appropriate.

Designers shall provide truck turning movement design calculations for all turning movements on all arterial roads, collector roads, and local industrial roads.

5.1.2. Intersection Geometric Design Improvements – Signalized

The basic configuration on MAIN ROAD approaches for proposed signal-controlled intersections must include directly-opposing, dedicated Left turn lanes for 4-legged intersections or one dedicated Left turn lane at T intersections; regardless of actual volume demands or capacity analysis results.

The basic configuration on SIDEROAD approaches for proposed signal-controlled intersections should include directly-opposing, dedicated Left turn lanes for 4-legged intersections; unless physical limitations make their implementation unjudicious.

On SIDEROADS for T intersections, separate Left & Right turn lanes would be preferred, but may be governed by actual volume demands or capacity analysis.

Consideration may be given to the provision of a dedicated Right turn lane where peak hour turning traffic demands exceed 200 vph and Synchro capacity analysis of the Thru lane produces results nearing or exceeding the threshold of acceptability.

Justification for a free-flow (uncontrolled) right turn channelization requires peak hour demands ≥ 600 vph. The proper design to provide free-flow operation requires a parallel Right turn deceleration lane into the Channelization and, either a Right turn acceleration taper away (minimum) or a parallel lane away (preferred). If a Right turn channelization is justified, it should not be provided with a sub-standard geometric design necessitating Yield control.

5.1.3. Intersection Geometric Design Improvements – Unsignalized

MTO Left Turn Lane Warrant Chart analysis is required to justify provision of a dedicated Left turn lane on the MAIN ROAD of any unsignalized intersection. Synchro capacity analysis results are not acceptable in determining Left turn lane requirements for unsignalized intersections.

Where a dedicated Left turn lane becomes warranted in any one direction on the MAIN ROAD approaches of an unsignalized 4-legged intersection, implementation of a directly-opposing Left turn lane with minimum 15m storage will also become justified.

A dedicated Left turn lane (or multi-lane configuration) is not permitted on any SIDEROAD approach to an unsignalized 4-legged intersections.

At T intersections, a multi-lane configuration (separate Left and Right turn lanes) is permitted on the SIDEROAD (stub) approach only if the intersection is located within an urban, low speed (Posted Speed \leq 60 km/hr) City.

5.1.4. Intersection Spacing

Intersections to be spaced as per design standards referenced in TAC and MTO Geometric Design Manual.

For circumstances where the above specifications cannot be achieved due to a single access proposed between two existing intersections with less than desirable spacing or where capacity analysis identifies a situation where a single access cannot be effectively or safely operated, minimum acceptable intersection spacing may be determined by the actual geometric design requirements needed to accommodate back-to-back Left turn laning facilities and/or future Thru queuing.

Design parameters for Left turn lanes will be as specified in the Geometric Design Manual. For back-to-back facilities, the opposing taper lengths may be overlapped.

When extended roadway sections require a number of back-to-back turning facilities, consideration should be given to application of a Continuous Two-Way Left Turn Lane.

Proposed new “T” accesses for major commercial or municipal street accesses should, where possible, be located directly opposite existing “T” intersections or accesses. If proposed new “T” access is opposite presently undeveloped, but developable lands, spacing considerations must be given to minimum storage turning facilities for a possible future access.

5.1.5. Roundabouts

The City of St. Thomas will consider the installation of roundabouts at these locations.

All Collector/Arterial Roads intersecting with other Collector/Arterial should be considered for the installation of a roundabout. All roundabouts are to be designed per the TAC Roundabout Design Guide, latest edition.

Prior to determining the feasibility of a roundabout, an initial screening must be completed, taking into account the following:

- Determine the scope of the intersection improvements to implement the traffic signals and other turning lanes and scope of work to implement a roundabout;
- Complete a Traffic Flow worksheet and preliminary lane configuration for the proposed roundabout;
- Develop a preliminary cost estimate to implement each of the traffic control alternatives (roundabouts and signals)
- Develop a 20-year injury collision costs and implementation costs for each alternative, adjusted to Present Value and compare the results.

The design of roundabout shall include a property line setback from the back of the curb with adequate space to locate utilities in their standard location.

5.1.6. Roundabout Signage

The roundabout signage shall be in compliance with the Roundabout Signage Plan in Section 15.

5.1.7. Channelization and Median Islands

Median and channelization elements including divisional, directional and refuge islands shall be designed in conformance with the Transportation Association of Canada (TAC) manual and reference standards. Warrants and capacity analysis shall be submitted where required in conformance to the TAC standards. Where a pedestrian crosswalk distance across an approach exceeds 20.0 metres (measured from between the edge pavements along the centerline of the crosswalk across an intersection approach) the intersection shall be channelized.

Medians and channelization elements shall normally be raised and surface treatment for medians shall comprise of:

- Barrier concrete curb surrounding the perimeter
- Concrete or other approved hard surfacing (excluding asphalt) between curbs.
- Provisions for landscaping may be made in medians only provided that:
 - The median is wider than 4.0 metres from lip-of-gutter to lip-of-gutter,
 - A Portland cement concrete strip 0.50 metres in width behind the back of curb is provided.
 - Provision for mower access is provided consisting of a minimum of two (2) dropped sections of curb at a minimum spacing of 100 metres,
 - Individual tree wells or continuous tree pits are provided with a minimum horizontal dimension of 1.5 m in any direction.

- Irrigated landscaping is provided for median areas between Portland cement concrete cross-section elements wider than 2.0 metres.
- Wheelchair ramps within pedestrian crosswalk zones.

5.2. Driveways

5.2.1. Driveway Widths and Details

If a concrete driveway is installed, expansion joints are to be installed at both sides of the sidewalk and at the curb. A construction joint is also required at the property line.

Maximum driveway width for Commercial/Industrial development is 9.0 metres. Any variance in this driveway width shall be at the discretion of the City Engineer or his designate.

Maximum driveway width for a 2 car residential garage is 6.0 metres, and a single residential garage is 4.0 metres while taking into account allowable driveway widths as per zoning by-laws.

All driveway approaches shall be paved (i.e. asphalt, concrete or interlocking stone) from the back of curb to the property line.

5.2.2. Minimum Driveway Thickness Requirements

The minimum compacted depth requirements for driveways shall be as follows:

Single Family Residential

- Asphalt - 50 mm HL3 surface
- Granular base – 200 mm of Granular 'A'

Commercial, Light Industrial and Apartments

- Asphalt
 - 40 mm HL3 surface course
 - 50 mm HL8 base course
- Granular Base
 - 150 mm of Granular 'A'
 - 300 mm of Granular 'B'

Heavy Industrial Driveways

- Asphalt
 - 50 mm HL3 surface course
 - 75mm HL8 base course
- Granular Base
 - 150 mm of Granular 'A'
 - 300 mm of Granular 'B'

5.2.3. Driveway Grades

The minimum grade for any driveway shall be 2%. The maximum permissible design grade for any driveway shall be **8%**. This maximum grade is not recommended and should be employed only in exceptional cases where physical conditions prohibit the use of lesser grades.

The specified grades for driveways shall be directed away from the houses. **The use of reverse fall driveways is not permitted.**

For industrial and commercial sites requiring site plan approval, a break in grade for driveways shall occur at the property line.

5.3. Temporary Roads and Turnarounds

When it is determined by the City that a temporary road for construction or access purposes is required and acceptable in an area where a development is proposed, the road shall be built in accordance with plans and specifications approved by the City. All costs (both construction and decommissioning) of temporary roads shall be borne by the Developer.

Where a temporary road is required as an alternate means of access to a proposed subdivision and will be used after residents occupy the subdivision the road shall be constructed to a 8m width, 2 lane graveled roadway. Signs indicating the temporary nature of the road shall be erected at each end of the temporary roadway.

Where a temporary road is required for construction access only, the road shall be constructed to a 6.0 m graveled lane standard. Where the road crosses curbs, gutters, sidewalks and trails provision shall be made to permit regular vehicle traffic to cross, without damaging, the curbs, gutters, sidewalks and trails.

Signs indicating the temporary nature of the road and that it is for construction traffic only shall be erected at each end of the temporary roadway. Where a roadway temporarily terminates at mid-block and has no provision for egress, a temporary turnaround shall be constructed.

Temporary roadways shall be shown on the design drawings complete with horizontal and vertical alignments, drainage details and cross sections.

5.4. Traffic Impact Assessment (TIA)

5.4.1. General

Engineering studies, assessing the impact of development generated traffic, may be required to be submitted to the City of St. Thomas as part of the approval of a complete planning application.

5.4.2. Warrants

A TIA will be required if:

- A development can be expected to generate more than 100 new peak-hour trips on intersecting or adjacent roadways;
- Where traffic problems such as high accident rates, traffic congestion, short cutting or access problems are being experienced in the area, regardless of the magnitude of peak hour volumes generated by the development,
- Change in land use may change directional distribution of site generated traffic by greater than 20%;
- Variances to the above may be permitted at the City's discretion.

Additional guidance may be obtained from the City.

5.4.3. Scope

The scope of a TIA shall generally conform to the reference standards outlined in Section 5.1.5 (Roundabouts) and shall also incorporate the following information and criteria:














5.4.3.1. Traffic Volume Generations

- Existing Turning Movement traffic counts older than 3 years must be updated
- Assume 2% background growth per year.
- 5 Year Projections required to determine the need for traffic control signals (for single-stage developments)
- 10 Year Projections required to determine geometric road improvements (for single-stage developments)
- Multi-stage proposals will require projected traffic data for each stage of development, as necessary to determine Traffic Control & Geometric requirements for each stage.
- a minimum two (2) peak hours must be developed for analysis, and may be comprised of:
 - **AM + PM** (for residential & industrial developments as determined from historic background traffic data)
 - **mid-day + PM** (for residential & industrial developments as determined from historic background traffic data)
 - **weekday PM + Saturday peak hour** (preferred for retail developments)
- If existing or expected heavy truck traffic exceeds 10% for any particular movement, lane or approach, Truck factoring of 1 T = 2 pcu's should be integrated into the volume generations

- Design horizon year for the development shall be the build-out year of the development or as stipulated in the reference standards,
- Background traffic volumes shall be consistent with the time horizons used in the City's current Transportation network study,
- Operating data for existing Traffic Signals will be provided by the City of St. Thomas,
- Mitigative measures, right-of-way requirements, improvements (including traffic control devices) and cost allocation.

5.4.3.2. Capacity Analysis

- Synchro 8, or later version, required to calculate signalized and unsignalized intersection or development access Capacity and Levels of Service.
- Ideal (Saturation) Flow Rates to be used within the city of St. Thomas as follows (in vphpl):

						
1775	1775	1850	1550	1650	1650	1550
Dual Turn Lanes	Left Turn Lane	Through Lane	Right Turn Lane	Through/ Left Lane	Through/ Right Lane	Single Lane Only
						
1650	1775	1775	1820	1765	1735	
Two Lane Through Left / Right	Two Lane Through Left	Two Lane Through Right	Three Lane Two Through Right	Single Lane Left / Right	Three Lane One through Left & Right	

- Link Speed = Posted Speed
- 95%-ile (LoS – "A") used to determine critical queuing.
- Volume/Capacity (v/c) & Delay Level of Service (DLoS) analysis required with the following thresholds of acceptability. Any specific movement v/c higher or intersection Delay LoS lower than these thresholds will require further analysis to determine geometric or signal phasing improvements:

Turning Movement	Acceptable V/C Ratio
Through Movements	≤ 0.85
Left Turn Phasing	≤ 0.95
Turning Movement	Acceptable Delay LoS
Existing Geometrics w/ Existing Volumes	E or better
Existing Geometrics w/ Projected Volumes	E or better
Proposed New Intersections or Improved Geometrics w/ Existing Volumes	D or better
Proposed New Intersections or Improved Geometrics w/ Proposed Volumes	D or better
Exclusive Turn Movement Signal Phases	E or better

The City may require higher LoS for these turning movements depending on historical data for the intersection. For example, the acceptable Delay LoS may be bumped up to D or better for existing geometrics if historical data reflected this as acceptable to commuters.

5.4.3.3. Traffic Signal Warrants

- Synchro peak hour performance results alone cannot be used to determine the need for traffic signals.
- Signalization can only be determined through compliance to the official Ontario Traffic Signal Warrants, as detailed in the Ontario Traffic Manual – Book 12 Traffic Signals (most recent version).
- Refer to OTM Book 12 for further details and information.
- Multi-staged developments will require Signal Warrant analysis for each stage. When Warrants become met at any one stage, the following stages will not require further Warrant analysis.

5.4.3.4. Standard Intersection Minimum Timings

The standard minimum intersection timings shall be as follows:

Parameter	Time
Minimum Vehicle through	8.0 Seconds
Minimum Advance Green	5.0 seconds
Vehicle Passage	3.0 seconds
Amber	Refer to the current timing. New timing calculated per OTM Book 12
All Red	Refer to the current timing. Calculated according to field measurement *
Min. Pedestrian Walk	8

Parameter	Time
Min. Pedestrian Flashing Don't Walk	5.0 seconds
Maximum Cycle Length	100 seconds

* 1 Second for advance phases

The total lost time must equal 4 seconds for all movements.

5.4.3.5. Analysis Procedure And Reporting Requirements

Travel demand forecasts, Capacity Analysis and Traffic Study procedures shall be carried out in accordance with the reference standards and guidance from the City.

Traffic study reports shall identify all assumptions made. All findings and recommendations shall be supported by acceptable analysis, maps, charts, figures, calculations, tables and modelling input and output files.

5.4.4. Parking Study Guidelines

5.4.4.1. Approach

- Data should be collected on a 20 minute interval for 12 hours based around the general operating hours of the surrounding businesses.
- The day of week the study is undertaken should be justified based upon the surrounding land use peak usage. The City would suggest that primarily commercial and residential areas have parking studies completed on a Saturday while a Central Business District should consider Monday – Friday.
- For non standard land use such as event based development, the proponent shall use good engineering judgment and provide the rationale for the study parameters.
- The collected data shall be processed to determine the following parking utilization statistics:
 - Average and maximum parking accumulation (average and maximum number of parked vehicles);
 - Average and maximum parking occupancy (ratio of the average and maximum number of parked vehicles to parking capacity, expressed as a percentage);
 - Average duration (average length of time vehicles were parked); and
 - Average space turnover (average number of times a parking space was used by a different vehicle within a given period of time).
- The study area should be shown graphically with appropriate parking time limits as displayed on the street/lot and confirmed with the City's current Traffic and Parking By-law.

5.4.4.2. General Reported Results

- The parking statistics to be identified as a result of this study include the following:
 - Number of different vehicles observed;
 - Average and maximum accumulation;
 - Parking duration; and
 - Parking space turnover.
- Findings should be summarized for on-street parking and for off-street parking spaces, respectively.

5.4.4.3. Parking Demand – Supply relationship

- The consultant traffic engineer hired by the developer will comment on the existing relationship (as studied) and contrast the potential demand from the proposed development. Short term and long term parking shall be evaluated with consideration for any future expansion where the City would not have the opportunity to be consulted (inclusion of unfinished suites).
- Parking should be expected to be fully managed and maintained on the development's property. City of St. Thomas does not permit on street parking spaces counting toward the requirements set forth in the City's Zoning By-law.

5.4.4.4. Parking Requirements – Typical Layouts

Off-street parking shall be in compliance with the Typical Parking Requirements Plan in Section 15.

5.5. Traffic Calming

Traffic Calming features are not supported. Design of new subdivision streets and land use should be undertaken to moderate vehicle speed and volume.

5.6. Traffic Signals

Should traffic signals be required, a separate Signal Wiring Plan; and Signalized Intersection Plan showing location of all poles and mounted hardware, handwells, ducts/cables, the controller, and full turn lanes (storage and taper). The plans shall be submitted at a scale of 1:250. PHM-125 record drawings are required for all traffic signal drawings.

6. SANITARY SEWERS

This document outlines the minimum requirements for the design of a sanitary sewer system within the limits of the City of St. Thomas boundary.

Sanitary sewer design computations shall be completed on a standard Sanitary Sewer Design Sheet. A copy of the design sheet, together with a Sanitary Sewer Drainage Plan, showing the tributary areas and shall be submitted as per the sample sanitary design sheet in Section 15.

6.0. General Requirements

Sanitary sewers are **not** permitted to accept foundation or weeping tile drainage or roof drainage.

All sanitary sewer and appurtenances are to be designed and constructed in accordance with the current City of St. Thomas and Ministry of the Environment standard drawings and specifications.

In cases of new subdivisions, the consulting Engineer is required to establish the geodetic invert elevations and ties of all sanitary sewer connections at street line and to make this information available on the as-built plans to the City of St. Thomas.

All sanitary sewers are to be constructed as per OPSS and OPSD specifications.

6.1. Peak Flow Calculation

6.1.1. Flow Formula and Roughness Coefficient

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

The Manning formula is as follows:

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

Where:

- Q = Flow capacity of sewer (m³/s)
- A = Cross Sectional Area of Pipe m²
- R = Hydraulic radius of pipe (D/4) (m)
- S = Sewer Slope m/m
- n = Manning roughness coefficient (unitless)

For the design of gravity sewers and open channels, the Manning Formula shall be used. Manning Roughness Coefficients shall be as follows:

Pipe Material	Mannings 'n'
Concrete Pipe	0.013
P.V.C Pipe	0.013
H.D.P.E Pipe	0.013
Corrugated Metal Pipe – 12mm corrugations	0.024
Corrugated Metal Pipe – 50mm corrugations	0.035

6.1.2. Allowable Flow Velocities

- Minimum velocity = 0.6 m/s
- Maximum velocity = 4.5 m/s

6.1.3. Minimum Pipe Sizes

- Sanitary sewers – 200 mm
- Private Drain Connections (PDC) – 150 mm

6.1.4. Design Criteria

In view of several different criteria having been used in the past, it is important that future sanitary sewers be designed on a consistent basis. The following design values should be used for all new development being modified where data is available.

- For new development, a value of 250 l/capita/day should be used for estimating flow rates.
- Infiltration and inflow should be estimated at 8,640 l/ha/day (0.100 l/ha/second) for new development.
- Continued use of available data for infiltration rates and sewage usage rates should be used for existing development.
- Population density equivalent for various types of development should be as follows:

Development Zoning	Population Density
Low density residential	44 persons/ha
Medium density residential	65 persons/ha
Institutional (schools, etc)	53 persons/ha
Commercial	60 persons/ha
Industrial	150 persons/ha

- Alternatively population density can be calculated on a lot basis using the following criteria:

Lot Basis

Single Family = 3 people/unit

Semi-detached = 6 people/unit

Sanitary sewers shall be designed in accordance with the Ministry of the Environment and Climate Change (MECP) guidelines for the design of sanitary sewage works.

6.1.5. Minimum Slopes for Pipes

The minimum slopes for sewers, flowing fully, are as follows:

Pipe Size	Slope
200 mm	0.40 %
250 mm	0.28 %
300 mm	0.22 %
375 mm	0.15 %
450 mm	0.12 %
525 mm	0.10 %
600 mm	0.08 %
675 mm	0.07 %
750 mm	0.06 %

6.1.6. Peak Rate of Flow

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

$$Q(d) = PqM + IA$$

Where:

Q (d) = Peak domestic flow L/s

P = Design population in thousands

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

M = Peaking factor derived from Harmon Formula

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

A = Gross tributary area in hectares

Harmon Formula:

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

Where:

M = Ratio of peak flow to average flow

P = Tributary population in thousands

6.2. Design Considerations

All sewers 750 mm in diameter or larger shall be shown with two lines in the plan view.

Fill beneath sewers and services is to be granular fill compacted to 95% Standard Proctor Maximum Dry Density (SPMDD).

All sewers shown within a road allowance should be 3m apart unless otherwise approved by the City Engineer.

Minimum elevation of new basements must be shown whenever the sanitary sewer in the street has less than 2.7m cover.

Bolt down covers are required where manholes are in flood plain or overland flow routes.

No decrease of pipe size from a larger size upstream to a smaller size downstream will be allowed regardless of increase in grade.

No sewer pipes greater than 375mm diameter may be turned at 90°.

6.3. Manhole Design

Changes of direction of flow, greater than 90° shall not be permitted in one manhole.

In sewers 900mm diameter and greater, changes in direction of flow greater than 45° shall not be permitted in one manhole.

Manholes on sewers shall be located at every change of size, grade or direction of flow but shall in no case exceed the maximum spacing.

- | | |
|--|------------|
| • for pipes up to and including 900mm diameter | 110 metres |
| • for pipes over 900mm diameter | 150 metres |

Allowances for bends in sewer alignments - fall through manholes shall be calculated in accordance with the Table below:

- for 45° bends - use $\frac{3}{4}$ of the losses for 90° bends.
- for 22 ½ ° bends – use $\frac{1}{2}$ of the losses for 90° bends.

Safety grating are required at the mid-point depth of manhole, when the depth is between 5.0 and 10.0m. Additional safety grates are required at third-point depths, when the manhole is equal to or greater than 10.0m to 15.0m deep. All in coming pipes are to be below safety gratings, where possible.

All manhole chamber openings shall be located on the side of the manhole parallel to the flow for straight run manholes, or on the upstream side of the manhole at all junctions.

The obvert of the inlet pipe(s) shall not be lower than the obvert of the outlet pipe.

The minimum drop across manholes shall be as follows:

Change of Direction	Minimum Drop (mm)
0°	20
1 ° to 45°	40
46° to 90°	50

Where the difference in elevation between the invert of the inlet and obvert of the outlet pipes exceeds 600 mm in height, a drop structure shall be placed on the inlet pipe, with the invert of the drop pipe located at the spring line of the outlet pipe. Design shall be in conformity with OPSD's.

All sewer manholes shall be benched as per OPSD 701.021.

For the case of constant diameter upstream and downstream with no lateral in-flow into a manhole, the coefficients in the following table are applicable:

Straight Manhole

Head loss coefficients K in terms of $\frac{v^2}{2g}$

Length of Manhole	Head Loss Co-efficient K
1 x pipe diameter	0.07
3 x pipe diameter	0.22

No radial pipe will be allowed for pipe having a diameter of less than 675mm. Minimum radii for radial pipe:

Diameter (millimeter)	Radius (meter)
675mm	14m
750mm	14m
825mm	14m
900mm	15m
975mm	15m
1050mm	17m
1200mm	18m
1350mm	20m
1500mm	21m

6.4. Pumping Stations

Sanitary sewers are required to carry domestic, commercial and/or industrial sewage from each area of the development under consideration. Flow is to be by gravity and pumping will be considered only where other alternatives are not possible and only with the approval of the City. City Staff shall be consulted on design criteria, operational preferences and other requirements during the pump station design. Stations shall have full backup power, SCADA connectivity, and flow monitoring.

6.5. Sanitary Private Drain Connections (PDCs)

Each property shall be provided with a sanitary PDC of a minimum diameter of 150 mm (6") having a minimum slope of 2%.

The sanitary sewer shall generally be located on the centerline of the street and the minimum depth of cover shall be 2.4m unless designing for a cul-du-sac, then see detailed drawing at the end of this section.

In industrial and commercial areas, an inspection manhole shall be located at property line on the service.

Sanitary PDC's shall not be connected into sanitary manholes. Any deviations must be approved by the City Engineer.

All sanitary sewer lateral connections shall be installed using prefabricated tees. All connections shall conform to Standard Drawings in Section 15.

Bedding for service laterals shall be equivalent to the bedding specified for sanitary mainline sewer pipe.

The location of the end of all lateral connections shall be marked by a 50mm x 100mm wooden stake, 2 meters long, projecting one meter above the ground with the stake painted **white**.

All locations and elevations of the sanitary PDC shall be recorded on a Building Services Report and submitted to the Environmental Services Department along with As-built Drawings for the project, whether part of a reconstruction project or new development. See Section 15 for a sample Building Services Report.

6.6. Easements

All sewer easements must be a minimum of 5.0m wide for one service. These minimum values must be increased where the depth or diameter of service dictates a greater working area.

6.7. Sanitary Testing Requirements

The contractor shall supply, at his own expense, all labour, equipment and materials necessary to carry out infiltration / exfiltration tests, deflection testing and video inspection of all sanitary sewer and appurtenances as specified under this section. All tests shall be carried out under the direction and supervision of the City of St. Thomas Environmental Services Department.

6.7.1. Infiltration / Exfiltration Tests

Infiltration and exfiltration tests shall be conducted on new sanitary sewers as per the requirements in OPSS 410.07.16.03 and 410.07.16.04.

6.7.2. Deflection Test

A deflection test shall be conducted on new sanitary sewers as per the requirements in OPSS 410.07.16.05.

6.7.3. Video Inspection

All new sanitary sewers shall be video inspected using Closed Circuit Television (CCTV) equipment. CCTV inspection shall be conducted in accordance to OPSS 409. Three digital copies of the CCTV inspection reports and videos shall be provided to the City of St. Thomas, Development and Compliance Division.

6.8. River Crossings and Forcemains

All river crossings and force main design must be reviewed and approved by the City Engineer and the Environmental Services Department.

7. STORM SEWERS

This document outlines the minimum requirements for the design of a storm sewer system within the limits of the City of St. Thomas boundary.

7.0. Storm Drainage Area Plans

Storm sewer design computations shall be completed on a standard Storm Sewer Design Sheet. A copy of the design sheet, together with a Storm Sewer Drainage Plan, showing the tributary areas shall be submitted as per the sample storm design sheet in Section 15.

In lieu of precise information on development on the whole or any part of a watershed area, the latest zoning by-law and Official Plan issued by the Planning Department shall be used for all external areas in the design and to determine the specific areas to which these values apply.

The external drainage area plan shall be prepared and shall be submitted at the functional servicing report stage and prior to the commencement of the detailed storm sewer design.

In the case of large areas under single ownership of blocks requiring future site plan agreements, the design shall be prepared on the basis of the whole area being contributory to one manhole in the abutting storm sewer unless more than one private storm connection is necessary to serve the property in which case the appropriate area tributary to each connection shall be clearly shown and taken into account in the storm sewer design.

7.1. Design Flows

7.1.1. Runoff Computations

The Rational Formula is to be used to determine the quantity of storm runoff. The use of other empirical runoff formulae must be approved by the City's engineer. The Rational Formula is as follows:

$$Q = 2.78 \times C \times i \times A$$

Where:

Q = Peak flow in L/s

A = Area in hectares

i = Average rainfall intensity in mm per hour for a duration equal to the time of concentration for a particular storm frequency

C = Runoff coefficient (see **Section 7.2.5**)

7.1.2. Drainage Area

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

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

7.1.3. Design Storm Frequency

The design storm frequency shall be a 5-year storm for residential lands and a 5-year storm for industrial or commercial lands.

Storm sewer design for the areas other than residential development shall be based on a return frequency as directed by the City Engineer.

7.1.4. Rainfall Intensity

For rainfall intensity, the following equation shall be used for the Rational Formula:

$$Intensity (i) = at^b$$

Where:

i = rainfall intensity (mm/hr)

a, b = rainfall parameters listed below

t = inlet time based off of time of concentration (hours)

Parameters for this equation are derived from the MTO's Intensity-Duration-Frequency (IDF) curve lookup tool that can be found here:

http://www.mto.gov.on.ca/IDF_Curves/terms.shtml

Return period	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
A	23.6	31.1	36.0	42.3	46.9	51.5
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

7.1.5. Time of Concentration

The time of concentration is the time required for flow to reach a particular point in the sewer system from the most remote part of the drainage area. It includes not only the travel time in the sewers, but also the inlet time, or time required to flow overland into the sewer system.

The inlet time for residential areas shall be **15 minutes**. For all other areas, supporting calculations shall be submitted to the City Engineer for review.

The time of concentration shall be adjusted when lateral flows account for 50% or more of the design flows.

Adjusted time of concentration shall be calculated using the formula:

$$T_{c-adj} = \frac{(T_{ct}Q_t) + (T_{cl}Q_l)}{(Q_t + Q_l)}$$

Where :

- T_{c-adj} = adjusted time of concentration (min.)
- T_{ct} = time of concentration in the trunk sewer (min.)
- Q_t = design flow in the trunk sewer (l/s)
- T_{cl} = time of concentration in the lateral sewer (min.)
- Q_l = design flow in the lateral sewer (l/s)

The adjusted time of concentration is used downstream of the junction manhole.

7.2. Storm Sewer Design

7.2.1. Flow Formula and Roughness Coefficient

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

The Manning formula is as follows:

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

Where:

- Q = Flow capacity of sewer (L/s)
- A = Cross Sectional Area of Pipe m²
- R = Hydraulic radius of pipe (D/4) (m)
- S = Sewer Slope m/m
- n = Manning roughness coefficient (unitless)

The Manning roughness coefficient (n) shall be as follows:

Pipe Material	Mannings 'n'
Concrete Pipe	0.013
P.V.C Pipe	0.013
H.D.P.E Pipe	0.013
PolyPropylene (PP)	0.013
Corrugated Metal Pipe – 12mm corrugations	0.024
Corrugated Metal Pipe – 50mm corrugations	0.035

7.2.2. Allowable Flow Velocities

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

7.2.3. Minimum Pipe Sizes

- Storm sewers = 250 mm
- Catch basin leads = 250 mm
- Private Drain Connections = 100 mm or 150 mm

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

7.2.4. Minimum Grades for Pipes

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

Size of Pipe	Minimum Slope
250 mm	0.56 %
300 mm	0.44 %
375 mm	0.32 %
450 mm	0.26 %
525 mm	0.21 %
600 mm	0.18 %
675 mm	0.15 %
750 mm	0.13 %
825 mm	0.11 %
900 mm	0.10 %
100 mm or 150mm	Connections 2.0 %

7.2.5. Runoff Coefficients

Runoff coefficients (C) to be used in the rational formula shall be as follows:

Land Use	C Value
Open Space Areas	0.25
Single Family/Semi-Detached	0.45 – 0.50
Townhouse/Condo	0.65
Apartments	0.65 – 0.70
Industrial, Institutional, and Commercial	0.70 – 0.90
Densely Built or Paved Areas	0.90

No allowances for infiltration are required in storm sewer capacity determination.

7.3. Manhole Design

Changes of direction of flow, greater than 90° shall not be permitted in one manhole.

Manholes on sewers shall be located at every change of size, grade or direction of flow but shall in no case exceed the maximum spacing.

- | | |
|--|------------|
| • for pipes up to and including 900mm diameter | 110 metres |
| • for pipes over 900mm diameter | 150 metres |

Allowances for bends in sewer alignments - fall through manholes shall be calculated in accordance with the Table below:

- for 45° bends - use $\frac{3}{4}$ of the losses for 90° bends.
- for 22 ½ ° bends – use $\frac{1}{2}$ of the losses for 90° bends.

Safety grating are required at the mid-point depth of manhole, when the depth is between 5.0 and 10.0m. Additional safety grates are required at third-point depths, when the manhole is equal to or greater than 10.0m to 15.0m deep. All incoming pipes are to be below safety gratings, where possible.

All manhole chamber openings shall be located on the side of the manhole parallel to the flow for straight run manholes, or on the upstream side of the manhole at all junctions.

The obvert of the inlet pipe(s) shall not be lower than the obvert of the outlet pipe.

The minimum drop across manholes shall be as follows:

Change of Direction	Minimum Drop (mm)
0°	20
1 ° to 45°	40
46° to 90°	50

Where the difference in elevation between the invert of the inlet and obvert of the outlet pipes exceeds 1.2m, a drop structure shall be placed on the inlet pipe, with the invert of the drop pipe located at the spring line of the outlet pipe. Design shall be in conformity with OPSD's.

All sewer manholes shall be benched as per OPSD 701.021. This will eliminate the potential for ground water to enter the sewer and into the pipe.

For the case of constant diameter upstream and downstream with no lateral in-flow into a manhole, the coefficients in the following table are applicable:

Straight Manhole

Head loss coefficients K in terms of $\frac{v^2}{2g}$

Length of Manhole	Head Loss Co-efficient K
1 x pipe diameter	0.07
3 x pipe diameter	0.22

No radial pipe will be allowed for pipe having a diameter of less than 675mm. Minimum radii for radial pipe:

Diameter (millimeter)	Radius (meter)
675mm	14m
750mm	14m
825mm	14m
900mm	15m
975mm	15m
1050mm	17m
1200mm	18m
1350mm	20m
1500mm	21m

7.4. Catchbasins

Catchbasins shall be located at a maximum interval of 100m between catchbasins, or 100m between a crest of a road to a catchbasin.

Catchbasins are to be 1.5 m clear of any driveway curb depression.

Double catchbasins or curb inlet catchbasins are to be used at all low points on a roadway. Inlet grate capacity shall be calculated by the Consulting Engineer, and adjust catchbasin spacing accordingly. Catchbasins shall be spaced such that no ponding occurs in the minor storm events (1:5 year storm event).

Catchbasin types (DICB, TICB, CICB, etc.) will be evaluated on an individual basis.

Catchbasins shall have subdrains installed 2.5m on each side, at a minimum. Material shall be corrugated steel pipe or PVC pipe, with perforations of 6 mm diameter in four rows positioned at 4, 5, 7, and 8 o'clock and 75mm apart longitudinally, or approved equivalent.

7.5. Major Overland Flow Routes

Storm drainage shall be provided on a major system and minor system basis, with stormwater management controls, as required by the appropriate agencies, in accordance with the MOECC's "Stormwater Management Practices, Planning and Design Manuals."

The maximum depth of ponding for major flow routes shall be 300 mm deep. No ponding shall occur in the roadway for the minor storm events.

The major storm drainage system shall permit continuous overland flow along roads and easements without flooding onto lots during a 100 year storm. The route of the flood flows resulting from this storm

through to a major watercourse shall be shown on a plan and any potential areas of flooding shall be identified.

7.6. Cover

A minimum cover of 1.5m (from future road grade) is required to the top outside edge of the pipe barrel from the storm sewers.

7.7. Easements

All sewer easements must be a minimum of 5.0m wide for one service, depending on the depth of the storm sewer. Any exceptions shall be approved by the City Engineer. These minimum values must be increased where the depth or diameter of service dictates a greater working area.

7.8. Storm Private Drain Connections (PDCs)

All PDC's shall be installed a minimum of 1.0 m past property line on all new construction.

No PDC's are to be connected directly into a maintenance hole unless design constraints arise (i.e. cul-de-sac). This design must be approved by the City Staff.

PDC's on private property of the town house complexes, row housing and apartments are to be connected to a maintenance hole located on the R.O.W. PDC's for industry and commercial property are also to be connected to a maintenance hole located on the R.O.W.

All PDC's shall be installed perpendicular to the sewer main using factory supplied tees, where possible. Under no circumstances, will flow from the PDC enter the main against the flow in the main. Connections shall be as per OPSD 1006.020.

Where there is a conflict with the proposed PDC location due to a maintenance hole etc., then long sweeps must be used to establish a perpendicular connection at the main and perpendicular to property locate at the R.O.W.

All locations and elevations of the storm PDC shall be recorded on a Building Services Report and submitted to the Environmental Services Department along with As-built Drawings for the project, whether part of a reconstruction project or new development. See Section 15 for a sample Building Services Report.

8. STORMWATER MANAGEMENT

This section defines the stormwater management (SWM) guidelines applicable in the City of St. Thomas. For all new SWM facilities in the City of St. Thomas, the developer shall contact the Environmental Services Department for further clarification and guidance on applicable requirements and standards that may influence the development's SWM facility.

8.0. Stormwater Management Design Criteria

8.0.1. Peak Flow Control

The peak flows discharged from the site shall not increase as a result of the proposed development for the calculated 2 through 100-year storm events. All stormwater management (SWM) measures shall provide an “Enhanced” level of protection in accordance with the MOE Stormwater Management Planning and Design Manual (March 2003).

Extended detention and storage of SWM facilities should discharge over a 24-48 hour period to the five year (5 year) storm event under pre-development conditions.

8.0.2. Low Impact Development (LID) Measures

The City of St. Thomas promotes the use of Low Impact Development (LID) SWM measures. LID measures, such as infiltration galleries, shall be distributed around the site rather than at a single “end of pipe” location.

All LID facilities shall have a design capacity that exceeds the existing conditions recharge volume by 15 percent as a factor of safety to account for aging, compaction and potential clogging. LID must also demonstrate reasonable drawdown time. Based on Environment Canada data, seven rainfall events occur in a typical month that is greater than 5 mm. A maximum drawdown time of 4 days shall therefore be required.

During construction all LID measures shall be bypassed to prevent accelerated clogging.

8.0.3. Design Storm Selection

In the design of SWM facilities, a 3 hour Chicago Rainfall Distribution storm should be applied in the City of St. Thomas. AES or SCS storm distributions may also be applicable in larger subwatershed study areas, and consulting engineers should confirm with the City when use of these other storm distributions are acceptable or applicable.

Design storm information used for the City of St. Thomas is derived from the MTO's Intensity-Duration-Frequency (IDF) curve lookup tool that can be found here:

http://www.mto.gov.on.ca/IDF_Curves/terms.shtml

The following information table was taken from website above.

Duration	Intensity (mm/hr)								
	5 min	10 min	15 min	30 min	60 min	120 min	360 min	720 min	1440 min
2 yr	126.8	77.9	58.6	36.0	22.1	13.6	6.3	3.9	2.4
5 yr	168.1	103.6	78.0	48.1	29.6	18.2	8.5	5.2	3.2
10 yr	195.0	120.3	90.7	55.9	34.5	21.3	9.9	6.1	3.8
25 yr	229.5	141.7	106.9	66.1	40.8	25.2	11.7	7.3	4.5
50 yr	254.7	157.4	118.8	73.4	45.4	28.1	13.1	8.1	5.0
100 yr	280.5	173.4	130.9	80.9	50.0	30.9	14.4	8.9	5.5

8.1. SWM Requirements for Development

The following is a summary of the Storm Water Management (SWM) requirements for development submissions. There may be additional information required depending on the site location and SWM variables.

- Provide all SWM calculations to show the existing (pre construction) storm water flows and the proposed (post-construction) flows. These flows shall be calculated based on the latest MECF guidelines and the City's Design Guidelines Manual.
- Provide calculations for SWM facility sizing, orifice sizing, and any other relevant calculations completed for the design of the facility.
- Identify the major overland flow routes and provide volume calculations for the routes at various cross sections to confirm that the major overland flow route will carry the major flow.
- Identify the levels of stormwater in the storage facility for the various rainfall events.
- All designs of SWM ponds must follow the most current edition of the Ministry of the Environment SWM Planning and Design Manual and must also reference the Best Management Practices.
- Identify the proposed landscaping in the vicinity of the SWM facility.
- Design storm sewer pipe system to 5-year storm return period for pipe flow condition.
- Keep development maximum outlet flows to pre-development values for the 2 to 100-year return period.
- Detain the first 13 mm or 24 mm, as applicable, of rainfall generated runoff from all new development for a period of 24 to 48 hours for quality control.
- Use of shallow grassy lined swales for storm water conveyance is recommended.

- Utilizing inlets for temporary ponding and buried perforated pipe covered with porous material (granular or topsoil material) for infiltration may also be considered.
- Typically, site plan developments require the installation of a storm water quality control device (i.e. Oil grit separator). The storm water quality control devices will be approved on an individual basis. Most areas within the City of St. Thomas fall under the 'Type 2 Habitat' designation.
- Include all design detail, sizing calculations, sediment removal rate and floatable storage capacity for the unit, ensuring its design and installation, will more than adequately suit the site plan development.

9. WATERMAINS

9.0. General

These specifications shall apply to all water services and to all watermains including appurtenances which are located within the City road allowance, or on property which will be transferred to City ownership. These specifications shall also apply to all water meter placements.

The designer shall design to City Specifications and also make reference to the Ministry of the Environment “Design Guidelines for Drinking-Water Systems” and to the MOECC’s “Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit”. If there is a discrepancy between the City Specifications and the MOE Guidelines then the Environmental Services Department shall be contacted to resolve the issue.

Any deviation from these specifications must be submitted in writing to the City Engineer.

These specifications shall apply to all services and private watermains and to all watermains up to 450mm diameter including appurtenances. For watermains larger than 450mm diameter and for any other water system installation, special specifications must be prepared for and approved by the City Engineer. These specifications are to be used as a supplement to all other specifications approved by the City Engineer for water system installation.

The water distribution system is for the purpose of supplying and distributing water, but does not include plumbing or other works to which the Ontario Building Code applies.

A water distribution system may exist for the purpose of distributing potable or non-potable water; however, water distribution systems for potable and non-potable water may not be intermixed or cross-connected. Private supplies of potable water may not be cross-connected to the municipal or public water distribution system.

9.1. Permitted Uses

Permitted and non-permitted uses of water are identified in By-Law 44-2000 (A by-law to provide for the regulation of Water Supply in the City of St. Thomas).

9.2. Watermain Design

9.2.1. Pressure and Flow Requirements

Watermains shall be sized to maintain the greater of:

- Maximum day demand plus fire flow at a pressure not less than 140 kPa at any hydrant lateral or potential fire service connections.

- Maximum hourly demand at a pressure not less than 275 kPa in residential areas and not less than 310 kPa in industrial areas.
- Average day demand at a pressure not less than 275 kPa.
- Maximum residential pressure should not exceed 690 kPa and a minimum residual pressure (peak hour) shall not be below 275 kPa.

The pipes shall be designed so that the velocity for normal rates will be between 0.6 and 1.5 m/s. The maximum velocity for fire demand shall not exceed 3.0 m/s. Fire flows shall be calculated on the standards of the Fire Underwriters Survey.

9.2.2. Design Water Demands

9.2.2.1. Total Water Demands

Gross water consumption rate recorded for the City is 450 L/d average per capita.

9.2.2.2. Domestic Water Demands

Average domestic unit demand varies from 270 to 450 L/d per capita. This demand varies with location and projected future increased use.

Applicable demands and peaking factors should be obtained from the City Engineer.

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

Maximum day plus fire flow (max day = 3.5 x avg. day)

Peak rate (maximum hourly demand) (max hour = 7.8 x avg. day).

9.2.2.3. Commercial, Institutional and Industrial Water Demands

These demands vary greatly with the type of water using facilities or process present in the development. If the Developer (designer) does not know the required demand, he should refer to the MOECC "Guidelines for the Design of Water Distribution Systems". The City Engineer can also provide typical demand and peaking factor data. For industrial demands, the Developer (designer) should discuss water requirements with the City Engineer.

The following demands shall be used as minimums in the absence of reliable flow data:

- Commercial: 28 m³ / hectare day
- Light industrial: 35 m³ / hectare day
- Heavy industrial: 55 m³ / hectare day.

Peak flow rates shall be determined with the City Engineer on a project by project basis.

9.2.2.4. Fire Demand

To estimate the fire flow requirements for a particular structure or area of a City, the designer should refer to the guide "Water Supply for Public Fire Protection - A Guide to Recommended Practice", (latest revision) prepared by Fire Underwriters Survey, Insurers Advisory Organization, 180 Dundas Street West, Toronto, Ontario M5G 1Z9, the Ontario Building Code and the Ontario Fire Code.

9.2.3. Friction Factors

The following Hazen-Williams "C" values shall be used for design, regardless of material:

Diameter	"C" Factor
100 and 150mm	100
200 and 250mm	110
300 to 600mm	120
Over 600mm	130

9.2.4. Minimum Pipe Sizes

The minimum pipe size for any domestic water service is 25mm.

The minimum size for watermains shall be 50mm for supplying only domestic services or 150mm if fire protection is to be provided. Actual watermain pipe size requirements are to be confirmed by modeling methods.

Accepted pipe sizes are 25mm, 50mm, 100mm, 150mm, 200mm, 250mm, 300mm, 400mm, 450mm, and 600mm. For larger pipe sizes, the designer should consult with the City's Environmental Services Department.

9.2.5. Water Quality

Watermains and their networks shall be designed such that water shall not remain unused in the watermain for more than three (3) days under average day demand.

To demonstrate a three day turnover, the consultant/designer shall provide a hydraulic analysis as outlined elsewhere in this document. The hydraulic analysis shall also provide calculations to determine if and where automatic flushing devices are required and determine the appropriate size of flushing device (25mm or 50mm).

The City of St. Thomas has primary responsibility to ensure that the minimum chlorine residuals are maintained in the distribution system and therefore reserves the right to require watermain looping and/or automatic flushing devices and/or blow-offs to facilitate the maintenance of the chlorine residual.

On private property, where there is concern (When a (3) day water turn-over cannot be achieved) that there may be degradation of the water quality in the private service, that has the potential to re-enter the municipal water system, the City reserves the right to require premise isolation. This shall consist of appropriate backflow protection to the risk posed and shall be installed at the property line and at the owners expense.

9.3. Watermain Layout

9.3.1. Location of Watermain in Road Allowance

Watermains shall be located in accordance with the City of St. Thomas Standard ROW Cross Sections. Deviation from the standard location must be approved by the City Engineer.

The standard location must be used on straight streets. On bends, the main may deviate from the standard up to 1.0m closer to the street line but not closer to the curb and gutter as approved by the Environmental Services Department. Maximum use may be made of pipe joint deflections so that a minimum number of bends are used on any curved laying line. PVC pipe will require more bends because the allowable joint deflection is smaller. Refer to AWWA C600 for Ductile Iron Pipe, AWWA M23 for PVC pipe and supplier specifications for allowable joint deflection and pipe bending.

Watermains shall be terminated opposite street lines or property lines.

9.3.2. Depth of Watermain

Watermains shall have no less than 1.7m nor more than 2.0m of cover from final surface grade. Variations from this cover may be made only if approved on plans or in writing by the City Engineer.

For unimproved roads with open ditches, watermains shall be laid 2.1m minimum below road grade or 1.2m below the bottom elevation of the ditch, whichever is greater. Consideration shall be taken by the designer for the vertical alignment of the road and its impacts with the watermain resulting from future road improvements.

9.3.3. Pipe Insulation

Where joint deflections, offsets, or other issues arise that require the watermain to be laid with less than 1.5m of cover from final surface grade, insulation shall be placed to prevent freezing.

Insulation is also required between a watermain and storm sewer/culvert where there is less than 1.5m minimum separation. Please refer to the City of St. Thomas Standard Contract Documents for insulation detail and requirements.

9.3.4. Blow-offs and Dead Ends

Dead end watermains shall not be permitted unless unavoidable. All dead end watermains are to have a 50mm blow off installed as per City of St. Thomas Standard Contract Documents.

Where a watermain ends in a cul-de-sac, a 50mm watermain loop shall be installed from the minimum 150mm watermain to last fire hydrant around the cul-de-sac, where the loop reconnects back to the watermain. The designer can contact the City's Environmental Services Department for further details of the cul-de-sac watermain loop.

A hydrant and valve shall be installed at the end of a watermain on a street that is to be extended in the future. A 50mm blow off may be substituted at the discretion of the City Engineer.

9.3.5. Thrust Restraint

See the City of St. Thomas Standard Contract Documents for thrust restraint details and requirements.

9.3.6. Separation between Watermains and Sewers/Utilities

Designers should refer to the Ontario Ministry of Environment and Climate Change (MOECC) Guidelines regarding the location of watermains relative to sewers and to the Public Utilities Act of Ontario regarding the location of watermains relative to other utilities.

9.3.7. Parallel Installations

Sewers and watermains located parallel to each other should be constructed in separate trenches maintaining the maximum practical horizontal separation.

Under normal conditions, watermains shall be laid with minimum 2.5m clear horizontal separation from any sewer or sewer manhole; the distance shall be measured from the nearest edges.

9.3.8. Crossings

The designer shall refer to the Ministry of the Environment's and Climate Change's Procedure F-6-1, Procedures to Govern the Separation of Sewers and Watermains.

Under normal conditions, watermains shall cross above sewers and Private Drain Connections (PDC) with a minimum vertical separation of 0.50m to allow for proper bedding and structural support of the watermain over the sewer or PDC.

Where it is not possible for the watermain to cross above the sewer or PDC, the watermain passing under a sewer or PDC shall be protected by providing:

- A vertical separation of at least 0.6m between the invert of the sewer or PDC and the crown of the watermain.
- That a minimum of 5.0m length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer or PDC.
- Structural support is provided to prevent excessive joint deflection and settling.
- The crossing is not within 2.0m of a watermain joint (for watermains larger than 450mm diameter).

The same criteria shall be applied in new construction (i.e. subdivisions) and in conditions where an existing watermain is present. Also, the same criteria as noted above shall be applied if the watermain crosses above or below a sewer, PDC or other utility.

9.3.9. Watermain Looping

Water distribution systems shall be designed to exclude any dead-ended pipe. Water distribution systems shall be designed so that no more than sixty (60) units with individual water services and meters shall be serviced from a single source of supply. If the looped watermain is connected to a single watermain, a valve must be installed in the watermain to permit isolation of supplies.

A looped watermain connected to a public or private watermain or watermains must be installed:

- when one water service will not supply the required flow for domestic use and fire protection or,
- for an apartment complex containing one or more structure and more than 300 dwelling units or,
- for a townhouse, condominium or similar complex having more than eighty (80) units with individual water services and meters.

The looped water servicing must be installed to service the private development from two sources. If the looped watermain is connected to one public watermain, an isolating splitter valve must be installed in the public watermain to permit isolation of supplies, at no cost to the City.

9.4. Easements

Easements may be required for watermains to be assumed by the City located outside a road allowance on privately owned property.

Easement widths are determined by the depth of cover from the centreline of the road/round to the invert of the watermain or a minimum of 5.0m, assuming no other services are located within the easement. If additional services are located in the easement, adequate width of easement and separation of services for construction and future maintenance purposes shall be provided.

Where a watermain is installed on an easement on a private property or between private properties with buildings located near the easement, the watermain shall be installed in a casing. Details of the casing shall be determined on a project by project basis.

9.5. Watermain Pipe Material

9.5.1. Reference Specifications

All materials for watermains and associated appurtenances shall be new and shall conform to those listed in the City of St. Thomas Standard Contract Documents and the latest revision of the Standards of the American Waterworks Association (AWWA).

Material other than that listed in the City of St. Thomas Standard Contract Documents may be used if it is approved in writing by the Environmental Services Department. The Environmental Services Department will designate the AWWA Standard and/or other specifications and conditions applicable for use of such approved material.

The City reserves the right to select any materials or product it deems appropriate for the application. The City also reserves the right to remove from the specifications any product previously approved but found inappropriate for the application. This includes but is not limited to pipe material, valves, or fittings. The designer shall clearly indicate on drawings and contract documents the materials which are acceptable for use in a particular application where the use of one or more of the approved materials list is not acceptable.

9.5.2. Pipe Material Transitions

Watermain pipe material transitions shall occur at valves or tees.

9.6. Disinfecting and Bacteriological Testing Of Watermains

For requirements regarding swabbing, flushing and disinfecting and bacteriological testing of watermains, see section the City of St. Thomas Standard Contract Documents.

9.7. Location of Valves

9.7.1. Residential Developments

In residential developments, valves shall be located so that any section of watermain serving up to a maximum of sixty residential water services can be isolated by operating not more than four valves. Phasing of developments should be considered and valving should be logical (i.e., at intersections). In residential areas, valves shall be spaced no more than 250 m apart. Valves shall be located on at least 3 legs of watermain at an intersection.

9.7.2. High Density Residential, Commercial, and Industrial Developments

In high density residential, commercial, and industrial developments, valves shall be located no more than 150 m apart.

9.7.3. Looped Services/Private Watermains

Valves shall be installed on looped services or private watermains to isolate buildings or groups of buildings so that no more than eighty (80) individual water services or apartment complex containing 300 dwelling units or more are on any one valved section. The Owner shall install a valve on the street watermain between connections to a looped private watermain if there is not an existing valve, at no expense to the City.

9.7.4. Watermain Crossings of Rivers, Railways, Bridges, Controlled Access Highways

Valves shall be placed on each side of a watermain crossing with a river, railway, bridge, or controlled access highway.

9.7.5. Locations of Valves at Street Intersections and Roundabouts

For street intersections, water valves shall be located at the extension of street lines.

For intersections with roundabouts, water valves may be placed in the raised portion of the roundabout island if possible. However, if conflicts occur with other features of the roundabout (i.e. curb and gutter of the island), the valves may alternatively be placed in the boulevard clear of curb and gutter from approaching streets to the roundabout.

9.8. Fire Hydrants and Fire Department Connections

All fire hydrants situated within the road allowance are the sole property of the City of St. Thomas and shall be installed in accordance with the City of St. Thomas Standard Contract Documents, and shall be maintained by and operated only by the City of St. Thomas.

The detail of hydrant and valve installations shall be according to the City of St. Thomas Standard Contract Documents.

9.8.1. Location and Spacing of Hydrants on Road Allowances

As a general guide, hydrant spacing shall be no greater than 150m in residential areas, and 105m in commercial and industrial areas, measured along the centerline of the main. Hydrants shall be placed

at every second intersection. Hydrants shall be placed on the property line between lots whenever possible.

Hydrants shall not be located on dead-end streets unless such streets exceed 90 m in length. Where located on dead-end street the hydrant shall be located at 90 m from the end and a smaller size watermain (minimum 50mm) shall be used beyond the hydrant so that water quality is maintained.

9.8.2. Addition or Relocation of Hydrants

Regardless of hydrant location shown on approved subdivision plans extra hydrants may be required or existing hydrants may have to be relocated. This may be due to circumstances unknown at the time of plan approval such as the position of a structure, Fire Department connection, driveway or landscaping feature.

Such addition and/or relocation shall be requested when the City approves the service plan and must be done at the expense of the Developer of the subdivision, or if the subdivision has been assumed, at the expense of the Developer of the property for which the additional or relocated hydrant is required.

9.8.3. Hydrants on Private Property

Hydrants will be located on private property where required by the City. Fire hydrants must be installed at grades such that they are readily accessible to the Fire Department. The Developer must pay for cost of installation of these hydrants.

9.8.4. Hydrants for Fire Department Connections

Requirements are given in Section 3.2 of the Ontario Building Code.

9.9. Water Services, Fire Services, and Private Watermains

For the design and materials requirements all water service pipe and fire service mains on private property, the Ontario Building Code shall apply. It shall be noted that water quality requirements are not addressed in the Ontario Building Code. Where there is a concern that there may be a degradation of water quality in the private servicing that has the potential to enter the municipal water supply system, the Environmental Services department reserves the right to require premise isolation. Premise isolation shall consist of appropriate backflow prevention measures to the risk posed, and shall be installed at the property line at the owners expense.

The following apply to the water services on public property up to the property line.

9.9.1. Size Required

The Developer will be responsible for private main and service sizing. The City Engineer shall be consulted for available pressures and flows at the main under design conditions. If the results of hydrant flow tests are to be used, the City Engineer shall be consulted for necessary adjustments since flow tests are not usually done at design conditions. Minimum size for services is 19mm diameter except in certain low pressure areas designated by the City where the minimum service size allowed is 25mm diameter. Acceptable service sizes are 19mm, 25mm, 40mm, 50mm, 100mm, 150mm, 200mm, 250mm, and 300mm diameter.

25mm diameter or larger services should be installed for estate lots, larger homes, deep setbacks or where automatic lawn sprinkler systems or fire sprinkler systems are to be used.

9.9.2. General Requirements

Each dwelling unit, including detached and semi-detached units, townhouses, multi unit and row houses, must be serviced with a separate water meter and water service connected to a main or private main.

Each unit in a commercial or industrial mall must be serviced with a separate water meter and water service connected to a main or private main.

Swimming pool facilities and lawn sprinkler systems must be serviced by a connection to the metered side of a water service that is in use yearlong and is located in a frost free structure.

Unless otherwise approved by the City Engineer, all structures not noted above shall have one water meter and one water service connected to a main or private main.

When there are two watermain on a road allowance, the water service shall be laid from the structure to the watermain which, in the opinion of the City Engineer, provides adequate flow and/or pressure.

Services to semi-detached housing must front the unit they serve.

Electrical systems of all new developments shall not be grounded to the water system. Refer to Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.

9.9.3. Looped Private Main / Service

A looped private main connected to a main or mains must be installed:

- When one main will not supply the required flow for domestic use and fire protection.
- For an apartment complex containing more than one structure and more than 300 dwelling units.
- For a townhouse, condominium, single family dwellings or similar complex having more than 60 units with individual services and meters.
- For a subdivision servicing more than 60 units.

- At the discretion of the City Engineer within new subdivision developments

9.9.4. Location

The service pipe must be installed at right angles to the main and in a straight line from the main to the meter. The standard single unit residential or subdivision service stub will be normally located as per the standard servicing locations (see Section 15 – Standard Drawings).

A private main to a complex of structures shall be located to serve all structures in the complex with the least amount of bends possible.

Services off a private main are subject to the same requirements as services off a main.

The Developer should ensure that services and private mains are located so that "berm" or "mound" type landscaping will not cause excessive cover over pipes.

Any deviations to service stub locations must be approved by the City Engineer.

All locations and elevations of the water services shall be recorded on an individual Building Services Report for each property and submitted to the Environmental Services Department along with As-built Drawings for the project, whether part of a reconstruction project or new development. See Section 15 for a sample Building Services Report.

9.9.5. Non-Conforming Installation

If a service stub, a service or a private main is installed or extended that is not in accordance with these specifications or with the service drawing approved by the City, such installation will be required to be removed and relocated to conform with the specifications or approved drawings.

All relocation work required shall be at the expense of the Developer or Contractor.

9.9.6. Fire Service

9.9.6.1. Fire Service Design

The determination of fire service requirements and the sizing of supply piping shall be the responsibility of the Designer. If a domestic service is combined with a fire supply service, the Designer is responsible to ensure that the supply pipe is large enough to carry the combined demand. Design and installation of sprinkler and standpipe systems and their supply services shall conform to the requirements of the Ontario Building Code, the St. Thomas Design Guidelines Manual, and the Fire Code and must be approved by the Chief Official (Fire Prevention Office) of the City of St. Thomas.

The designer shall obtain information from the City Engineer regarding flows and pressures available for fire systems. If the flows and pressures required are in excess of the minimum design standards

given in this manual and in excess of the actual capacity of the system, the Developer shall install booster pumps and/or storage to satisfy the required demand.

9.9.6.2. Fire Service Layout

Layout and installation of fire services to the structure including required valves and hydrants must be approved by the City Engineer and the City of St. Thomas Fire Department. This requires a submission of plans as specified in Section 3.

A domestic sprinkler or standpipe service may each be installed as a separate service from the main.

Sprinkler and standpipe services may be combined or a domestic service may be combined with either or both but the Developer is advised to obtain the approval of his Insurance Underwriter before combining them.

If combined, the domestic service can be connected to the fire service inside the building provided the complete system is designed as specified in this Section. If not combined, the domestic service must be installed separately from the main or private main.

All fire protection systems must have a backflow prevention device conforming to the Ontario Building Code, as amended. They must be ULC approved alarm check valves or ULC approved resilient seat check valves installed immediately downstream from its connection with the domestic service or immediately inside the building if the fire service is not combined with the domestic service.

Fire services are not metered with the exception of a sprinkler system in individually metered dwelling units.

9.9.7. Service to Blocks in Subdivisions

Where service stub size and/or location for any block cannot be determined prior to street construction, the City Engineer will not approve installation of the service stub. The following policy administered by the City Engineer will apply and the cost will be paid by the Developer of the block serviced. Where any water service connection is required to be made following construction of curb, gutter, concrete sidewalk and/or wearing surface coat of asphalt on any street in the new subdivision, such water service connection shall not be made using open cut methods but shall be made using drilling or boring techniques and in such a manner as to eliminate the possibility of settlement of such curb, gutter, concrete sidewalk or wearing surface coat of asphalt; it being understood that this policy shall apply except where, in the opinion of the City Engineer, ground conditions are such that the use of drilling and boring methods become unreasonable or uneconomical.

9.9.8. Backflow Prevention on Commercial / Industrial Services

New commercial or industrial services must have a backflow prevention device conforming to the Ontario Building Code as amended.

9.9.9. Service and Private Main Valves

Services shall be located such that curb stops are not located in driveways. Main valves shall not be located in driveway entrances.

On services of 50mm diameter and smaller, a main or corporation stop shall be installed at the main and a curb stop shall be installed on the property line.

On services of 100mm diameter and larger where the main cannot be closed off for the service connection, a tapping sleeve and valve will be required at the main. Where the main can be closed off and a tee cut into it, or where a new main is being installed, an approved valve shall be installed on the property line.

Approved valves shall be installed on looped private mains to isolate buildings or groups of building so that no more than sixty (60) individual services are on any one valved section. The Developer shall install a valve on the street main between connections to a looped private main if there is no existing valve.

All service valves shall be installed with approved valve boxes. Curb stops shall be installed with approved valve boxes and operating rods.

38 mm or larger water services shall have a 50 mm square operating nut and 130 mm diameter screw type service box with “Bubba Base” and shall have a rod extension (as per City standard and W-04 DWG).

9.9.10. Meters

All domestic services must be metered. Fire services are not metered except sprinkler systems in individually metered dwelling units. The meter shall be installed immediately inside the first external wall (excluding cold storage rooms) at the point of service entry into the building. Any variation from this location must be approved in writing by the City Engineer. The Developer shall provide sufficient space for installation and maintenance of the meter. The City's staff will supply and install the meter. The meter must be accessible for reading and maintenance and must be protected from freezing and other damage.

The meter or piping shall not be installed above or below any electrical panel and no closer than one metre horizontal distance.

10. DEVELOPMENT GRADING

10.0. General

All development shall be graded in accordance with the following specifications. General and individual lot grading plans shall be prepared by the developer's engineer and approved by the City along with the subdivision servicing drawings.

10.1. Lot Grading Details

The following minimum design details are to be considered during the lot grading design:

- Yard surfaces shall have a minimum of 1.5%, preferably 2%
- Drainage flows shall be directed away from houses
- Drainage flows which are carried around houses are to be confined in defined swales located as far from the house as possible
- Desirable swale depth to be 225 mm. Minimum swale depth to be 150 mm. Maximum swale depth to be variable, but dependent on location and safety considerations
- Maximum distance from rear lot line to centre of swale is 1.5m.
- Swales shall have a minimum grade of 1.5%, preferably 2%.
- The maximum flow allowable in a side yard swale shall be that from four backyards
- The maximum flow in rear yard swales shall be that from ten to fifteen backyards depending on lot size and grade. The maximum length of a rear yard swale shall be 100 m. The maximum area contributing to the rear yard swale shall be 0.5 hectare.
- No front yard catch basins shall be allowed
- Driveways:
 - Optimum grade: 2% to 4%
 - Maximum grade: 8%
 - Walks: Optimum cross slope: 2%
- Maximum slope between houses in new developments shall be 3:1 (3 horizontally to 1 vertically)
- Retaining walls shall not be used in new subdivision development.

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

10.2. Boulevard Grading

All boulevards between the curb and street line shall be fine graded. The slopes on boulevards shall be not less than 2%, preferably 3%, and not greater than 8%. All debris, rubbish and junk shall be removed from the street right-of-way before final acceptance of the subdivision.

10.3. Area Grading

The development area grading shall have a self-contained grading design and a major/minor overland flow direction to a maximum depth of 300 mm on the road and 450 mm off the roadway, and acceptable public outlet.

As a condition of obtaining building permits, builders shall be required to submit site plans with sufficient detail, elevations and in accordance with the approved development grading plan. Further, builders will be required to submit to the City lot grading certificates, signed and sealed by a professional engineer/Ontario Land Surveyor after final grading has been completed.

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

11. PARKS, OPEN SPACE AND LANDSCAPING

11.0. General

When parkland dedication is required pursuant to the Planning Act or the Development Agreement, the areas so designated shall be identified on the development plans with sufficient details, notes and typical sections as may be required to identify lot grading, drainage, landscaping, access and other details as may be required. The developer shall complete the necessary works as identified by the City's Parks, Recreation and Property Management Department within the Subdivision Agreement. Access for maintenance must be incorporated into the layout.

Within new developments, the City desires to help facilitate the integration of the stormwater management (SWM) facilities into open space and passive recreation opportunities where possible. Trails, sidewalks and other pedestrian connections should be created to promote and accent adjacent natural areas within the new developments.

11.1. Passive and Active Recreational Uses

The design and site preparation of the parkland and open space shall take into account the intended and future passive and/or active recreational uses in accordance with the City's Cycling Master Plan, Trails Master Plan and other Master Plans as required.

11.2. Site Clearing

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

11.3. Site Grading / Drainage

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

11.3.1. Drainage

- Drainage of parkland dedications shall be self contained such that areas drain to channels or swales which outlet to catch basins and storm sewers or other suitable outlet, so that park drainage does not adversely affect other properties.
- Swales should have gently sloping sides and should be used wherever possible rather than steep sided ditches. The minimum slope of channel and swale inverts shall be 1.5%. Maximum side slope permitted is 4:1.

- Maximum depth to bottom of channel shall be 1 metre. Minimum depth of swale shall be 150mm.
- Except for natural watercourses, in general, catch basins shall be provided in open channels and swales at maximum intervals of 100 metres.
- Swales or open ditching shall not cross the entrance way into the park area.
- Natural wetland areas may require special attention and preservation.

11.3.2. Grading

- In general, the minimum grade for grassed areas shall be 2%. However, areas to be developed for future soccer or baseball facilities may have grades less than 2%. Subsurface drainage may be required.
- Grassed slopes shall not have gradients steeper than 4:1 so as to allow safe use of moving equipment.
- All lands must be satisfactorily graded before the lands will be accepted by the City for park purposes.
- Grading or natural contours which result in undrained areas are not acceptable. If overland drainage cannot be modified, catch basins and pipe will be required.
- The Developer shall do all rough grading and filling where required, under all landscaped areas, to establish the sub-grade parallel to the finished grades indicated on the grading plans, to allow sufficient topsoil depth. All soft and unstable areas below sub-grade, shall be excavated and filled with compacted select fill material.
- All areas shall have uniform slopes between points for which finished grades are indicated on the plans or between such points and existing grades. Grades shall be smoothly rounded at top and toe of slopes.
- Sub-grade shall be scarified to minimum depth of 75mm to produce an even, loose textured surface free of all stones, roots, branches, etc. larger than 50mm in diameter.
- Topsoil shall be loose textured and free of all stones, roots, branches, etc. larger than 50mm in diameter.

11.4. Walkways

Where walkways are required through parklands, they shall be constructed as per the Standard Drawings in Section 15.

11.5. Fencing

Where permanent fencing is required within or along parkland boundaries, it shall be 1.5 meters high and shall meet material specifications as approved by City on a project by project basis.

11.6. Tree Planting

All tree plantings associated with Planning applications and Capital projects shall follow the **City of St. Thomas Tree Planting Standards (2018)**. If any discrepancies exist between this manual and the Tree Planting Standards, the Tree Planting Standards shall take precedence.

11.7. Topsoil Requirements

Topsoil shall be a fertile, natural loam, capable of sustaining healthy growth, containing organic matter for clay loams and organic matter for sandy loam.

Topsoil shall be loose and friable, free of subsoil, clay lumps, stones, roots or any other deleterious material greater than 25mm diameter. Topsoil shall be free of all litter and toxic materials that may be harmful to plant growth. Topsoil containing sod clumps, crabgrass, couch grass or other noxious weeds is not acceptable. Topsoil shall not be delivered or placed in a frozen or excessively wet condition.

Where necessary and at the discretion of the City of St. Thomas, the Owner shall be required to provide topsoil test recommendations to the City confirming topsoil type (i.e. percentage of sand, clay and organic content), macro and micronutrient content and pH levels. The Owner shall ensure fertilizers and soil amendments are incorporated into the topsoil in accordance with topsoil test recommendations.

11.8. Landscaping Plan

Landscaping plans are typically required for site plan control applications. All plans shall be reviewed by the Parks and Recreation Department.

For subdivision developments, tree boulevard planting plans are required, and shall be reviewed and approved by Parks and Recreation Department, in conjunction with Environmental Services Department.

11.9. Roundabout Landscaping

11.9.1. General

A roundabout is a type of circular intersection at which traffic enters a one-way stream around a central island incorporating splitter islands at each leg of the intersection. The splitter islands guide traffic into and out of the roundabout and provide a refuge for pedestrians. Its primary functions are for traffic

calming, allocation of right-of-way and increased traffic capacity. Generally, roundabouts are used to connect collectors and/or arterial roads; however, in some instances they can be used at the junction of a local road with a collector or arterial road.

11.9.2. Roundabout Landscaping

Landscaping should be designed to ensure that vehicles can observe the signing and shape of the roundabout as they approach and have adequate visibility for making decisions within the roundabout. The sight distance requirements at the roundabout dictate the size and types of landscaping materials appropriate for the various areas within and adjacent to the roundabout. Landscaping within the critical visibility areas must be limited to a height of 2 ft (0.6 m) to ensure adequate sight distance.

Generally the planting of roundabout central islands (including the truck apron) less than 10 meters (33feet) in diameter is inappropriate, as the need to provide driver visibility leaves only a small central area available. Such a restricted area of planting is out of scale with a roundabout as a whole.

11.9.3. Planting Strategy

Careful selection of low maintenance plants and trees is the critical factor to ensure that landscaping objectives are achieved and minimize maintenance requirements. The City's approved plant materials list shall be used in the selection of plants and trees. When planting in an old road bed, as for the central island, it is necessary to excavate the old road bed out (to a depth of 1.8 m deep and 1.8 m in diameter below the original road surface) and backfill with approved topsoil to provide for adequate growing conditions. Adequate drainage must be provided in such self contained, small areas.

11.9.4. Design For A Project Life Of 30 Years

For urban areas, plants and trees selected should have a minimum of 30 years life span, to be in line with the long design life of the other elements of the road. For rural and bushland areas the use of short lived shrubs and groundcovers is acceptable provided they can self regenerate. Short lived, highly flammable, fine leaf tussocks should be avoided.

11.9.5. Cul-de-sacs / Turning Circle / Center Median / Roundabout Landscaping

Landscaping applications and requirements can vary greatly within centre islands of roundabouts or medians. Landscaping that is required in centre islands of cul-de-sacs, centre medians, or roundabouts shall be reviewed and approved by the Parks and Recreation Department, in conjunction with the Environmental Services Department.

11.10. Stormwater Management Facility Landscaping

All landscaping of the stormwater management facility shall be supplied and installed by the developer, in accordance with the approved Landscaping Plan, during the first planting season after the registration of the development agreement.

Native and non-invasive trees, shrubs, ground covers and aquatic plants are required in a low maintenance landscape design which has regard for the ecology of the site and the eco-region.

All lands conveyed to the City are to be seeded. Seeding of exposed soil surfaces should be done as soon as possible after fine grading is completed.

All landscape treatments as specified in the approved landscape design shall be installed after the seed has established, but within 2-years of registration of the subdivision or development agreement.

All slopes greater than 4:1 from a horizontal distance of 3.0 meters from the bottom of the basin to the property line (not including walkways and trails) shall be planted.

Low maintenance vegetated buffers will be required around the pond perimeter. This buffer shall be comprised of tall grasses and wild flowers, followed by trees and densely planted shrubs. A densely vegetated margin on the aquatic safety bench would serve as an aesthetic amenity and an additional barrier. Where trees are to be planted, they must be planted at a minimum rate of 1 tree (50mm cal.) per 50 square metres.

12. TRAILS AND CONNECTIVITY

12.0. Bicycle Lanes and Multi-Use Trails

The Developer shall provide for the construction of bicycle lanes or multi-use trails in a location agreed to with the City during the consultation process.

12.1. Design

Multi-use trails shall be a minimum width of 3.0m, located as determined by the City, and constructed as per the City's standard drawings (see Section 15). Alternative materials must be submitted to the City for approval.

Bicycle lanes shall have the same structural standard as the remainder of the roadway. Bicycle lanes shall be designated through pavement marking and shall be 1.5 metres wide. Where bicycle lanes are adjacent to the curb and gutter, they shall be measured from the edge of pavement.

Bike lanes shall be delineated and signed in accordance with the Transportation Association of Canada Standards and Ontario Traffic Manuals.

The width of paved shoulders shall be designed as per the following table:

Operating Speed	AADT<3000	AADT>3000
Shared Lanes	Permitted	Not Permitted
<50km/h	1.5m	1.5m
51km/h – 70km/h	2.0m	2.0m
>70km/h	2.5m	2.5m

Notes:

1. The construction of new Sidewalks within City limits shall comply with the design standards and requirements as set under Accessibility for Ontarians with Disability Act (AODA) Act 2012.
2. In addition to complying with the accessibility design standards set out in the Accessibility for Ontarians with Disabilities Act, the developer must also meet the accessibility design requirements and standards set out by the City of St. Thomas.

12.1.1. Connectivity

Pedestrian access shall be provided where appropriate and connectivity and looped walkway concept designs will be encouraged.

In the event that a community trail has been identified and/or required by the City in the vicinity or adjacent to a stormwater management facility, they shall be implemented no less than 0.5 meters above the 100-year stormwater level.

Asphalt or concrete trails shall follow the cross section provided in Section 15 (Standard Drawings), and be designed with 1% to 4% cross-sectional slope with a maximum 8% longitudinal profile slope.

To enhance public comfort and safety, a 3.0 meter buffer area on each side of the community trail shall be designed and maintained in such a way that sightlines are preserved. If a trail crosses a City street, appropriate signage is required. If barriers are required, they must not interfere with visibility or create entrapment areas. In situations where a community trail is designed within the active storage area, the 3.0 meter buffer area above the trail shall have a 5:1 maximum slope. The buffer area shall be planted with low ground cover.

Deciduous trees should be planted at a minimum distance of 1.5 meters from the edge of the trail. Maintenance is required to ensure that tree canopies are raised to a minimum of 2.2 meters and shrubs must be regularly prevented from naturalizing this area. The planting of coniferous trees within this zone is not permitted.

13. STREET LIGHTING

13.0. General

This section describes the standards to be followed for the design of street lighting in the City of St. Thomas and is to be used where required in conjunction with IESNA RP-8-14 Standard Practice for Roadway Lighting and the TAC Guide for Design of Roadway Lighting.

The classification of roadways and their recommended luminance light levels are as per IESNA RP-8-14 and TAC-2006 Guide for the Design of Roadway Lighting.

Street lighting in the City is to provide uniform lighting at a level that is adequate and comfortable for vehicular and pedestrian movement on City streets and sidewalks. All street lighting in the City shall be designed by a qualified lighting designer using the luminance method as described in RP-8-14, unless otherwise noted, incorporating the information presented in this design standard.

Street lighting design shall take into consideration all of the approved luminaires of a given type so as to allow interchangeability of luminaires during maintenance operations.

Recommendations given herein are to be used for the specific cross section of road layout shown. Variations in cross section, road layout or pedestrian conflict levels must be dealt with on an individual design basis and a specific lighting design and associated calculations submitted to the City for review.

All street lighting design and construction is subject to ESA inspection and approval. All materials used for street lighting in the City of St. Thomas must meet CSA specifications.

Energy efficient luminaires (i.e. LED lighting) shall be used in all new developments and roadway installations.

13.1. City Lighting Policy

It is the policy of the City that all street and sidewalk lighting design shall be based on ANSI / IESNA RP-8-14 as referred to above.

All lighting designs must be submitted to the City for review with the necessary back-up material. Shop drawings, lighting design data, cross sections, etc. must be provided. Where the City's standard are not applicable, the designer shall submit the appropriate road cross section(s), the proposed road and pedestrian conflict classifications and lighting levels to the City for review. No design shall proceed without the City's approval of the road and pedestrian conflict classifications.

In an effort to reduce light pollution, the City requires that street lighting be designed and constructed to limit the amount of light directed towards the sky. This includes limiting both the amount of light used in an area and limiting uplight from luminaires. Since the impact of lighting differs in relative terms depending on the surrounding area, "Lighting Zones" have been developed describing different ambient

lighting conditions. The appropriate lighting level restrictions for each “Lighting Zone” are being finalized by IES. Refer to IES RP-33 Outdoor Environmental Lighting.

13.2. Pavement Classification

In general the pavement classification to be used in luminance calculations shall be R3 which represents the average asphalt roadway surface in Ontario. Refer to Section 2.3 of RP-8-14.

13.3. Lighting Design

A photometric plan for exterior lighting shall be prepared by an electrical lighting specialist competent in lighting and photometrics or an electrical engineer and submitted to the City for review. The plan must be legible and have sufficient information to show light levels. The designer must determine if luminaire shields are required and their orientation, and specify them as part of the shop drawing submission.

13.4. Light Trespass

In general, the City policy is that exterior lighting systems shall be designed such that the vertical illuminance level at property lines within the municipal right-of-way does not exceed a maximum of 3.0 lux for residential and 15 lux for dense urban developments (downtown) at a height of 1.5m above finished grade along the property line. If this level cannot be achieved approval must be obtained from the City for a variation.

13.5. Adaptive Lighting

Adaptive lighting is provided by a lighting system that is able to adjust lighting levels to better adapt to local conditions, time of day, special events, or minimum maintained lighting levels thereby providing energy conservation and reduced light pollution.

For luminaires to be compatible or “ready” for future incorporation into a street lighting control management system by means of the installation of an external remote control module, the luminaire LED driver would need to have 0 – 10V dimming functionality and the luminaire housing needs to be fitted with a wired C136-41 (dimmable) type photocell socket.

13.6. Material Specifications

13.6.1. New Developments

All new developments shall use either Energy Efficient type cobrahead or decorative style luminaires that are dark sky compliant subject to approval by the City. All submissions to the City must have photometric calculations submitted along with approval drawings.

Developers may submit an alternative decorative style luminaire to the City for approval to be used throughout a new development. Alternative decorative luminaires need to meet all lighting criteria as described in this section prior to acceptance by the City.

13.6.2. LED Luminaire Specifications

The luminaire shall be of type designed for arm or pedant mount. The luminaire shall be cUL or CSA listed, have a IP 66 classified enclosure, and pass 3G vibration test. The enclosure shall be cast aluminum with integral weather tight LED driver compartments and high performance heat sinks specifically designed for LED lighting applications.

The luminaire shall be of sufficient wattage to meet the minimum applicable requirements needed to meet RP-8-14, equipped with a built-in power driver, and shall be designed for operation on a 120 volt, 60 Hz, and shall operate normally in temperatures from -20 degrees Celsius to 50 degrees Celsius. The correlated color temperature (CCT) shall be 4000K. The Minimum Color Rendering Index (CRI) shall be 65. System efficacy has to be no less than 70 lm/W.

All equipment shall be as specified herein or approved equal.

The luminaire shall contain a surge protection device (SPD) to protect all electrical components from harmful line transient voltage surges as a result of utility line switching, lightning strikes, or other electrical supply system disturbances. The SPD shall meet a 6kV, 3kA surge level and meet application and testing requirements as per ANSI/IEEE C.62.41.2 for Category C-Low operation and ANSI/IEEE C62.45. The SPD shall be mounted such that it is easily accessible and replaceable.

13.6.3. Photo-Electric Controllers

Photo-electric controllers shall be electronic twist lock photo controllers with:

- A filtered (human eye spectral response) silicon light sensor with infrared blocking filter
- MOV surge protection
- Rated for 120 volts
- Load rating: 1000 watts, 1800vA ballast
- Turn on level at 16 lux and turn off at 1.5 times turn on
- Operating temperature range from -40°C to 70°C

Photo-electric controllers must be manufactured using non-hazardous materials. All photo-electrical controllers must meet CSA specifications and are subject to ESA inspection and approval.

13.6.4. Photometric Requirements

Submissions of luminaires for approval to the City shall include the certified photometric test data report, the light distribution pattern, the luminaire efficiency and measurements as per IES- LM- 79-08. The test report shall certify that the luminaire complies with the photometric requirements, and includes

the performance data of the luminaire over time and junction temperature. cUL or CSA certification, IP 66 certification and 3G vibration certification shall also be submitted.

All tests shall be performed by an independent and recognized testing laboratory. See site below for list of approved labs (<http://lightingfacts.com/approvedlabs>).

13.6.5. Guarantee

The Supplier shall guarantee the entire luminaire against defects of materials and parts, workmanship, and failure to operate properly in service for a period of ten (10) years after date of final delivery or ten (10) years after being placed in service, whichever occurs first. Guarantee shall cover operation of luminaire, luminaire shall be considered defective if any part of the luminaire fail, power driver is not performing correctly, lighting output has decreased by 30% of the initial delivered lumens, or lighting color has changed to outside the specified range.

Upon luminaire failure within the guarantee term, the warranty shall include for complete luminaire replacement (exclusive of labour to remove and re-install) from the manufacturer. Individual component replacements in the field by the supplier (or their agents) will not be permitted.

13.6.6. Identification of Wattage and Labeling

On the housing of the luminaire there shall be an identification means permanently attached to allow for identification of the wattage. The means shall be visible to an observer standing at street level under the installed luminaire and shall be subject to approval at the time the sample is submitted. Identification means shall consist of a black number on a gold colored square.

A label shall be included inside the luminaire. It shall have light output lumens, watts, lumens/watt (Efficacy), color rendering index (CRI), correlated color temperature (CCT) and IESNA LM-79-2008.

13.6.7. Submission

The following information is to be submitted as part of the shop drawing approval package:

- Nominal line voltage
- Luminaire wattage
- Lamp type and ANSI designation
- Ballast type
- Optical system
- ANSI/IES luminaire classification and distribution type
- Photometric curve or test report number
- Shielding options
- Luminaire shop drawings with options supplied clearly shown
- Photometric calculations for roadway luminaires are to be installed

13.7. Poles

New luminaires are to be placed on existing poles wherever possible. Where no suitable existing pole is available, a new pole compatible with existing poles is to be installed.

For (urban) roadways with barrier curbs having 60 km/hr or less design speed, light poles shall be located a minimum of 1.0 metre behind the back of the curb.

For (rural) roadways (that is, with no curbs) with a design speed of 60km/hr or less the minimum pole setback shall be 3.0 m minimum subject to the guiding principles outlined below.

For rural roadways, poles shall be located behind the ditch on the same side of the street, preferably at common lot lines. Due to the variability that may occur in rural subdivision design, the location of the poles may vary between developments. However, the guiding principles for the pole location shall be;

- No closer than 1.0 m to the property line (frontage)
- In a consistent offset from the property line for each street
- A minimum of 1.0 m behind the top of the ditch
- At a location where the luminaire height is within the manufacturers and/or utility guidelines

For all roadways with design speeds greater than 60 km/hr, pole offsets shall be in accordance with TAC guidelines for clear zone requirements based on roadway design speed.

Light poles shall be located minimum 5 metres offset from large shade trees and minimum 3 metres offset from small ornamental trees.

The recommended light pole heights above ground are provided in the following table.

Roadway Classification	Lanes	Median	Pole Height
Local	2	N/A	7.5 m
Collector	2	N/A	9.1 m
Collector	3	N/A	9.1 m
Arterial	2	N/A	9.1 m
Arterial	3 or 4	N/A	12.0 m
Arterial	4	Yes	12.0 m

13.8. Brackets

Luminaires are to be placed over the roadway and not over the boulevard wherever possible.

14. SEDIMENT AND EROSION CONTROL

The sediment and erosion control measures as indicated on the servicing drawings shall be installed and implemented prior to any construction taking place.

Sediment and erosion control measures and notes are to be identified on all lot grading drawings, storm water management facility drawings, channels, outlet structure drawings and plan and profile drawings where applicable. If sediment and erosion control measures are extensive a separate drawing may be required.

All sediment and erosion control measures and notes shall follow the guidelines as per the Ministry of Natural Resources Guidelines on Erosion and Sediment Control for Urban Construction Sites.

Any regulated works other than those identified on the servicing drawings shall require additional approvals from all applicable authorities.

The consulting engineer shall monitor all sediment and erosion control measures during construction and make any modifications to the measures as required to ensure that no silt or sediment enters onto private property, existing roadways, existing sewer systems, rivers or watercourses and Environmentally Sensitive Areas (ESA).

Rip Rap

Rip rap shall be placed in conjunction with an approved geotextile within inlet/outlet structures, over flow protection, channel banks, gabions and rockfill structures.

Gradation shall be in sizes ranging from 100mm to 200mm, as per Ontario Provincial Standard Specifications.

Rock Protection

Gradation shall be in sizes ranging from 100mm to 500mm, as per Ontario Provincial Standard Specifications.

Turfstone

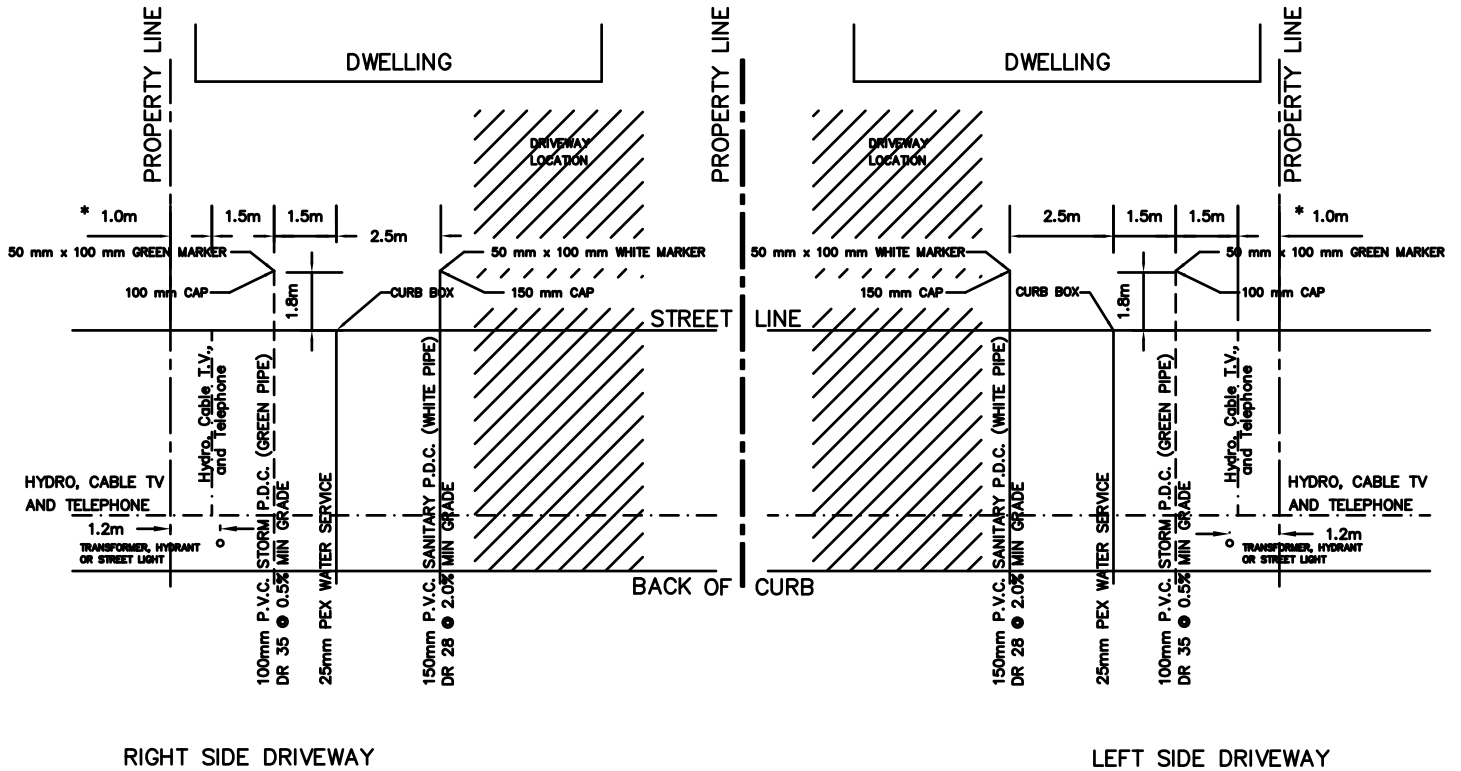
Constructed in conjunction with an approved geotextile, for use as over flow protection, channel lining, and/or surface access roads using City approved products.

Turfstone voids are to be filled with topsoil and seeded.

Geotextile

Geotextiles shall be constructed within inlet/outlet structures, sub-drains, blanket drains, gabion lining, retaining walls, ditch lining, channel linings, access roads, rockfill structures, dykes and energy dissipaters. Type and sizing of geotextile is to be approved by the City.

15. STANDARD DRAWINGS



NOTES:

1. MINIMUM DEPTH OF SANITARY PDC AT PROPERTY LINE SHALL BE 2.4 m AS PER DRAWING S-1
 2. MINIMUM DEPTH OF STORM PDC AT PROPERTY LINE SHALL BE 1.5m
 3. PLACE SAND BACKFILL WITHIN 2m OF TRANSFORMERS ON STORM PDC'S
 4. EXTEND STORM PDC'S 2m ON LOTS WHICH WILL HAVE UTILITY PEDESTALS
 5. ANY SERVICES UNDER DRIVEWAY SHALL BE SAND BACKFILL
 6. LOCATION OF TREES SHALL BE IN ACCORDANCE WITH THE "TREE PLANTING STANDARDS" MOST CURRENT EDITION
 7. STORM AND SANITARY PRIVATE DRAIN CONNECTIONS TO EXTEND 1.8 m BEYOND STREET PROPERTY LINE.
- * INCREASE THIS DIMENSION TO 4.0 m ON CORNER LOTS

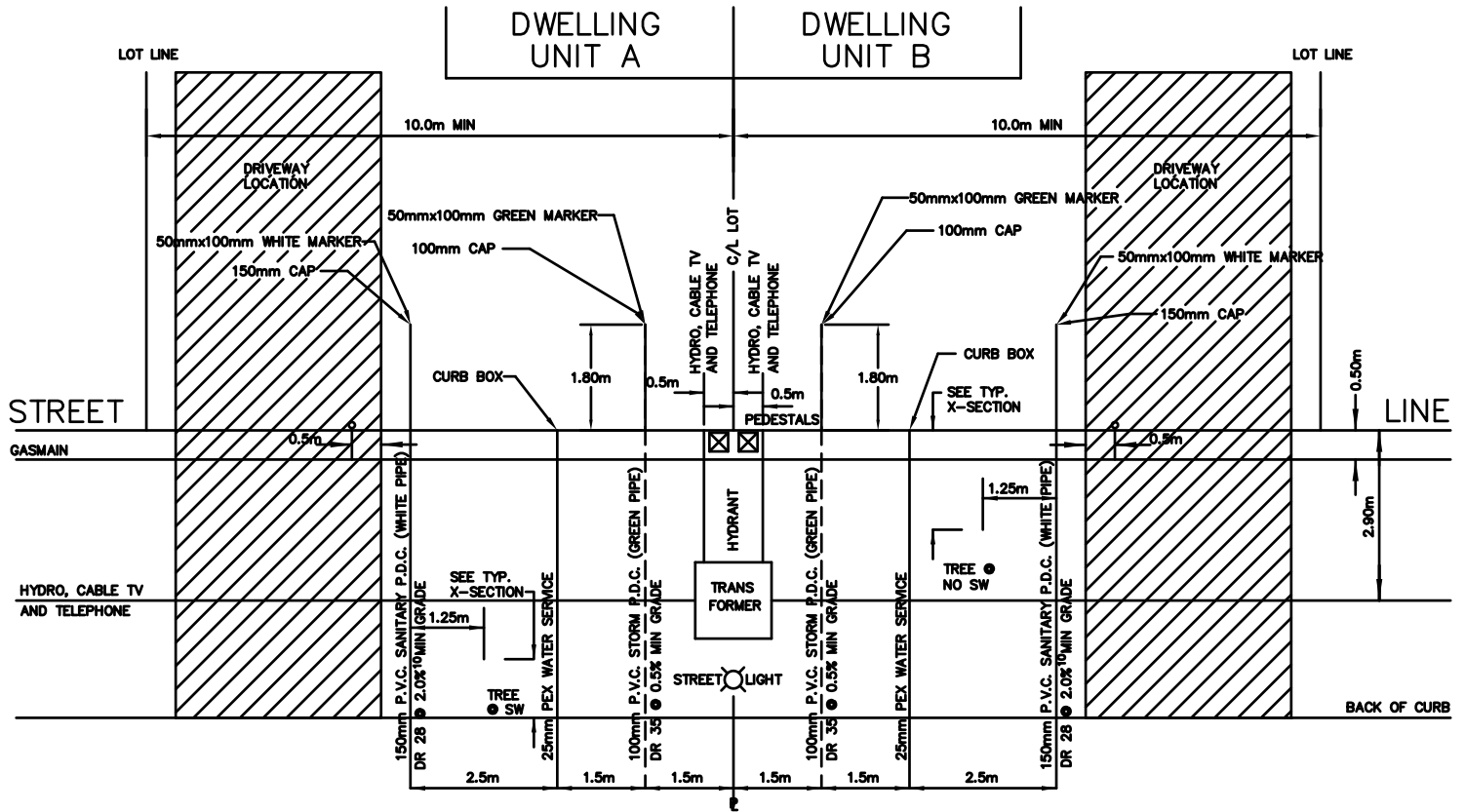
NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

SERVICING LAYOUT SINGLE LOT

REVISION DATE: DEC 2018

DRAWING #: **D-01**



NOTES:

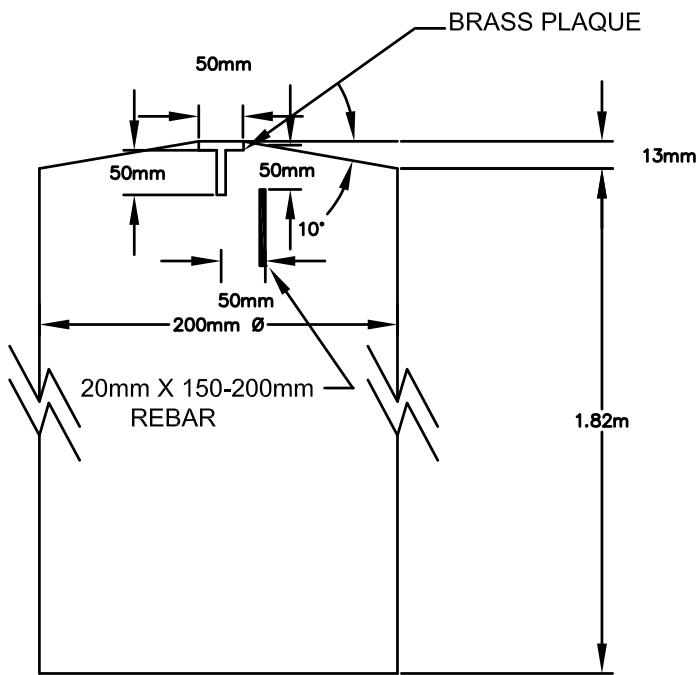
1. MINIMUM DEPTH OF SANITARY P.D.C. AT PROPERTY LINE SHALL BE 2.4 m AS PER DRAWING S-1
2. MINIMUM DEPTH OF STORM P.D.C. AT PROPERTY LINE SHALL BE 1.5m
3. 4-PLEX LAYOUT SHALL BE THE SAME AS SINGLE LOT EXCEPT, WATER SERVICE SHALL INCREASE TO 38 mm
4. PLACE SAND BACKFILL WITHIN 2m OF TRANSFORMERS ON STORM P.D.C'S
5. EXTEND STORM P.D.C'S 2m ON LOTS WHICH HAVE UTILITY PEDESTALS
6. LOCATION OF TREES SHALL BE IN ACCORDANCE WITH THE MOST CURRENT EDITION OF THE "TREE PLANTING STANDARDS"

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

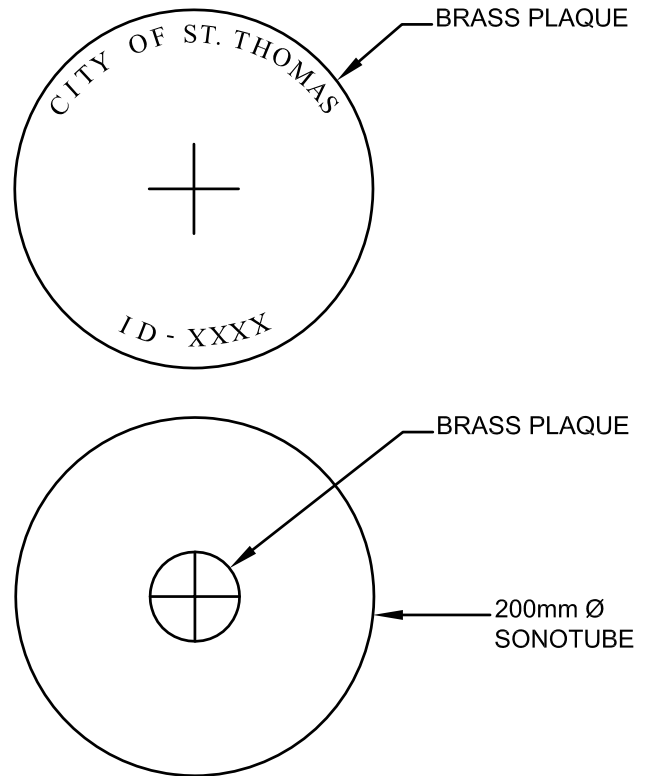
CITY OF ST. THOMAS STANDARD DRAWING

SERVICING LAYOUT SEMI-DETACHED LOT

REVISION DATE: DEC 2018
DRAWING #: **D-02**



CROSS SECTION



PLAN VIEW

NOTES:

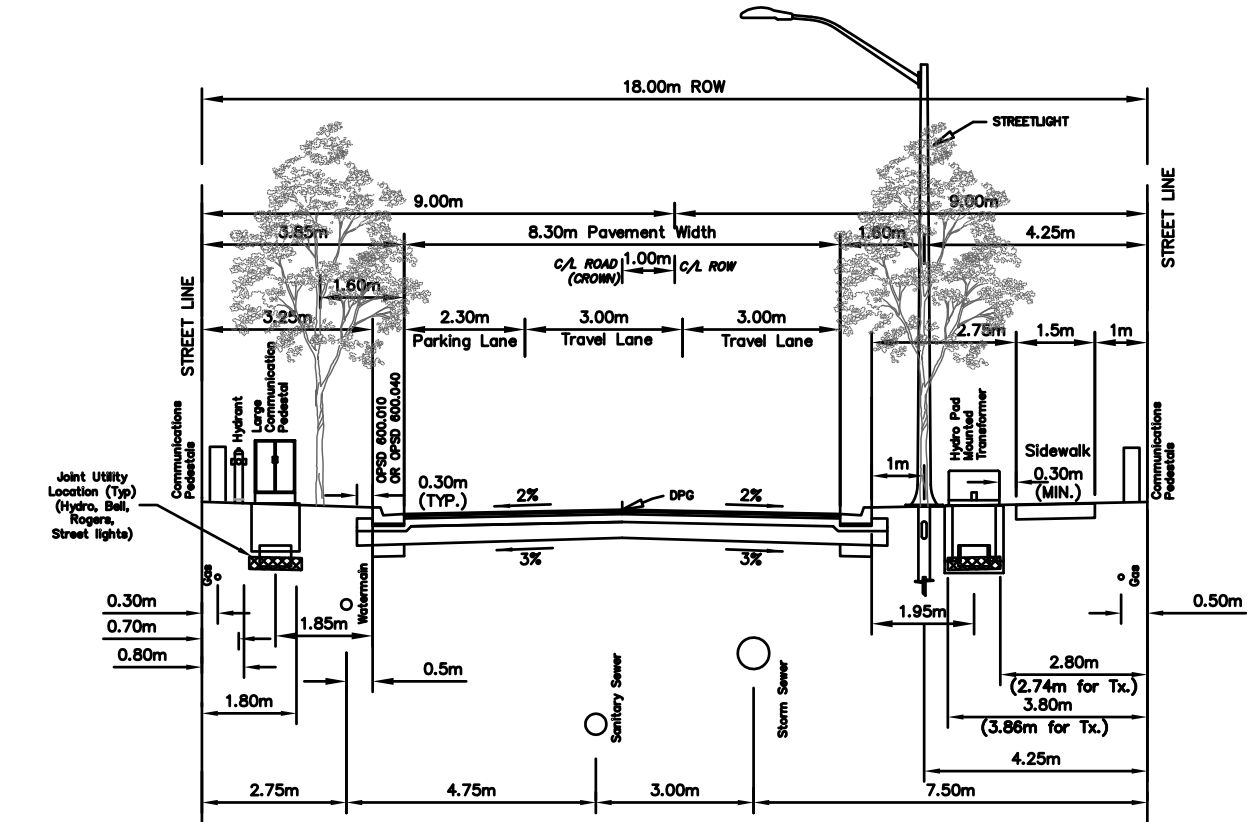
1. BRASS PLAQUE TO BE SUPPLIED BY THE CITY OF ST. THOMAS ENVIRONMENTAL SERVICES DEPARTMENT.
2. REBAR TO BE EPOXY COATED.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**GPS MONUMENTATION TYPICAL LAYOUT
DETAILS**

REVISION DATE: DEC 2018
DRAWING #: **D-03**



NOTES:

1. THIS ROAD SECTION TO BE USED WHERE NUMBER OF UNITS ARE LESS THAN 30, SIDEWALK IS REQUIRED WITHIN ONE BOULEVARD, OR AS DIRECTED BY THE CITY ENGINEER.
2. THE PAVEMENT STRUCTURE IDENTIFIED ARE MINIMUM REQUIREMENTS. ACTUAL PAVEMENT STRUCTURE TO BE RECOMMENDED BY A QUALIFIED GEOTECHNICAL CONSULTANT.

Utility	Min cover in Blvd	Min cover for Road crossing
Gas	0.9m	1.0m
Hydro	1.0m	1.0m
Comm.	0.75m	1.0m
Water	1.7m	1.7m
Storm	1.5m	1.5m
Sanitary	2.4m	3.0m

MINIMUM PAVEMENT DESIGN

40mm	HL3
50mm	HL8
150mm	GRANULAR 'A'
300mm	GRANULAR 'B' (TYPE II GRADATION)

TYPICAL CROSS SECTION

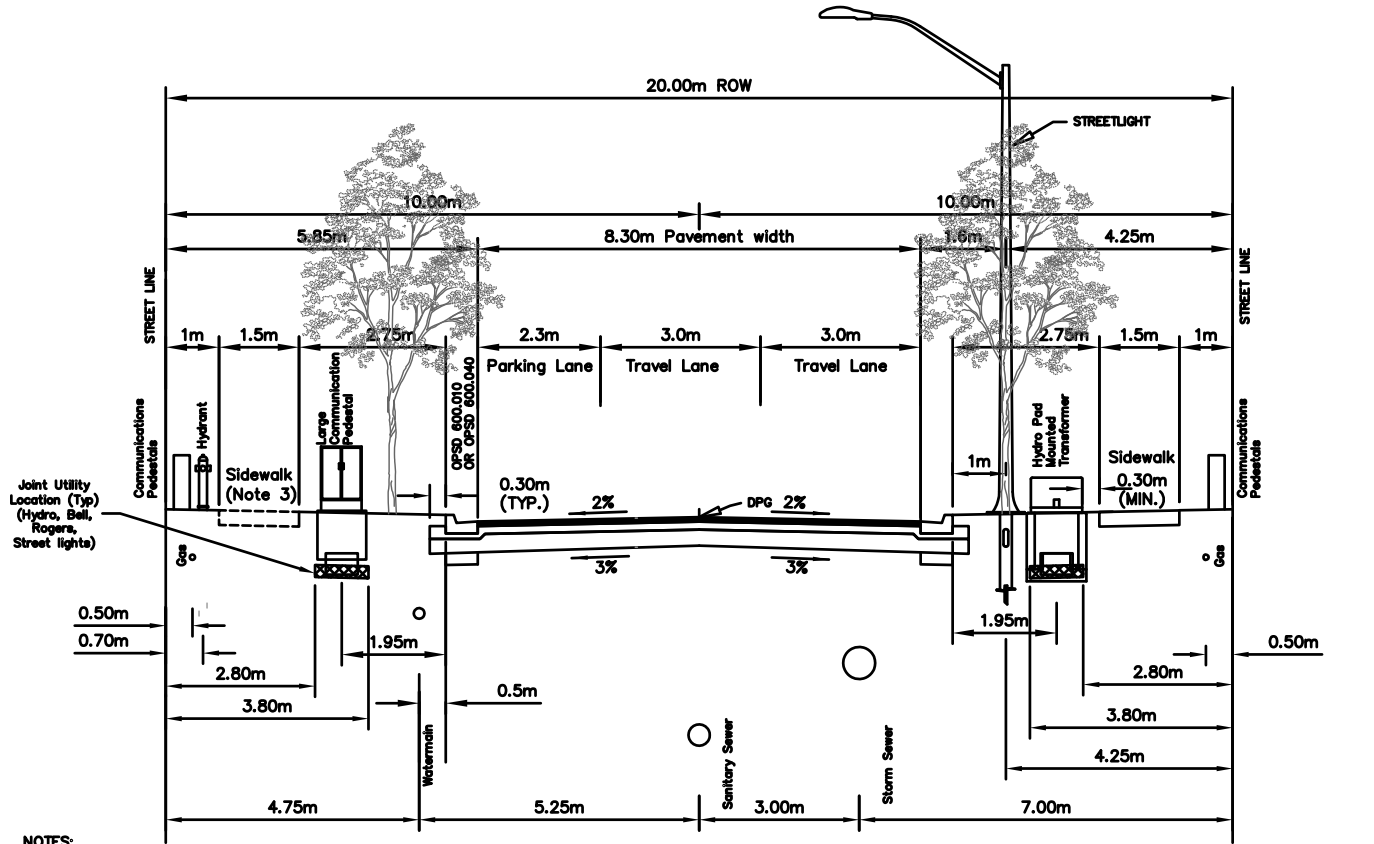
NOT TO SCALE
ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**URBAN MINOR LOCAL ROAD
ASYMMETRICAL CROSS-SECTION**

REVISION DATE: DEC 2018

DRAWING #: **R-02**



NOTES:

1. SIDEWALK MAY BE INSTALLED IN FUTURE, IF REQUIRED FOR PEDESTRIAN CONNECTIVITY NEEDS.
2. THE PAVEMENT STRUCTURE IDENTIFIED ARE MINIMUM REQUIREMENTS. ACTUAL PAVEMENT STRUCTURE TO BE RECOMMENDED BY A QUALIFIED GEOTECHNICAL CONSULTANT.
3. PARKING ON ONE SIDE OF STREET ONLY ON OPPOSITE SIDE OF INBOUND LANE.
4. BASE ASPHALT THICKNESS MAY BE INCREASED TO 80mm HL8 DEPENDING ON SUBSEQUENT SUBDIVISION PHASING.
5. WHEN BICYCLE LANES ARE REQUIRED, INCREASE PAVEMENT WIDTH AND ROW WIDTH BY 3m.

MINIMUM PAVEMENT DESIGN

40mm	HL3
50mm	HL8
150mm	GRANULAR 'A'
300mm	GRANULAR 'B' (TYPE II GRADATION)

Utility	Min cover in Blvd	Min cover for Road crossing
Gas	0.9m	1.0m
Hydro	1.0m	1.0m
Comm.	0.75m	1.0m
Water	1.7m	1.7m
Storm	1.5m	1.5m
Sanitary	2.4m	3.0m

TYPICAL CROSS SECTION

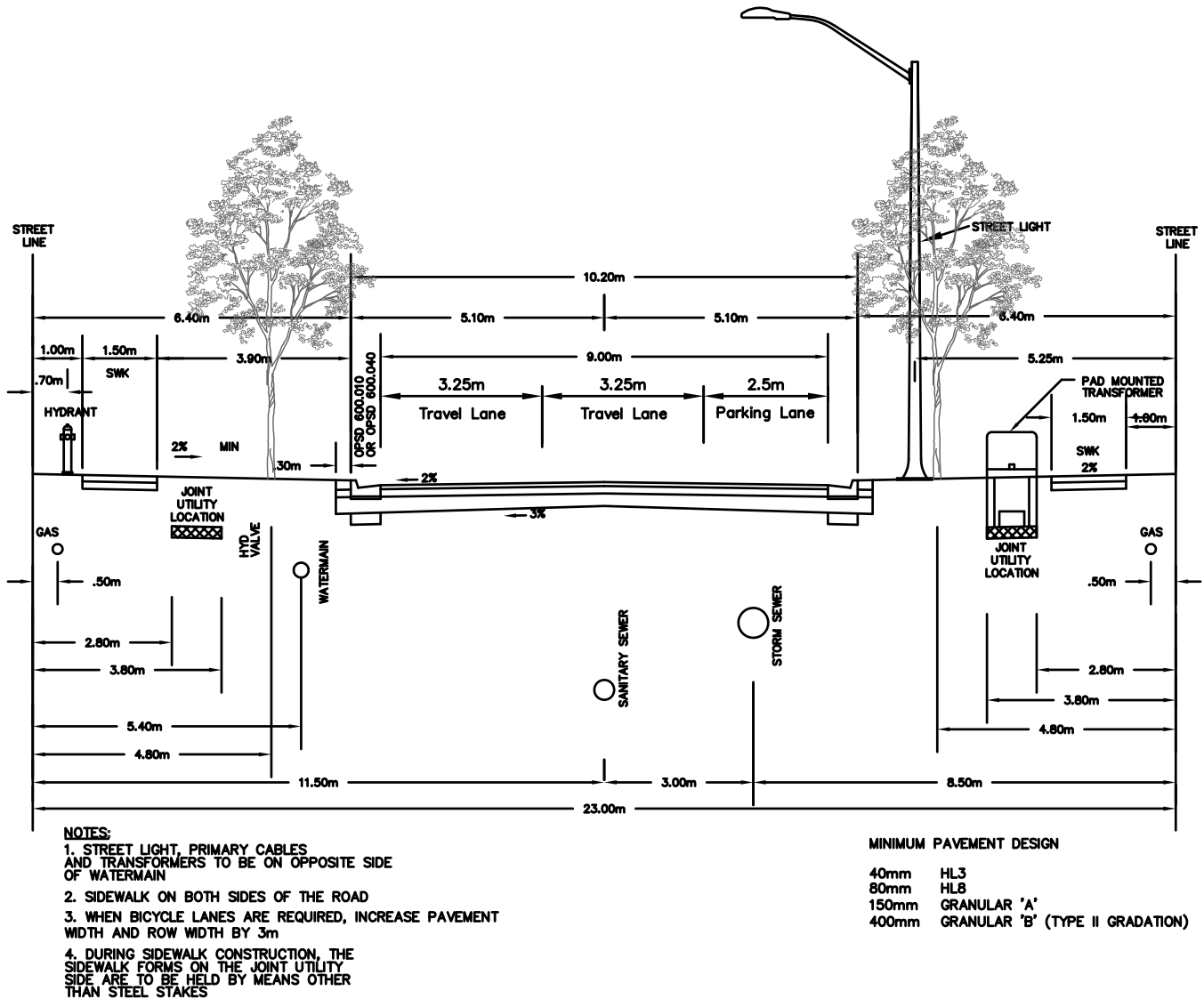
NOT TO SCALE
ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**URBAN LOCAL ROAD
CROSS-SECTION**

REVISION DATE: DEC 2018

DRAWING #: **R-03**



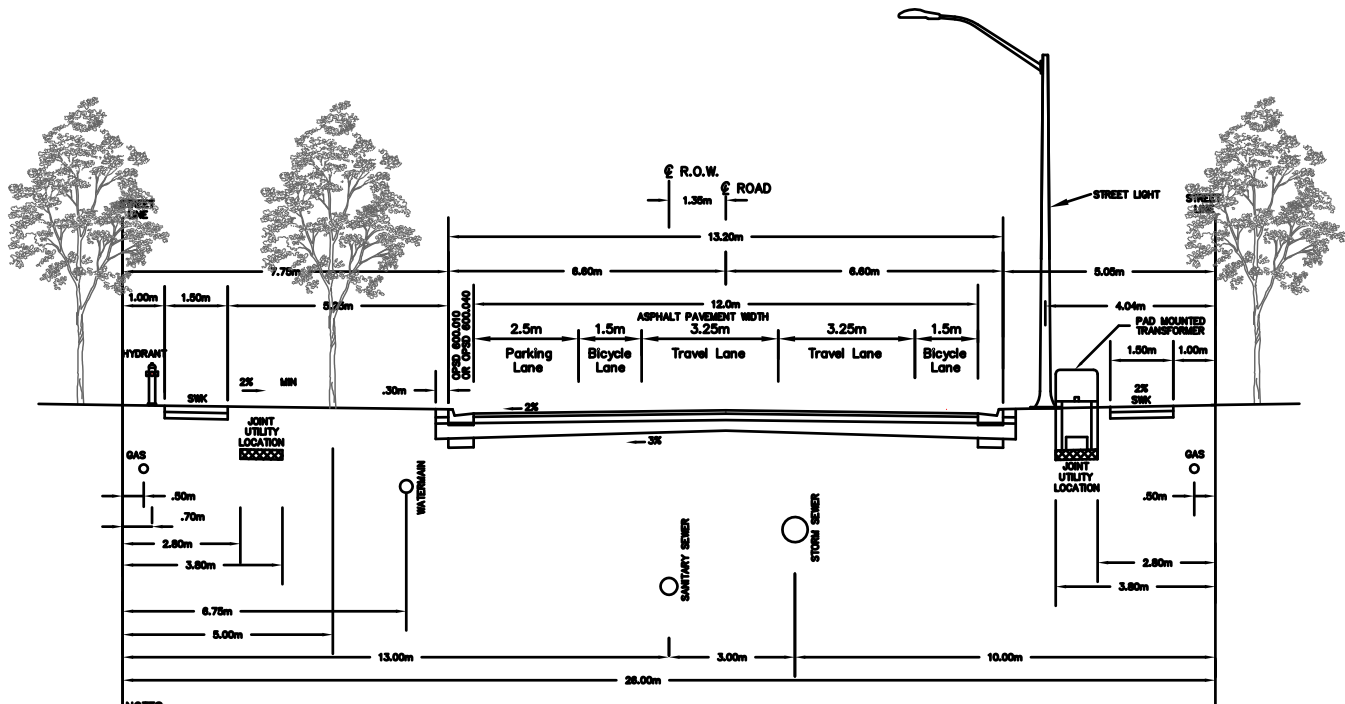
TYPICAL CROSS SECTION

NOT TO SCALE
ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

MINOR URBAN COLLECTOR ROAD CROSS-SECTION

REVISION DATE: DEC 2018
DRAWING #: **R-04**



NOTES:

1. STREET LIGHT, PRIMARY CABLES AND TRANSFORMERS TO BE ON OPPOSITE SIDE OF WATERMAIN.
2. SIDEWALK ON BOTH SIDES OF THE ROAD.
3. BASE ASPHALT THICKNESS MAY BE INCREASED TO 80mm HLB DEPENDING ON SUBSEQUENT SUBDIVISION PHASING.
4. DURING SIDEWALK CONSTRUCTION, THE SIDEWALK FORMS SHALL BE SET UP. THE SIDES ARE TO BE HELD BY MEANS OTHER THAN STEEL STAKES.

MINIMUM PAVEMENT DESIGN

40mm	HL3
80mm	HL8
150mm	GRANULAR 'A'
400mm	GRANULAR 'B' (TYPE II GRADATION)

TYPICAL CROSS SECTION

NOT TO SCALE

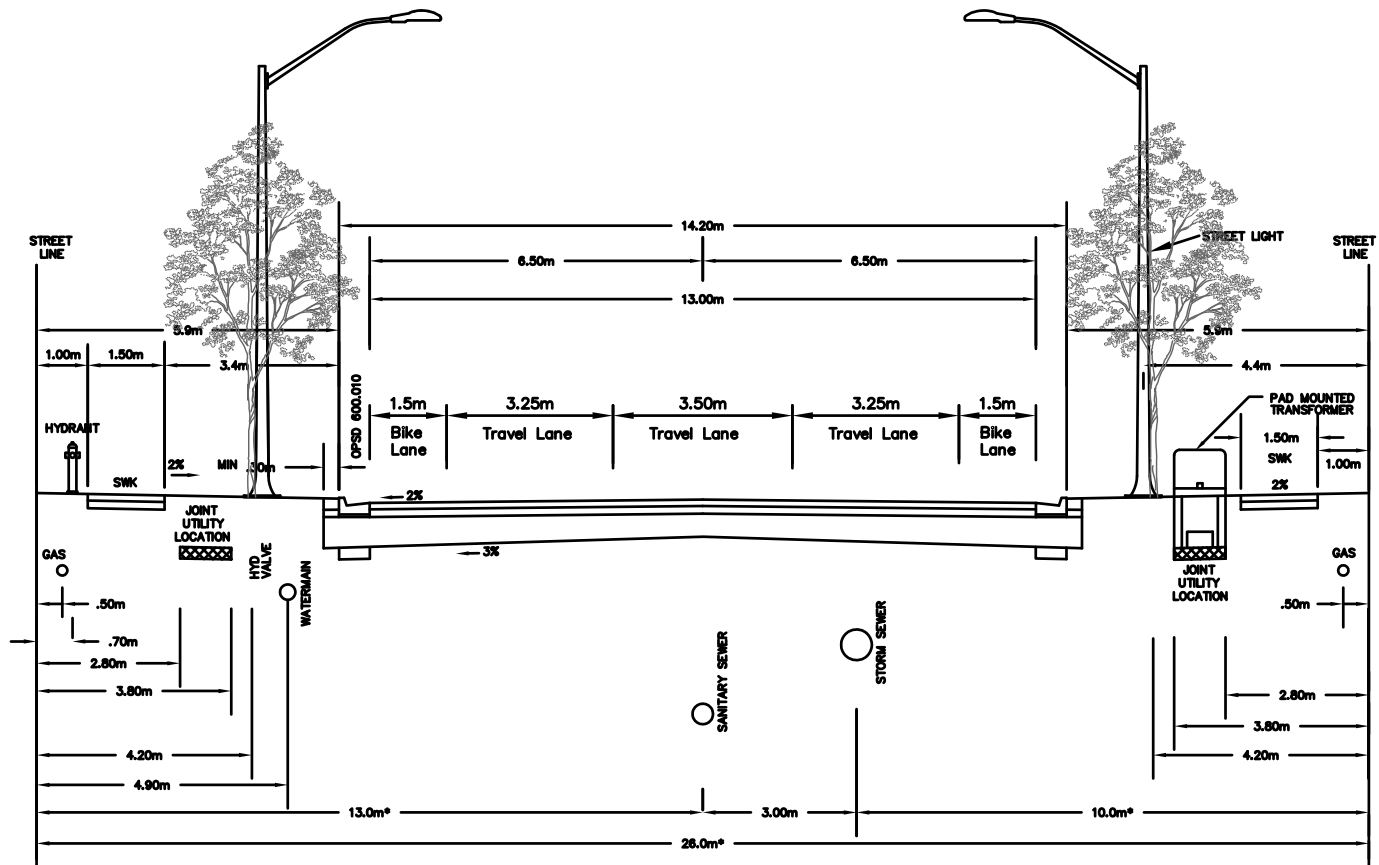
ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

URBAN COLLECTOR ROAD CROSS-SECTION

REVISION DATE: DEC 2018

DRAWING #: R-05



NOTES:

1. STREET LIGHT, PRIMARY CABLES AND TRANSFORMERS TO BE ON OPPOSITE SIDE OF WATERMAIN.
2. SIDEWALK ON BOTH SIDES OF THE ROAD.
3. DURING SIDEWALK CONSTRUCTION, THE SIDEWALK FORMS ON THE JOINT UTILITY SIDE ARE TO BE HELD BY MEANS OTHER THAN STEEL STAKES.

4. BASE ASPHALT THICKNESS MAY BE INCREASED TO 80mm HL8 DEPENDING ON SUBSEQUENT SUBDIVISION PHASING.
 5. BICYCLE LANES ARE REQUIRED, INCREASE PAVEMENT WIDTH AND ROW WIDTH BY 3m.
- * DISTANCES VARY DEPENDING ON THE RIGHT-OF-WAY
* THIS CONFIGURATION ALSO SUPPORTS 4 - 3.25m LANES

MINIMUM PAVEMENT DESIGN

50mm	HL3
100mm	HL8
150mm	GRANULAR 'A'
450mm	GRANULAR 'B' (TYPE II GRADATION)

TYPICAL CROSS SECTION

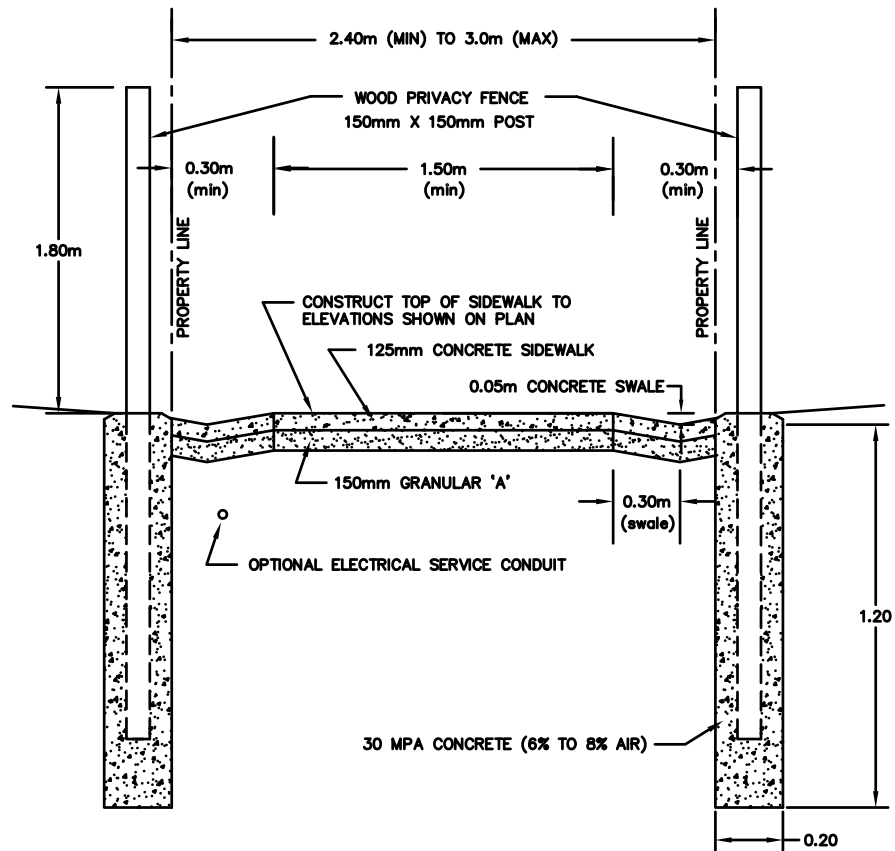
NOT TO SCALE
ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

URBAN ARTERIAL ROAD CROSS-SECTION

REVISION DATE: DEC 2018

DRAWING #: **R-06**



NOTES:

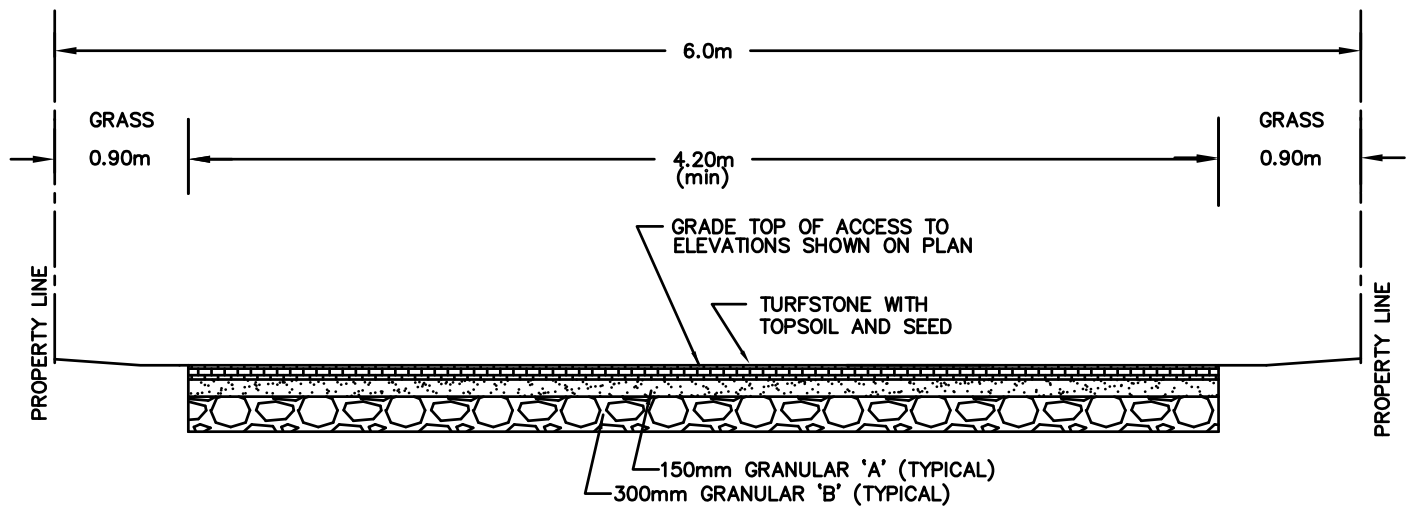
1. FENCE TO BE 1.80m HIGH PRESSURE TREATED BOARD FENCE, 150mm X 150mm PRESSURE TREATED WOOD POSTS.
2. OPTIONAL ELECTRICAL SERVICE CONDUIT FOR POTENTIAL WALKWAY LIGHTING – CITY TO REVIEW IF PROPOSED LOCATION IS SUITABLE FOR ELECTRICAL SERVICE
3. PAVEMENT STRUCTURE IS SUBJECT TO RECOMMENDATIONS BY GEOTECHNICAL ENGINEER.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**WALKWAY TYPICAL HARD SURFACE
SECTION**

REVISION DATE: DEC 2018
DRAWING #: **R-07**



NOTES:

1. ACCESS ROADWAY STRUCTURE IS SUBJECT TO RECOMMENDATIONS BY GEOTECHNICAL ENGINEER

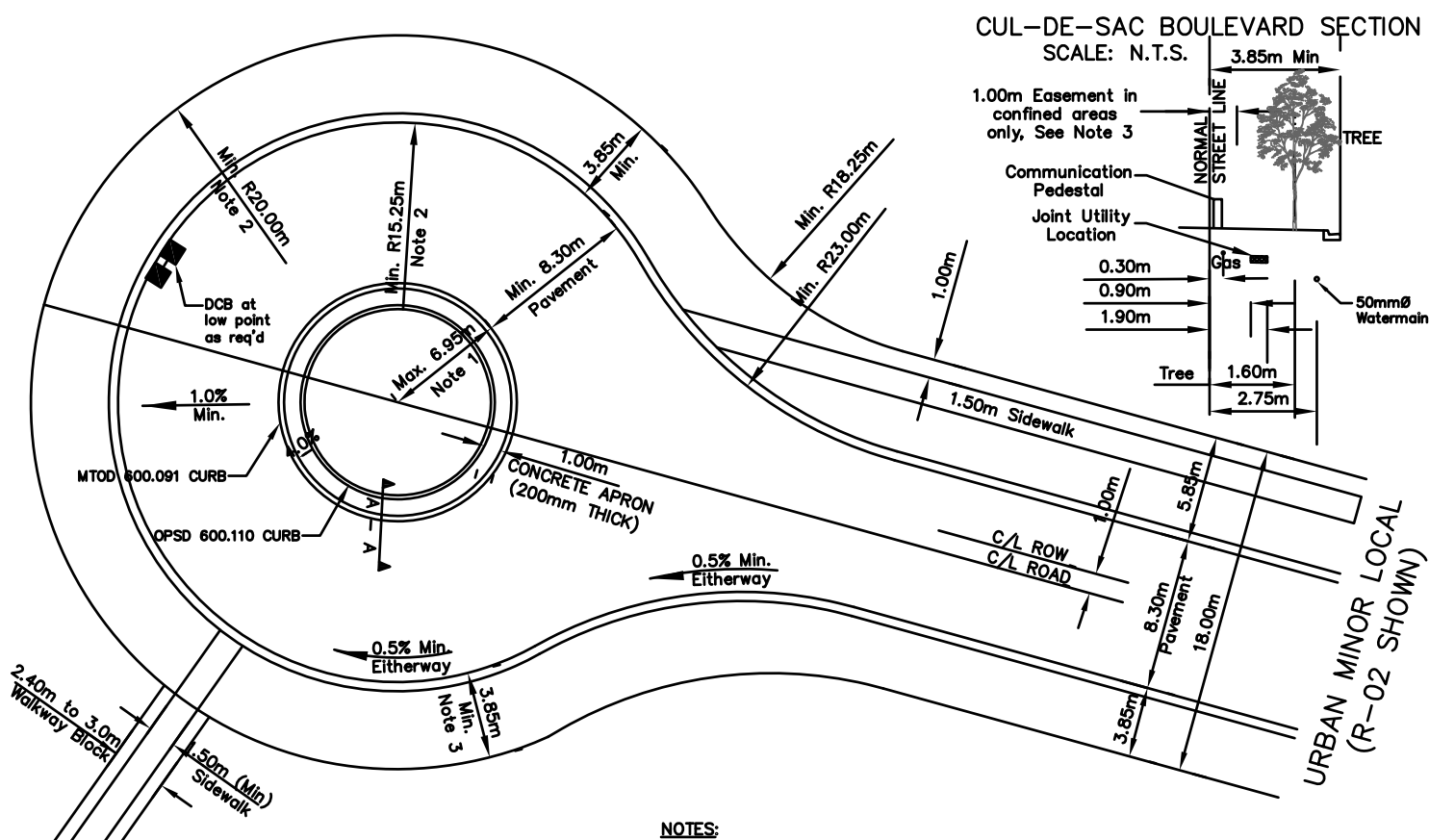
NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

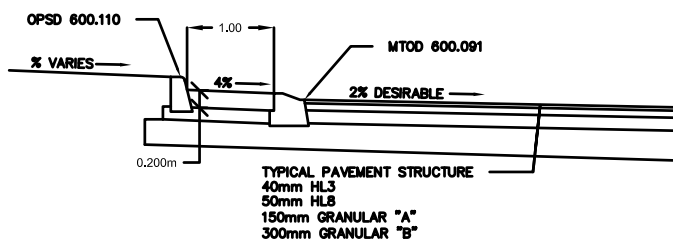
**TYPICAL VEHICULAR ACCESS IN 6.0 METRE
RIGHT OF WAY**

REVISION DATE:
DRAWING #:

DEC 2018
R-08



SECTION A - A



NOTES:

1. BULB ISLAND IS OPTIONAL WITH 15.25m (MIN) PAVEMENT RADIUS
2. REDUCTION TO 13.0m EDGE OF PAVEMENT WILL BE CONSIDERED IN CONFLICT AREAS, IN 17.75m RIGHT-OF-WAY.
3. REDUCTION TO 3.85m BOULEVARD WILL BE CONSIDERED IN CONFLICT AREAS SUBJECT TO 1.0m FRONT YARD EASEMENT FOR GASMAIN, IE. 16.75m PROPERTY LINE RADIUS PLUS 1.0m EASEMENT.
4. EACH BOULEVARD TO BE 3.85m PER R-02 IF SIDEWALK IS NOT REQUIRED.
5. STREET LIGHTS WITHIN CUL-DE-SAC SHALL BE LOCATED 1.0m FROM BACK OF CURB

NOT TO SCALE

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

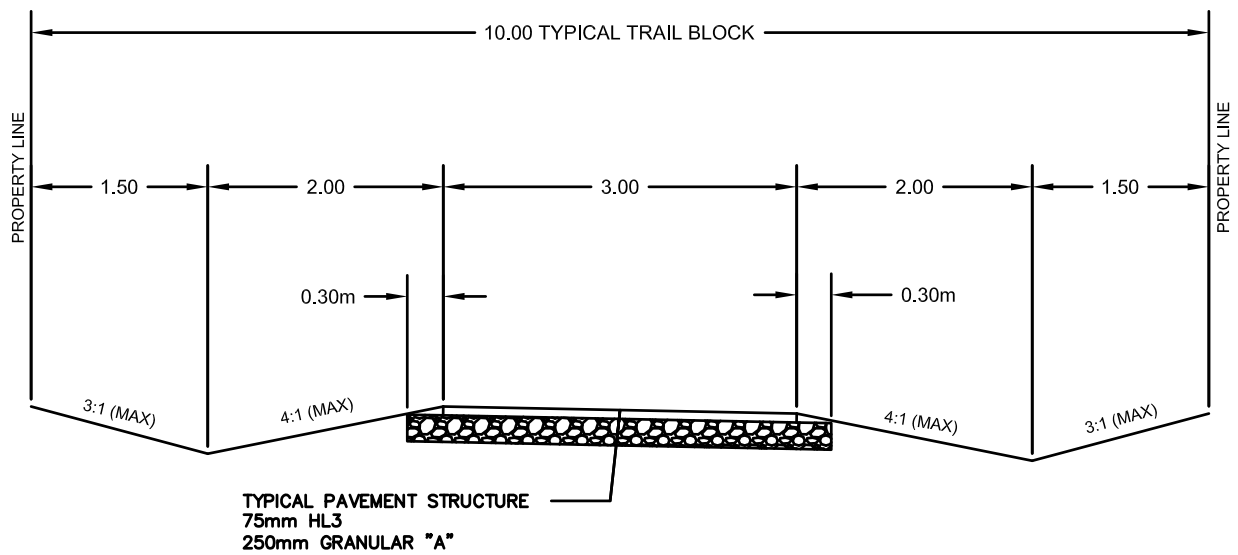
MINIMUM CUL-DE-SAC ON MINOR LOCAL STREET

REVISION DATE:

DEC 2018

DRAWING #:

R-09



NOTES:

1. HARD SURFACE ROOT BARRIER, 60mm THICK, SHALL BE INSTALLED IN THE VICINITY OF ANY TREES
2. ALL DISTURBED AREAS SHALL BE RESTORED WITH 100mm TOPSOIL AND SOD OR HYDROSEED

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

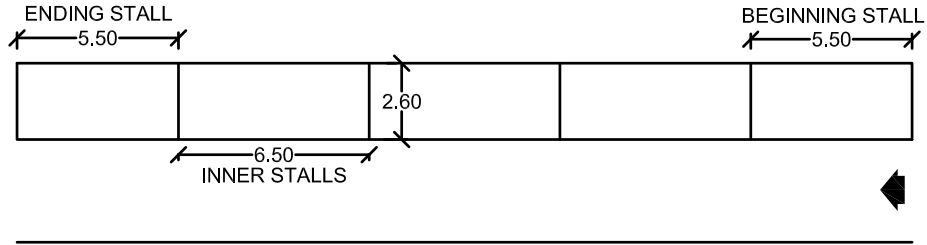
CITY OF ST. THOMAS STANDARD DRAWING

TYPICAL MULTI-USE TRAIL

REVISION DATE: DEC 2018

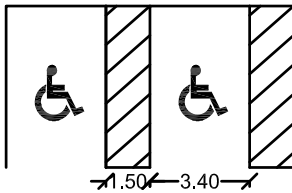
DRAWING #: **R-10**

ON-STREET PARKING REQUIREMENTS

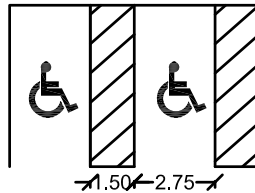


ACCESSIBLE PARKING REQUIREMENTS

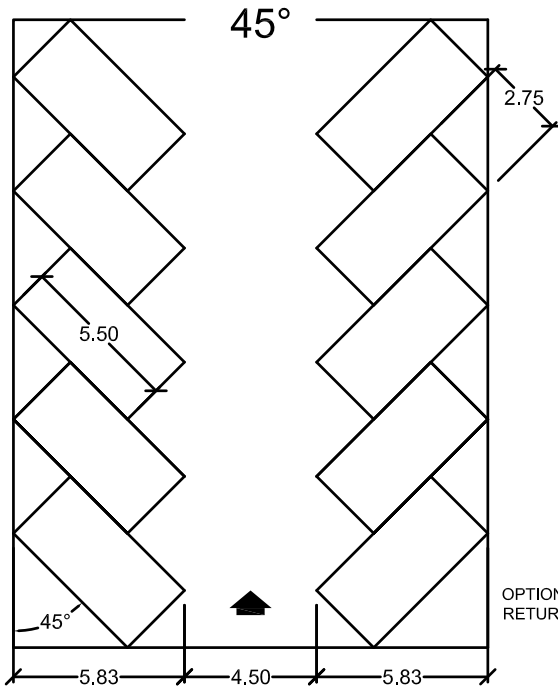
TYPE A - VAN ACCESSIBLE



TYPE B - STANDARD

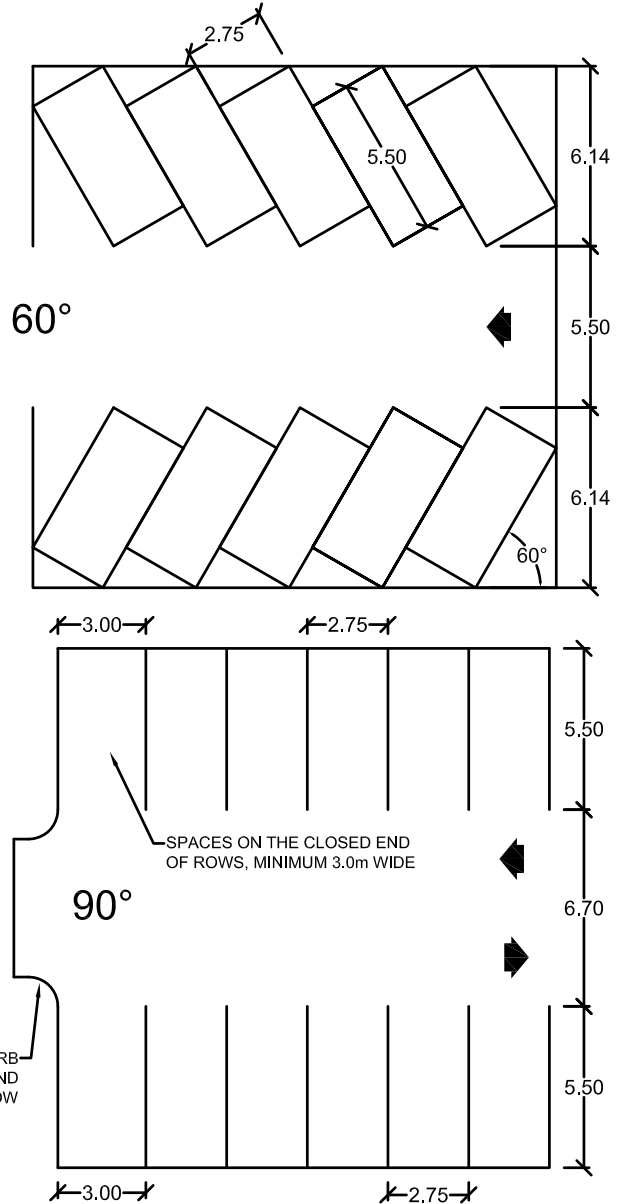


* REQUIRED SIGNING, NUMBER AND TYPE OF ACCESSIBLE SPACES SHALL BE AS PER APPLICABLE AODA, IASR AND O. REG. 191/11 OF THE INTEGRATED ACCESSIBILITY STANDARDS



NOTE: ALL DIMENSIONS PROVIDED ARE THE MINIMUMS REQUIRED

OPTIONAL CURB RETURN AT END OF ROW



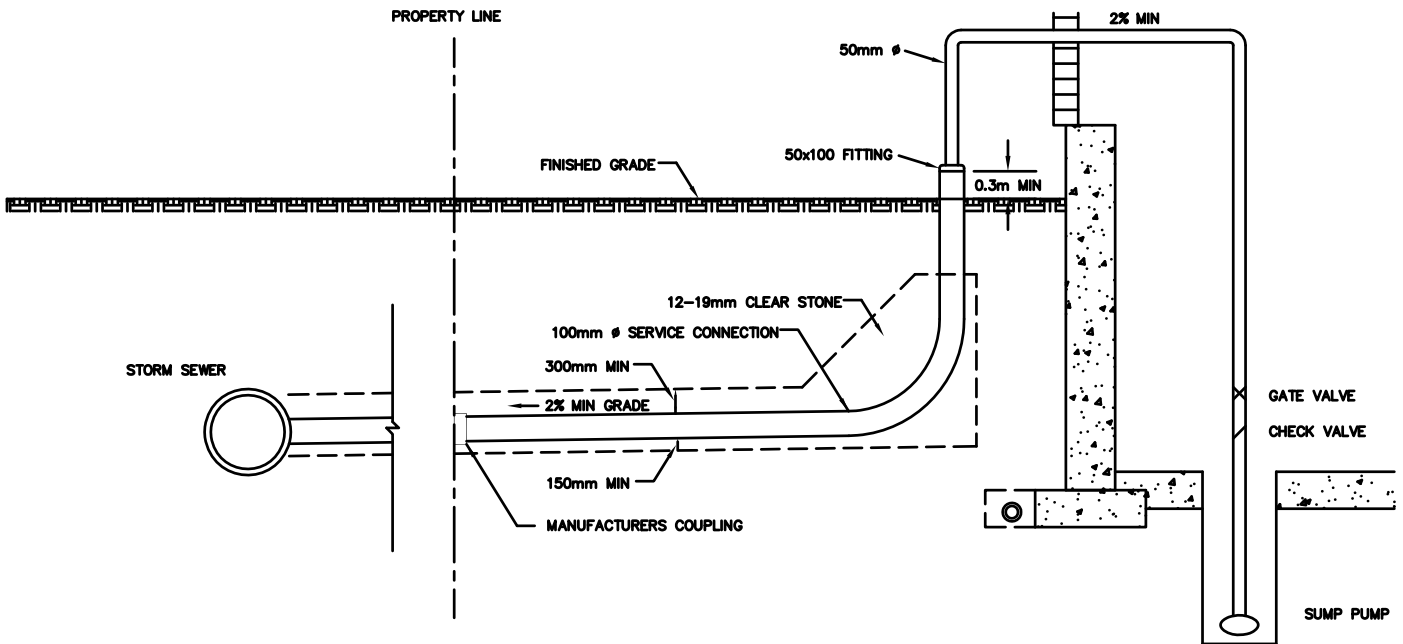
SCALE: 1:250

CITY OF ST. THOMAS STANDARD DRAWING

TYPICAL PARKING REQUIREMENTS

REVISION DATE:
DRAWING #:

DEC 2018
R-12



DRAIN CONTRACTOR

1. APPLY FOR INSPECTION PERMIT FROM PLANNING AND BUILDING SERVICES DEPARTMENT
2. INSTALL 100mm SERVICE CONNECTION PIPE TO GRADE COMPLETE WITH CAP
3. TO BE INSPECTED BY ENVIRONMENTAL SERVICES DEPARTMENT PRIOR TO BACKFILLING FROM STREET TO PROPERTY LINE.
4. ALL PIPE SHALL BE BELL AND SPIGOT WITH APPROVED WATERTIGHT GASKETED JOINTS
5. MULTI-UNIT LOTS WILL HAVE 150 mm Ø PDC CONNECTIONS

PLUMBER

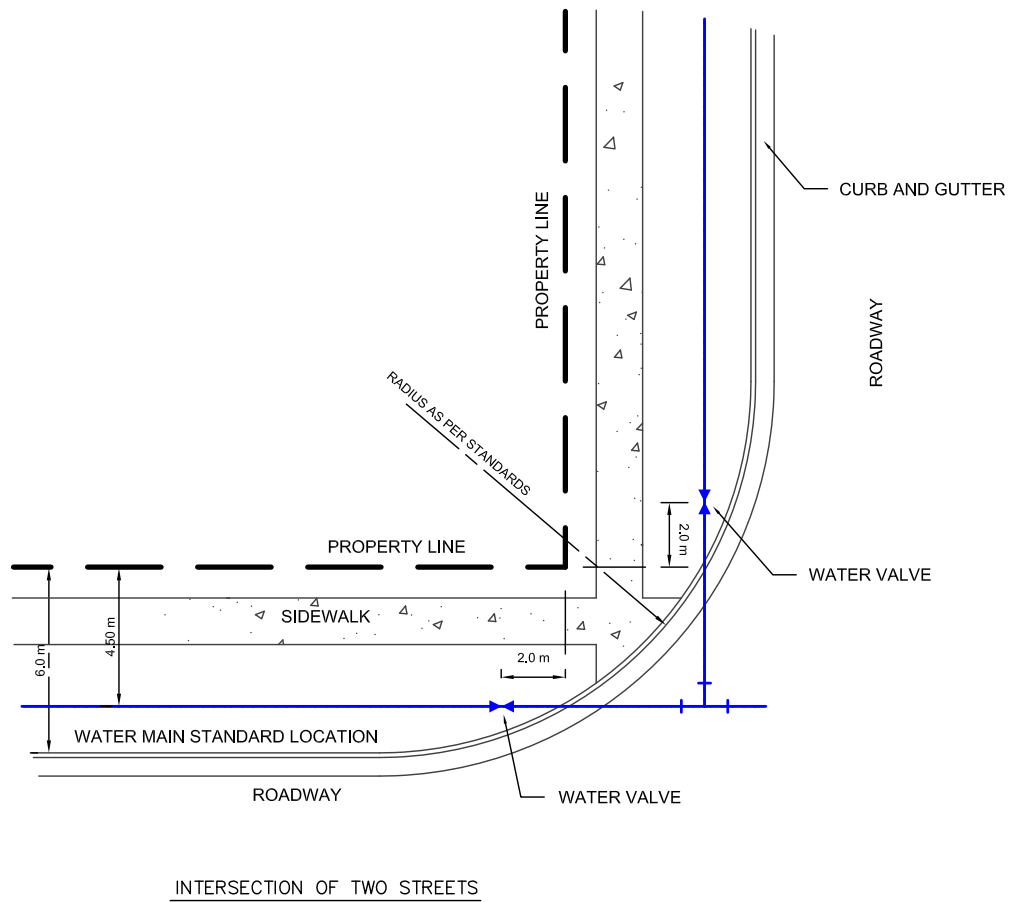
1. REMOVE CAP
2. INSTALL 50mm x 100mm FITTING (MULTI-UNIT WILL BE 50 X 150)
3. CONNECT TO SUMP PUMP
4. TO BE INSPECTED BY PLUMBING INSPECTOR (631-1680)

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

STORM SUMP DISCHARGE DETAIL

REVISION DATE: DEC 2018
DRAWING #: **S-03**



NOTE:

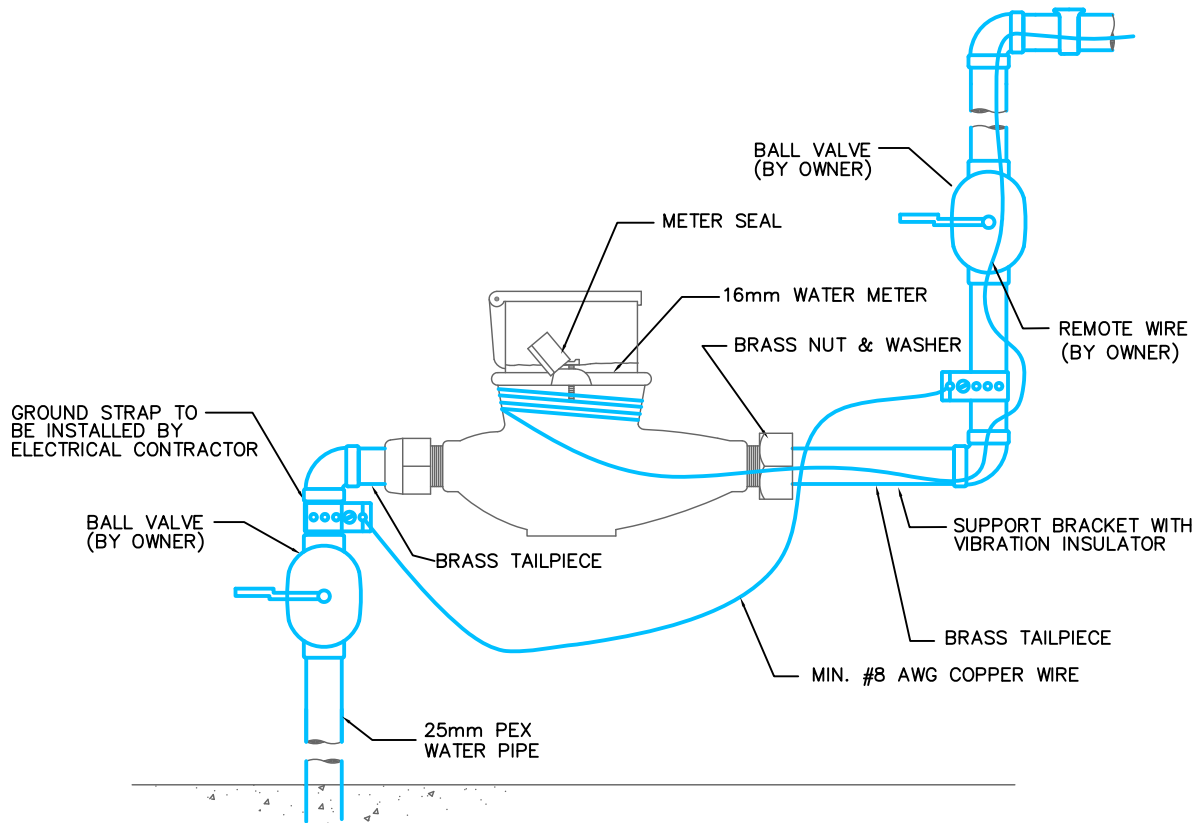
This standard may not apply for all road cross-sections. The objective is to prevent valves from being installed in the gutter. Where the intent of this detail cannot be met, the City of St. Thomas will approve an alternative location.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**STANDARD LOCATION OF WATER VALVES
FOR URBAN INTERSECTIONS**

REVISION DATE: DEC 2018
DRAWING #: **W-05**



NOTES:

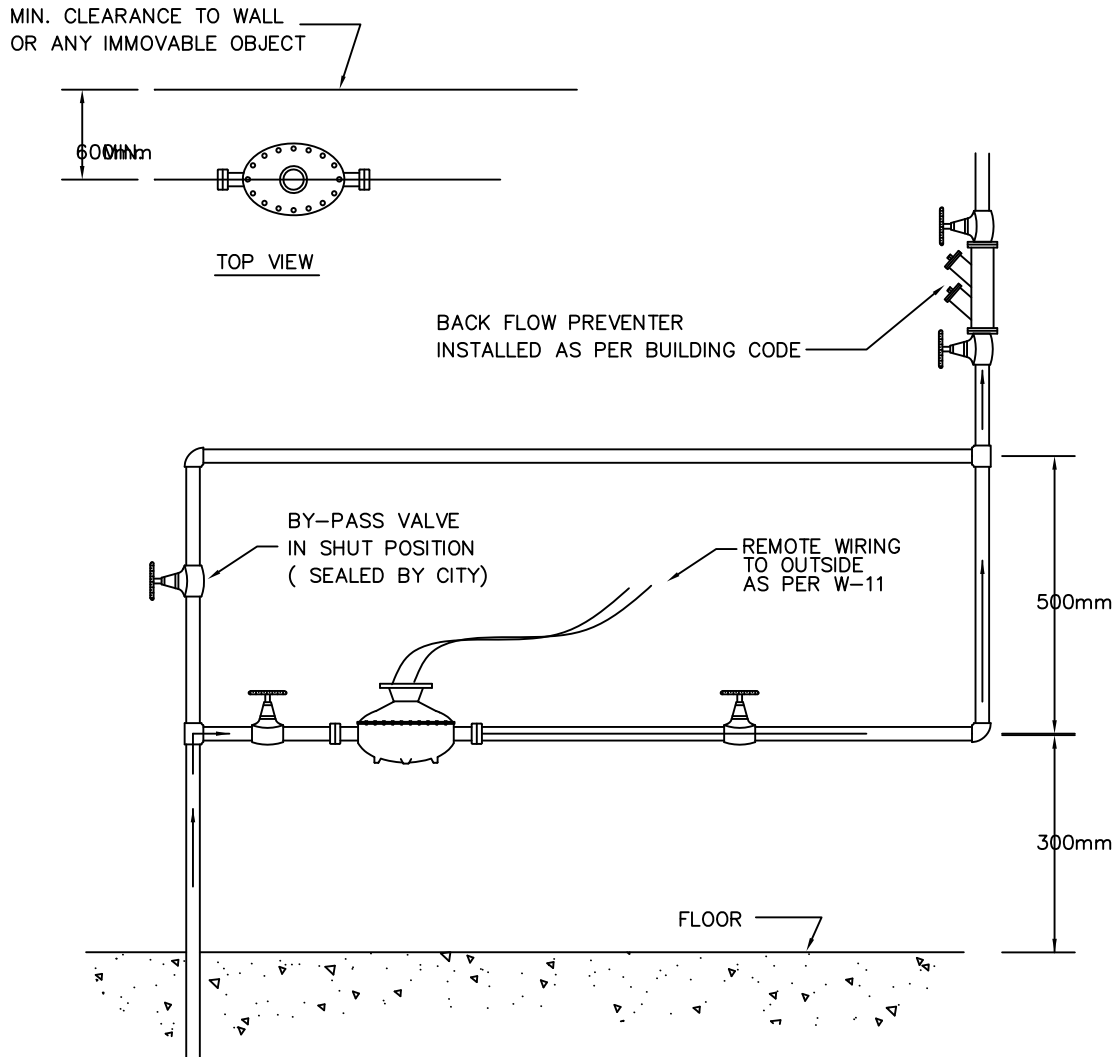
1. The meter is to be installed in a horizontal position as close as possible to the front foundation wall of the incoming water service entrance. (within 1 m of wall)
2. Meter to be kept from freezing (do not install in cold room)
3. Meter to be accessible for changing and maintenance.
4. Meter to be properly supported.
5. Remote wire to be run by owner from meter to outside remote location leaving 1.0m looped at both ends for connection by City staff, properly strapped and 0.5m loops left at each end with tie wraps used every 0.5m on conduit and plumbing.
6. 4 – 22 AWG or 3 – 20 AWG solid remote wire installed without splicing will only be acceptable to the City.
7. A 25 mm servicing line shut-off valve is to be installed within 0.5 m of where the service enters through the wall/floor of the customer's premises and a second valve is to be installed on the outlet side of the meter.
8. Provision is to be made for installing the meter immediately following the service line valve and in a horizontal position. (30 cm is to be left between 19 mm threaded female couplings for installing meter)
9. Meter and tail pieces supplied by City.
10. Refer to W-11 for details of remote water meter register installation.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**STANDARD INSTALLATION OF WATER
METERS UP TO 25 mm**

REVISION DATE: DEC 2018
DRAWING #: **W-08**



NOTES:

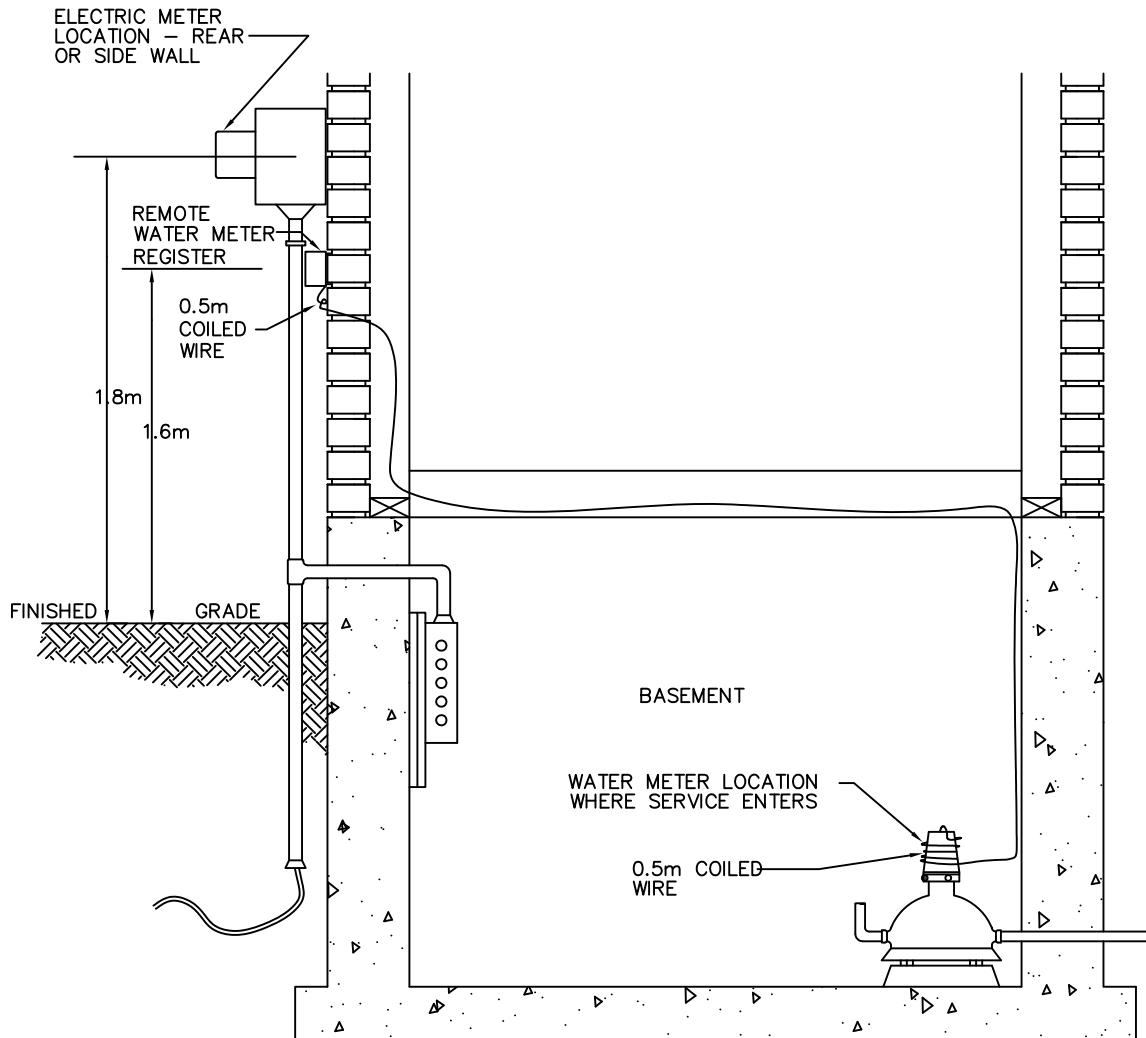
1. All 38mm meters and larger and any meter supplying more that one customer requires a bypass unless otherwise approved by the City. All commercial designated buildings require a by-pass for 25mm and larger water services. A 25mm meter installation does not requires a by-pass unless special conditions exist above and beyond those listed in Section 4.6.1 of the City specifications.
2. Meter and bypass piping to be equal in size.
3. Soldered copper pipe and fittings may be used.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

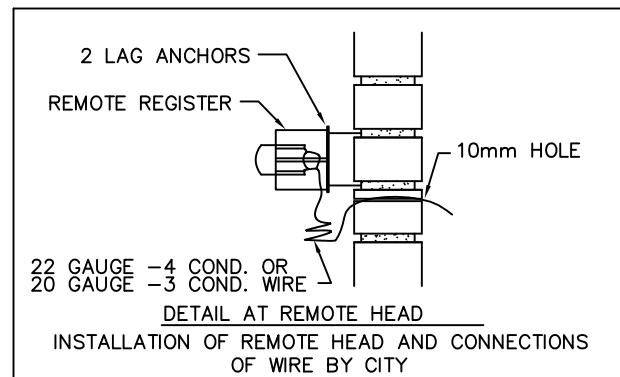
**TYPICAL INSTALLATION FOR 40 mm, & 50
mm DISC TYPE WATER METER**

REVISION DATE: DEC 2018
DRAWING #: **W-10**



NOTES:

1. Remote water meter register to be located immediately below electric meter secured to stack.
2. 4 – 22 AWG or 3 – 20 AWG solid remote wire installed without splicing will only be acceptable to the City.
3. 0.5 m of coiled wire to be left at both water meter and remote register installation.
4. Where electric meter is recessed, the remote register shall be secured to wall.

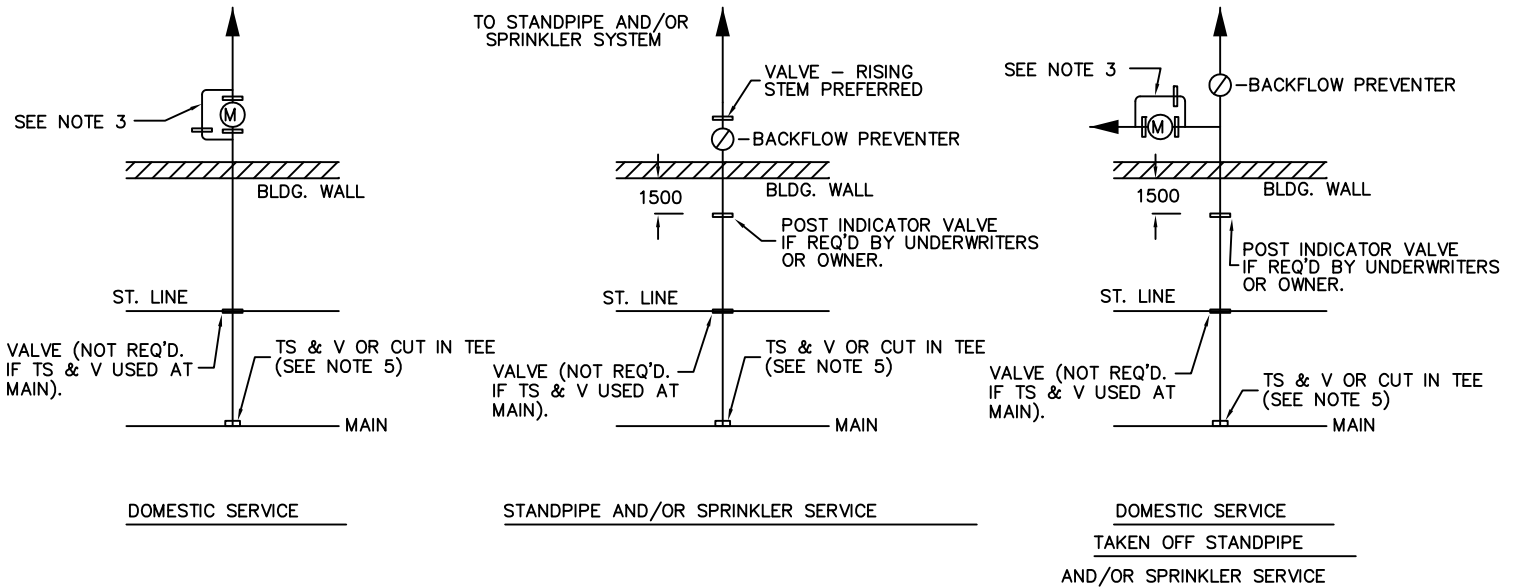


NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**REMOTE WATER METER REGISTER
INSTALLATION**

REVISION DATE: DEC 2018
DRAWING #: **W-11**



NOTES:

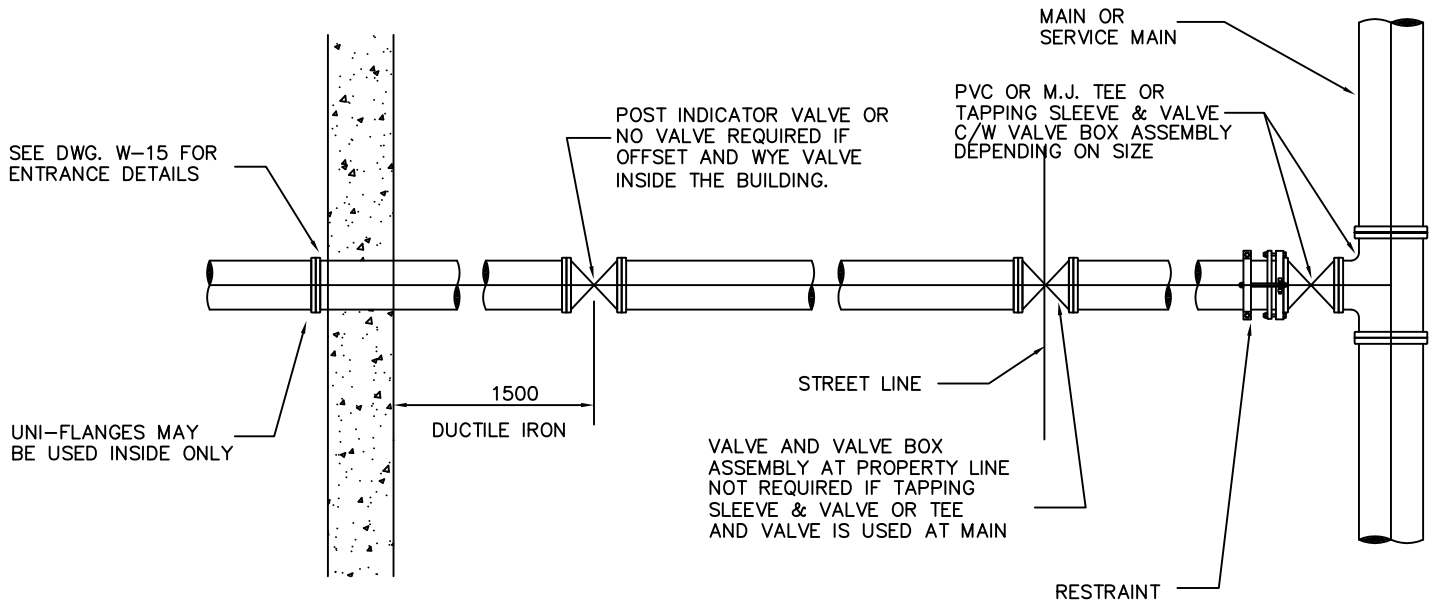
1. All dimensions are in mm unless otherwise shown.
2. The domestic water may be taken from the sprinkler service and/or the standpipe service inside the building if approved by fire underwriters. If not, the domestic service shall be installed to the main as shown with a minimum of 300 mm separation from the fire service.
3. Domestic valves, meter and by-pass if required, shall be immediately inside the structure wall. Valves are preferred to be rising stem. See DWG. W-13.
4. Control and check valves on fire services shall be as required by Ontario Building Code.
5. If the service is off a service main, a tapping sleeve and valve or a tee and valve shall be installed at the service main.
6. See DWG. W-14 for details of service.
7. For backflow preventer requirements refer to Spec. Sec. 4.4 Ontario Building Code.
8. Ductile iron starts 1.5m from building front, into building and up through floor.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**SCHEMATIC LAYOUT OF 100 mm & LARGER
SERVICE**

REVISION DATE: DEC 2018
DRAWING #: **W-12**



NOTES:

1. All dimensions are in mm unless shown otherwise.
2. See DWG. W-12 for typical service layouts.
3. Fire and domestic lines will terminate with flanged ends inside the building.
4. If the service is off a service main a tapping sleeve and valve or a tee and valve shall be installed at the service main.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

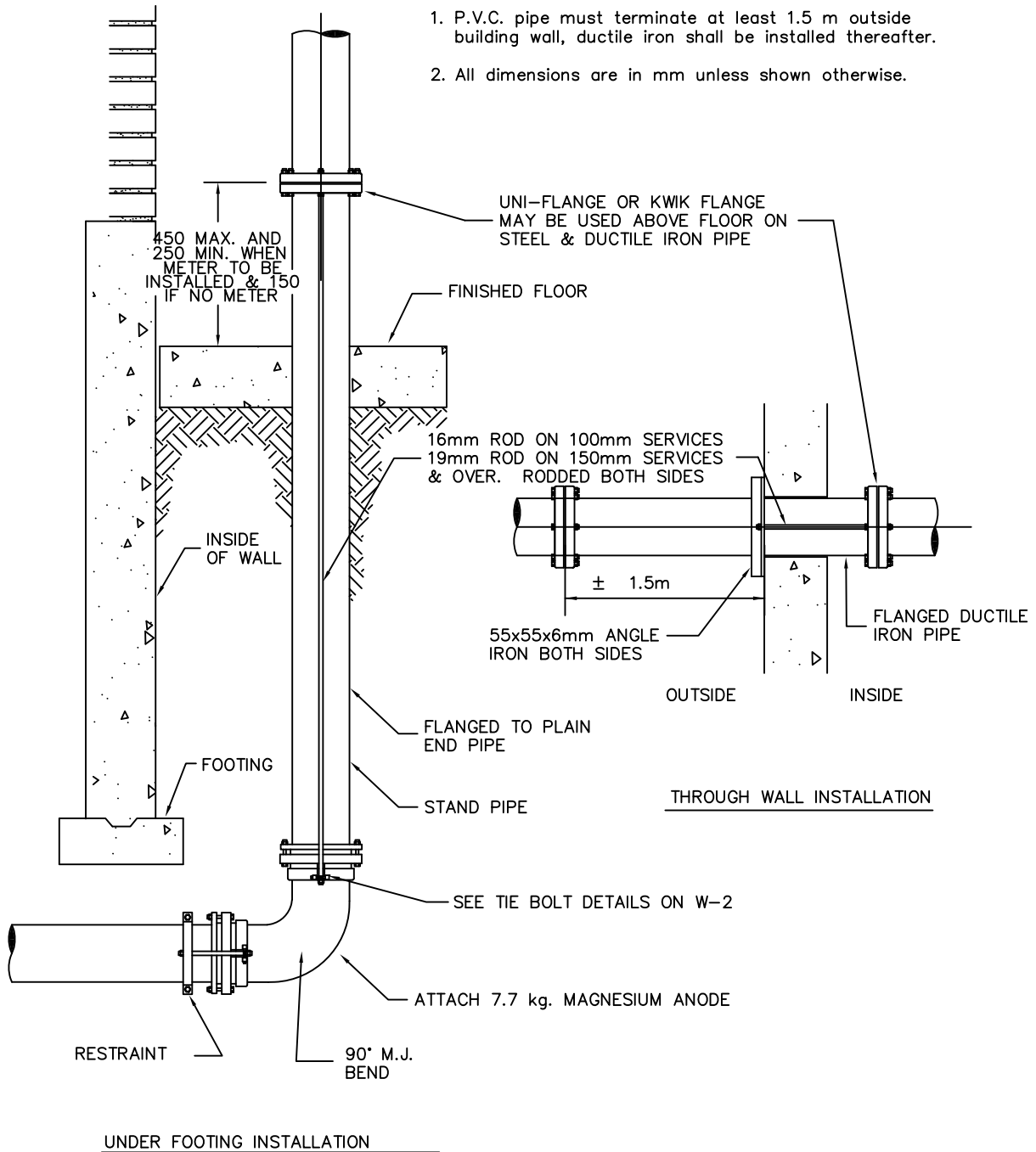
CITY OF ST. THOMAS STANDARD DRAWING

**TYPICAL DETAILS OF 100 mm & LARGER
SERVICE**

REVISION DATE: DEC 2018
DRAWING #: **W-14**

NOTES:

1. P.V.C. pipe must terminate at least 1.5 m outside building wall, ductile iron shall be installed thereafter.
2. All dimensions are in mm unless shown otherwise.



NOT TO SCALE

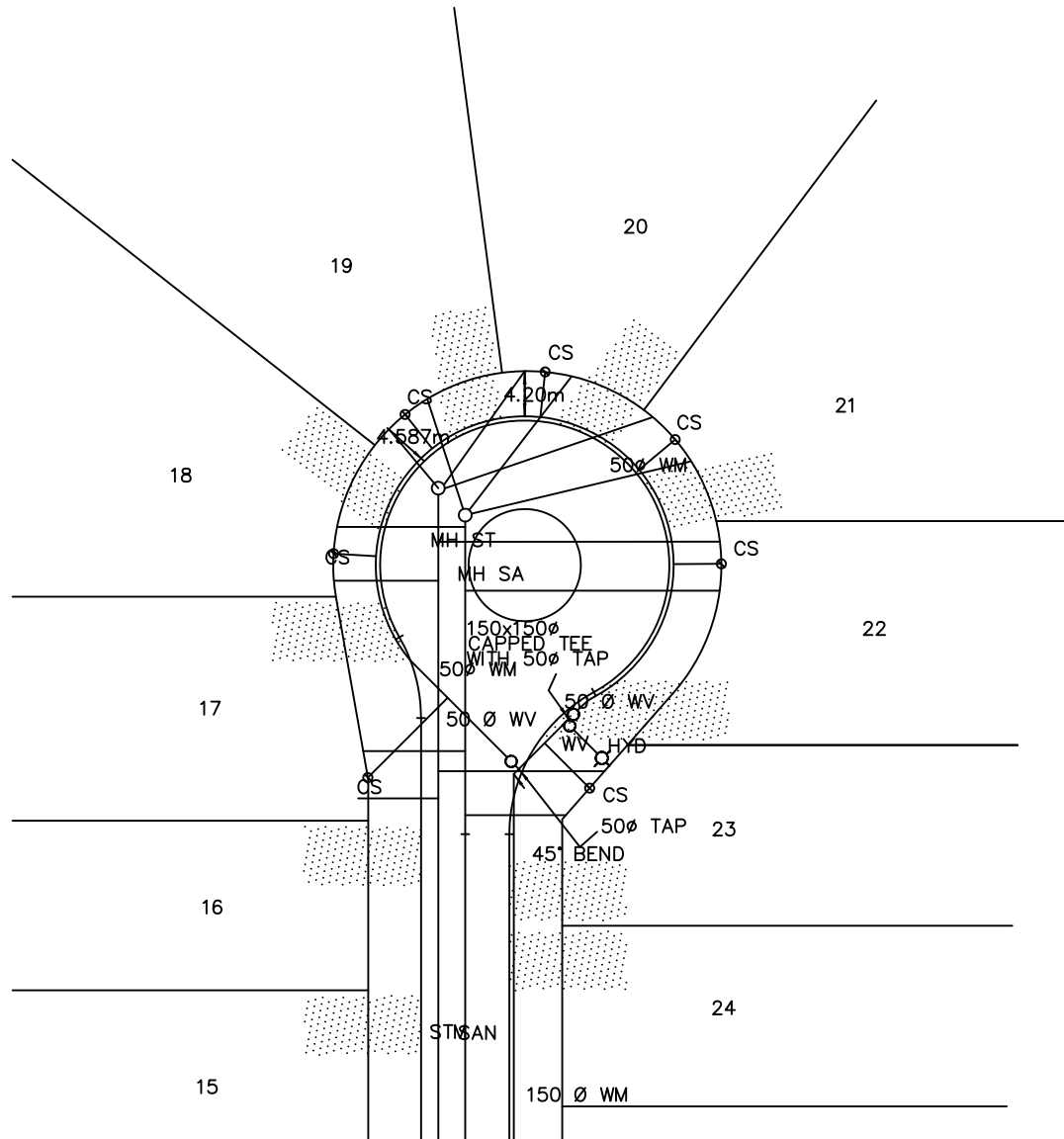
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**TYPICAL SERVICE ENTRANCES 100 mm TO
200 mm**

REVISION DATE: DEC 2018

DRAWING #: **W-15**



NOTES:

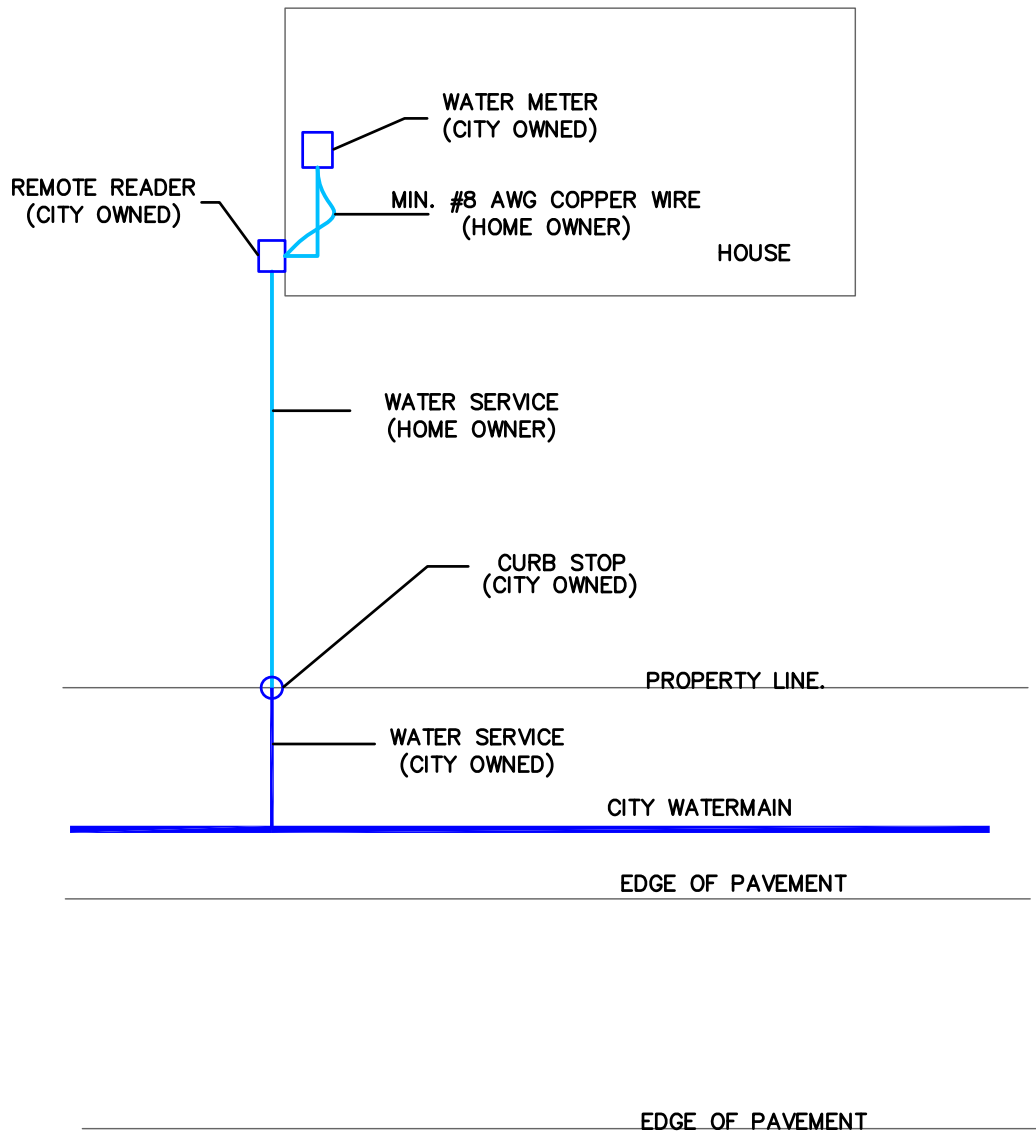
1. All dimensions are in mm unless shown otherwise.
2. All pipe joints are to be restrained on the 50 mm Ø watermain loop.
3. Pipe radius as per manufacturers specifications.
4. Acceptable 50 mm Ø products for use in cul-de-sacs include Crosslinked Polyethylene (PEX) Tubing.

NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**TYPICAL DETAIL OF 50 mm WATERMAIN
LOOP**

REVISION DATE: DEC 2018
DRAWING #: **W-19**



NOT TO SCALE
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

CITY OF ST. THOMAS STANDARD DRAWING

**OWNERSHIP OF WATER SERVICE, WATER
METER, REMOTE READER &
APPURTENANCES**

REVISION DATE: DEC 2018
DRAWING #: **W-21**

IMPORTANT

- This Detail does not represent any particular species
- Trees must be at least 50mm unless otherwise approved by the Parks and Forestry Division
- Will not accept trees with more than 1 leader, no central leader, trees showing signs of stress, nutrient deficiencies, mechanical injury, or trees that have been excessively pruned
- Any trees planted too deep or too high will have to be immediately re-adjusted.
- Trees are to be thoroughly watered at the time of planting .
- If trees have a central leader that has a defined lean, direct away from any overhead obstructions
- Remove all nursery tabs, plastic, cardboard or metal.
- Backfill shall be the soil that was excavated from the tree pit, compacted enough to support a free standing tree, be free of air pockets, and of a loam topsoil mixture equivalent to ISA standards if excess soil is required
- Tree guard (not shown) shall either be big O or Arbogard+, unless otherwise approved by the Parks and Recreation Department.
- Fertilizing is not permitted
- All locates are the responsibility of the contractor

Do not prune the **Central Leader**

Crown Thin only where branches are dead, broken, rubbing, or have a tight 'V' shaped branch union

Stakes shall be bamboo poles or 2in x 2in wooden stakes, inserted outside the root ball and located opposite each other parallel to the road or in the direction of the prevailing wind when location is exposed to strong winds

Ties shall be biodegradable, non-abrasive, placed opposing each other, and allow for some movement

Mulch shall be 4 inches deep and should consist of composted wood chips or organic material, at a diameter to be the size of root ball plus 1 foot

Root Flare shall be level with the final grade of the surrounding soil, where clay exists plant 2-5 centimeters high

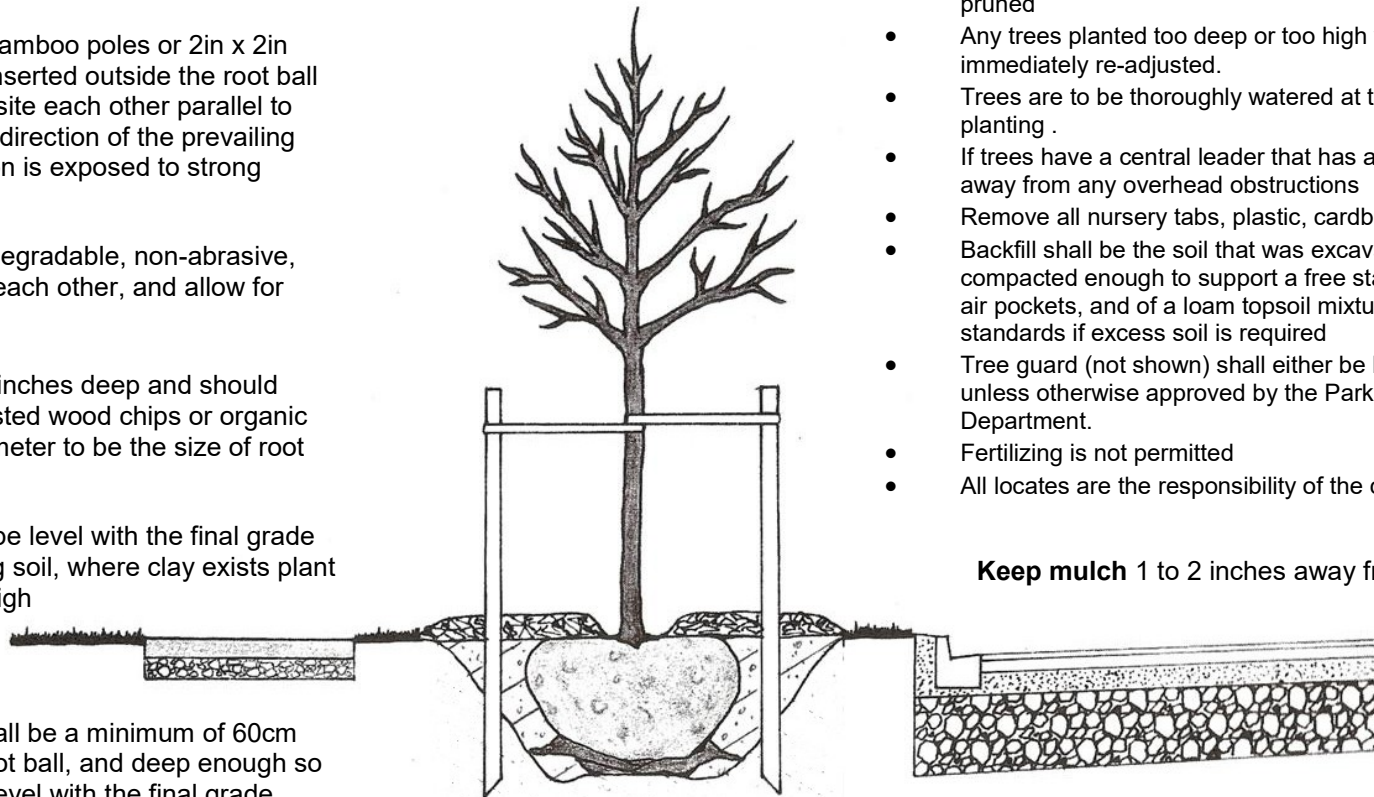
Planting hole shall be a minimum of 60cm larger than the root ball, and deep enough so the trunk flare is level with the final grade.

Base of the planting hole shall be undisturbed or firmly tamped enough to not allow the root ball to settle

Drainage shall be designed to comply with specific road specifications

Keep mulch 1 to 2 inches away from the base of tree

Cut and Remove all wire, burlap, and twine from around the base of the trunk, and the top 2/3 of the root ball. Remove these items after the tree has been placed in the hole



City of St. Thomas Tree Planting Standard

SCALE NTS	DRAWN BY JT	CHECKED BY RT CS	LAST REVISION 2018	TEMPLATE 8.5" x 11"	LETTER B
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BUILDING SERVICES REPORT**SANITARY/STORM/WATERMAIN**

Lot No.

Date

File #:

Municipal
Address

Subdivision

Sanitary

Obvert Elev. of Main	<input type="text"/>	m
Invert Elev. of PDC at P/L	<input type="text"/>	m
Depth at C of Road	<input type="text"/>	m
PDC Size	<input type="text"/>	mm
Main Size	<input type="text"/>	mm <input type="checkbox"/> T or <input type="checkbox"/> Y
Pipe Material	<input type="text"/>	
Comments	<input type="text"/>	
Inspector	<input type="text"/>	

Storm

Obvert Elev. of Main	<input type="text"/>	m
Invert Elev. of PDC at P/L	<input type="text"/>	m
Depth at C of Road	<input type="text"/>	m
PDC Size	<input type="text"/>	mm
Main Size	<input type="text"/>	mm <input type="checkbox"/> T or <input type="checkbox"/> Y
Pipe Material	<input type="text"/>	
Comments	<input type="text"/>	
Inspecting Forman	<input type="text"/>	

Water

Obvert Elev. of Main	<input type="text"/>	m
Service Elev. at P/L	<input type="text"/>	m
Depth at C of Road	<input type="text"/>	m
Service Size	<input type="text"/>	mm
Main Size	<input type="text"/>	mm <input type="checkbox"/> T or <input type="checkbox"/> Y
Pipe Material	<input type="text"/>	
Comments	<input type="text"/>	

Please write any additional comments on back of sheet.

[Rodding/ Repair
Reports](#)

Corporation of the City of St. Thomas



Intensity Option # 2

3) Insert Intensity

b=

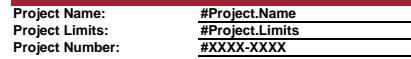
b=

-0.699

Outlet Invert Elevation=

[illegible]

Corporation of the City of St. Thomas



Designed by: _____
Date: _____

Outlet Invert Elevation=

The Peaking Factor was derived:

Using Harmon Formula= (Y or N)

From a Table= N

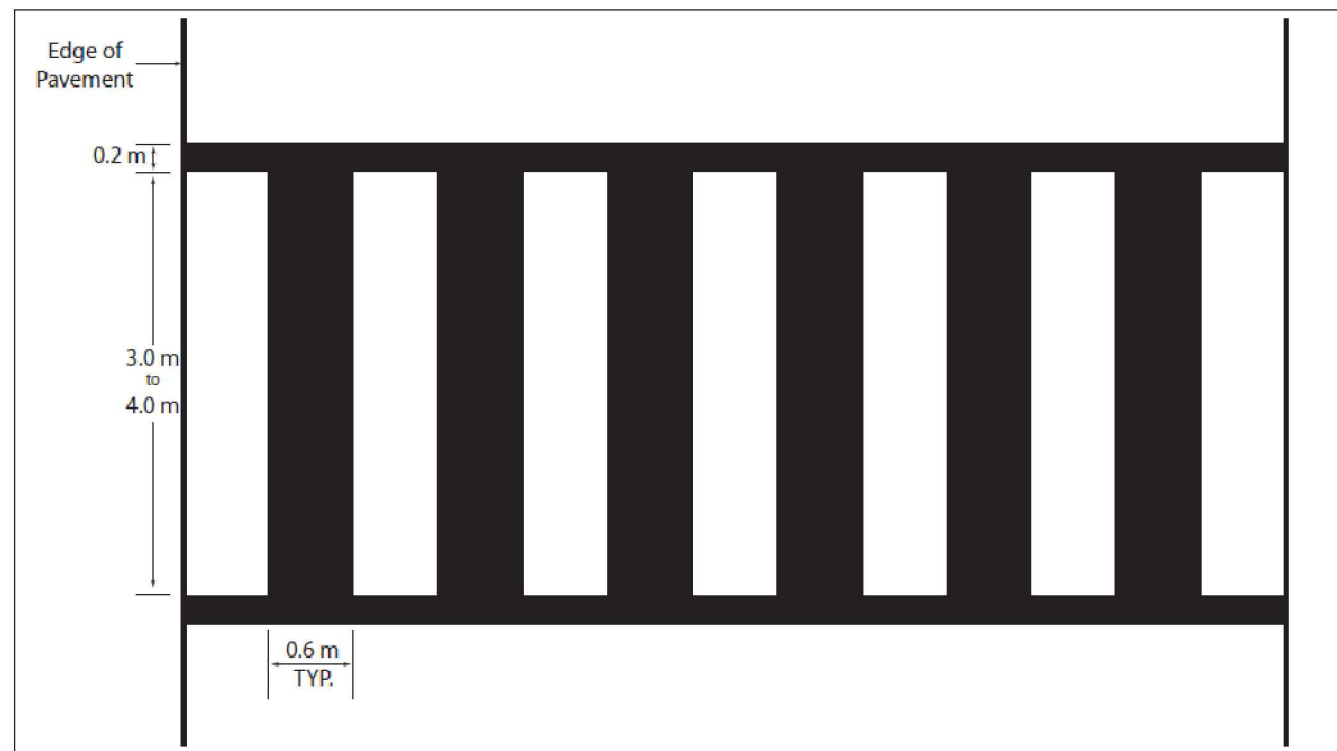
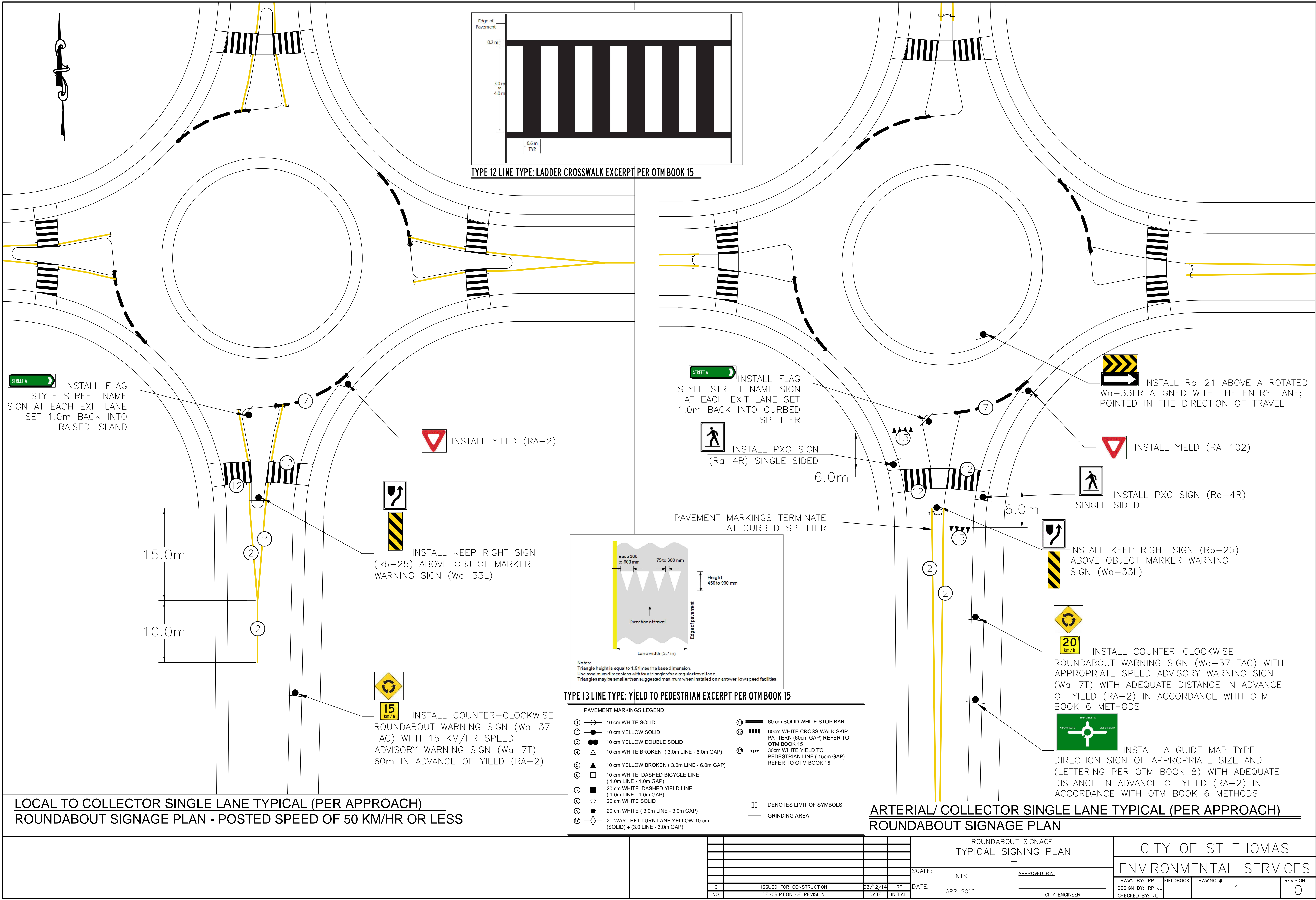
Residential Avg Daily Flow= 250 L/Cap.D

Mannings 'n' = 0.013

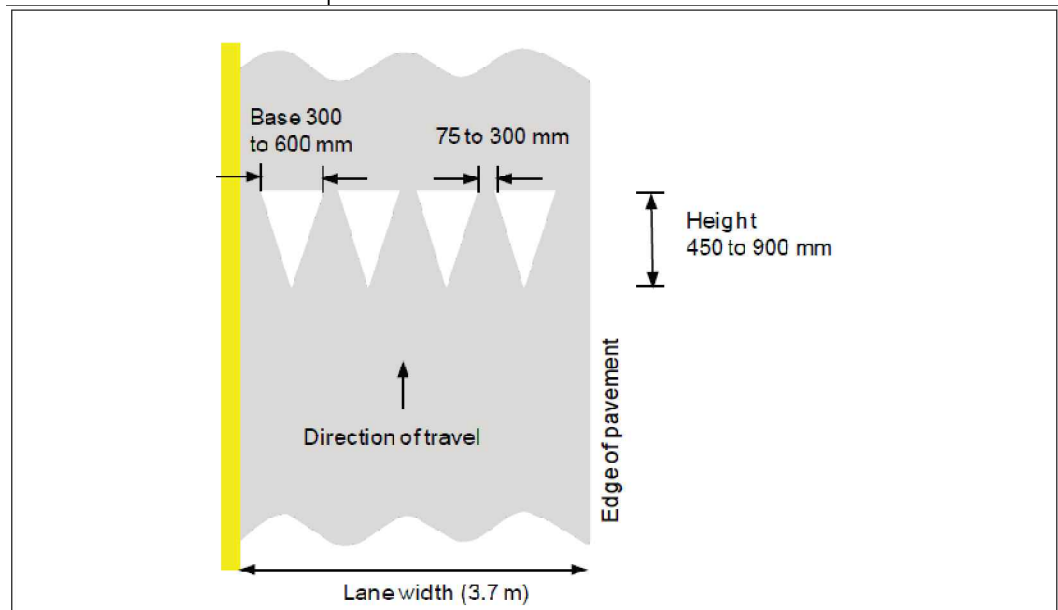
Peak Extraneous Flow= 0.100 L/Ha.S

Total Area= -

[illegible]



TYPE 12 LINE TYPE: LADDER CROSSWALK EXCERPT PER OTM BOOK 15



Notes:
Triangle height is equal to 1.5 times the base dimension.
Use maximum dimensions with four triangles for a regular travel lane.
Triangles may be smaller than suggested maximum when installed on narrower, low speed facilities.

TYPE 13 LINE TYPE: YIELD TO PEDESTRIAN EXCERPT PER OTM BOOK 15

PAVEMENT MARKINGS LEGEND			
①	10 cm WHITE SOLID	①	60 cm SOLID WHITE STOP BAR
②	10 cm YELLOW SOLID	②	60cm WHITE CROSS WALK SKIP PATTERN (60cm GAP) REFER TO OTM BOOK 15
③	10 cm YELLOW DOUBLE SOLID	③	30cm WHITE YIELD TO PEDESTRIAN LINE (.15cm GAP) REFER TO OTM BOOK 15
④	10 cm WHITE BROKEN (3.0m LINE - 6.0m GAP)		
⑤	10 cm YELLOW BROKEN (3.0m LINE - 6.0m GAP)		
⑥	10 cm WHITE DASHED BICYCLE LINE (1.0m LINE - 1.0m GAP)		
⑦	20 cm WHITE DASHED YIELD LINE (1.0m LINE - 1.0m GAP)		
⑧	20 cm WHITE SOLID		
⑨	20 cm WHITE (3.0m LINE - 3.0m GAP)		
⑩	2 - WAY LEFT TURN LANE YELLOW 10 cm (SOLID) + (3.0 LINE - 3.0m GAP)		
		— —	DENOTES LIMIT OF SYMBOLS
		—	GRINDING AREA

LOCAL TO COLLECTOR SINGLE LANE TYPICAL (PER APPROACH)
ROUNDAABOUT SIGNAGE PLAN - POSTED SPEED OF 50 KM/HR OR LESS

ARTERIAL/ COLLECTOR SINGLE LANE TYPICAL (PER APPROACH)
ROUNDAABOUT SIGNAGE PLAN

ROUNDABOUT SIGNAGE TYPICAL SIGNING PLAN				CITY OF ST THOMAS ENVIRONMENTAL SERVICES			
SCALE: NTS	APPROVED BY:			DRAWN BY: RP	FIELDBOOK	DRAWING #	REVISION
DESIGN BY: RP JL	DATE: APR 2016			CITY ENGINEER		1	0
CHECKED BY: JL							