



**The Town of Ingersoll
Design Guidelines
And Specifications for
Municipal Work
Draft 2015**



DATED

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The purpose of this manual is to provide consistency in design guidelines and specifications for infrastructure located and owned by the Town of Ingersoll. This document is intended for Municipal Staff, Consulting Engineers, Developers and others who are involved in submitting land development and engineering projects within the Town of Ingersoll.

The information contained within this document is intended to provide guidance beyond legislative and standard practices. There will be specific situations where the design will not conform to these guidelines and supplemental specifications and it is not the intention of the Town of Ingersoll to anticipate every situation.

Any deviation from the design guidelines and specifications contained herein must be submitted in writing to the Town Engineer for approval. Approval must be granted before proceeding with design changes contrary to this document.

Municipal staff will review yearly this document for the purpose of updating existing criteria when necessary and introducing new products or procedures if applicable to the design and construction practices. It is the sole responsibility of those who perform the planning, design, and construction of Town of Ingersoll owned municipal infrastructure to verify that the design and installation is in strict accordance with the latest revision of this document.

This document can also be found on the Town of Ingersoll website at www.ingersoll.ca located under Residents - Engineering Services - Design Guidelines and Specifications.

Should you have any questions regarding the information contained in this document, please contact the Town of Ingersoll at 519-485-0120, Monday to Friday between the hours of 8:30am to 4:30pm.

Sandra Lawson
Engineer
Town of Ingersoll



ACKNOWLEDGEMENT OF SOURCES

This document consists of a compilation of design practices used by The Town of Ingersoll. This compilation consists primarily of practices that have been developed over a period of time within the Town and from practices developed by others, chosen by the Town of Ingersoll for use within the municipality.

The Town of Ingersoll would like to acknowledge the following resources and design practices in the development of this document.

1. Town of Ingersoll Storm Water Management Report – Feb 2007
2. Town of Ingersoll Standard Contract Documents
3. Town of Ingersoll Standard Drawings
4. County of Oxford Official Plan
5. County of Oxford Design Guidelines and Supplemental Specifications for Municipal Services - 2013
6. County of Oxford – Ingersoll Servicing Strategy Assessment Report - April 2002
7. City of London - Design Specifications and Requirements
8. City of Brantford - Design Specifications and Requirements
9. Town of Tillsonburg – Urban Design Guidelines
10. Erie Thames Power and CRU Solutions
11. Ministry of Environment, Guidelines.
12. Ministry of the Environment Noise Assessment Criteria in Land Use Planning”
13. Ministry of Natural Resources
14. Ministry of Transportation
15. Municipal Engineer’s Association Municipal Works Design Manual (2nd Edition, 1984)
16. Ontario Provincial Standard Specifications
17. Ontario Provincial Standard Drawings
18. Ontario Traffic Manual – Book 7 – Temporary Conditions
19. Ontario Traffic Manual – Book 11
20. Ontario Traffic Manual – Book 12
21. Ontario Highway Bridge Design Code
22. IMSA Manual
23. Environmental Protection Act Manual
24. TAC – Bikeway Traffic Control Guidelines for Canada – 2nd Edition
25. Upper Thames River Conservation Authority
26. Credit Valley Conservation – Low Impact Development Stormwater Management



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SECTION 1 – GENERAL

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1.1 Introduction

The information contained herein comprises the Town of Ingersoll Engineering Services Design Specifications and Requirements which are to be utilized for the design of work within the Town of Ingersoll, on municipally owned road allowances, municipally owned property and for municipally owned infrastructure on easements.

The design information contained in this manual is intended to provide guidance beyond legislative and standard design practices for use in the Town of Ingersoll. There may be specific situations where the design may deviate from these practices as it is not possible nor is it the intention of the Town to anticipate every situation.

This document, along with the Ontario Provincial Standard Specifications and the Ontario Provincial Standard Drawings provide the basis for the design of municipal construction projects and work intended for assumption by the Town of Ingersoll.

These specifications and drawings may be revised from time to time as considered necessary by the Town. It will be the responsibility of the Owner(s) and/or Contractor(s) who is performing the installation of these systems to be in accordance with the latest revision of these Specifications.

The Town of Ingersoll maintains the right to accept or refuse any design submissions. The Town requires an acceptable design for any given circumstance. Notwithstanding any item that may be contained or not included herein, the decision of the Town Engineer concerning any matter shall be final.

Any deviation from the following specifications must be submitted in writing to the Town Engineer for their approval. Approval must be granted before construction can commence.

1.2 Definitions

For the purpose of these specifications, the following definitions will be recognized:

- a) **“Town”** shall mean The Corporation of the Town of Ingersoll.
- b) **“County”** shall mean The Corporation of the County of Oxford
- c) **“Owner”** shall include any person who or any firm or corporation that is the registered owner of the property under consideration or any agent thereof, a person entitled to a limited estate in land, a trustee in whom land is vested, an executor, an administrator and a guardian.

1.2 Definitions (cont'd)

- d) **“Developer”** shall mean the Owner or party specifically named in a Development Agreement or in a Subdivision Agreement.
- e) **“Sub-Divider”** means the Owner or Party specifically named in a Subdivision Agreement.
- f) **“Contractor”** means a person, partnership, or corporation who is contracted to undertake the execution of work commissioned by the Owner.
- g) **“Subcontractor”** means the person or Corporation having a contract with the Contractor (or with another subcontractor) for the execution of a part or parts of the Work included in the Contract, or for the supplying of material for the Contract and worked to a special design according to the Drawings and Specifications.
- h) **“Engineer”** shall mean the Town of Ingersoll and/or the County of Oxford Engineer.
- i) **“Consulting Engineer”** means the firm of the Consulting Engineers registered with the Professional Engineers Ontario (PEO) who has been retained by the Town or Developer to act as their agent for the construction of municipal infrastructure herein.
- j) **“approved equal”** means written permission from the Town Engineer.
- k) **“Inspector”** shall be defined as the duly authorized representative of the Town of Ingersoll Engineer for the purpose of performing the duties and functions of inspection of the work, and with authority limited as outlined herein.
- l) **“OPSD”** means Ontario Provincial Standard Drawings
- m) **“OPSS”** means Ontario Provincial Standard Specifications
- n) **"Drawings"** means all plans, drawings, profiles, sections and elevations, sketches, or copies thereof, exhibited, used or prepared for, or in connection with the proposed work.
- o) **“Contract”** includes the Agreement to do the work entered into with the Corporation, the Bond or Security, the Specifications, the General Conditions, the Supplementary General Conditions, the Drawings, the Special Provisions, the Information for Bidders or Tenderers, the Tender and all other documents referred to or connected with the said Agreements.

1.2 Definitions (cont'd)

- p) “OBC” is the reference to the Ontario Building Codes
- q) “Work” means labour, material and other required to complete the work that is shown, described or implied in the Contract Documents.
- r) Whenever the words "directed", "required", "authorized", "considered necessary", or word of like import are used, it shall be understood that the "direction", "requirements", etc., of the Town Engineer is intended and similarly the word "approval", "satisfactory", or words of like import shall be "approved by", "acceptable", or "satisfactory" to the Town Engineer.
- s) The words “shall”, “may”, “herein”, “person”, “writing”, “written”, “surety”, and “security” and words used in the singular number or the masculine gender shall, have the same meaning and effect as given in The Interpretation Act of the Revised Statutes of Ontario.

1.3 Consulting Engineer

The Developer will hire the services of a Consulting Engineer acceptable to the owner to prepare the detailed design of the project and to direct the Developer’s field staff and construction forces through the construction process. All drawings are to be stamped by a Professional Engineer.

1.4 Sub-Divider and Consultant Responsibilities

The sub-divider and their consultants shall:

- a) Prepare and submit to the Engineer a field inspection report setting out the salient engineering features of the Work, and the Engineer’s proposed design methods in consideration of these features.
- b) Provide a Geotechnical report which shall examine and confirm subsurface conditions and the impact on construction of public works and building construction within the plan of subdivision. The submitted report shall be signed and sealed by a licensed professional engineer.

The report shall specifically examine subsurface conditions such as:

- Soil Type
- Groundwater levels
- Depth of refusal, bedrock, etc.
- Soil bearing capacity
- Soil corrosivity
- Environmental conditions

1.4 Sub-Divider and Consultant Responsibilities (cont'd)

The report shall address the suitability of native soils, excavated and/or imported materials for roadway construction, trench backfill, building foundation construction, and size and type of cathodic protection should this be required.

In addition to the following, the report shall identify proposed construction methods, including those related to backfilling and the placement of fill materials, trenchless technologies, choice of structures, and routes. The submitted report shall also be accompanied by a scaled plan of the subdivision showing test pits or borehole locations, together with a log of the test pits or borehole findings tied to geometric datum.

- c) Prepare and recommend alternate concepts and designs, geometrics, property cost, and environmental features.
- d) Prepare a preliminary plan showing the principal features and geometrics of any proposed structures, which shall be submitted in duplicate to the Town. The plan shall provide standard design scales at 1:500 meters for the Town to mark locations of available connection points and feeder mains required.
- e) Provide field survey work required after the design criteria and function alignment have been established, which shall include all survey work for the detailed setting of alignment and grade to fit controlling natural and artificial topographic and underground features, mains, laterals and service connections and stabilization requirements of these structures.
- f) Investigate and confirm the present location of all above and below ground facilities, update plans and profiles to show the present location and proposed location, and prepare additional drawings required for alternative utility relocation as required.
- g) Participate in a reasonable number of meetings for informative, negotiate or presentative purposes with the Town. Prepare and distribute minutes of project design meetings with clearly defined action items if required.
- h) Design the complete water, sanitary and storm systems and supply design drawings according to criteria and specifications provided by both the County of Oxford and the Town of Ingersoll. The plans will show the location of all the mains on the street, complete with all appurtenances showing their sizes and type of pipe. All other utilities must be shown as well. Plan and Profile details will be given where crossings with other utilities are required and where complex arrangements of fittings are required.

1.4 Sub-Divider and Consultant Responsibilities (cont'd)

- i) Co-ordinate the design with other utility services and resolve any conflicts. Hydro-excavation may be necessary to verify location of infrastructure.
- j) All plans relating to the installation of:
 - Sanitary sewers must be submitted to the County of Oxford for approval by their Engineer. (See County of Oxford Guidelines)
 - Storm sewers must be submitted to the Town of Ingersoll for approval by their Engineer.

Once approved by both parties, a draft copy of the Environmental Compliance Approval (ECA) will be sent to the Ministry of the Environment.

Before beginning any of the work, evidence must be filed with both the County and the Town that approval from the Ministry of the Environment has been obtained.

- k) All plans relating to the design and installation of watermains must be submitted to the County of Oxford for approval by their Engineer. (See County of Oxford Guidelines)
- l) Arrange any approvals or applications required by any Board or other body having jurisdiction over utility systems.
- m) Provide all field layout of the system; changes from the approved drawings or specification must have prior approval in writing from the Owner. The Sub-Divider and/or Consultant shall make all efforts to mark and preserve all existing survey monumentation. If these markers are disturbed or destroyed during construction it will be responsibility of the Sub-Divider and/or Consultant to have these markers re-established.
- n) Notify the Owner in advance when factory or field inspections may be made.
- o) Be responsible for the ordering of all material and the letting and administration of the contract.
- p) The Owner on completion of construction shall be provided with the complete set of "as constructed" CAD files that have been geo-referenced.

1.4 Sub-Divider and Consultant Responsibilities (cont'd)

q) Final inspection for acceptance of the installed municipal services will not be performed after the 2 year maintenance period until all "as constructed" information has been submitted to the Owner at no cost.

1.5 Drawings and Design Requirements

All drawings shall be prepared in a digital format that is compatible with the Town of Ingersoll's current version or as acceptable by the Town Engineer.

The following scales are required for each drawing type:

Drawing Type	Scale
Overall Engineering Plan	1:1,000
Drainage Area Plan	1:1,000
Plan and Profile	1:200 to 1:500 Horizontal 1:50 Vertical
Site Servicing Plan	1:500
Grading Plan	1:500

A Key Plan should be provided on all drawings. Overall plans shall have a Key Plan drawn at a scale that provides sufficient detail to identify the location of the development within the community. Drawing sheet size shall be 610x915 (24"x36")

Existing contours shall be shown on approximate drawings at intervals to accurately illustrate the topography of the site. Existing contours at 1m intervals are acceptable, but at the discretion of the Town, lesser contour intervals down to 0.25m may be required based on topography or engineering requirements.

All drawings are to be submitted, referencing the UTM 17 NAD 83 Coordinates. Additionally, all Geodetic Benchmarks shall be shown providing horizontal and vertical location.

All plan view drawings shall have a North Arrow. All drawings shall have a Title Block, which shall include the scale of the drawing.

A legend shall be provided that clearly references any symbols or abbreviations used on the drawing.

All drawings shall bear the seal of a Professional Engineer, signed and dated, or where appropriate a Landscape Architect.

1.5 Drawings and Design Requirements (cont'd)

The following is a list of the Town's requirements for drawings submission:

Title Sheet

- Name and Location of Development
- Name of Developer
- Date of Submission
- Name, address, phone number, email and contact name for the Developer's Professional Engineer.

Sanitary Drainage Area Plan (See County Guidelines)

- Road allowance, lots, blocks and easements
- Phasing (if applicable)
- Proposed sewers including sizes, lengths, flow direction arrows, and grades
- Entire sanitary drainage area (including external drainage areas)
- Existing services
- Sanitary maintenance holes including numbering
- Design criteria
- Maximum Daily Flow

Storm Drainage Area Plan

- Road allowance, lots, blocks and easements
- Phasing (if applicable)
- Proposed sewers including sizes, lengths, flow direction arrows, and grades
- Entire storm drainage area (including external drainage areas)
- Existing services
- Storm maintenance holes including numbering
- Design criteria

Water Distribution Plan (See County Guidelines)

- Road allowance, lots, blocks and easements
- General notes summarizing material and installation specifications
- Proposed watermain including size and material
- Water service connection
- Watervalves, hydrants and reducers etc.
- Blow-off, swab launchers (if applicable)
- Phasing (if applicable)

1.5 Drawings and Design Requirements (cont'd)

Plans and Profiles

- Road allowance, lots, blocks and easements
- Dimensions of lots and block frontage
- Bore hole locations (if applicable)
- Benchmark locations
- Sewer lengths, sizes, material, and grades
- Proposed watermain including size, material, typical depth (as per specifications)
- Water, sanitary, and storm service connections
- General notes summarizing material and installation specifications
- Phasing (if applicable)
- Watervalves and hydrants (existing and proposed)
- Maintenance holes including numbering (existing and proposed)
- Sewers and watermains on profile, as well as maintenance hole and water valve station inverts and top of lid elevations on profile
- Road centreline stations and grades at 20m spacing
- Show proposed sub-grade depth on profile
- All vertical curve data

1.6 Cross Section Layout

Town Standard S-14 Typical 20m Residential Standard Local Cross Section
Town Standard S-15 Typical 25M Industrial Standard Local Cross Section
Town Standard S-16 Typical 25M Industrial Standard Local with Ditches Cross Section

Any deviation from the above standards must be submitted in writing to the Town Engineer for approval.

1.7 Applications and Approvals

- a) When an agreement has been reached between the Consultant and the Town, the Consultant will submit four copies of the plans with the appropriate application to the Ministry of the Environment (one copy of the application including one set of plans to be retained by the Town). These applications will contain the signature of the Town Engineer. In addition, the Consultant will submit to the Town a copy of the plans in Cad dwg. format.
- b) No work shall be started on the installation of any sanitary or storm sewers until approval has been obtained from the Ministry of the Environment.

1.7 Applications and Approvals (cont`d)

- c) The County of Oxford must approve all waterworks before installation.
- d) Review and approval from Upper Thames River Conservation Authority (UTRCA) is required, prior to the construction, of works, services and sediment and erosion control measures within flood plain areas and in or adjacent to open watercourses, ravines and natural areas under the jurisdiction of UTRCA.
- e) All agreements must be signed and the required monies paid over to both the Town and County prior to the commencement of any work.

1.8 Municipal Consent Application

The Town of Ingersoll is responsible for the management of all Municipal Right-of-Ways within their jurisdiction. In order to properly manage those right-of-ways, the Engineering Department establishes this policy which outlines the requirements of any person or company wishing to place utilities, signs, steps, walls, etc. within a Town Right-of-Way. Before any work within the Town of Ingersoll, on any Right-of-Way may proceed, a municipal consent must be obtained from the Engineering Department. This consent must be stamped Approved and Dated by the Town Engineer, or their designate.

A Municipal Consent shall present the following to the Engineering Department:

1. Two copies of the drawing(s) of the proposed location of work and a cover letter outlining the work to be completed. The drawing should contain the following:
 - True north arrow
 - The Municipal Right-of-Way Name
 - Proper Scale (minimum 1:200)
 - Actual existing conditions i.e. road, sidewalk, curb and gutter, catchbasins, maintenance holes, utility poles, utility pedestals, existing utilities, sewers, watermains and any easements etc. complete with dimensions
 - Dimensioning must be from existing R.O.W. limits (Property line) as well as existing or future sidewalks, curb and gutter.
 - A copy of a letter signed by the owner(s) of the property or properties affected by the works that they have been informed of the work that is to take place.
2. A commencement and completion date must be established and documented on either the drawings or the cover letter.
3. As-Built drawings must be presented to the Town of Ingersoll's Engineering Department not more than 90 days from the completion of the work. Electronic format is preferred however; a hard copy will be accepted. The As-Built drawings shall be to scale.

1.8 Municipal Consent Application (cont`d)

The Town may assist any applicant by supplying electronic versions of drawings, for the sole purpose of reference only. **It is the responsibility of the applicant to verify any and all information shown on these drawings as current and correct.**

Should the applicant request hard copy drawings from the Engineering Department, the applicant will be required to reimburse the Town as per the fee schedule in effect at the

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**SECTION 2 – DRAFTING AND DRAWING
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SECTION 2 – DRAWING and DRAFTING STANDARDS

2.0 Overview

This document covers the Town of Ingersoll hard copy and digital (CAD) standards and plan submissions that apply to any proposed and as built drawings regarding work within the town.

The Engineering Drawing Standards will be in effect as of **January 2015**, with all drawings submitted after this date complying with them.

The need for these standards was a result of various outside firms and utilities having multiple types of their own standards, thus making it impossible for the Town to have conformity with there drawings.

The need for this conformity was a result from advances in information technology and record management, with significant changes for as constructed drawings showing services and utilities, not only in newly constructed areas. With the addition of CAD, a newly created drafting format had to be adapted.

Engineering drawings are a vital part of the Town of Ingersoll's municipal record system. The implementation of drawing standards will greatly assist the Town in plan interpretation, allows for efficient extraction of digital information for the GIS Department and provide more efficient reuse of the information in the future. These standards are designed to facilitate all of these needs.

The plan submissions requirements outlined are intended for the Town of Ingersoll record keeping requirements as mandated by the Municipal Act. This document also covers submission requirements for drawing review as required.

2.1 Application

The Engineering Drawing Standards and submission requirements apply to all engineering work that is to be done in Ingersoll, and will be assumed by the Town in the future or that will be privately owned but is located on town property.

Examples include but not limited to:

- All municipal works projects done under contract for the Town of Ingersoll.
- External works that are the result of Development Agreements including Subdivisions, Condominiums, Site Plan Servicing Agreements
- Utility installations done under agreement with the Town

2.1 Application (cont`d)

Exclusions:

- Legal surveys, Architectural drawings or Engineering Structural drawings (ie. Bridges etc.)

2.2 Engineering Drawing Submission

The following is the Town of Ingersoll required drawing submission's for all of work being performed within the town.

1. Municipal Construction and/or Re-construction

All Submissions: Require 1 Set of hardcopy drawings, a PDF image of the set and all DWG files.

Drawing Set must include:

Title Sheet

- Project and/or Contract # complete with Job Description, Key Plan Map and Town Crest.
- Date of Submission
- Name, address, phone number, email and contact name for the Developer's Professional Engineer (if required)

Plan and Profile - All Streets and Easements

- Road allowance, lots and easements
- Bore hole locations (if applicable)
- Benchmark locations
- Sewer lengths, sizes, material, and grades
- Proposed watermain including size, material, typical depth (as per County specifications)
- Water, sanitary, and storm service connections
- General notes summarizing material and installation specifications
- Watervalves and hydrants (existing and proposed)
- Maintenance holes including numbering (existing and proposed)
- Sewers and watermains on profile, as well as maintenance hole and watervalue station inverts and top of lid elevations on profile
- Road centreline stations and grades at 20m spacing
- Show proposed sub-grade depth on profile
- All vertical curve data

2.2 Engineering Drawing Submission

1. Municipal Construction and/or Re-construction

Typical Section

The Town will permit Typical Sections, Details and Cross Section to be submitted within the contract documents and/or drawings, however must be submitted.

- As per town Standard Drawings, complete with street name and stationing
- Typical section of sewer excavation limits at easements, complete with location of foundations (if required)
- Typical sections at proposed walkways, complete with labels and dimensions
- Any permanent detail drawings in regards to the contract
- OPSD referred to in the contract

2. Subdivision Drawing Set.

All Submissions: Require 1 Set of hardcopy drawings, a PDF image of the set and all DWG files.

Drawing Set must include:

Title Sheet

- Name and Location of Development
- Name of Developer
- Date of Submission
- Name, address, phone number, email and contact name for the Developer's Professional Engineer.

Sanitary Drainage Area Plan (See County Guidelines)

Water Distribution Plan (See County Guidelines)

2.2 Engineering Drawing Submission (cont`d)

2. Subdivision Drawing Set (cont`d)

Storm Drainage Area Plan

- Road allowance, lots, blocks and easements
- Phasing (if applicable)
- Proposed sewers including sizes, lengths, flow direction arrows, and grades
- Entire storm drainage area (including external drainage areas)
- Existing services
- Storm maintenance holes including numbering
- Design criteria (may be on separate drawing)

Storm Water Management Facility

- Road allowance, lots, blocks and easements
- Phasing (if applicable)
- Proposed sewers including sizes, lengths, flow direction arrows, and grades
- Entire storm drainage area (including external drainage areas)
- Existing services
- Storm maintenance holes including numbering
- Design criteria (may be on separate drawing)
- Typical Sections

Plan and Profile - All Streets and Easements

- Road allowance, lots, blocks and easements
- Dimensions of lots and block frontage
- Bore hole locations (if applicable)
- Benchmark locations
- Sewer lengths, sizes, material, and grades
- Proposed watermain including size, material, typical depth (as per specifications)
- Water, sanitary, and storm service connections
- General notes summarizing material and installation specifications
- Phasing (if applicable)
- Watervalves and hydrants (existing and proposed)
- Maintenance holes including numbering (existing and proposed)
- Sewers and watermains on profile, as well as maintenance hole and watervalue station inverts and top of lid elevations on profile

2.2 Engineering Drawing Submission (cont`d)

2. Subdivision Drawing Set (cont`d)

Plan and Profile - All Streets and Easements (cont`d)

- Road centreline stations and grades at 20m spacing
- Show proposed sub-grade depth on profile
- All vertical curve data

Lot Grading Plan

- Road allowance, lots, blocks and easements
- Dimensions of lots and block frontage
- Phasing (if applicable)
- Existing contours at 1m intervals are acceptable, but at the discretion of the Town, lesser contour intervals down to 0.25m may be required based on topography or engineering requirements.
- Road centreline stations at 20m spacing
- Road centreline proposed elevation
- Proposed sidewalks and walkways
- Existing and Proposed Maintenance holes and catchbasins as well as rear yard catchbasins
- Proposed sewer easements
- Proposed driveway locations per unit
- Proposed underside of footing elevation
- Proposed top of foundation elevation
- Existing elevations where lots match existing or future lots
- Proposed elevations at all corners of lot
- Proposed lot grade and flow arrows
- Label building type (ie walkout)
- Show all proposed slopes, swales and grades of such
- Proposed retaining walls
- Label engineered fill lots
- Tree planting and removals or preservations

Typical Section

- As per town Standard Drawings, complete with street name and stationing
- Typical section of sewer excavation limits at easements, complete with location of foundations (if required)
- Typical sections at proposed walkways, complete with labels and dimensions

2.2 Engineering Drawing Submission (cont`d)

2. Subdivision Drawing Set (cont`d)

Erosion Control and Sediment Control Plan

- Road allowance, lots, blocks and easements
- Existing contours at 1m intervals are acceptable, but at the discretion of the Town, lesser contour intervals down to 0.25m may be required based on topography or engineering requirements.
- Limits of grading
- Show temporary drainage
- Locate and label sediment fencing
- Typical detail of all type of sediment control measures

Also included in the drawing set will be all General Notes, Typical Lot Servicing Detail and Servicing Note and a detailed Legend.

All drawings must be Engineered Stamped, Signed and Dated.

3. Site Plans

All Submissions: Require 1 Set of hardcopy drawings, a PDF image of the set and all DWG files.

Drawing Set must include:

- Removal Drawings – if re-developing
- Site Grading Plan
- Site Servicing Plan
- Plan and Profile Drawings
- Detail Drawings, Typical Drawings etc.

Also required in the drawing set:

- Key Plan
- General Notes
- Servicing Notes
- Legend
- Sanitary and Storm Design Sheets

All drawings must be Engineered Stamped, Signed and Dated.

2.2 Engineering Drawing Submission (cont`d)

4. Municipal Consent Drawing

All Submissions: Require 1 Set of hardcopy drawings, a PDF image of the set and all DWG files.

Plan View Drawing(s) must include:

- Utility Name, address, phone number and email
- Municipal Right of Way Name
- True North Arrow
- Proper Scale (minimum 1:200)
- Actual existing conditions
- Dimensions from the existing ROW limits as well as future sidewalks or curb and gutter
- All existing utilities
- Key Plan
- General Notes
- Utility Consent Drawing Number
- Legend

5. Drawing Format and Content

The drafting and digital format standards contained in this document apply to all facets of submissions and all such drawings must substantially comply with these standards. Any proposed deviations from these standards must be pre-approved by the Town Engineer.

6. Assignment of Responsibilities

By stamping and signing the submitted drawings, the Owner or Consultant's Engineer accepts full responsibility for all aspects of the work shown on the drawings. The Owner or Consultant is also responsible for the surveying and drafting work required to depict existing services and utilities but otherwise assumes no responsibility for them.

The Town's Engineering Department and/or Building Department will be responsible for reviewing the format and content of these drawings and will ensure existing service information has been compiled to the satisfaction of the Town.

2.2 Engineering Drawing Submission (cont'd)

6. Assignment of Responsibilities (cont'd)

However, any surveying and drafting work deemed necessary to bring the drawings in compliance with this document will continue to be the responsibility of the consultant until the plans are formally accepted by the Town.

7. Town Supplied Information

The Town may assist any applicant by supplying electronic versions of drawings, for the sole purpose of reference only. It is the responsibility of the applicant to verify any and all information shown on these drawings as current and correct.

Should the applicant request hard copy drawings from the Engineering Department, the applicant will be required to reimburse the Town as per the fee schedule in effect at the time.

8. Hardcopy Plans

All hardcopy drawings submitted to the Town, including the final approved construction drawings, will be retained by the Town in their original unmodified form as a permanent record of the certified engineering works completed by the consulting engineer.

9. Digital CAD Files and Plans

Digital CAD files and plans must be submitted in the Town's current software version or in a compatible version less than one year from submission date.

Digital files will be subject to re-use and modification but in all cases the Town will ensure that all references to the original consultant, including the company name, logo and project engineer, are first removed.

10. Legal Survey Drawings

The Town requires that the legal boundary limits for all municipal works projects be accurately surveyed and monumented by an Ontario Land Surveyor licensed to perform cadastral (legal) surveys. As part of this work, the surveyor will perform a title search, field survey, and verify and monument the project limits as necessary.

2.2 Engineering Drawing Submission (cont'd)

10. Legal Survey Drawings (cont'd)

The surveyor must also establish project control which would facilitate the delivery of the legal base plan tied to the Town of Ingersoll UTM control network (see Section 2.3) along with a list of project control monuments to support the topographic survey for detailed design.

11. Preliminary Drawings

Preliminary submission and re-submission drawings must follow the format under the **Engineering Drawing Submission** section for each type of submission. The Town's Engineering Department will review, comment and stamp each set of submissions until the Town Engineer sees fit to release the drawings as Final Approval.

The Town's Engineering Department has developed a Prototype Package which is to be followed by any outside engineering firms or consultants. Included in this package is the Town's Plot Style Files (.ctb), Blocks/Symbols (.dwg), Layer States (.las), Pipeworks (.dfm), Layout Templates (.dwt) and Sheet Layouts (.dwg) files.

This Prototype package is available by contacting the Engineering Department and may be received electronically.

Any deviation from this prototype must be pre-approved by the Town Engineer.

12. As-Constructed Drawings

As-Constructed submission drawings must follow the format laid out in **Section 2.2.2 Engineering Drawing Submission** and **Section 18.1 Assumption of Subdivisions**. The Town's Engineering Department will review the Final Submission for Town Standard conformity. Should the Town Engineer deem these drawings not to Town Standards, then they must be re-submitted for approval with all revisions before they can be stamped Approved. Once approved, the Owner or Consultant will receive a copy of these stamped drawings for their records.

The digital files will be subject to re-use and modification but in all cases the Town will ensure that all references to the original consultant, including the company name, logo and project engineer, are first removed.

2.2 Engineering Drawing Submission (cont`d)

13. Municipal Consent Drawings

The Town of Ingersoll has a policy in place for the submission of Municipal Consent drawings. Refer to Section 2.2 Engineering Drawing Submission – Item 4 for drawing submission.

As part of the Municipal Consent procedure, the Town also requires:

Cover Letter

- with the utilities header, address, phone number and email
- contact person
- reference or project number
- proposed work to be completed.
- commencement and completion date for said work

Road Excavation Permit

- commencement and completion date for said work
- permission granted to information
- invoice information
- description of work

This permit is located on the Town's web site (www.ingersoll.ca).

2.3 Surveying and Mapping

1. Georeferencing

All drawing submissions to the Town of Ingersoll must be relayed to the town's horizontal and vertical Geographic Referencing systems. The Town of Ingersoll horizontal mapping system is based on the Universal Transverse Mercator (UTM) projection with NAD83 datum, Zone 17, Meter; Central Meridian 81d W. The vertical datum is based on the Canadian Geodetic Vertical Datum 1928 (CGVD28) incorporating the 1978 Southern Ontario Adjustment (Revision #3-1980).

All digital files are to be submitted at UTM grid scale such that the files can be referenced directly with the Town's UTM based datasets. All elevations must be geodetic.

The Town of Ingersoll's Engineering Department may supply their current calibration file. Information regarding benchmarks and values for control within the Town of Ingersoll may be obtained from the Engineering Department, if available.

2.4 Drafting Specifications

1. Metric Units

All plan and drawing submissions shall be drawn using metric units and dimensions must be shown to two decimal places of a metre.

2. Compatibility

Digital CAD files and plans must be submitted in the Town's current software version or in a compatible version less than one year from submission date.

The geo-referencing systems must match the Town's control system of Universal Transverse Mercator (UTM) projection with NAD83 datum, Zone 17, Meter; Central Meridian 81d W. The vertical datum is based on the Canadian Geodetic Vertical Datum 1928 (CGVD28) incorporating the 1978 Southern Ontario Adjustment (Revision #3-1980).

3. Dimensioning

The metric system is the standard by which the Town of Ingersoll supports and conducts all surveys and drawings by.

Units of millimeters and metres are only to be used on the drawings.

Decimal places are to be placed as follows:

- Pipe length – 2 place
- Pipe Grade – 2 places
- Stationing – 2 places (minimum)
- Elevations – 2 places (minimum)
- Road Grades – 2 places
- Measurements – 2 places

4. Orientation

All drawings must show a properly oriented north arrow. Also acceptable, but not required is a construction north arrow.

2.4 Drafting Specifications (cont'd)

5. Survey Monuments and Benchmarks

All existing survey monuments and benchmarks should be shown with labels and elevations. These may be referenced to in the Legend location or directly on the plans.

On all proposed roads, every intersection corner and bearing change on the right of way, a bar must be shown.

6. Municipal Addressing

All plans must show all existing municipal street names, addressees and easements as well as any newly proposed street names and lot numbers.

Each new lot must have the frontage labeled and the proposed driveway location shown or marked.

7. Utilities and Services

Plans must show all existing public and private utilities and services and physical features within the limits of the project. Any abandoned services which have been verified should be shown as well.

All proposed sewers and watermains and physical features must be shown on the plans. However, any proposed utilities may be shown on the typical section drawings if using. Refer to Town Standard drawings S14-S16.

8. Label References

All drawings should have labels as follow:

- **Ex.** - all existing surfaces, services and utilities.
- **Ab.** - all abandoned services or utilities.
- **Prop.** - all proposed surfaces, services and utilities.
- **Future** - reference to work not pertaining to current work

2.4 Drafting Specifications (cont'd)

9. Drawing Labels

Plan View

Label All:

- Street Names – Ex. and Prop.- Bold Lettering
- All Sewers – Ex. and Prop. - show length, diameter, material and grade.
- Sanitary Laterals – Ex. and show elevations on as built.
- Maintenance Holes – Ex. and Prop.
- Watermains and Components (ie Bends etc.) – Ex. and Prop.
- Hydrant Sets, Valves and Curb Stops – Ex. and Prop.
(Curb Stops are to be shown as WS)
- Curb Type as per OPSD
- Sidewalks and width.
- Chainage – 20m increments

Profile View

Label All:

- All Sewers – Ex. and Prop. - show length, diameter, material and grade.
(Label Manufacturer and Material on As Builts)
- Watermains - Ex. and Prop. - show length, diameter and depth.
(Label Manufacturer and Material on As Builts)
- Centrelines – Ex. and Prop., as well as Sub-grade of proposed road.
- Centreline Elevations – Ex. and Prop.
- Vertical Curve information
- Intersections and Stationing
- Maintenance Holes – Stationing, Offset and Elevations (Lid and Inverts)
- Road Grades and Sub Grade
- Chainage – 20m increments

If the consultant is given permission to use their own sheet layout, then profile labeling for stationing and elevations should be as follows:

Fourth line from bottom – watermain centreline elevation
Third line from bottom – storm sewer invert elevation
Second line from bottom – sanitary sewer invert elevation
Bottom line – centerline station.- Ex. and Prop.

2.5 Digital CAD Specifications

1. CAD Standard

In recognition that AutoCAD® and its variants is the most popular civil engineering design software in Ontario, the Town of Ingersoll has adopted the basic DWT/DWG drawing file format as its official CAD standard for engineering drawings. In order to encourage maximum compliance and refrain from dictating proprietary digital standards the Town has adopted an accommodative stance. Hence, the Town emphasis on digital standards lies not with the underlying design software used but focuses on the format the DWG file, and in particular the layers, line styles, blocks etc. used to create the drawing. The Town of Ingersoll has outlined this topic in their Prototype Package.

Accordingly, the Town will currently accept any DWG file and plans in their current software version or in a compatible version less than one year from submission date.

The files can be delivered in 3-D format (eg. Civil3D) or elevation separated files together with their support files provided that the 2-D information in the files can be opened and read by the Town's AutoCAD®.

2. File Submission and Specifications

1. DWG files capable of being opened and read in the Town's current software version
2. DWG files capable of being opened and read by a version no less than one year from submission dates
3. The files must include an unrotated, continuous full scale (1:1) plan view of the project related to the Town's Universal Transverse Mercator (UTM) NAD83 co-ordinate system (ie. "Model Space") together with an associated continuous profile, as well as Sheets in "Paper Space" or their equivalent.
4. Digital submissions must be complete and include all reference files and any other supporting files needed to make full use of the data to support future design work.
5. All graphics within any computerized drawing must conform to the drawing standards specified in this document and as per the supplied Prototype package.

2.5 Digital CAD Specifications (cont'd)

2. File Submission and Specifications (cont'd)

6. Any use of digital topographic information from other sources must be converted, as necessary, to conform to these digital standards.
7. All submitted digital drawings files must be purged of any remnants of the drawing process.

2.6 Prototype Elements

1. Blocks and Symbols

The Town of Ingersoll has created its own DWG files of blocks, which they use on all types of drawings. These blocks have been created in a unitless, 1 to 1 format so that they can be used in multiple types of scaled drawings.

2. Layout Templates

The Town's Engineering Department has developed their own set of dwt. files for specific drawings creations. It is recommended that these .dwt files are used, however, the Town will accept other versions of dwt. files, but only if components of the Towns are incorporated into them (ie Existing and Proposed components).

3. Layer States

The Town's Engineering Department has developed their own layer states for specific drawings, such as Preliminary, As Built, Design and Profile. This function is not a requirement of the Town, but may be used as a helpful tool in drawing presentation.

4. Sheet Layout

The Town of Ingersoll has created drawing sheets, in which it uses in their contract documents and hardcopy drawings. The sheet sets exist in multiple types of dwg. files which may be used by others.

2.6 Prototype Elements (cont'd)

5. Pipeworks

The Town of Ingersoll uses the Pipeworks component of Civil 3D for the creation of their existing sewers and proposed sewers as well as their design components. Several dxf. files have been created by the Engineering Department and are recommended for any consultant using Pipeworks and are submitting drawings to the town.

6. Plot Styles

The Town of Ingersoll has created Plot Styles so that all their drawings have conformity in appearance. Consultants must obtain these files prior to hardcopy submission and final approval by the Town Engineer. The Town is aware that it may not be possible to configure all outside linework to appear as theirs but every attempt should be made to co-ordinate the different types of linework.

2.7 Notations

1. General Notes

The Town of Ingersoll requires that all consultants place on their drawings, either in the drawing window or notation column, a set of general notes from which the contractor must refer to during all facets of the construction.

All specifications regarding roadwork and storm sewers, as well as OPSS and OPSD references to these items must be shown.

All specifications regarding sanitary sewers and watermains are shown as per the County of Oxford Design Guidelines and Supplemental Specifications, current version.

2. Revision Notes

All revisions made as part of the submission process must be documented by the consultant. These comments should document the reason for re-submission. (ie Comments by Town)

3. Engineer Stamp

In any case where engineered stamped drawings are required for submission, a signed and dated professional seal must be placed on every drawing.

2.7 Notations (cont'd)

4. Utility Notes

In the case where existing utilities are shown on drawings, a utility note must be shown to alert the contractor that locates must be obtained prior to excavation. This note may be located either in the drawing window or the notation column.

5. Benchmark Notes

Survey Monuments and Benchmarks, shown should be referenced to on the drawing or area designated in the notation column.

Each reference should show the number, location and elevation.

6. Legend

In the case where the Town does not supply specific designations or the consultant has used their own (ie symbols), a legend is be required to specifically identify these. These must be shown in the notation column.

7. Copyright Stamp

Consulting firms may place their copyright stamp on the submitted hardcopy drawings, but as stated in the As-Constructed section, the digital files will be subject to re-use and modification. The Town will ensure that all references to the original consultant, including the company name, logo and project engineer, are removed.



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SECTION 3 – TRANSPORTATION

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3.0 Road Design

1. Design Speeds

The Town of Ingersoll is posted as a 50km/h on all residential streets unless signed otherwise.

Design speeds shall be based on the following chart:

Posted Speed (km/h)	Design Speed (km/h)
40	60
50	60
60	70
70	80

Figure 3.1

2. Centreline Radii

New Construction - Collector and Local Streets

- i) Collector roads and local streets shall have centerline horizontal curves which meet or exceed the Town of Ingersoll design speeds. See Figure 3-1.
- ii) Local streets with bends of approximately 90 degrees are to have a minimum inside street-line radius of:

Road Allowance of 20.0m = Street Line Radius of 9.0m

3. Curb and Gutter Radii

- a) Intersection Radii for curb and gutter should be measured to the gutter line.

The following chart illustrates the required radii.

	TO	
FROM	COLLECTOR	LOCAL
COLLECTOR	10m	10m
LOCAL	10m	8m

Figure 3-2

- b) Daylighting Requirements – a 9.0m daylighting triangle is required along the property lines on any road type connection. (Collector or Local)
- c) Cul-de-sacs – for minimum required radii of curvature for curb and gutter in residential and commercial cul-de-sacs - Refer Town of Ingersoll Standard Drawings, S-34 and S-35.

3.0 Road Design (cont'd)

4. Right of Way and Pavement Widths

Pavement widths and Right of Way widths shall be based on the following chart. (Pavement width is from edge to edge or face of curb to face of curb)

Usage	R.O.W. (m)	Pavement (m)	Town Standard Dwg
Industrial/Commercial	25	9.4 (min.)	S-15
Collectors	20	9.4 Standard	
Residential	20	8.4 Standard	S-16

Figure 3-3

5. K Values

On vertical curves, the K factor shall be derived from the following table.

Design Speed (km/h)	50	60	70
Crest (minimum K)	8	15	25
Sag (minimum K)	12	18	25

Figure 3-4

6. Maximum and Minimum Road Grades

a) The Town of Ingersoll has set any new or reconstructed road grades to be:

Minimum of 0.5%

Maximum of 8%

b) A flat see-saw profile (identical high and low points) will not be allowed on the road profile design. See-saw profiles must slope in a cascade that allows major storm flows (Overland Flows) to drain along the road to an acceptable Overland Flow Outlet.

c) In reconstruction projects within the Town of Ingersoll, where the existing profile and driveway conditions cannot accommodate a cascading see-saw profile, the proposed profile must provide for adequate road drainage and be approved by the Town Engineer.

3.0 Road Design (cont'd)

7. Drainage Issues

a) Overland Flow Routes

- i) The design of all road profiles for New Development Projects are required to accommodate and direct major overland flow routes to an acceptable outlet. This design element is to be considered at the earliest stage of design for review and acceptance by the Town of Ingersoll.
- ii) The design of all road profiles for Capital Works Projects are required to accommodate and direct major overland flow routes to an acceptable outlet. This design element is to be considered at the earliest stage of design for review and acceptance by the Town of Ingersoll.
- iii) In reconstruction projects within existing developed areas in the Town, where the existing profile and driveway conditions cannot accommodate a formalized overland flow route, the proposed profile must provide for adequate road drainage and be accepted by the Town Engineer.

b) Culverts Under Town Owned Roads

- i) New culverts or culverts that are being redesigned, replaced or impacted by road works/road widening must be designed to meet the hydraulic requirements established by the Ministry of Transportation for inlet or outlet control culverts.
- ii) Town practice requires that culverts must convey the minimum storm events as specified in Figure 3-5.

Road Classification	Minimum Storm Event To Be Conveyed By Culvert
Local	25 year storm event
Collectors	50 year storm event
Bridges	100 year storm event or Regional storm event(250 years), subject to UTRCA conditions

Figure 3-5

3.0 Road Design (cont'd)

7. Drainage Issues

c) Private Drain Connections

Where residential and/or commercial drainage cannot be accomplished by overland flow by a property owner(s), that said owner may request in writing to the Town Engineer a private storm connection. It will be solely at the Town's discretion that this connection be allowed.

Should the Town allow such a connection, the property owner must enter into a legal maintenance agreement with the Town of Ingersoll.

8. Pavement Structure

The Town of Ingersoll has set out Minimum Standard Road Designs for both Residential and Commercial/Industrial. Refer to Town of Ingersoll Standard Drawings, S-14 and S-15.

For any new development or reconstructed projects with-in the Town, a geotechnical report must be completed. The Town Engineer will review the pavement design and recommendations, however if they fall short of the Town's Minimum Standards, they may not be accepted.

9. Length of Turning Lanes

Should a turning lane(s) be required off of an existing roadway, the length will be determined during the site plan and/or subdivision review process.

10. Sidewalks and Pedestrian Walkways

a) Residential subdivisions:

- i) Sidewalks are required on both sides of all collector roads, unless approved otherwise by the Town Engineer.
- ii) Sidewalks are required on both sides for the complete length of any road on which a school property fronts.
- iii) Sidewalks may be required on both sides of an entrance to a subdivision from an arterial road, unless approved otherwise by the Town Engineer.
- iv) Sidewalks are required on one side of abutting arterial and collector streets along the full frontage of the subdivision, or as otherwise specified by the Town Engineer.
- v) Sidewalks are required on one side of cul-de-sac.

3.0 Road Design (cont'd)

10. Sidewalks and Pedestrian Walkways (cont'd)

a) Residential Subdivisions (cont'd)

vi) Sidewalks are to be located on the outside of a crescent street, unless approved otherwise by the Town Engineer.

vii) Sidewalks are to be located on one side of the road where the above conditions are not met.

viii) Sidewalk Gradient – All sidewalks should follow the road gradient in a residential subdivision. The minimum gradient of a sidewalk in a subdivision is 0.5% to a maximum of 8%.

ix) All sidewalk constructed in residential subdivisions shall have a minimum crossfall of 2% and a maximum of 5% consistent with the boulevard and/or driveway crossfall.

b) Industrial Subdivisions:

Sidewalks are required on all streets within industrial subdivisions and are required on abutting arterial and collector streets as otherwise approved by the Town Engineer.

c) Sidewalk and Walkway Construction

All sidewalks constructed within the Town of Ingersoll are to have a minimum thickness of 0.15m and a Granular 'A' (or equivalent) base of not less than 0.100m.

<u>Typical Sidewalk Conditions</u>	<u>Width</u>
i) residential sidewalk with boulevard	1.5m.
ii) residential sidewalk constructed as curb face	2.0m
iii) residential sidewalk at intersection	2.0m
iv) residential walkways	3.0m
v) industrial sidewalk with boulevard	1.5m
vi) industrial sidewalk constructed as curb face	2.0m
vii) industrial sidewalk at intersection	2.0m

Asphalt pavement will not be accepted for walkways unless otherwise approved by the Town Engineer.

Where existing sidewalks in reconstruction projects are deemed not to Town Standards, the Town will require the sidewalk to be replaced to meet the new sidewalk condition requirement widths.

3.0 Road Design (cont'd)

10. Sidewalks and Pedestrian Walkways (cont'd)

The Town of Ingersoll in conjunction with their Asset Management Policies have established a Concrete Sidewalk Specifications which all Developers, Consultants and Contractors must abide by. **This document is located in the Town Specification Document Section XX.**

11. Bicycle Lanes and Markings

Overview

Ingersoll's Town Council has recognized that bicycling is a viable alternative to other modes of transportation that is environmentally sound and promotes and supports active, healthy lifestyles and, wherever possible, shall promote and initiate improvements that enhance bicycling as a means of transportation.

The Town of Ingersoll has adopted a Bicycle Transportation Plan which will establish comprehensive bicycling networks and the priorities for bicycling facility improvements. Town Council will encourage bicycleways within neighbourhoods, communities and linear parks systems.

Any new development or reconstruction project within the Town must recognize this Town Plan in their design stages, and shall co-operate with the Ministry of Transportation, the County of Oxford, the Upper Thames River Conservation Authority and other affected agencies in implementing those elements of the Bicycling Plan under their jurisdictions and provide for the integration of bicycling facilities designed, constructed, operated or maintained by other jurisdictions, within the Town.

Markings and Signage

All design stages of current and future bicycle lanes must follow:

- Ontario Traffic Manual – Book 18 – Cycling Facilities
- TAC manual – Bikeway Traffic Control Guidelines for Canada – Second Edition which can be located at www.tac-atc.ca
- Ontario Traffic Manual – Book 5 – Regulatory Signs

3.0 Road Design (cont'd)

12. Curb and Gutter

Types and Applications

- i) Concrete Semi-Mountable Curb with Standard Gutter as per OPSD 600.060 shall be used on all commercial and industrial roads with a 25m road allowance, unless otherwise specified by the Town Engineer.
- ii) Concrete Semi-Mountable Curb with Standard Gutter as per OPSD 600.060 shall be used on all new residential roads with a 20m road allowance, unless otherwise specified by the Town Engineer.
- iii) Concrete Barrier Curb with Standard Gutter as per OPSD 600.040 shall be used on all radii of new residential roads, with a 20m road allowance, unless otherwise specified by the Town Engineer.

Where the radii curb is to be placed, an additional 50mm lip is to be placed to support the adjacent sidewalk. Refer to OPSD 310.020

Transitions and Terminations

- i) A transition of 3.0m is required between curb types.
- ii) Curb termination as per OPSD 608.010 shall be used within temporary turning circles and dead end streets or intersections which abut or are adjacent to a future phase of a subdivision.
- iii) At radii ramping transitions, refer to OPSD 3010.030.
- iv) For a transition of an outlet at an end of run, refer to OPSD 605.030.

Outlets

Should an outlet be required within a run of curb, refer to OPSD 604.010 or OPSD 605.010.

Catchbasins

- i) Refer to the Storm Sewer Section for design information regarding catchbasins.
- ii) Where a concrete setback is required at catchbasin, refer to Town of Ingersoll Standard drawing S-28. The setback depths may vary depending on underground services and site conditions.

3.0 Road Design (cont'd)

12. Curb and Gutter (cont'd)

New Access

Where new access points meet an existing road, the curb and gutter should be entirely removed to the nearest joint and replaced with the appropriate concrete OPSD curb type.

The Town of Ingersoll in conjunction with their Asset Management Policies have established a Concrete Curb and Gutter Specifications which all Developers, Consultants and Contractors must abide by. This document is located in the Town Specification Document Section XX.

13. Pavement Markings

Overview

All pavement markings must be in accordance with the Ontario Traffic Manual – Book 11 and must be approval by the Town Engineer. .

Material

The Town of Ingersoll allows the following marking types.

All Weather Paint – consisting of a non-toxic high-build waterborne paint and bonded core elements resulting in a pavement marking that is highly reflective.

Thermoplastic Pavement Marking – shall conform to OPSS 1714.

Durable Pavement Marking Tape - reflective tape for lanes and center lines, edge lines, and turning symbols. Should this type of material be used, then it must be applied by inlaying directly into the hot asphalt surface.

Application

All markings must be placed after the base coat is placed, and be maintained by the Owner until topcoat is to be placed.

Once topcoat is placed, the markings must be placed again and maintained by the Owner until the Town assumes responsibility.

3.1 Traffic Calming Measures

1. Methodology

Traffic calming measures are applied on primary and secondary roads, and occasionally on local roads. They enhance residents quality of life by encouraging low traffic speeds and volumes, minimizing conflicts between types of street users, and discouraging through traffic. Traffic calming makes the area safer and more inviting for pedestrians and cyclists, without restricting local motorist's access to the arterial road network.

To be effective, traffic calming shall be applied only after careful study of the local transportation network and land use. It should be implemented on an area-wide basis, considering impacts on the surrounding road system. Non-motorized modes of travel should not be impeded by the applied measures. Consultation on the impact of the measures on emergency services, snow plowing, street cleaning and garbage removal shall be completed as part of the planning process.

Traffic calming is only one design tool for safer roads. The most effective traffic calming measures have modest negative impacts on some aspects of the area in which they are installed. Because of this, other techniques such as education and enforcement, and design factors such as pavement width and street network design, should be considered in any traffic calming study.

2. Signage

Entrance points to where traffic calming measures have been installed, shall be posted with the Traffic Calmed Neighbourhood sign, located in the TAC manual *Canadian Guide to Neighbourhood Traffic Calming*.

The Town may elect to use the appropriate regulatory signs from the *Ontario Manual of Uniform traffic Control Devices* as a traffic calming measure. Appropriate signage may include, but not limited to, Maximum Speed, Right or Left Turn Prohibited, One Way and Stop signs.

3. Speed Humps

Speed humps are used to reduce vehicle speeds, by causing discomfort to occupants of vehicles crossing them at high speeds.

The hump shall consist of an 80mm high, 3m-long raised table, with 1.5m long ramps on the leading and trailing edges for an approximate grade of 5.3%. The table shall be crowned for a grade of not less than 1%, to allow drainage. The sides of the hump shall be ramped to the edge of pavement to allow drainage along the gutter.

3.1 Traffic Calming Measures (cont'd)

3. Speed Humps (cont'd)

Both edges of the ramps should be milled and keyed into the existing asphalt to provide a continuous road surface. The leading edge of the ramp shall be marked with durable solid white reflective triangles, with the point at the top of the ramp. A Speed Hump sign (T.A.C. *Canadian Guide to Neighbourhood Traffic Calming* Wa-50) shall be installed beside the leading edge of the ramp.

4. Roundabouts

A roundabout is a raised island located in the centre of an intersection, which requires vehicles to travel through the intersection in a counter-clockwise direction around the island.

All approaches to the circle shall be protected by a Yield sign, so that vehicles already traveling on the roundabout have right-of-way over vehicles entering it. A One Way sign Rb-21A, indicating a counter-clockwise direction of travel, shall be installed on the centre island opposite each approach.

The curb and gutter in the island shall be barrier style OPSD 600.01.

For maintenance purposes, maintenance holes are not permitted to be located within the raised centre island of the roundabout unless otherwise approved by the Town Engineer.

5. Raised Median Traffic Islands

Raised median traffic islands may be installed in the centre of roads with at least 8.4m existing pavement width.

A concrete island is used to reduce pavement width and thereby reduce the speed of passing traffic.

A minimum width of 4.0m shall exist between the curb faces on both sides of the island.

The island shall be not less than 5m in length, with the maximum length dictated by local conditions. A longer island is desirable. The island shall be not less than 15m distant from all intersections. It should have barrier curb around its perimeter, except at pedestrian ramps and driveways. Wherever possible, the grade of the road should be restored so that water drains to the existing curb and gutter. In this case, gutter-less curb may be installed around the perimeter of the island.

3.1 Traffic Calming Measures (cont'd)

6. Temporary Measures

Temporary traffic calming measures shall be reviewed and approved by the Town of Ingersoll prior to installation.

3.2 Noise Attenuation Barrier

1. Application and Methodology

Noise barrier walls for use in a new subdivision are to comply with the Ministry of the Environment "Noise Assessment Criteria in Land Use Planning" requirements and approved by the Town Engineer.

Detailed fabrication and layout drawings of the proposed barrier, sealed by a Registered Professional Engineer, shall be submitted to the Town as part of the engineering drawings for acceptance prior to manufacture or construction.

2. Noise Assessment Study

A noise study or report is required when a proposed subdivision is situated within certain design setbacks from a provincial highway or railway line. The noise study is to comply with the Ministry of the Environment "Noise Assessment Criteria in Land Use Planning". All recommendations and details from the noise barrier wall studies/reports are to be reflected on the servicing drawings.

3. Dimensions and Locations

The minimum height of the barrier is to be 2.44m (8') above the finished centerline elevation on the road allowance side of the wall. The minimum height of the barrier on the private property side must be 1.84m (6'). The bottom panel measuring up 0.15m from the base shall be a material resistant to rotting or damage. There shall be no gaps or holes from the finished grade to the top of the barrier, except along the bottom where it is deemed necessary for drainage.

Masonry or Concrete noise walls are to be constructed on the road allowance within 0.3m (1') reserve, and maintained by the Owner until such time as the Town accepts ownership of the subdivision. If no reserve exists, the masonry or concrete noise barrier shall be placed adjacent to the property line located entirely within the right of way.

Wooden noise walls, including posts and brick pillars, are to be located entirely on private property and maintained by the Owner.

3.2 Noise Attenuation Barrier (cont'd)

3. Dimensions and Locations (cont'd)

Dimensions and locations are to comply with the Noise Assessment Study, the Railway Line Setbacks, and the Draft Plan Conditions.

4. Materials

All panel materials shall be durable and impervious to ultraviolet light, with a predicted maintenance-free lifespan of 20 years. The barrier system and its components shall be designed in accordance with the requirements of the Ontario Highway Bridge Design Code. The barrier shall be constructed to meet a reference wind pressure of 0.36kPa for a 10 year return period, and the wall surfaces are to be “sound absorptive”. For a barrier, the material shall have a surface density not less than 20kg/m², and a demonstrated Effective Sound Transmission Class (E.S.T.C.) of 32 or greater.

Concrete for the post footings shall be 200MPa, in accordance with OPSS 1350.

Wooden Noise Walls shall have steel posts.

3.3 Construction Signage

1. General

Use of the Ontario Traffic Manual – Book 7 – Temporary Conditions for all construction signage applies.

2. Traffic Control and Detour Plans

Traffic control plans must be submitted to the Town of Ingersoll for approval before any work may begin.

Should it be deemed necessary for a detour to be established, plans must be first submitted to the Town of Ingersoll two weeks prior to for approval.

Once the detour has been approved, it will be the Owners responsibility to supply and place, and maintain throughout the duration of the job.

3. Pedestrian Safety

Construction projects in proximity to high pedestrian areas, including schools, commercial areas and any source of high pedestrian volumes should take extra precaution to separate construction activity from pedestrian movements.

3.3 Construction Signage (cont'd)

3. Pedestrian Safety (cont'd)

Sidewalks that are closed or removed should have signed alternate routes.

Any material deliveries or construction vehicle movement crossing pedestrian areas should be carefully monitored by a traffic control person.

Schools in close proximity to projects should be notified in the preconstruction letters and kept informed of progress.

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**SECTION 4 – SANITARY SEWER and WASTEWATER
TREATMENT**

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SECTION 4 – SANITARY SEWER And WASTEWATER TREATMENT

4.0 Ownership

The County of Oxford is the sole owner of the wastewater treatment plant, as well as all wastewater systems constructed within the right of ways and easements throughout the Town of Ingersoll. The Town of Ingersoll in conjunction with the County of Oxford is responsible for all reviews of proposed and reconstructed wastewater systems designed for County's Assumption. However, the County of Oxford has final approval on acceptance of design and completion of work before assumption.

4.1 Definition

Public Sewage Systems

A piped collection system that transports wastes of domestic origins which is human body waste, toilet or bathroom waste, waste from other showers and tubs, liquid or water borne culinary and sink water or laundry waste, and such other waste as is suitable for treatment at a sewage treatment facility in accordance with the County of Oxford's By-law No. 2719-87.

Private Sewage Systems

A sewage system (or systems), with a total design capacity of 10,000 litres per day or less, shall be designed, constructed, operated and maintained in accordance with Part 8 of the Ontario Building Code.

A sewage system (or systems), with a total design capacity greater than 10,000 litres per day, falls under the jurisdiction of the Ministry of Environment.

4.2 Materials, Design, Construction and Testing

All proposed new and reconstructed sanitary projects within the Town of Ingersoll must follow the County of Oxford – Design Guidelines and Supplemental Specifications for Municipal Services - Section 4 – Sanitary.

This Guideline is located on the County of Oxford website at:

<http://www.oxfordcounty.ca/Services-for-You/Water-Wastewater/Design-guidelines>

On private property the design, construction, materials, and testing shall comply with Part 7 of the Ontario Building Codes



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5.0 Background Information

The Town of Ingersoll is facing continuing development pressures to meet community housing and servicing needs. Since the first stormwater management study undertaken in 1982, development pressure has intensified, particularly in the recently annexed lands at the southerly Town limit and along the outer fringes of the community. In the past, the Town has implemented a set of stormwater management criteria for new developments, based mainly on the 1982 report that focused on quantity control. However, stormwater management policies, criteria, design and construction techniques have changed considerably over the past two decades.

Continued growth in the watershed could result in local flooding, deteriorated water quality, adverse impacts on the flow regime, and deterioration in the local aquifer, increased erosion rates and channel migration. Now, also there is an increase in public awareness and understanding of the negative impacts of uncontrolled urban development on our environment, and the rising expectation for corrective actions to be taken to maintain and/or improve ecosystem conditions.

Accordingly, there is a need to undertake a comprehensive stormwater management study based on the latest provincial standards to ensure orderly development and to provide protection to the human and natural environment. The Town of Ingersoll and the Upper Thames River Conservation Authority have partnered on a Stormwater Management Strategy project to develop a stormwater model and have prepared a Interim Stormwater Policies and the Terms of Reference for future updating of the Stormwater Management Strategy.

In 2007, The Town of Ingersoll Council adopted this interim report into policy. The Interim Stormwater Management Strategy report is located on the Town of Ingersoll web site at:

<http://www.ingersoll.ca/docman/engineering-reports/235-stormwater-management-strategy-study-executive-summary>

The Town of Ingersoll and the Upper Thames River Conservation Authority will continue to complete their Stormwater Management Strategy and do series of follow-up studies as new information is collected.

SECTION 5 STORMWATER MANAGEMENT

5.1 Goals

Where stormwater management ponds are to be implemented, they shall incorporate a water resources management approach, be consistent with the ecosystem and shall be created in a manner that is technically sound, aesthetically pleasing, ecologically diverse and where passive and active pursuits may be realized in a generally safe environment. Creatively designed and developed, these ponds will comply with and satisfy the required stormwater management functions while providing as a significant asset to the open space system within the community.

5.2 Aims/Purpose

The proposed SWM Pond Requirements have six aims/purposes:

- 1) to minimize the risk of threat to life and health of the public while avoiding fencing of the stormwater management ponds;
- 2) to ensure compliance with all applicable municipal requirements and provincial legislation;
- 3) to provide requirements for use by developers on new projects (temporary and/or permanent) and the Town for retrofit applications;
- 4) to expedite the development of safety-oriented and naturalized stormwater management ponds that present an aesthetically pleasing amenity to the community and reduce the reliance on heavily engineered designs;
- 5) to provide opportunities to integrate stormwater management systems into neighborhood open space systems; and
- 6) to implement a stormwater management system that has due regard for the Ecosystem and watershed as dynamic and living systems and is integrated with the urbanized human community while managing conveyance, erosion, flooding and quality of the stormwater flows.

5.3 Approvals

Based on Ontario Water Resources Act (OWRA), Section 53, SWM works are subject to Environmental Compliance Approvals for this work and must be in compliance with the MOE requirements associated with the Storm/drainage and SWM servicing works, as well as be in compliance the Town's SWM design requirements as follows:

- Permanent stormwater management (SWM) facilities are required to be located on lands that the proponent shall dedicate to the Town of Ingersoll.

5.3 Approvals (cont'd)

- Stormwater management (SWM) facilities are required to be located on lands that are dedicated to the Town as an easement by the proponent to ensure that the Town will be able to comply with the emergency requirements in accordance with the Environmental Protection Act and Ontario Water Resources Acts.

- Temporary Stormwater management (SWM) facilities that become permanent SWM facilities based on the Master Plan and/or Municipal Class Environmental Assessment (EA) recommendations will be required to be located on lands that the proponent shall dedicate to the Town of Ingersoll.

- Designs shall have due regard for appropriate provincial legislation and the Town's design standards, policies, guidelines including but not limited to:
 - Town of Ingersoll Stormwater Management Strategy Study, 2007
 - the Town of Ingersoll Design Specifications
 - Consistency with the County of Oxford official plan.

- Development Approval - Until such time as sub-watershed studies are approved, an application for approval for development may be required to submit for approval a stormwater management report to the County, the Ministry of the Environment, the Ministry of Natural resources, and/or the Conservation Authority with jurisdiction providing the following information:
 - a plan for the provision of stormwater drainage facilities to accommodate the proposed development, including consideration of the feasibility of using at-source infiltration to achieve stormwater management objectives
 - a grading plan for the proposed development
 - an assessment of the pre-development and post-development discharge of water during all runoff conditions including flood conditions on any stream. Post development flows should not exceed pre-development conditions.
 - An assessment of the proposed development on the water quality of any stream or watercourse and the means of mitigating any potential reductions in water quality
 - An assessment of the stormwater capacity on any proposed receiving watercourse
 - The means for controlling erosion, sedimentation and in-stream bank stability using the best available construction and management practices both during and after the construction of the development
 - An assessment of how development will maintain or enhance the minimum baseflow of an affected watercourse and maintain storage levels during periods of minimum baseflow for flow augmentation.

5.3 Approvals (cont'd)

In accordance with the Professional Engineers Ontario Use of the Professional Engineer's Seal Guideline storm/drainage and SWM reports must be signed and sealed by a Professional Engineer.

SWM Designs may incorporate innovative approaches, provided the intent of the SWM Pond requirements, goals, aims and purposes derived for public benefit are achievable.

A hydrogeological evaluation including a water balance may be required to support the development depending on the specific characteristics of the site. The hydrogeological report should be supported by monitoring data.

The water balance evaluation and calculations are required to include an assessment of existing conditions and recommended measures to mitigate the impact to the water balance under post development conditions.

5.4 SWM Modeling and Design Criteria

Until the completion of the Stormwater Management Strategy Plan for the Town, it is recommended that a set of interim design criteria summarized in Section 3.5, in particular Table 3 of the Strategy Study should be used for quantity, quality, erosion, and base flow control. The use of this unified approach applicable within the Town's watersheds, (and preferable should apply to areas outside the Town's municipal boundaries) would ensure that the design of stormwater management practices would meet the flood, water quality, erosion control and groundwater recharge policies.

A Professional Water Resources Engineer is responsible for recommending all SWM modeling parameters to ensure the application of adequate engineering knowledge is applied. At the same time, The Town of Ingersoll, County of Oxford and UTRCA will review the proposed SWM systems and selection of the SWM modeling parameters/criteria to ensure compliance with Town, County and Provincial standards, requirements and practices, and also ensure the adequate protection of the people and properties of the Town of Ingersoll and County of Oxford.

1. Stormwater Management Criteria

Water Quality Storage

Impervious percentage is described by two parameters, Total Impervious Percentage (TIMP) and Directly Connected Impervious Percentage (XIMP) values. The required storage is to be determined using the TIMP value in

5.4 SWM Modeling and Design Criteria (cont'd)

1. Stormwater Management Criteria (cont'd)

Water Quality Storage (cont'd)

accordance with Table 3.2 of the Ministry of the Environment's Stormwater Management Planning and Design Manual (2003).

The water quality storage volumes per hectare are established in Table 3.2 of the MOE Manual and consist of two components: 40m³/ha of extended detention quality control storage (live storage) and the remaining portion represents permanent pool quality storage (dead storage). The required 40 m³/ha of quality extended detention storage is constant and required in all cases. The remaining permanent pool component of water quality storage is dependent upon the three following factors:

- i) impervious percentage (discussed in Section 6.4.3.1);
- ii) Protection Level of the Receiving Watercourses (the protection level of receiving watercourses will be revisited in the subwatershed studies updates); and
- iii) proposed type of SWM facility (i.e. wet pond, dry pond, wetland, infiltration)

Additional extended detention storage may be required for erosion/stream morphology and attenuation control and/or to address lack of conveyance capacity in the outlet system. These parameters are to be established by the Consulting Engineer all to the satisfaction of the Town Engineer.

Erosion Control Storage

Erosion control storage volumes reflect the need to maintain existing fluvial geomorphology, protect watercourses from further deterioration and ensure protection of public safety and property.

All facilities require a minimum of 40 m³/ha of extended detention storage. Additional erosion control protection may be required if the facility is to be located within a subwatershed that identifies specific erosion control requirements on top of the quality control extended detention. Should the consulting engineer complete a site specific geomorphological/fluvial assessment, alteration to the erosion control requirements may be considered.

5.4 SWM Modeling and Design Criteria (cont'd)

2. Hydrologic Modeling

This section provides guidance in the selection and implementation of hydrologic modeling parameters. Consultants may make use of available water resources management manuals and texts as a reference to aid in the selection of hydrologic modeling parameters. Any externally referenced material employed in parameter selection should be properly referenced in the SWM Report and included in the document appendices.

Imperviousness

Current the Town of Ingersoll practices for determining site runoff for Conceptual and/or Preliminary SWM plans use the values for Total Impervious Percentage (TIMP) and Directly Connected Impervious Percentage (XIMP).

TIMP represents the ratio of area covered by an impervious surface (e.g. asphalt, concrete) to the entire area. XIMP represents the ratio of impervious areas directly connected to the conveyance system. An example of a directly connected impervious area would be a parking lot, a portion of roof areas, driveways, or roads that contain catchbasins draining to the storm sewer. An example of a non-directly connected impervious area is an outdoor basketball court surrounded by park land or roof area draining to a rear yard.

In order to ensure that the proposed SWM volumes, land requirements and the size of the SWM block are estimated correctly, impervious percentage selection is extremely important. If the SWM block is oversized, there may be adverse effects on the economic viability of the proposed development, and if undersized, there could be negative impacts on adjacent existing properties and homeowners.

The table below lists current Town of Ingersoll preferred TIMP and XIMP values based on land use. These allowable ranges for TIMP and XIMP should be applied at the conceptual/preliminary design stage to ensure sufficient land is allocated for the proposed facility. Adjustment of Impervious Percentage values at the functional/detailed design stage will always be considered and accepted, subject to the consulting engineer providing engineering calculations to justify the revision of these parameters.

5.4 SWM Modeling and Design Criteria (cont'd)

2. Hydrologic Modeling (cont'd)

Imperviousness (cont'd)

Land Use	TIMP	XIMP
Residential	55% 51% - 60%	45% 43% - 48%
Medium and High Density Residential	70% 65% - 75%	55% 45% - 55%
Commercial/Industrial	75% - 90%	70% - 80%

The other option which the Town will accept are:

- At the Master Plan level, TIMP and XIMP should be assigned the MAXIMUM (not average) imperviousness allowed by the Town.
- At the detail design level, TIMP and XIMP can be assigned the “actual” imperviousness.

Models for Determining Site Runoff

Site runoff for both pre-development and post-development conditions is determined by subtracting the predicted infiltration volume from the estimated total rainfall volume. There are multiple models and methods for determining infiltration and thus total runoff. The Town of Ingersoll will consider all accepted methods/models for determining infiltration and runoff provided they are applicable and appropriate to the proposed development.

Initial Abstraction

Initial abstraction (I_a) represents the interception, infiltration, and surface depression storage of rainfall at the beginning of storm events.

These values are applied by the majority of Water Resources Engineering practitioners across the Province.

SECTION 5
STORMWATER MANAGEMENT

5.4 SWM Modeling and Design Criteria (cont'd)

2. Hydrologic Modeling (cont'd)

Initial Abstraction (cont'd)

Land Cover	Ia – Typical Values
Impervious	2 mm
Pervious – Lawns	5 mm
Pervious – Meadows	8 mm
Pervious - Woods	10 mm

In order to consider any deviation from these recommended Ia values, the proposed SWM modeling will need to be tested in the field and technical data presented to confirm the suitability of the calibrated parameters.

Curve Number

The curve number (CN) is a parameter used to determine the extent of rainfall that infiltrates, rather than becoming surface runoff. It is a measure of a watershed's hydrologic response potential and is usually selected from available government documents and handbooks. CN values must be consistent with provincial guidelines and standard water resources management practices and correspond with the specific geotechnical conditions of proposed developments.

Design Storm Selection

In the design of individual SWMF's a 3-hour Chicago Rainfall Distribution should be applied as recommended in the subwatershed studies. The Chicago distribution is widely accepted as a synthetic distribution to be used in the design of urban areas.

Also, where: Rainfall intensity (mm/hr) = $A/(t+B)^C$

Parameter	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	250 Year
A	724.69	1330.31	1497.19	1455.00	1499.06	1499.53	3048.22
B	5.5	7.938	7.188	5.000	4.188	3.297	10.030
C	0.8	0.855	0.850	0.820	0.809	0.794	0.888

The developer's consulting engineer is required to evaluate all applicable storms and recommend the most appropriate on a case-by-case basis. For each problem (i.e. Water Quality, Flood Control, Erosion Control), a "critical" storm should be selected for design purposes.

5.5 SWM Inlet Pipe Design Criteria

According to the MOE Guidelines for the Design of Storm Drainage Systems, the SWM facility inlet pipe should represent a free outlet. Therefore, the inlet pipe invert is to be above the projected 2-year storm ponding elevation. Non-compliance with this standard may create surcharge conditions within the new storm sewer system requiring additional maintenance associated with the potential sediment accumulation, as well as create potential liabilities under the Ontario Highways Act should surface ponding occur on streets.

Should, in rare cases, we need to consider deviation on the above noted design criteria, the subdivider's consulting engineer will be required to undertake an engineering analysis to demonstrate that the proposed deviation will have a minimum effect on the proposed sewer Hydraulic Grade Line and will not create an adverse effect on the system.

The storm sewer systems are generally designed for minor system and based on current Town of Ingersoll practices it is a 2-year storm event. Special cases representing exceptions to this general rule will be evaluated on a site-by-site basis. Surcharging is expected during major storm events and a major flow route must be established to accommodate these flows up to the 250 year storm event.

5.6 Design Requirements

1. General

SWM facilities (temporary and/or permanent) shall meet engineering, maintenance, safety, planning, environmental, aesthetic and economic requirements, while avoiding fencing.

SWM Pond requirements for private property/developments are to generally conform to the design criteria in this manual, all to the satisfaction of the Town of Ingersoll.

2. References

The basis for implementing these requirements will be a design criteria that includes but is not limited to the following and subject to approval by the applicable SWM agencies:

- County of Oxford Official Plan
- UTRCA Guidelines for the SWMFs located in Flood Plains;
- The Stormwater Management Practices Planning and Design Manual developed by the Ministry of the Environment in 2003;

5.6 Design Requirements (cont'd)

2. References (cont'd)

- Best Management Practices (BMPs) issued by the MOE and successfully implemented by various municipalities in southern Ontario; and
- All applicable Town of Ingersoll municipal requirements and provincial legislation.

3. Parks, Open Spaces and Pathways

Where stormwater management facilities are designed to be integrated with adjacent parks, open spaces or pathway systems, greater setbacks may be required subject to Planning Division Requirements and Approvals.

Since SWM Facility land is claimable under the rules of the Urban Works Reserve Fund (UWRF), where additional land, beyond the technical requirements of the SWM Facility is required, these lands will be identified as a separate Park/Open Space Block on the registered plan.

4. Specific Design Features

Fifteen key SWM Pond design features have been identified to reduce the risk of injury to children (aged 1 to 8 years), while maintaining facility function. These biophysical safety features are intended to restrain access to deep standing water through a series of spatial, physical, natural and aesthetic barriers or through alternatives to direct access. This is not intended as a replacement for adult supervision but rather as a deterrent to casual accidents. **The intent is to replace fencing with an appropriate alternative**, while maintaining SWM function and public safety. The 15 key SWM Pond design features include:

1. A sediment forebay is incorporated to induce treatment and improve pollutant removal by trapping larger particles near the outlet of the pond:
 - a) the sediment forebay must be 1.0-1.5m deep to minimize a potential re-suspension and ecological conditions for the West Nile Virus.
 - b) the sediment forebay sizing must be done in accordance with the MOE's SWM Practices Planning and Design Manual.
 - c) the sediment forebay should be constructed with a maintenance access route to permit future monitoring and maintenance as well as provide access in the event of an emergency.

5.6 Design Requirements (cont'd)

4. Specific Design Features (cont'd)

2. A pond depth of 1.5-2.0m is preferred. Shallow ponds of less than 1.0m are likely to be ineffective, and should be discouraged due to the possible re-suspension of sediment and greater land requirements. The maximum SWM facility depth shall not exceed 3.0m with a maximum 0.3m freeboard. A positive overland flow path must be provided at the 3.3m water level. The permanent pool depth in wet SWM facilities must be 1.0-1.5m deep.
3. A naturalized low flow channel with a shallow channel depth (0.3 to 0.6m preferred) leading to the area of pond draw down; SWM facility inlet sewers must be designed to enter the facility as free outlet systems during 1:2-year storm events. This standard is in accordance with the Ministry of the Environment Guidelines for the Design of Storm Sewer Systems.
4. For extended detention/hybrid and wet facilities 5:1 side slopes maximum or flatter, for dry facilities 4:1 side slopes maximum must be applied around the perimeter of the sediment forebay and upper and lower cell; slopes may vary around a facility to create a natural appearance with the preferred slopes being maximums.
5. Steeper slopes (maximum 3:1) may be allowed to be used when these slopes are:
 - representing only 15-20 % from the total perimeter at the 0.3 m above the 100 year storm event elevation ;
 - combined with a minimum buffer of 5.0m from 0.3 m above the 100 year storm event elevation to the property line; and
 - combined with unfriendly vegetation.
6. The two year storm event extended detention and storage component of wet facilities should discharge over a 24 to 48 hour period and the quality control ponds are not allowed to be located in line. Dry facilities should be used mostly as an attenuation/flood control system and ponding will be of relatively short duration and infrequent in occurrence; the permissible discharge for all facilities is based on detailed engineering analysis;

All maintenance holes located within stormwater management ponds require hard surface access. Access roads below the 100 year flood line will require a turfstone surface on a granular base. The turfstone voids shall be filled with Granular A.

5.6 Design Requirements (cont'd)

4. Specific Design Features (cont'd)

7. Stormwater from the forebay shall be held in a permanent wet retention pond and should be located in the facilities lower cell (assuming the general main cell design reflects an overall safety criteria of gentle slopes and aquatic safety benches or suitable barriers);

8. Any SWM facility proposed to be located within Flood Plain lands are subject to:

- a) UTRCA guidelines and approvals;
- b) forebays being located above the 50 year storm line with any deviation from this requirement being subject to specific technical justifications approved by the Town;
- c) main facilities being located above the 25 year flood line;

9. A naturalized landscape plan, approved by the Town Engineer, is required for all stormwater retention and detention facilities.

Seeding of exposed soil surfaces should be done as soon as possible after fine grading is complete. All landscape treatments specified in the approved plan should be installed after seed has established, but within two years of registration of a subdivision plan or development agreement.

10. In lieu of fencing, unmowed vegetated buffers will be required around the perimeter. This buffer should 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 natural barrier.

This dense unfriendly vegetation should act as a natural barrier to all but the most determined individuals. Openings can be provided if warnings are posted advising those who approach the facility of its purpose, operation and potential safety hazards; posted warnings should be visible as emergency access points in the event that the barrier is penetrated;

The requirements for fencing stipulated in the Town of Ingersoll Fencing By-Law, are not applicable to SWM Facilities.

11. An aquatic safety bench must be constructed around the forebay and the main treatment cells with the lower edge to be located 0.9 m above the pond bottom with a minimum 2 m width and incorporate a minimum slope of 10:1 or flatter.

5.6 Design Requirements (cont'd)

4. Specific Design Features (cont'd)

12. Pedestrian and cycle paths must always be located no lower than the 5 year storm event water elevation and used in conjunction with the preferred slopes discussed in item (4) to further maximize recreational user safety and minimize public risk and liability. Paths below this point and leading to the lower portions of a facility should be posted to warn the public of potential safety hazards during pond operation; and

13. Restricted area signage will be necessary to warn the adult public to avoid areas or activities under certain conditions if a number of these features are modified extensively and/or not included.

14. The minimum buffer width (separation area between the SWMF and land features such as ESA, main watercourses, significant ecological features and open space designation, etc.), is subject to County of Oxford Official Plan requirements, policies, Provincial and Federal Acts, Policies and Requirements.

15. A Sediment and Erosion Control Plan during the construction activities must be developed and included in the Functional SWM Report for the proposed SWM Facility, to be reviewed and accepted by the Town. Specific requirements for the protection of adjacent natural areas may be required as outlined in the relevant Environmental Impact Statement for the development.

These requirements must be applied to all SWM applications. It is recognized that in some instances, unique circumstances may arise where some requirements cannot be accommodated. In these cases, the onus is on the proponent to demonstrate how the proposed design deviates from the requirements, yet still meets the spirit and intent of this overall document. Deviations must be approved by the Town of Ingersoll.

5. Emergency Sanitary Sewer Overflow

Emergency sanitary sewer overflow (SSO) outletting upstream of the SWM facility or directly to SWM facilities is not permitted.

5.7 Commissioning Considerations

1. Maintenance and Monitoring Prior to Assumption

Maintenance and monitoring of the SWM facility prior to the Town's assumption, must be:

- carried out by the Subdivider/Developer to demonstrate the effectiveness of the performance of these facilities in accordance with the approved design construction practices;
- in compliance the MOE's Monitoring Guidelines
- carried out by the Subdivider, prior to the Town's assumption, at no cost to the Town;
- In compliance to specific monitoring requirements as a result of an EA or EIS for the facility or development; and
- All landscape materials are to be maintained in a healthy state in accordance with the approved landscape plan until the time of assumption. A final inspection is required by the Town, prior to assumption of the facility.

2. Proportional Cost Sharing

Proportional Cost Sharing for maintenance and monitoring of the SWM facility amongst benefiting developers will be required. The Subdivider/Developer constructing a SWM Pond which services other subdivisions and that carry out maintenance, operations and monitoring of SWMF's prior to the Town's assumption, should be allowed proportional cost sharing by others serviced by these SWMF's. The above noted proportional cost sharing shall be based on contributing storage volume of a SWM facility.

Contributing Subdivider/Developer's payments to third parties shall:

- commence upon completion of the subdivider's service work connections to the existing unassumed SWM services; and
- continue until the time of assumption of the affected services by the Town

3. Operation Prior to Assumption

Operation of the SWM facility, prior to the Town's assumption, shall be in compliance with the Operational and Maintenance Manual developed by the subdivider's Consulting Engineer and approved by the Town of Ingersoll.

This may include periodic dredging of silt deposits from the sediment forebay of the SWM pond. Removal of potentially contaminated sediments may require compliance with regulations under the Environmental Protection Act.

5.7 Commissioning Considerations (cont'd)

3. Operation Prior to Assumption (cont'd)

Lawn mowing, litter removal, trail maintenance and vegetation inspection and maintenance (especially where a SWM facility is part of an open space scenario) will also be the responsibility of the subdivider until the SWM pond has been assumed by the Town.

5.8 Interim Conditions

In situations where storm water from a road widening or development will be designed prior to the ultimate storm/drainage flow path being established the interim conditions must be designed to the same degree as the ultimate design in accordance with the Town Standards and Requirements.

5.9 Low Impact Development (LID)

1. Overview

Low Impact Development (LID) is an innovative stormwater management approach that treats, infiltrates, filters and retains runoff at the source. LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed.

2. Principles of LID

Practices include innovative site design strategies that minimize runoff (i.e., nonstructural LID practices). They also include distributed, small scale lot level and conveyance practices (i.e., structural LID practices) such as rainwater harvesting, green roofs, soakaways, bioretention, vegetated filter strips, permeable pavement, perforated pipe systems, and swales.

The approach is to attempt to reproduce the predevelopment hydrologic regime through innovative site design and distributed engineering techniques aimed at infiltrating, filtering, evaporating, harvesting and detaining runoff, as well as preventing pollution. Key principles for low impact development design can be summarized as follows:

5.9 Low Impact Development (LID)

2. Principles of LID (cont'd)

1. Use existing natural systems as the integrating framework for planning
 - Consider regional and watershed scale contexts, objectives and targets;
 - Look for stormwater management opportunities and constraints at watershed/subwatershed and neighbourhood scales;
 - Identify and protect environmentally sensitive resources;
 - see Chapter 2 for further guidance on the landscape-based approach to stormwater management planning and design
2. Focus on runoff prevention
 - Minimize impervious cover through innovative site design strategies and application of permeable pavement;
 - Incorporate green roofs and rainwater harvesting systems in building designs;
 - Drain roofs to pervious areas with amended topsoil or stormwater infiltration practices;
 - Preserve existing trees and design landscaping to create urban tree canopies
3. Treat stormwater as close to the source area as possible
 - Utilize decentralized lot level and conveyance stormwater management practices as part of the treatment train approach;
 - Flatten slopes, lengthen overland flow paths, and maximize sheet flow;
 - Maintain natural flow paths by utilizing open drainage (e.g., swales).
4. Create multifunctional landscapes
 - Integrate stormwater management facilities into other elements of the development to conserve developable land;
 - Utilize facilities that provide filtration, peak flow attenuation, infiltration and water conservation benefits;
 - Design landscaping to reduce runoff, urban heat island effect and enhance site aesthetics.
5. Educate and maintain
 - Provide adequate training and funding for municipalities to monitor and maintain lot level and conveyance stormwater management practices on public property;
 - Teach property owners, managers and their consultants how to monitor and maintain lot level stormwater management practices on private property;
 - Establish legal agreements to ensure long-term operation and maintenance.

5.9 Low Impact Development (LID)

2. Principles of LID (cont'd)

Typical LID designs incorporate more than one type of practice or technique to provide integrated treatment of runoff from a site. For example, in lieu of a treatment pond serving a new subdivision, planners might incorporate a bioretention area in each yard, disconnect downspouts from impervious surfaces, remove curbs and install grassed swales in common areas. Each LID practice incrementally reduces the volume of stormwater as it moves from the source area to the receiving waterbody. In doing so, LID practices are applied to meet stormwater management targets for water quality, channel erosion control and water balance. Although LID practices are not intended to meet stormwater management targets for flood control, they do provide some benefit in this regard.

LID practices, applied together with conventional end-of-pipe facilities, can provide better runoff and pollutant load reduction, be more cost effective, have lower maintenance burdens, and be more protective of aquatic habitat during extreme storms than end-of-pipe facilities alone. Several practices may be needed to achieve the required storage volume. The precise type and number of LID practices depends on several factors including land use, soils, geology, groundwater levels, groundwater uses, and the sensitivity of the receiving waterbody.

3. Site Design Strategies

The goal of LID site design strategies is to minimize the conversion of undeveloped or agricultural land cover to urban uses, and the application of storm sewer systems. Avoiding downstream impacts through non-structural, innovative site design methods is more economical, operational efficient and aesthetically pleasing than concentrating all stormwater management efforts on treating and controlling runoff downstream.

Therefore, site designers should exhaust all opportunities for non-structural methods to prevent runoff from being generated before determining how to mitigate the land cover change and storm sewer impacts through structural LID practices and detention ponds.

5.9 Low Impact Development (LID)

3. Site Design Strategies (cont'd)

The following four themes need to be considered together as they all overlap and relate to each other.

1. Preserving Important Hydrologic Features and Functions

These features include, but are not limited to; highly permeable soils, pocket wetlands, significant small (headwater) drainage features, riparian buffers, floodplains, undisturbed natural vegetation, and tree clusters. These features act as sponges and can sometimes be used to buffer the hydrologic impacts created by neighbouring development. They preserve the natural character of the site and in many cases improve the aesthetics and value of the developed property.

All areas of hydrologic importance should be delineated at the earliest stage in the development planning process. Once these areas have been mapped, they can guide the layout of the site.

Strategies

- Preserve stream buffers, including along intermittent and ephemeral channels. Buffers provide filtration, infiltration, flood management, and bank stability benefits. Unlike stormwater ponds and other structural infrastructure, buffers are essentially a no capital cost and low maintenance form of infrastructure. In general, the literature recommends stream buffers for pollutant removal and support of aquatic and terrestrial riparian habitat.

The benefits of buffers diminish when slopes are greater than 25%; therefore steep slopes should not be counted as buffer.

- Preserve areas of undisturbed soil and vegetation cover. Typical construction practices, such as topsoil stripping and stockpiling, and site grading and compaction by construction equipment, can considerably reduce the infiltration capacity (and treatment capacity) of soils. In some instances, the bulk density of construction compacted soils is similar to values for impermeable surfaces. Native undisturbed soils have a structure that takes many, if not hundreds of years, to develop. The structure is created by the growth and decay of plant roots, earthworm, and insect activity. In addition to destroying the structure during topsoil stripping and stockpiling, biological activity in the soil is greatly diminished. The shallow rooted turf of lawns and landscaped areas will not provide the same stormwater benefits as the agricultural and native vegetation that it replaces. During construction, natural heritage features and locations where infiltration-based SWMPs will be constructed should be delineated and not subject to construction equipment or other vehicular traffic, nor stockpiling of topsoil.

5.9 Low Impact Development (LID)

3. Site Design Strategies (cont'd)

- Avoid development on permeable soils. Highly permeable soils (i.e., hydrologic soil groups A and B) function as important groundwater recharge areas. Compacting or paving over these areas will have significant hydrologic impacts. To the greatest extent possible, these areas should be preserved in an undisturbed condition or set aside for stormwater infiltration practices. On sites with a variety of soil types, impervious land cover should be concentrated in areas with the least permeable soils and underlying geology. Where avoiding development on permeable soils is not possible, stormwater management should focus on mitigation of reduced groundwater recharge through application of stormwater infiltration practices.

- Preserve existing trees and, where possible, tree clusters. Mature stands of deciduous trees will intercept 10 to 20% of annual precipitation falling on them, and a stand of evergreens will intercept 15 to 40%. Depending on understory vegetation, soils and topography, tree clusters may only produce surface runoff for major flood event storms. Preserving mature trees will provide immediate benefits in new developments, whereas newly planted trees will take 10 years or more to provide equivalent benefits. Tree clusters can be incorporated into development in many ways, including parking lot interiors or perimeters, private lawns, common open space areas, road buffers, and median strips. Any areas of reforestation or new urban tree plantings need an uncompacted soil volume that allows the root systems to get air and water. An uncompacted soil volume of 15 to 28 cubic metres is recommended to achieve a healthy mature tree with a long lifespan.

2. Siting and Layout of Development

The site layout is determined in part by the opportunities and constraints of the natural heritage system. The location and configuration of elements, such as streets, sidewalks, driveways, and buildings, within the framework of the natural heritage system provides many opportunities to reduce stormwater runoff. The goals of the site layout are to provide a functional and livable urban form while minimizing environmental impact. The techniques below highlight some of the ways in which site layouts can minimize their hydrologic impacts and preserve natural drainage patterns.

Strategies

- Fit the design to the terrain. Using the terrain and natural drainage as a design element is an integral part to creating a hydrologically functional landscape (Prince George's County, 1999). Fitting development to the terrain will reduce the amount of clearing and grading required and the extent of necessary

5.9 Low Impact Development (LID)

3. Site Design Strategies (cont'd)

underground drainage infrastructure. This helps to preserve predevelopment drainage boundaries which helps to maintain distribution of flows. Generally, siting development in upland areas will take advantage of lowland areas for conveyance, storage, and treatment.

- Use open space or clustered development. Clustering development increases the development density in less sensitive areas of the site while leaving the rest of the site as protected community open space. The open space can be undisturbed natural area or actively used recreational space. Features that often characterize open space or clustered development are smaller lots, higher density of structures in one area of a site, shared driveways, and shared parking. From a stormwater perspective, clustered development reduces the amount of impervious surface, reduces pressure on buffer areas, reduces the construction footprint, and provides more area and options for stormwater controls including LID practices.

- Use innovative street network designs. Certain roadway network designs create less impervious area than others. These layouts by themselves may not achieve the many goals of urban design. However, used in a hybrid form together or with other street patterns, they can meet multiple urban design objectives and reduce the necessary street area. A study comparing different road network designs for a hypothetical community showed a fused grid pattern can reduce impervious cover by 4.3% compared to a traditional neighbourhood design.

- Reduce roadway setbacks and lot frontages. The lengths of setbacks and frontages are a determinant for the area of pavement, street, driveways, and walkways, needed to service a development. Municipal zoning regulations for setbacks and frontages have been found to be a significant influence on the production of stormwater runoff.

3. Reducing Impervious Area

Unnecessary hardscape can be found all around urban areas from paved but unused traffic and parking lot islands to rarely used overflow parking. Many of the strategies described previously are primarily for the purpose of reducing impervious area on a macro scale. The following strategies provide examples of how to reduce impervious area on a micro or lot level scale. Individually, these reductions in impervious area may seem small but they can add up to substantial decreases in runoff and infrastructure costs.

5.9 Low Impact Development (LID)

3. Site Design Strategies (cont'd)

Strategies

- Reduce building footprints. Reduce the building footprint by using taller multi-story buildings and taking advantage of opportunities to consolidate services into the same space. A single story design converted to a two-story structure with the same floor space will eliminate 50% of the building footprint impervious area.
- Reduce parking footprints. Parking footprints can be reduced in several ways. Excess parking not only results in greater stormwater impacts and greater stormwater management costs but also adds unnecessary construction and maintenance costs and uses space that could be used for a revenue generating purpose.

Keep the number of parking spaces to the minimum required. Parking ratio requirements are often set to meet the highest hourly parking demand during the peak season. The parking space requirement should instead consider an average parking demand and other factors influencing demand like access to mass transit.

Reductions in impervious surface can also be found in the geometry of the parking lot. One way aisles when paired with angled parking will require less space than a two way aisle. Other reductions can be found in using unpaved end-of-stall overhangs, setting aside smaller stalls for compact vehicles, and configuring or overlapping common areas like fire lanes, collectors, loading, and drop off areas.

4. Using Natural Drainage Systems

The use of natural drainage picks up where stormwater leaves impervious areas. Rather than collect and move stormwater rapidly to a centralized location for detention and treatment, the goal of these strategies is to take advantage of undisturbed vegetated areas and natural drainage patterns (e.g., small headwater drainage features). These strategies will extend runoff flow paths and slow down flow to allow soils and vegetation to treat and retain it. Using natural systems or green infrastructure to provide communities with environmental services is often more cost effective than traditional drainage systems, and they provide more ancillary benefits.

5.9 Low Impact Development (LID)

3. Site Design Strategies (cont'd)

Strategies

“Disconnect” impervious areas. Impervious areas have varying degrees of hydrologic impact depending on their connection to the receiving waterbody. Roof leaders or downspouts, parking lots, driveways, sidewalks, and patios should be disconnected from the storm sewer and directed towards stabilized pervious areas where possible. Opportunities for directing impervious surface runoff to pervious areas are first considered during the site layout stage. Sheet flow should be encouraged from all impervious surfaces draining to pervious areas. In cases of concentrated flow, the flow can be broken up with level spreaders or flow dissipating riprap. Use the following guidance for the pervious runoff receiving areas:

- Undisturbed densely vegetated areas and buffers – A hydrologist and/or ecologist should be consulted before designing a site to drain to sensitive natural heritage features like pocket wetlands.
- Landscaped and disturbed areas – With the proper treatment, the landscaped areas of the site can accept runoff from impervious areas. Deep tilling or soil aeration is recommended for topsoil that has been replaced or compacted by construction equipment. Former agricultural lands tend to develop a “hardpan” or compacted layer 0.5-1 meter below the soil surface from repeated plowings and farm equipment. Breaking up the hardpan may improve infiltration rates. Soil amendments can be applied to hydrologic soil group (HSG) C and D soils to encourage runoff absorption. Use deep rooting vegetation in landscaped areas when possible which will maintain and possibly improve the infiltration rates over time.
- Preserve or create micor-topography - Undisturbed lands have a micro-topography of dips, hummocks and mounds which slow and retain runoff. Site grading smoothes out these topographic features. Micro-topography can be restored in areas of ornamental landscaping or naturalization. Any depressed areas should drain within 48 hours, or they may provide breeding habitat for mosquitoes.
- Extend drainage flow paths - Slowing down flows and lengthening flow paths allow more opportunities for stormwater to be filtered and infiltrated. Extending the travel time can also delay and lower peak flows. Where suitable, flows should be conveyed using vegetated open channels.

5.9 Low Impact Development (LID)

4. Structural Design Practices

Since the practice of using Low Impact Development is in its early stages of development in Southern Ontario, the Town of Ingersoll and the UTRCA have yet to establish a **true** Planning and Design Guideline for the Upper Thames watershed region.

The Town of Ingersoll and UTRCA are currently referencing the Credit Valley Conservation Authorities Low Impact Development Stormwater Management Planning and Design Guide – Version 1.0 – 2010 manual for all LID project submissions.

LID projects have starting to become a common component within the Town and UTRCA watershed area, and the Town is currently adopting the use of Bioretention within in its limits. The use of retention ponds and rain gardens are some of the early stage structural designs that have been accepted. However, as per the CVC Guidelines the following designs are available for review by the Town and UTRCA:

- Bioretention
- Rainwater harvesting
- Green roofs
- Soakaway, infiltration trenches and chambers
- Vegetated filter strips
- Enhanced grass swales
- Dry swales
- Permeable pavement

Any of the above mentioned projects must come with an Engineer's report outlining the following issues:

- Application
- Typical drawings and detail
- Design guidance
- BMP sizing
- Design and material specifications
- Maintenance and Inspection
- Construction considerations

It should be noted that several of the practices outlined above have only been implemented for a few years, and the Engineer's Report can only be based on current information as it becomes more commonplace within the UTRCA watershed area.

5.9 Low Impact Development (LID)

5. Landscape Design

The basics of planting design that are outlined below should be applied to LID practices, as they are to any other landscape design. The most successful landscapes balance aesthetic and function, combining fundamental principles of design with the appropriate use of plants for the site. This Landscape Design should be submitted with the LID Engineer's Report, with the Town of Ingersoll and UTRCA having final approval on all landscape submittal.

It is essential that the surrounding context is taken into account. While a planting design can have a natural appearance, the landscape should never appear haphazard or messy. The aesthetic goal is to achieve a visual sense of fit and scale with the site. The design should be intentional, appropriate and pleasing to the eye and consider the following:

- Maintain visual interest throughout the seasons
- Use of selective species palate
- Use of one or two species or elements to create an accent
- Consistency in plant placement and spacing; incorporating mass groupings, repeating plant groupings, materials and/or design elements.
- Avoid sparsely spaced greenery; the planting beds should be fully vegetated.
- Consider habitat attributes of plant material
- Enhanced LID function related to pollutant uptake, temperature mitigation, filtration, and evapotranspiration

The basic principles of landscape design that should be considered in the creation of any planting plan are described below. Not all need to be applied in each case, but a basic understanding provides guidance for the designer. The manner in which these principles are applied creates a particular aesthetic.

Unity/Simplicity - A degree of unity and simplicity in a planting design is essential to create an appealing aesthetic. This can be achieved through repetition and consistency. The landscape associated with an LID practice needs to convey that all parts of the planting design fit together to make a whole. The repetition of groups of plants or the character of elements (ie. height, size, texture, and colour) throughout the landscape design can assist on creating a sense of unity in the landscape.

Repetition/Rhythm - Repetition is the key element used to achieve unity. However, it is important not to overuse this technique as the result can become monotonous. A landscape design that employs a variety of species in groupings that are repeated throughout a site assists in achieving unity and interest. In

5.9 Low Impact Development (LID)

5. Landscape Design (cont'd)

contrast, a design that utilizes two or three species which are repeated throughout the entire LID practice may be monotonous.

Grouping/Massing - Planting different species as single individuals can create a disjointed and un-natural aesthetic in a landscape design. Plants should be placed into groupings of varied numbers to create a mass, which can create a much greater visual appeal. One way to create a grouping is by beginning with a larger specimen, and then adding smaller species with complementary textures, colours and shapes. To create a seasonal grouping, evergreen species, and species with dormant season distinctiveness (ie. form, height, colour) should be included.

Balance - Balance in a landscape design can be either symmetrical or asymmetrical. A symmetrical design is one that exactly duplicates itself along an axis. The informal nature of many LID practices tends to promote the application of the asymmetrical balance approach. This is achieved through the irregular placement of plant groupings along an imaginary axis so that the resulting mass is balanced.

Scale/Proportion - Scale and proportion simply refer to the size of the elements of the landscape in relation to one another and the site. While there are no rules dictating how this principle is to be achieved, it is important to consider scale and proportion when designing. For example, the placement of a large tree in a stormwater planter would be out of scale for this site condition, while the planting of an individual ornamental flower species may appear insignificant in a bioretention cell. Some plant materials may require management (thinning, pruning) in order to maintain the scale and proportion of the intended design over time.

Colour - Colour animates a landscape design. It changes throughout the seasons. Flowers, fruit, leaves or bark of vegetation contribute to colour variation, in response, the designer should understand the details of the life cycle of the plants to be utilized. Colour theory dictates that warm colours (red, orange, yellow) take prominence in the view, while cool colours (green, blue, violet) recede. Colour can be used in developing unity, repetition and balance in a landscape design, and to direct the eye to a focal point if desired.

Texture - The designer should be aware of the texture of the planting materials specified. An appealing aesthetic can be achieved by contrasting fine textured vegetation such as grasses with coarser texture species. However, in exploring design solutions it is important to understand the distance from which the LID practices will be viewed, and to mass vegetation textures accordingly when applying this element to the design.

5.9 Low Impact Development (LID)

6. Landscape Design (cont'd)

Line - Straight lines represent more formal organizing elements in a design and imply a sense of direction and movement. Curved, organic lines promote a more 'natural' aesthetic. In either case, clean and contrived shapes have a greater visual interest than weak shapes or indistinct edges.

Form - Form describes natural shape of an individual plant. The variety of forms include weeping, globular, spreading or columnar. The form of plants should be considered both individually and as they relate in the composition of the design.

7. References

The Town of Ingersoll and the Upper Thames River Conservation Authority are currently using the Credit Valley Conservation Low Impact Development Stormwater Management Planning and Design Guide – Version 1.0 – 2010 manual and the Credit Valley Conservation Landscape Design Guide for Low Impact Development as their guidelines for low impact stormwater management.

These manuals is located at:

Conservation Low Impact Development Stormwater Management Planning and Design Guide

http://www.creditvalleyca.ca/wp-content/uploads/2014/04/LID-SWM-Guide-v1.0_2010_1_no-appendices.pdf

Landscape Design Guide for Low Impact Development

<http://www.creditvalleyca.ca/wp-content/uploads/2012/02/cvc-lid-swm-guide-appendix-b.pdf>



SECTION 6 – STORM SEWER COLLECTION SYSTEMS

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SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.0 Location and Design

1. Ownership

The Corporation of the Town of Ingersoll is the sole owner of all the Stormwater Sewers and Retention Systems constructed within the right of ways and easements throughout the Town of Ingersoll. The Town is responsible for all reviews of proposed storm sewer systems and retention devices designed for their assumption. The Town Engineer will have final approval for any proposed projects within the town limits.

The following are guidelines from which the Town of Ingersoll has established for all outside Consultants, Engineers and Developers to follow during their design process.

2. Purpose

Storm sewers are drainage systems that collect rainfall and other forms of precipitation.

The Towns storm sewers may consist of one or any combination of pipes, ditches, culverts, open channels and storm water management facilities that carry storm water flows.

These flows are created from rainfall or other forms of precipitation.

3. Permitted Use

Storm sewers shall be designed to collect storm water discharge from pervious and impervious areas both on private land and public lands via catchbasins.

Private drain connections from sump pumps or storm PDC's are currently not permitted by the Town of Ingersoll. The Town will consider PDC's on a case by case situation, and where the applicant can prove that there is no other alternative for drainage. The Town Engineer will be the sole judge of this decision.

Should the acceptance of the PDC connections be approved, then a Storm Sewer Permit will required by the Town of Ingersoll Building Department.

4. Geotechnical Reports

The Town of Ingersoll requires that all proposed development and reconstructed projects within the town's right of way or lands to be assumed by the town shall require a Geotechnical Report prior to any acceptance of sewer design work.

6.0 Location and Design

4. Geotechnical Reports (cont'd)

The design of the storm sewers should be based on the recommendations of this report. (ie excavation, bedding design and backfill etc)

5. Location and Alignment

Storm sewers are to be located in front of, or in locations accessible to each lot and block facing a Town street. Storm sewers are to be 4.5m from centre line of the road as per **Town Standard Drawing S-14**, unless otherwise approved by the Town Engineer.

Storm sewers on private property are regulated by the Ontario Building Code (OBC). Where there are no specific regulations in the OBC, details from this manual will apply.

6. Drainage and Sub-Drainage Area Plans

Drainage and sub-drainage area limits are to be designed for, contain and follow the lot/block lines to the proposed maintenance holes located on the ROW.

Note : All areas and coefficients are to be shown for each drainage and/or sub-drainage area.

7. External Watershed Limits and Drainage Areas

When design abuts undeveloped areas, identify the external watershed limits to be designed for.

Note : All areas, coefficients and time of concentration are to be shown for all drainage areas within external watershed limits.

8. Design Charts

Storm sewer design calculations are to be completed on a standard design chart that are compatible with the Town of Ingersoll for review.

6.0 Location and Design

9. Peak Flow Calculation

Flows shall be calculated using the formula : $Q = 2.78 \times A \times C \times I$

Where : Q= peak flow (l/s)
A= area (hectares)
C= runoff coefficient
I= average rainfall intensity (mm/hr)

10. Design Criteria

Storm Design Curve

The criterion used in the design of storm sewers is to be based on the 2 year rainfall intensity curve.

Major overland routes are to be designed for storm sewers greater than a 2 year storm.

Time of Concentration

- a) The time of concentration for residential areas at the upstream end of a system shall be 15.0 minutes.
- b) The time of concentration is to be adjusted when lateral flows account for 50% or more in the design flows.

- i) 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)

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

6.0 Location and Design

10. Design Criteria (cont'd)

Runoff Coefficients

The Town of Ingersoll uses the following coefficient:

Parks, Open Space and Playgrounds.....	0.20
Residential – Single family	0.55
Townhouse/Rowhouse	0.65
Industrial – Light.....	0.65
Industrial – Heavy.....	0.75

Intensity

Rainfall intensity is to be taken from the standard – Rainfall Intensity – Duration Curve for Storm Sewer Design Chart.

Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all HDPE (Boss 2000), concrete and PVC pipe up to 1650mm in diameter.

A coefficient of 0.011 is to be used for all pipe over 1800mm in diameter.

11. Pipe Sizing

Storm sewer pipe sizing is based on the following formula, where the pipe design flow is equal to or greater than the calculated peak flow :

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

- Where:
- Q = Design flow (m³/sec)
 - n = Manning's roughness coefficient
 - A = cross sectional area of flow (m²)
 - R = hydraulic radius (area/wetted perimeter)
 - S = slope of pipe (m/m) - %

The minimum allowable size of a storm sewer shall be 300 mm.

The minimum allowable size of a single catchbasin lead shall be 200 mm.
The minimum allowable size of a double catchbasin lead shall be 300 mm.

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.0 Location and Design

11. Pipe Sizing (cont'd)

On private property, the size for storm building sewer shall be, in accordance with Part 7 of the OBC.

12. Flow Velocity

Velocities in storm sewers shall be calculated using the following formula:

$$V = \frac{Q}{A}$$

Where: V = flow velocity (m/s)
Q = Design flow (L/s)
A = cross sectional area of flow (m²)

Minimum and Maximum Velocities

The minimum velocity permitted in storm sewers is 1.0 m/s

The maximum velocity permitted in storm sewers are:

- a) 4.5 m/s for 300 mm to 825 mm diameter sewer, and
- b) 6.0 m/s for 900 mm diameter and larger storm sewers

To determine velocities based on actual flow, as per Figure 5.2 “Hydraulic Elements of Circular Pipe”.

Maximum Grades

- a) The minimum grade on a 300 mm diameter storm sewer is 0.50%.
- b) The minimum grade on all other sewer sizes shall be established by determining the minimum grade required to achieve a velocity of at least 1.0 m/s

13. Pipe Depth

Minimums

The minimum depth of a storm sewer shall be 1.5 m from the finished ground elevation to obvert of the pipe.

Maximum Depth of Cover

- a) Concrete Pipe - The maximum allowable cover permitted on concrete pipe shall be as per OPSD 807.01, 807.03, 807.04 and 807.05.

6.0 Location and Design

13. Pipe Depth (cont'd)

Maximum Depth of Cover (cont'd)

b) Flexible Pipe - The maximum allowable cover permitted on flexible pipe shall be as per OPSD 806.021, 806.040 and 806.06.

Vertical Separation

In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a sanitary sewer, a 0.30 m clearance shall be maintained between the two pipes. When crossing over or under a watermain, a 0.50 m clearance shall be maintained between the two pipes.

This practice must also be followed when storm laterals are in conflict with any sanitary sewer, watermain or water service.

Horizontal Separation

The minimum distance allowed by the Town and County for sanitary and storm sewers and watermain separation is 3.0 m, and should be constructed in separate trenches as per OPSS specifications.

If it is not possible to maintain this separation, approval by the Ministry of Environment is required.

14. Maintenance Holes

Maintenance holes shall be constructed as per OPSS 407. Where required, frost straps shall be installed as per OPSD 701.100.

The void between the sewer pipe and the cored hole of the precast maintenance hole shall be filled with cement bricks and approved non-shrinkable grout. All joints between bricks are to be completely filled with concrete mortar. Bricks shall be parged on the outside and inside of the maintenance hole. Parging shall contain an approved bonding agent. All mortar and approved non-shrinkable grout shall be mixed and placed in accordance with manufacturers specifications.

The Town has a maximum spacing between storm maintenance holes of no more than 115 m measured horizontally from centre of chamber to centre of chamber.

6.0 Location and Design

14. Maintenance Holes (cont'd)

When placing a maintenance hole in the vicinity of a roundabout, storm maintenance holes should be placed within the area of a roundabout. Storm maintenance holes are permitted to be located within the grassed area of the roundabout provided any proposed landscaping does not hinder the access to the maintenance hole.

Sizing Criteria

All sizing of storm pre-cast maintenance holes are based on incoming and outgoing pipe sizes and should be sized and conform to Town of Ingersoll Sizing Chart S-2.

Maintenance Hole Diameter

Precast maintenance hole diameter requirements shall be as per OPSD 701.

Maintenance Hole Frame and Grate

Maintenance hole frames and covers are required for all maintenance holes.

Maintenance hole frames and covers shall be as per OPSD 401.010 or OPSD 400.110 where the maintenance hole is located in the curb line.

For all of the above mentioned covers, a maximum of 150 mm of adjustment rings will be allowed, as per OPSD 704.01 and be effected by the use of precast concrete adjustment units or equivalent as approved by the Town Engineer.

When using precast concrete adjustment units, only approved PVC shims will be allowed. Concrete, clay brick and wood spacers will not be allowed.

Maintenance Hole Steps

Maintenance hole steps are required for access as per OPSD 405.010 or 405.020. Only steps supplied by the maintenance hole supplier will be accepted. They must be made of galvanized steel or aluminum. The reuse of existing steps is not acceptable.

The Town requires steps be installed as per OPSD 704.010.

6.0 Location and Design

14. Maintenance Holes (cont'd)

Maintenance Hole Drop Structures

The Town of Ingersoll requires that on any storm sewer structure where there is a drop of 600mm or more of fall from inlet invert to outlet invert, a drop structure is required.

External drop structures as per OPSD 1003.010 or 1003.020 will be accepted.

Internal drop structures shall be used in maintenance holes 1500 mm diameter and larger.

Drop pipes shall be one size smaller than the incoming sewer with a minimum of 150 mm diameter and a maximum of 375 mm diameter. Anchor straps shall not be placed within 150 mm of any maintenance hole section joint.

Internal drop structure system shall be as per OPSD 1003.030 for Existing Maintenance Holes and as per OPSD 1003.031 for New Maintenance Holes and must be approved by the Town Engineer.

Maintenance Hole Safety Landing

Maintenance hole safety landings shall be as per OPSD 404.020. Maintenance hole safety landings are required in maintenance holes with a depth of between 5.0 m and 10.0 m and should be shown on all proposed drawings or outlined in the general notes. All incoming pipes should be below any safety platform. Additional safety landings are required at third-point depths, when the maintenance hole is equal to or greater than 10.0 m to 15.0 m deep.

Waterproofing of Chambers and Manholes

In areas of high groundwater waterproofing of chambers and manholes is required.

Waterproofing membrane shall be supplied and installed on all exterior concrete surfaces of the chambers and manholes, including the edges of the base slab, up to within 300 mm of the cover elevation.

The membrane shall be applied over a prime or tack coat and hand rolled to assure positive adhesion. A compatible elastomeric mastic shall be applied to seal horizontal and vertical terminations, as a flashing and to form corner fillets.

6.0 Location and Design

14. Maintenance Holes (cont'd)

Waterproofing of Chambers and Manholes (cont'd)

Openings in walls or roof slabs for piping or access chimneys shall be sealed with two layers of membrane material and mastic to provide a tight seal.

Waterproofing membrane shall be Sealtight Mel-Rol waterproofing system as manufactured by W.R. Meadows or approved equal.

Benching

All maintenance holes require benching at the bottom of the maintenance hole. Benching shall be as per OPSD 701.021. Where benching is different from OPSD 701.021, a benching detail is required.

Should an existing maintenance hole require additional benching to improve the hydraulics then the existing benching should be removed and new benching placed to the obvert of the existing pipes.

Adjustment Units

Maintenance hole adjustment units shall be as per OPSD 704.010. Maintenance hole adjustment units are required on all maintenance holes to ensure that proper grade is provided between the top of the maintenance hole and the top of the maintenance hole lid. The difference in grade between the top of the maintenance hole lid and the first ladder rung shall not exceed 450 mm.

A maximum of 150 mm of adjustment rings will be allowed, as per OPSD 704.01 and be effected by the use of precast concrete adjustment units or equivalent as approved by the Town Engineer.

When using precast concrete adjustment units, only approved PVC shims will be allowed. Concrete, clay brick and wood spacers will not be allowed.

15. Stormceptor/Standard Treatment Cell

The Standard Treatment Cell (Stormceptor) was developed to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

6.0 Location and Design

15. Stormceptor/Standard Treatment Cell (cont'd)

The Town and/or UTRCA may require the use of STC's in any design where runoff may occur in downstream creeks and/or river, or as a storm water management tool.

Stormceptor Design

The Stormceptor design must allow for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

Using local historical rainfall data and continuous simulation modeling, the Stormceptor unit should be designed for each individual site and the corresponding water quality objectives.

Using the Stormceptor System, it can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

For single inlet pipes, the inlet to outlet invert elevations should not be more than 25mm to 75mm in difference. Where multiple pipe inverts are required, the invert elevations should not be more than 75mm in difference.

Stormceptor has a minimum cover from finish grade to invert of 1.2m, but this must be pre-approved by the Town engineer as it does not meet Town standards.

Type of Stormceptor

The Town will accept the following stormceptor products.

1. Inline Stormceptor

The Inline Stormceptor, is the standard design for most stormwater treatment applications. The design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

6.0 Location and Design

15. Stormceptor/Standard Treatment Cell (cont'd)

Type of Stormceptor (cont'd)

2. Inlet Stormceptor

The Inlet Stormceptor, is designed to provide protection in spill prone locations (ie. parking lots, loading bays and gas stations). The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

3. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

Installation

The installation of the concrete Stormceptor should conform to Ontario Provincial Specifications for installation of maintenance holes and as per the manufacturer's specifications.

Maintenance

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the manufacturer guideline values.

The Town requires an annual servicing complete with all records of the work being performed. The frequency of maintenance may need to be increased based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually).

6.0 Location and Design

15. Stormceptor/Standard Treatment Cell (cont'd)

Maintenance (cont'd)

Oil should be removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 600 mm opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port.
2. Remove any oil separately using a small portable pump.
3. Decant the water from the unit into a separate containment tank.
4. Remove the sludge from the bottom of the unit using the vacuum truck.
5. Document the complete procedure and submit a copy to the Town for their records.

16. Easements

Easements are required for all storm sewers to be assumed by the Town located outside a road allowance on privately owned property.

An easement is required to ensure that the municipal services and utilities crossing the site can be properly installed and maintained by the appropriate authority (Town and private). An easement provides the right to use private land for a specific purpose which is in the public's interest.

Type of Easement

Municipal (Servicing) Easement - is required for storm sewers that cross a site and which are maintained by the Town of Ingersoll.

Utility Easement - is required for telephone, hydro, gas and cable television services. Each utility company should be consulted for their specific requirements.

Private Servicing Easement - is required for private storm sewers that cross a parcel of land to service other private lands. A joint access and maintenance agreement between the interested parties shall be entered into.

Temporary Easements and Working Easements - are required for storm sewers that cross a site temporarily. The services in the easement are to be maintained by the owner of the services.

6.0 Location and Design

16. Easements (cont'd)

Minimum Easement Widths

Easement widths are determined by the depth of cover from the centerline of the road/ground to the invert of a sewer or a minimum width of 5.0 m (2.5 m each side of pipe), assuming no other services are located within the easement.

17. Catchbasins

Catchbasins shall be constructed as per OPSS 407 with standard 600 mm sump unless otherwise specified. Catchbasins are to be provided to collect drainage from both pervious and impervious areas. The following are the general guidelines to be used in the provision of catchbasins and catchbasin leads.

Location

- a) Street – On street corners and intersections, the catchbasin is to be located at end of radii of beginning of curb (BC) and end of curve (EC) of the curvature.
- b) Lot/Rear Yard – The catchbasin and lead are to be located 0.6 m from the property lines, entirely on one lot or block.
- c) Parks – Catchbasins are to be located to minimize flow across pathways and provide positive drainage from park facility.

Minimum Lead Diameter and Grade

- a) Street – The minimum diameter and grade of a catchbasin lead on a street is 200 mm @ 1.0%
- b) Lot/Rear Yard – The minimum diameter and grade of a catchbasin lead in a rear yard is 300 mm @ 1.0%
- c) Parks – The minimum diameter and grade of a catchbasin lead in a rear yard is 300 mm @ 1.0%

Spacing

The desired maximum distance between catchbasins or from a crest in a road to a catchbasin is 75 m, measured along the curb line on each side of the road.

6.0 Location and Design

16. Catchbasins (cont'd)

Depth of Cover

The minimum depth of cover over a catchbasin lead is to be 1.5 m within the road allowance and 1.2 m off the road allowance. Where minimum depths cannot be achieved and therefore frost protection is warranted, insulation shall be required.

Allowable Ponding

No surface ponding is allowed to develop under a 2 year design storm event. Ponding on major overland flow routes allows for 300 mm on street catchbasins and 450 mm on rear yard catchbasins.

Requirement for Leads

Standard catchbasins (600 mm x 600 mm), maintenance hole catchbasins and maintenance holes are to be constructed/connected in accordance with the following:

- a) Catchbasins must have their leads connected into the main sewer, unless otherwise approved by the Town Engineer.
- b) Catchbasins within 3.0 m of a maintenance hole are to have their leads connected into the maintenance hole.
- c) Catchbasin leads over 15.0 m in length must be connected into a maintenance hole.
- d) Where new leads are to be placed within an existing PVC or HDPE storm system, the existing pipe must be cut out and a new tee placed for lateral connection.
- e) Where new leads are to be placed within an existing concrete storm system, the existing pipe must be cored out and a sealed gasket assembly installed for lateral connection.

6.0 Location and Design

16. Catchbasins (cont'd)

Catchbasin Frame and Grate

The Town of Ingersoll will accept the following types of frame and grates:

- a) On all Town right of ways and road surfaces - OPSD 400.110 - Cast Iron , Square Frame with Square Overflow Type Flat Grate for Catch Basins, Perforated Openings
- b) On all Town road surfaces where catchbasins must be set back due to utilities etc. – OPSD 400.082 – Cast Iron, Raised Curb Inlet Frame with Cover for Catchbasins Out of Roadway
- c) On all Town right of ways and existing ditches etc. – OPSD 403.010 - Galvanized Steel, Honey Comb Grating for Ditch Inlets

Catchbasin Steps

- a) Maintenance Hole Steps – Hollow - To be constructed as per OPSD 405.010.
- b) Maintenance Hole Steps – Solid - To be constructed as per OPSD 405.020

Catchbasin Subdrains

Pipe subdrains shall be provided on both sides of all catchbasins installed in hard surface areas. Subdrains are not required in rear lot catchbasins or in a catchbasin located in grassed areas.

All subdrains shall be 150 mm diameter, minimum 3.0 m long, of perforated PVC pipe with geotextile filter sock MIRAFI 150N or Terrafix 200R. Pipe ends to be capped.

6.1 Storm Sewer Inlet and Outlet Structures – Headwalls

Headwalls are required at the end of all storm sewer systems which provide for a transition from the storm sewer to an open channel, river, creek, SWM pond or other received body of storm water. In some cases, headwalls are required at the inlet of a storm sewer and/or large storm drain.

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.1 Storm Sewer Inlet and Outlet Structures – Headwalls

1. Types of Headwall

The following headwall designs are based on the velocity and in certain cases the diameter of the storm sewer, as per Municipal Works Design Manual (Municipal Engineers Association – MEA) and OPSD.

There are five types of headwall designs:

- a) Under 1.3 m/s with pipe diameters under 600 mm – as per OPSD 804.03
- b) Under 2.1 m/s – MEA Type 1, as per OPSD 804.04 where applicable or detail design modifying of OPSD 804.04.
- c) Between 2.1 – 2.7 m/s – MEA Type 2, as per OPSD 804.04 where applicable or detailed design modifying OPSD 804.04 and 1 baffle post.
- d) Between 2.7 – 4.6 m/s – MEA Type 3, as per OPSD 804.04 where applicable, or detailed design modifying OPSD 804.04 and 3 baffle post.
- e) Between 4.6 – 10.0 m/s – MEA Type 4 (stilling basin) or detail design.

2. Concrete Strength

The concrete for all headwalls is to have a minimum strength of 30 MPa with a 5% to 7% air entrainment and 70 to 90 mm slump.

3. Chamfers

All exposed corners of all headwalls should be chamfered 25 mm or more depending on the size of the headwall.

4. Weeping Tiles

Weeping tiles are to be provided on each side at the base of the sewer outlet and extended through the headwall. On larger headwalls they shall be placed on the side or wing walls.

5. Baffle Posts

Baffle posts are to be provided for sewer flows between 2.1 m/s and 4.6 m/s. The location of the posts are per the type of headwall. The height of the baffle posts should be equal to the full depth of flow. Sizing of the posts are 1/6 the size of the pipe diameter together with reinforcing bars.

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.1 Storm Sewer Inlet and Outlet Structures – Headwalls

6. Grill/Grates

Hot dipped galvanized grills/gates are to be placed over the storm outlets horizontally or vertically as required and should be fixed to the headwall with anchor bolts. Grills and gates as per OPSD 804.05.

7. Railing

A railing is required on all headwalls which exceed 1.0 m in height from the top of the headwall to the proposed top of slope, as per OPSD 980.101.

8. Rip Rap/Rock Protection

Rip rap is to be constructed as per OPSD 810.01 at the end of headwalls, on the bottom and sides up to design water level, downstream until the projected side wall meets the channel slope at half the design water depth of flow, and at creeks and rivers.

6.2 Material

1. Pipe Material

Both rigid and flexible pipe are permitted in the construction of storm sewer systems including catchbasin leads. These materials include concrete, polyvinyl chloride (PVC) and high-density polyethylene (HDPE). All materials shall be CSA certified. **Field cut tees will not be permitted.**

Should the use of private drain connection be deemed necessary, then the material list above is acceptable for this situation.

On private property, materials for storm sewers and private sewers shall comply with Part 7 of the OBC.

The Contractor must get approval for pipe selection from the Town of Ingersoll prior to supplying the material to the site.

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.2 Material

2. Approved Material

Polyvinyl chloride (PVC)

- a) Polyvinyl chloride (PVC) pipe – smooth wall (CSA B182.2) – 100 mm – 600mm inclusive. Storm PVC main shall be SDR 35 as per OPSS 1841.
- b) Polyvinyl chloride (PVC) pipe – ribbed (CSA B182.4) – 200 mm – 600 mm pipe inclusive.

Where Storm PDC's are required, they must be PVC SDR-28 (white) and have a factory placed tee at the main. All PVC and fabricated moldings shall be CSA certified.

Concrete

Trench conditions shall be determined by the Consulting Engineer. Trench conditions shall be as per OPSD 807.010, 807.030, and 807.040. Concrete pipe material must comply with the following CSA requirements.

- a) Non-Reinforced – CAN/CSA257.1 Class 3 concrete for pipes 450 mm or less in diameter.
- b) Reinforced – CAN/CSA257.2 65-D concrete for pipes more than 450 mm in diameter.

High-Density Polyethylene (HDPE)

High-density polyethylene (HDPE) double wall smooth interior annular profile pipe (CSA B182.6) with integral bell and spigot (Boss Poly-Tite) for use on storm sewer only (200 mm to 600 mm inclusive).

3. Directional Drilling Material

Pipe material used for directional drilling shall be HDPE DR11 DIPS (Brown Stripe) or PVC. PVC pipe used for the directional drilling process must meet or exceed the pressure rating of HDPE DR 11.

For directional drilling of PVC pipe only the “Terra Brute”, “Cobra Lock” or fusible PVC jointing process shall be permitted. Inside diameters shall meet or exceed typical sizing requirements associated with PVC pipe.

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.2 Material

3. Directional Drilling Material (cont'd)

HDPE fittings shall be butt fusion or mechanical joint only as per AWWA Specifications C110, C153 and C906. Push-on fittings are not permitted.

Pipe fittings including tees, bends, service saddles, etc. shall be rated at the same pressure rating or higher than the pipe. Mechanical joint adaptors shall include stiffener or as specified by the pipe manufacturer.

4. Bedding Material

All pipe bedding should be designed from a Geotechnical Reports as specified in Section 5.0 - 4, and should be in accordance with OPSD 802.010 for flexible pipe and OPSD 802.030 and OPSD 802.031 for rigid pipe.

The bedding material should consist of a bedding sand material meeting OPSS 401.05.02 requirements, and should be specified in all contract documents.

Should a Geotechnical Report identify an area in question or a field determination is made by the Town of Ingersoll of wet conditions, than clear stone or crushed stone bedding may be used as bedding below the spring line of the pipe necessary to facilitate dewatering and provide stabilization to the excavation base.

6.3 Installation

The installation of storm sewers shall be as per OPSS 401, 404, 410, 517, and 1010 with the following exceptions/amendments.

1. Open Cut

Line and Grade

- a) Contractors shall provide stakes to indicate the line and grade of the storm sewer as well as the location of fittings, bends, tees, reducers and plugged or capped dead-ends in accordance with the approved drawings before beginning any work. Line and grades shall be marked a minimum of 20 m to a maximum of 50 m. Mains shall be laid and maintained to the required grades and locations with all fittings, etc. to be plumb and in accordance with the drawing locations. No deviation in excess of 150 mm will be permitted.
- b) Contractors shall carry out explorations where necessary to establish or discover the location and elevation of existing pipes, conduits or other buried objects.

6.3 Installation

1. Open Cut (cont'd)

Frozen Ground

Existing or imported material is not allowed to be placed on frozen ground. Should the bottom of the trench become frozen remove and replace the frozen material with bedding material compacted to 100 percent Standard Proctor Density.

Excavation and Trench Preparation

- a) All excavations and trenching operations shall comply with the associated provisions of the Construction Projects Regulation (O.Reg 213/91). Trenches shall be provided so that pipe can be laid with the proper alignment and depth so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at all points between the Bell holes.
- b) Where trench excavations are not kept within the design limits of the pipe, the Town Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.
- c) Where the sub-grade in its natural state is inadequate to support the pipe, the Town Engineer will give instructions as to the proper procedure.
- d) The sub grade shall be removed where it has been adversely changed by construction operations and is not adequate to support the pipe. Replace with crushed stone or other approved material as directed by the Town Engineer.

Dewatering

- a) Where dewatering work has been predetermined (ie Geotechnical Report), all MOE approvals must be completed prior to the beginning of any storm sewer work.
- b) Always maintain the excavation free of water.
- c) The use of storm sewers for the discharge of water from the trench is prohibited, unless otherwise approved by the Town Engineer.

Lowering & Laying

- a) Before lowering and while suspended, the pipe shall be inspected for defects. Proper implements, tools and facilities as required by the Town Engineer

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.3 Installation

1. Open Cut (cont'd)

Lowering & Laying (cont'd)

shall be provided by the Contractor. All materials shall be lowered into the trenches by suitable means.

- b) The interior of the pipe shall be inspected and completely cleaned of all sand or foreign materials before placing in the line. No foreign materials are to be placed in the pipe during its laying.
- c) The inside of the bell and the outside of the spigot shall be brushed and free from all oil, grease or dirt before jointing. Precautions must be taken to prevent dirt from entering the joint space. At all times when pipe laying is not in progress the open ends of the pipe shall be closed by water-tight plugs or other means approved by the Inspector. This must be adhered to during the noon hour as well as overnight. The trench shall be kept dry and free from water, no pipe shall be laid in water except by permission of the Town Engineer. No water shall be allowed to run through installations during construction.
- d) Cutting of the pipe shall be done in a neat manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.
- e) Pipe shall be laid with the bell ends facing in the direction of laying. Deviation from this shall only be permitted by the Town Engineer.
- f) At grades above 10 percent, laying shall start at the bottom with the bell ends facing upward. When deflection in the line laying is required, either in the vertical or horizontal plane, the deflection may be made at the joints with the maximum allowable deflections not being exceeded. Pipe deflection will be done as per manufacture's specifications. If in the opinion of the Inspector, the deflection is excessive they will order the job stopped. The Town Engineer or their representative, if they deems it required, will order the installation of specials in order to provide the required deflection. Offset locations and details shall be shown on Construction and As-Constructed Plans.
- g) When a new sewer crosses existing utilities, or where an existing watermain is undermined during laying operations, the Town Engineer may order the installation of support beams. Support beams shall be approved by the Town Engineer prior to placement. The removal or replacement of an undermined section of the existing watermain or sewer may also be required. The Town

6.3 Installation

1. Open Cut (cont'd)

Lowering & Laying (cont'd)

Engineer shall decide the method to be used. In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150 mm layers to a minimum of 95 percent Standard Proctor density. Pipe must not be laid on blocks.

- h) No pipe shall be laid until the preceding pipe joint has been compacted and the pipe carefully embedded and secured in place.
- i) All pipe and fittings shall be installed strictly in accordance with the manufacturer's instructions. At least two copies of the manufacturer's manual of instructions shall be kept on the job site; one copy in the possession of the foreman, the other with the pipe layers.
- j) Installations shall be kept thoroughly clean throughout, during the progress of the work and until the completion and final acceptance thereof. They shall be left clean on the completion of the work.
- k) The Contractor shall supply all fittings to complete the installation to the lines and grades shown on the drawings. Where vertical or horizontal curves are shown, the pipe line shall not deviate more than 300 mm from line, no more than 75 mm from grade.

Bedding

For the purpose of this specification all materials placed between the trench bottom and 300 mm over the top of the pipe shall be considered as bedding.

- a) The bedding material should consist of a bedding sand material meeting OPSS 401.05.02 requirements, and should be specified in all contract documents.
- b) Bedding material shall be placed full width of trench. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.
- c) The depth of trench excavations shall be sufficient to allow for the bedding required below the pipe invert.

6.3 Installation

1. Open Cut (cont'd)

Bedding (cont'd)

- d) The Inspector may order the trench to be bedded by hand from the bottom of the trench to the centre line of the pipe with sand, placed in layers of 75 mm and compacted by vibratory equipment. Bedding material shall be deposited on each side of the pipe simultaneously.
- e) From the centre line of the pipe, fittings and appurtenances to a depth of 300 mm above the top of the pipe shall be backfilled by machine or by methods approved by the Inspector. The type of backfill material used shall be sand, gravel or approved excavated material. The Contractor shall use special care in placing and compacting this portion of the backfill so as to avoid damaging or moving the pipe.

Backfilling

- a) Backfill shall be considered as starting from 300 mm over top of the pipe. All materials below this point shall be considered as bedding.
- b) If the Town Engineer decides that the site selected excavation material either wholly or partially, is not suitable for backfill, then suitable imported material shall be provided of a type approved by the County Engineer.
- c) Backfill trenches from the top of the pipe bedding to the underside of surface restoration with site selected excavated material. Provide backfill free of roots, organic material and stone larger than 250 mm. Backfill material shall be placed in lifts not exceeding 300 mm and compact to 95 percent Standard Proctor Density.
- d) Backfilling on a public road allowance, either Town or County within the Town of Ingersoll or in an area that is to be designated as a public road allowance within the Town, shall be done in accordance with the requirements of the Town Engineer. Backfill on all travelled portion of the roadway within the road allowances in the Town shall be granular material as set out in the Ontario Provincial Standards.

Installation of material will be as directed by the Town Engineer.

- e) No frozen material shall be used for backfilling nor shall backfilling be carried out where material in the trench is frozen.

6.3 Installation

1. Open Cut (cont'd)

Backfilling (cont'd)

- f) The surface shall be restored so that all pavement, sidewalks, curbs, gutters, shrubbery, fences, poles, sod and other property and surface structures removed or disturbed during the work shall be restored to a condition at least equal to that before the work began.

Compaction Test

The Town of Ingersoll requires compaction tests on all trench backfill to be carried by an independent testing company. All test results must be submitted to the Town before any assumption of storm sewer.

The Town of Ingersoll must approve the testing company before any work can be completed.

Test requirements:

- a) For backfill compaction, tests will be performed in accordance with the testing company's recommendations.
- b) Scheduling the placing and compaction of backfill so that tests can be progressively taken.
- c) When tests show that the compaction does not meet the specified requirement, the Contractor will carry out further compaction in a manner directed by the Town Engineer, and pay for further testing to establish proof of the specified compaction.

2. Direction Drilling

This specification covers the requirements for the installation of pipes by horizontal directional drilling.

Definitions

Directional drilling is defined as trenchless installation of pipes pulled through a drilled and reamed hole.

6.3 Installation

2. Direction Drilling (cont'd)

Definitions (cont'd)

A pilot hole is drilled under and across the surface area that cannot be disturbed along a predetermined horizontal and vertical design profile. Direction and elevation is controlled by a steering mechanism in the drill string just behind the cutting head.

Reaming is enlargement of pilot hole to a suitable size to allow for the installation of the pipe.

Submission

Submit shop drawings showing all equipment and plans required to complete the pipe installation by direction boring. This information shall include:

- a) Direction boring equipment and specifications;
- b) Sequence of operation;
- c) Location of entry and exit points;
- d) Location of positioning of individual plant items such as drilling equipment, slurry holding tanks, power generation units, slurry recovery units and pumps, etc;
- e) Disposal site for cuttings;
- f) Dewatering plan; and
- g) Slurry management plan.

Design Requirements

Procedures, materials, and water management plan are to be acceptable to the Ministry of Environment (MOE), Ministry of Natural Resources (MNR), local Conservation Authority and the other public agencies having jurisdiction over the project.

All plant, personnel and construction activity must be contained within working areas or easement limits shown on the Contract Drawings.

6.3 Installation

2. Direction Drilling (cont'd)

Record Drawing Requirements

Record drawings shall be provided following pipe installation. Record drawings shall include the following details:

- a) Horizontal (plan) location of installed pipe tied to known reference points.
- b) Profile of the installed pipe with elevations.
- c) Location of all joints and flanged connections tied to known reference.
- d) Subsurface ground conditions encountered (soil, clay, rock, etc.)

Equipment

The drilling equipment shall be suitable for installation of the pipe size and length required. The boring equipment shall consist of: the drilling rig, cutting and steering head, drill stems, power and control equipment, mixing tanks for drilling fluids and a slurry recovery system.

The steering system shall include a probe situated behind the cutting head that can interface with an above ground portable computer control console. The probe shall be able to indicate the orientation of the steering and cutting tool.

The cutting tool shall be steerable from the above ground computer control console so that any deviation from the design alignment can be corrected as boring progresses.

The drilling equipment shall be capable of being retractable and reset to a different horizontal alignment should obstacles such as boulders, tree roots, etc. be encountered. The Contractor shall not change the vertical alignment without the approval of the Town Engineer.

A surface probe shall be provided that can detect the location and depth of the cutting tool/steering system. The surface probe shall be used to confirm that the pipe alignment is within the easement and at the location identified.

Construction

The Contractor shall provide all necessary equipment, drilling fluids, and power to perform the work specified.

6.3 Installation

2. Direction Drilling (cont'd)

Dewatering

The proposed dewatering method for the entry and exit pits and all excavations shall not be modified without written consent from the Town Engineer.

All water extracted during any dewatering process shall be diverted through a filter system or settling ponds/basins to ensure minimum sediment transport. The filter system or ponds/basins shall be located so as not to interfere with normal construction activity and the public use of such areas.

Line and Grade

Line and grade control will be maintained to the locations and elevations on the Contract Drawings. Variations in grade will not be acceptable.

The control system must be capable of maintaining line and grade to ± 100 mm over the total distance between the ground entry and exit points.

Soil Transportation System

The directional boring system shall have a slurry system designed to enable excavated soil removal. The slurry system shall have a system of screens and desilting/sedimentation tanks to separate the soil from the slurry. The drilling fluids may be transported to the drill rig for reuse. Disposal of the slurry on-site or into drainage systems will not be permitted.

Entry and Exit Points

The Contractor shall review site conditions and make an assessment of entry and exit points.

Assessment shall take the following items into consideration:

- a) Entry and exit angles to facilitate boring equipment and allow for pulling pipe into reamed hole.
- b) Setbacks or open cut excavation requirements at entry and exit points to provide the pipe profile and construction of appurtenances as indicated on the Contract Drawings.
- c) Location of other surface features (eg. adjacent structures, walkways, fences, poles, trees, etc.)
- d) Location of other underground features (eg. utilities, foundations, etc.)

6.3 Installation

2. Direction Drilling (cont'd)

Entry and Exit Points (cont'd)

- e) Protection of water courses against the transport of excavated or other materials into receiving waters.

Pipe Installation

High Density Polyethylene (HDPE) pipe shall be butt fusion welded to the required length at ground surface. PVC pipe shall be joined using the jointing process. The pipe shall not be laid to a radius greater than that recommended by the pipe manufacturer.

The successfully tested pipe shall then be installed in the reamed hole. The Contractor shall ensure by the use of shear couplings or other means that the amount of tension applied does not exceed the tensile capacity of the pipe during the pipe installation process.

The Contractor shall allow sufficient time for the longitudinal stresses in the HDPE to dissipate before the pipe is cut for connection.

The installed pipe shall be cut to the length and at elevations detailed in the contract drawings. The ends of the pipe shall be prepared for butt fused flanged connections. All joints shall be restrained.

Disposal of Materials

Surplus excavated material and slurry shall be disposed off-site. The Contractor shall make his own arrangements for off-site disposal and for carrying out soil tests to ensure that disposal is consistent with MOE guidelines, policies and regulations.

3. Connections

Connections to Existing Sewers

The Contractor shall notify the Town of Ingersoll in writing a minimum of 48 hours in advance of their intention to connect to the existing storm sewer. The method of connecting shall be determined by the Town Engineer. The Contractor shall submit a program for this work which shall be approved by the Town Engineer before the work commences.

6.3 Installation

2. Direction Drilling (cont'd)

Jointing of Push on Joint Pipes

- a) The jointing of the Push On pipes will be in accordance with the pipe manufacturer's specifications. Joints shall be bell and spigot with rubber gaskets.
- b) The deflection of Push On joint pipes, in order to form long radius curves, shall not exceed the manufacturer's recommendations.
- c) On straight lengths, no lateral deviation in excess of 150 mm will be tolerated and on straight grades no grade deviation in excess of 75 mm will be tolerated.

6.4 Service Installation

Storm sewer private drain connections (PDC's) are not permitted on Town or County Roads within the Town of Ingersoll.

If a storm PDC is required it will be as approved by the Town of Ingersoll.

Storm sewer PDC's when required shall be installed as described in this section.

Location

Private Drain Connections (PDC's) to single family, semi detached and row housing lots are to be located in accordance with **Town Standard Drawing S-XX**.

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 Town Engineer.

PDC's on private property of 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. Under no circumstances will flow from the PDC enter the main against the flow in the main. Connections shall be as per OPSD 1006.010 or OPSD 1006.020.

6.4 Service Installation

Location (cont'd)

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

Minimum Size and Grade

All residential, commercial, industrial, and institutional private drain connections shall be sized according to the design criteria and must be shown on all design sheets and drawings for approval by the Town Engineer.

The following are the minimum standards:

- a) For residential, single family and semi-detached homes, the minimum diameter of pipe is 100 mm with a minimum allowable grade of 2.0%.
- b) For multi-family block, the minimum diameter of pipe is 300 mm with a minimum grade of 1.0%
- c) For commercial, the minimum diameter of pipe is 300 mm with a minimum allowable grade of 1.0%.
- d) For institutional and industrial, the minimum diameter of pipe is 375 mm with a minimum allowable grade of 1.0%.

Connections to Maintenance Holes/Sewers

When connecting PDC's to existing sewers in a lot infill situation, connections must be made with an approved saddle or premanufactured tees, as per OPSS 410 and OPSD 1006.020. Drop structures for maintenance holes shall be as per OPSS 1003.010, 1003.020, 1003.030, and 1003.031.

- a) Residential - PDC's of 100 mm, 150 mm, 200 mm, and 250 mm in diameter must be connected to the main sewer. No storm PDC's of this size are to be connected into any maintenance hole.
- b) Multi-family, Commercial, Institutional and Industrial - PDC's of 300 mm in diameter or larger are to be connected to the main sewer at maintenance holes, except in the cases where the main sewer is 900 mm in diameter or larger, in which the PDC may be connected directly into the sewer.
- c) Connections to Existing Sewers - In situations of a lot severance or lot infill where a new storm service will be connected to an existing main, the advocate of the severance/infill, or their agent, must determine if the existing

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.4 Service Installation

Connections to Maintenance Holes/Sewers (cont'd)

sewer is at risk for surcharging or has a history of surcharging. This information, if available, may be obtained from the Town of Ingersoll.

If it is determined that there is a surcharge risk, then the development advocate must provide surcharge protection to their development. Connection can only occur if a Town Inspector is present.

When connecting to existing manholes only cored holes with proper rubber connectors are acceptable. Written notice is required 48 hours in advance to schedule an inspection.

Vertical Clearance

As outlined in 5.0 – 13. of this Section, the Town has established a minimum clearance, when storm sewers cross other services. In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a sanitary sewer, a 0.30 m clearance is required between the two pipes.

When crossing over or under a watermain, a 0.50 m clearance is required between the two pipes.

Where there is conflict in crossing existing utilities, and the utility is unable to relocate, a separation of 0.15 m is required between the two.

Risers

Risers may be required in situations where there is a conflict of sewers or a greater than expected grade change. These risers must be manufactured, approved, supplied and placed as per OPSD 704.010.

Cleanouts

Where PDC's cleanouts are required within the R.O.W., approval must be granted by the Town Engineer.

Where private maintenance hole cleanouts are required, they shall be located off of the R.O.W. For private PDC cleanouts, Part 7 of the OBC takes precedence.

SECTION 6 STORM SEWER COLLECTION SYSTEMS

6.4 Service Installation

Depth

The minimum depth of a storm PDC shall be 1.2 m from the finished property line elevation to the obvert of the pipe. In existing areas where new sewers are being constructed, the depth of service at property line may vary based on main line sewer designs and existing topography. The Town of Ingersoll does not guarantee basement drainage.

Where storm PDC's are installed at depths of 3.5m or greater, laterals shall require a controlled settlement joint fitting. When the lateral is installed between 45° and 67.5° the controlled settlement joint shall be installed at the sewer tee. The controlled settlement joint permits axial movement of the riser when laterals are placed in deep excavations.

Marking and Recording of PDC Service Connections

Green painted and labeled surface stakes 50 mm x 100 mm shall be placed during trench restoration to mark the termination of the storm PDC. These stakes shall extend from PDC invert to minimum 500 mm about finished boulevard grade.

Once the PDC has been placed, a record of its location must be produced for the As-Constructed drawings and provided digitally to the Town. Pipes are to be located on these drawings by showing proper plan view locations 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 property line.

6.5 CCTV Inspection

The Owner/Developer or Contractor must have CCTV Inspection of all newly installed storm pipe. This CCTV inspection company shall be hired at the contractor's expense and of the contractors choosing.

All sewer inspection shall follow OPSS 409.

Flushing and Cleaning

The purpose for flushing and cleaning is to facilitate the CCTV Inspection of the sewer mains.

Completion of the CCTV Inspection shall occur within 24 hours of flushing and cleaning. During this time, it is the Contractor's responsibility to ensure that the main remains clean. If any damages occur from negligent cleaning and flushing operations, the contractor shall be held fully responsible.

SECTION 6
STORM SEWER COLLECTION SYSTEMS

6.5 CCTV Inspection

Flushing and Cleaning (cont'd)

The purpose of flushing is not to clean the pipe but to remove any obstructions that might prevent the CCTV Inspection from being completed. Any debris flushed back to the manhole must be removed and disposed of accordingly. If excessive debris is found during the CCTV inspection the inspection will be halted and the main cleaned until deemed acceptable. The flushing will also allow the video inspection to pick up any standing water (ponding) within the pipe.

The Contractor shall be responsible for the transporting and disposal of all waste material associated with cleaning and/or flushing to an approved disposal site. The term debris includes sludge, dirt, rock, grease (that can be removed by flushing), and other solid or semisolid materials. Abandoning of foreign materials in adjoining sewer lines is strictly prohibited.

Prior to work commencement, the Contractor shall provide the Town with written approval from all receivers accepting the waste materials generated from the flushing/cleaning operation. The approval notice shall be addressed to the Contractor and the receiver's M.O.E. Registration Number must be indicated.

The Contractor shall provide the Town with copies of all disposal tickets from the receiver.

Video Inspection

Storm sewer pipes and structures including catch basin leads and catch basin structures shall be cleaned and flushed prior to video inspection.

The contractor shall video inspect all storm pipes with either a Town inspector present, or with notification to the Town's Inspector including the date and time of the proposed inspection. The deficiencies that are found shall be rectified immediately and the relevant sewers and appurtenances re-videoed at the contractor's expense prior to the Town establishing the date of substantial performance or final assumption.

6.5 CCTV Inspection

Video Inspection (cont'd)

Video reports shall be submitted to the Town in the following formats, with the noted number of copies, within 10 Business Days of the completion of the fieldwork:

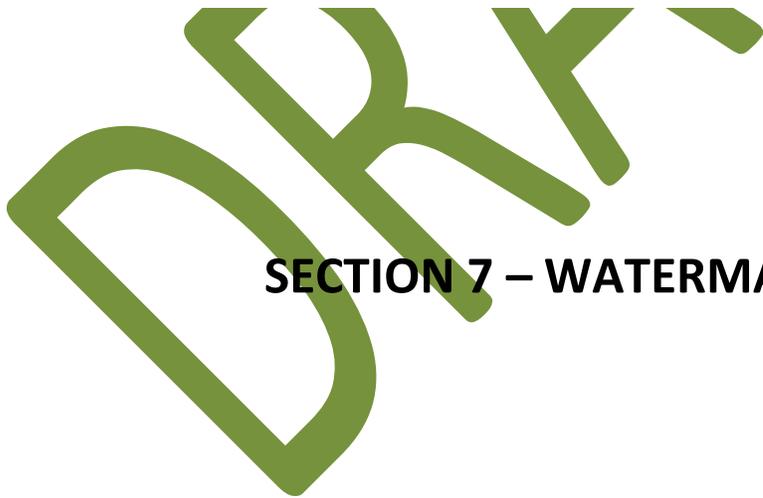
- a) 2 copies of the printed survey report.
- b) 2 copies of the digital video on a USB flashdrive, each containing the identical survey report information as in the printed copies.
(VHS video tape submission is not acceptable)

Entire inspections shall be contained within one USB flashdrive.

When possible, reverse set-up inspections shall be recorded immediately after the original inspection.

No top lift asphalt shall not be permitted until the required CCTV report has been submitted to the Town for their final approval.

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SECTION 7 – WATERMAIN

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7.0 Ownership

The County of Oxford is the sole owner of the well water supply system as all of the components of the watermain systems fed from these wells, constructed within the right of ways and easements throughout the Town of Ingersoll. The Town of Ingersoll in conjunction with the County of Oxford is responsible for all reviews of proposed and reconstructed wastewater systems designed for County's Assumption. However, the County of Oxford has final approval on acceptance of design and completion of work before assumption.

7.1 Materials, Design, Construction and Testing

All proposed new and reconstructed sanitary projects within the Town of Ingersoll must follow the County of Oxford – Design Guidelines and Supplemental Specifications for Municipal Services - Section 3 – Watermain.

This Guideline is located on the County of Oxford website at:

<http://www.oxfordcounty.ca/Services-for-You/Water-Wastewater/Design-guidelines>

On private property the design, construction, materials, and testing shall comply with Part 7 of the Ontario Building Codes

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**SECTION 8 – STREET LIGHTING,
TRAFFIC SIGNALS and SIGNS**

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**SECTION 8 – STREET LIGHTING
And TRAFFIC SIGNALS**

8.0 Street Lighting Warrants

Street lighting shall be considered warranted on all urban roads within the Town of Ingersoll.

8.1 Street Lighting - Design Criteria

1. Source Type

All light sources shall be of the Light Emitting Diode Type or L.E.D. type.

2. Wattage

Cobra Lamp Wattages

Composed of 32 to 48 High Performance L.E.D.'s. 42-80 Watt Lamp Wattage. Color Temperature 4000 Kelvin nominal, 70 CRI. Operating Lifespan 100,000 hours after which 50% still emits over 70% of its original lumen output. Optical system (LE3) I.E.S. type III.

Town of Ingersoll has chosen a fixture supplied by Philips as Model numbers, RVS-42W32LED4K-R-LE3-UNIV-API-BL-DMG-012-RC-NP, RVS-55W48LEDK-R-LE3-UNIV-API-BL-DMG-009-RC-NP, RVS-80W48LED4K-R-LE3-UNIV-API-BL-DMG-008-RC-NP or approved equivalent.

Decorative Lamp Wattages

Composed of 48 or 49 High Performance L.E.D.'s. 55-90 Watt Lamp Wattage. Color Temperature 4000 Kelvin nominal, 70 CRI. Operating Lifespan 100,000 hours after which the system emits 70% of its original lumen output. Optical system (LE3) I.E.S. type III.

Town of Ingersoll has chosen a fixture supplied by Philips as Model numbers, L40U-STM-90W49LED4K-ACDR-C-LE3-120-API-RC-BKTX, MPTC-55(80)W48LED4K-ES-LES-120-API-RC-NP or approved equivalent.

**SECTION 8 – STREET LIGHTING
And TRAFFIC SIGNALS**

8.1 Street Lighting - Design Criteria (cont'd)

3. Illumination Design Levels

All design criteria shall be in accordance with, or exceed current I.E.S. standards.

Lighting levels are measured in two ways Average Maintained Footcandles.

The metric equivalent of (A.M.F.C.) is measured in Lux. The conversion from Footcandles to Lux is $(FC \times 10.76) = Lux$.

The A.M.F.C. (Average Maintained Footcandles) and uniformity ratios for Municipal roads shall be:

<u>Type of Road</u>	<u>A.M.F.C.</u>	<u>Average to Minimum Ratio</u>
Arterial	0.8	3:1
Collector	0.6	4:1
Local	0.4	4:1
Rural Local	0.2	8:1
Walkways	0.2	8:1

A.M.F.C. is to be within 0.05 of requirements.

Intersections shall have an illumination equal to the sum of values of the intersecting roadways and shall show stopped cars in silhouette.

4. Pole Locations

Preferred installation of street light fixtures is to be on one side of street. Staggered orientation of street light fixtures will require approval from the Town.

Poles shall be installed as per the municipality's roadway standards.

5. Wiring

All wiring in new subdivisions to be underground and the lighting completed prior to occupancy.

Typical streetlight conductor is to be 8/2 copper NMWU-90. Conductor must be direct buried in the utility trench. In road crossings, the conductor is to be installed in minimum 50mm diameter DBII conduit.

**SECTION 8 – STREET LIGHTING
And TRAFFIC SIGNALS**

8.1 Street Lighting - Design Criteria (cont'd)

6. Inspection

Final installation shall be inspected by and subject to the Town of Ingersoll & or E.S.A. inspection/approval.

7. Standard Design - Roadway Lighting

Luminaire: Shall be of the “Cobra Head” type, distribution III medium cut off, composed of 32-48 high-performance white LEDs, individually photo controlled and internally ballasted.

Photometrics: Shall be of the type (LE3), IES type III (asymmetrical). System rated IP66. Photometric performance shall be tested per LM63, LM79 and TM15 (IESNA) in order to certify the performance of the fixture.

Mounting Height: Luminaires shall be mounted at a thirty-two foot (32) foot +/- 4 feet height.

Bracket/Davit: Shall be tapered elliptical aluminum. Brackets shall be bolted directly to the pole (banding is prohibited). Bracket lengths shall be as required to position the luminaire with two (2) feet + over the near edge of the travelled portion of the road. In no case shall the bracket exceed ten (10) feet.

Poles: Shall be either spun concrete tapered, or Aluminum tapered and of sufficient size and structural capability to support the type of fixture as required and at the heights required.

Cross Section:	Tapered Round
Finish:	Smooth concrete//Aluminum
Colour:	Natural concrete grey or natural Aluminum

All materials shall be of the best quality and shall be vandal resistant with poly carbonate or glass lens or equivalent approved by the Vice President/Roads Superintendent.

Spacing: Shall be on one side of the road spaced at 40m to 45m for Cobra head style installations, preferred. Staggered installation accepted upon approval.

SECTION 8 – STREET LIGHTING And TRAFFIC SIGNALS

8.1 Street Lighting - Design Criteria (cont'd)

8. Decorative Design - Subdivisions and Walkways

Option 1 - Roadway Lighting

Luminaire: Shall be of the “Lantern” type, distribution type III medium cutoff, composed of 49 high performance white LEDs, individually photo controlled and internally ballasted.

Photometrics: Shall be of the type (LE3), IES type III (asymmetrical). System rated IP66. Photometric performance shall be tested per LM63, LM79 and TM15 (IESNA) in order to certify the performance of the fixture.

Colour: Shall be medium Grey, natural aluminum or black paint (where specified) in accordance with AAMA 2603.

Mounting Height: Luminaires shall be mounted at a twenty-two (22) foot +/-2 ft. height.

Bracket/Davit: Shall be 5 feet in length and shall be compatible in construction with both the luminaire and pole. Brackets shall be bolted directly to the pole (banding is prohibited). The colour of the bracket shall match the luminaire.

Poles: Shall be spun concrete (Utility Structures Inc. (USI)) poles or Aluminum tapered and of sufficient size and structural capability to support the type of fixture as required and at the heights required.

Spacing: For Decorative light fixture installations 25m to 30m distance between fixtures on one side of street.

Option 2 - Roadway Lighting

Luminaire: Shall be of the “Post top” type (Urbanscape), distribution type III medium cutoff, composed of 48 high performance white LEDs. Dark Sky Compliant with 0% uplight.

Photometrics: Shall be of the type (LE3), IES type III (asymmetrical). System rated IP66. Photometric performance shall be tested per LM63, LM79 and TM15 (IESNA) in order to certify the performance of the fixture.

Colour: Shall be medium Grey or natural aluminum paint in accordance with AAMA 2603.

SECTION 8 – STREET LIGHTING And TRAFFIC SIGNALS

8.1 Street Lighting - Design Criteria (cont'd)

8. Decorative Design - Subdivisions (cont'd)

Option 2 - Roadway Lighting

Mounting Height: Luminaires shall be mounted at a twenty-two (22) foot +/-2 ft. height.

Poles: Shall be spun concrete (Utility Structures Inc. (USI)) poles or Aluminum tapered and of sufficient size and structural capability to support the type of fixture as required and at the heights required.

Spacing: For Decorative light fixture installations 25m to 30m distance between fixtures on one side of street.

All materials shall be of the best quality and shall be vandal resistant with polycarbonate lens or equivalent.

Disconnects: The street light disconnect will be either an SL or SLM series from Pedestal Solutions Inc., or approved equivalent.

8.2 Traffic Control Signal Warrants

The Town of Ingersoll and the County of Oxford has multiple shared intersections within the Town limits. In this situation where a controlled traffic signal is required, the County of Oxford has jurisdiction over the warrants of traffic signals.

Traffic signals shall be considered warranted if:

- a) intersection conditions meet or exceed the warrant requirements of Section 4.3 of the Ontario Traffic Manual – Book 12;
- b) approval is granted by the County of Oxford (if shared intersection); and/or
- c) approval is granted by Town Council.

8.3 Intersection Pedestrian Signal (I.P.S.) Warrants

As stated in Section 8.2, County of Oxford shall have jurisdiction over shared intersections within the Town of Ingersoll. They too will have jurisdiction over any I.P.S.'s as well.

SECTION 8 – STREET LIGHTING And TRAFFIC SIGNALS

8.3 Intersection Pedestrian Signal (I.P.S.) Warrants (cont'd)

Intersection pedestrian signals shall be considered warranted if:

- a) conditions meet or exceed the warrant requirements of Section 4.8 of the Ontario Traffic Control Manual – Book 12;
- b) approval is granted by the County of Oxford (if shared intersection); and/or
- c) approval is granted by Town Council.

8.4 Electrical and Plant Design

Electrical design for intersections shall be governed by the following three documents, in order:

- a) Town of Ingersoll Street Lighting and Traffic Signal Specifications;
- b) items not addressed in (a) shall conform to the Ministry of Transportation Traffic Signal Design manual, where addressed; and
- c) items not addressed in (a) or (b) shall conform to the Ontario Provincial Standards & Specifications (O.P.S.S.).

The design of Traffic Signals, Temporary Traffic Signals and the Relocation of Existing Traffic Signals must be completed, signed and sealed by a fully qualified Professional Electrical Engineer that meets the criteria identified in the Registry, Appraisal and Qualification System (RAQS) list.

Designs shall be completed by the Owner or their consultant and submitted for review by the Town of Ingersoll's assigned representative. Once it has been reviewed, it must be approved by the Town Engineer.

8.5 Materials

Unless otherwise specified by the Town of Ingersoll, all traffic signal and street lighting components for installation shall be new, fabricated and supplied by recognized equipment manufacturers to meet the requirements of the Operating Authority. All materials, components or custom equipment shall be CSA approved, where applicable, and comply with the requirements of the Electrical Safety Authority with respect to their application.

All materials shall be stored in accordance with manufacturers' instructions to prevent damage, soiling, or finish spoilage. New poles shall be stacked to prevent bending or warping and shall be protected against any condition that may cause chipping or pitting in the finish.

SECTION 8 – STREET LIGHTING And TRAFFIC SIGNALS

8.6 Inspection

Subdivision approval must be approved by the Town of Ingersoll, before any installation of poles can commence.

The Town of Ingersoll must also approve the qualifications of the electrical contractor that is to complete the installation of any pole(s).

All contractors shall obtain permits for all work requiring ESA Inspection and shall file applications for inspection with ESA as necessitated by the progress of the work. The Contractor shall pay all fees related to permits, applications, inspections and connections.

Upon completion of all work, the Contractor shall obtain a final certificate of approval from ESA and shall furnish one copy of the certificate to the Owner and Town of Ingersoll.

8.7 Activation of New Traffic Signals

A traffic signal system shall be switched on for operation to conform with the following requirements:

- a) For the testing of circuitry and components, operation of the system shall take place with the signal head covers in place
- b) The Contractor shall give a minimum of three working days' notice of when the system will be ready for operation and shall reconfirm that the work will be done as scheduled 24 hours prior to doing the work.
- c) Testing and switch on for operation will not be permitted on Mondays, Fridays, Saturdays, Sundays, or statutory holidays without permission of the Town Engineer.
- d) The Contractor shall complete all preliminary system testing and inspect all components. All repairs or replacement of defective components shall be done prior to final energization.
- e) The Contractors shall complete all bonding and grounding systems prior to signal activation.
- f) The Contractor shall arrange for a police officer to be on site during signal testing and energizing.

SECTION 8 – STREET LIGHTING And TRAFFIC SIGNALS

8.8 Street and Traffic Signs

Subdivisions

The owner or developer must erect at their own expense, a Town supplied sign warning that roads are yet to be assumed and that operators are to use at their own risk. The owner/developer shall purchase the sign(s) from the Town's Engineering Services Department and erect and maintain the sign(s) at all times in a condition satisfactory to the Town Engineer. The sign(s) shall be placed at locations designated by the Engineer. No sign(s) will be removed until the Town assumes the development. Signs shall be erected in conformance with the Ontario Traffic Manual. **The cost of the sign shall be included in "Moneys due the Corporation".**

Permanent street signs and location must be pre-approved by the Town Engineer before any placement is allowed on streets, intersections or other locations within the subdivision. Permanent street signs shall be erected upon completion of curb and gutter and base asphalt. All street signs designating street names shall be installed and maintained prior to the construction of any dwellings and maintained by the owner until final assumption.

All street name signs shall have a red coloured poppy preceding the name on the sign.

No sign is to be erected to an existing utility pole or street lamp pole.

Construction and/or Reconstruction Projects

Any contractor working in or on a Town project is responsible for the removal, protection and replacement of all traffic and street signs within that project area.

Should the Engineer specify that any sign is to be relocated; the contractor at the Town's expense shall erect the sign at the new location in conformance with the Ontario Traffic Manual.

Storage of signs is to meet with the satisfaction of the Town Engineer. Failure to protect these signs from damage will result in replacement of the sign(s) or support(s) at the contractor's expense.

No sign is to be erected to an existing utility pole or street lamp pole.

SECTION 8 – STREET LIGHTING And TRAFFIC SIGNALS

8.9 Sign Placement and Location

All signs placed within the Town's right of way must be approved by the Town Engineer, follow the guidelines set out in Typical Detail drawing S-25 and/or in conformance with the Ontario Traffic Manual.

All sign posts placed within any landscaped section of the right of way must be constructed of 100x100 (4"x4") pressure treated lumber. Should the erected sign be 900x900 or larger, than the use of 150x150 (6"x6") may be required.

Sign posts placed within concrete boulevards or walkways are to be placed on U flange posts within a PVC casing. The casing or tubing is then be filled with a grout material.

All posts are to be placed at a depth of not less than 0.5m below finished grade.

The Town is not responsible for supplying signs to private owners or developers.

All new signs placed are to be identified to the Town's Asset Department, by completing Form AM-14 before final acceptance of work.

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SECTION 9 – GRADING

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9.0 Grading Requirements

Grading in a plan of subdivision, site plan (guidelines where applicable) and infill lots are to be designed by a Professional Engineer and certified by a designated professional and are to be in accordance with the following standards:

Subdivisions

Developments created by a draft plan of subdivision shall conform to the following lot grading standards and will not adversely affect the abutting or adjacent properties.

Site Plans

Developments subject to site plan approval are to be graded and drained internally in compliance with the Drainage By-Law and should not adversely affect adjacent properties. The sites grading and drainage shall conform to the overall drainage pattern of the adjacent lands as certified by the design engineer at the time of the permit for each building. On site grading will also be subject to the Site Plan Design Manual Guidelines.

Severances, Lifting of Part Lot Control & Infill Lots

Developments created by severance, lifting of Part Lot Control and infill lots for residential lots shall conform to the lot grading standards in a plan of subdivision and are not to adversely affect the abutting and/or adjacent properties.

Blocks

Development on blocks within registered plans of subdivision are subject to site plan approval (as above). Drainage and grading of such blocks shall conform to the accepted overall subdivision design and shall be certified by the site design engineer.

Capital Projects

When grading is required, the designer shall determine match points that appear to naturally blend proposed design grades with existing topography. Consideration shall be given to transitions with intersecting streets, driveway profiles, drainage, utilities, existing retaining walls, potential impacts on trees and other landscaping features. Consideration should also be given to maintenance and aesthetics of grassed areas such as lawns and boulevard areas.

Grades should not be altered around trees on the basis of 30cm of distance from the stem for each 3cm of trunk diameter at breast height 1.5m above ground.

9.0 Grading Requirements (cont'd)

Capital Projects (cont'd)

While a 4:1 slope or greater is desirable from a maintenance perspective, a maximum 3:1 slope is acceptable.

Proposed driveway grades shall not exceed 10% unless approved by the Town's Engineer.

Parks and Open Space

Overall grading of Park and Open Space Blocks within new plans of subdivision shall conform to the master grading plan for the subdivision and must accommodate overland flow routes, etc.

Variations / Modifications

There will be site specific situations where all the criteria may not apply. Proposed grading that does not conform to the appropriate grading requirements standards will be reviewed taking into account the mitigating circumstances that require the proposed variations or modifications.

9.1 Major and Minor Storm Design

As Storm sewer systems (referred to as the minor system) are designed to accommodate storm runoff from a 2 year storm event, the lot grading design (referred to as the major storm system), must be designed to accommodate runoff from storm events that exceed the design capacity of the storm sewer system. These allowances, in the form of major overland flow routes, shall provide for the effective routing of major overland storm flow from residential areas to an acceptable overland flow outlet location.

When designing overland flow routes, the following criteria shall apply:

- The Major overland flow routes are generally to follow low areas in subdivision grading, and be in compliance with an accepted SWM report.
- In order of preference, overland flow routes should be directed along:
 - arterial and primary collector roads;
 - secondary collector roads;
 - local streets;
 - parks, open spaces; and
 - rear yards
- Building opening elevations adjacent to overland flow routes on roadways shall be at least 300mm above the road centreline elevation.

9.1 Major and Minor Storm Design (cont'd)

- The maximum allowable ponding at gutters on roads is 300mm.
- Building opening elevations adjacent to overland flow routes through lots or blocks in a subdivision shall be at least 450mm above the overland flow route elevation (no window wells, or other openings).
- Ground elevations at buildings abutting overland flow routes are to be 225mm above the elevation of the overland flow route.
- The maximum ponding permitted at rear yards catch basins is 450mm.
- The maximum ponding permitted at parking areas in Multi-family, commercial and institutional blocks is 300mm.
- Accommodate all overland flow routes into a stormwater management pond (if applicable).
- Show existing and proposed major overland flow route directional arrows on all grading drawings

9.2 Grading Requirements along Proposed/Existing Roads

Arterial and Collector Roads

The property line (including the adjacent boulevards) abutting road allowances of all roads shall be graded to blend with the future road grades proposed for the street. Where these future grades have not yet been established and approved by the Town Engineer, the owner, shall at no expense to the Town, retain a Consulting Engineer to obtain the necessary information to establish the future centreline road profile and property line grades, and have such approved by the Town Engineer.

Other Situations

On all other streets not mentioned above, the owner shall grade the property line and adjacent boulevards so that they blend with the proposed or existing street grades.

9.3 Grading Standards

The following standards are to be considered when designing lot and adjacent boulevard grading:

Drainage

- The boulevard and a minimum 6.0m at the front of any residential lot must drain towards the abutting road.
- Show the location and direction of drainage along the rear and side lot lines. Show one drainage direction arrow for each change in grade for all lots.

9.3 Grading Standards (cont'd)

Drainage (cont'd)

- The drainage from single-family lots in the same subdivision may be drained between other single-family lots (from back to front).
- The drainage from impervious areas on lots in a new subdivision is not to flow across existing lots abutting the new subdivision.
- The drainage from single-family and semi-detached lots is not to drain onto Multi-family, Commercial or Institutional blocks (with the exception of the overland flow routes).
- All multi-family, commercial and institutional block drainage is to be self-contained.
- Where a new subdivision abuts an existing development or undeveloped land, the existing ground elevations at the common property line are to remain unchanged and existing drainage of abutting lands is not to be disturbed, or obstructed, unless written permission is granted by the affected land owner
- Localized surface drainage from abutting properties, to be developed in future, may be discharged onto the proposed lots in a subdivision.
- Identify existing vegetation and set grades to retain where possible.

Elevations

- Show existing elevations by contours. Contours are to extend a minimum of 30m beyond the limit of the site plan, or subdivision.
- Show existing spot elevations at all lot/block corners along the boundary of the development, and along all major overland flow routes.
- Show existing centreline of road elevations every 20m for existing, abutting and connecting streets.
- Show existing spot elevations around existing house/units and at house/unit openings for new proposed major overland flow routes through existing developments.
- Show proposed elevations on ALL corners of the proposed lots.
- Show finished ground elevations around house/unit.
- Show final centreline road elevations, every 20m as well as at break points and
 - high and low points in the road profile. Identify (label) the break points,
 - high/low points.
- Show proposed elevations at all high points or break points where the direction of drainage along rear and side lot lines changes.
- Show proposed bottom of swale elevations at pertinent intervals, and at property lines.
- Show proposed elevations at the top and bottom of all steep slopes (3H: 1V, max.).

9.3 Grading Standards (cont'd)

Elevations (cont'd)

- Show proposed top and bottom retaining wall elevations.
- Show proposed top and bottom noise barrier wall elevations.
- Show underside of footing elevation.
- Show top of foundation elevation.

Slopes

- Yard surfaces shall have a minimum slope of 2%.
- Front yard surfaces shall have a maximum slope of 10%.
- Rear yard/side yard (walkouts/back splits) surfaces including swale cross-falls shall have a maximum slope of 3H: 1V.
- Berms shall have a maximum slope of 3H: 1V.
- Road and boulevard surfaces shall have a minimum cross-fall grade of 2% and a maximum cross-fall grade of 4% in new subdivisions or developments.
- Driveway surfaces shall have a minimum grade of 2% and a maximum grade of 10%.
- Specify stepped foundations, side to side for lots fronting streets with a road grade of more than 3%.

Swales

- Drainage flows which are carried around houses are to be confined in defined swales, located as far from the house as possible.
- Minimum swale grade is 2%.
- Maximum of 16 lots draining to a rear yard swale, outletting to a rear yard catch basin.
- Maximum length of swales permitted is 76m, outletting to a rear yard catch basin.
- The maximum flow allowable in a side yard swale or a swale discharging across a boulevard onto a Town Right-of-Way shall be that from 4 backyards.
- The side yard swale is to be a minimum of 150mm lower than the finished ground elevation at the house.
- The average rear yard swale depth is 225mm. The minimum swale depth allowed is 150mm. The maximum swale depth is variable, but is dependent on location and safety considerations.
- Show the location and direction of flow in swales by means of arrows. Show at least one arrow at the rear of each lot.

9.3 Grading Standards (cont'd)

Catchbasins

- The maximum length of swales permitted to drain to a catch basin is 76m.
- A maximum of 16 lots draining to a rear yard catch basin is allowed.
- Front yard catch basins are not permitted, except in unusual circumstances where a rear-yard catch basin cannot be provided.
- No surface ponding is allowed during a two year design storm event
- Under a 100 year design storm event, 300mm surface ponding is allowed at catchbasins on roads, and 450mm surface ponding is allowed at rear yard catchbasins.
- Flat see-saw profiles (identical high and low points) will not be allowed in rear yard swale designs. See-saw profiles must slope in a cascade that allows major storm flows (Overland Flows) to drain along the lots to an acceptable Overland Flow Outlet

Drawings

The Town of Ingersoll has specified their requirements for their Lot Grading Plan submission in Section 2 of the Drawing and Drafting Standards, but the following is also required:

- Town of Ingersoll Title Block
- North Arrow
- Engineer Stamp
- Street Names
- Existing Features (trees, fences and houses)
- Sediment and Erosion Control Measures

Where Applicable:

- Sewer Easements
- Building setback for rear yard catchbasin leads
- Steep Slopes
- Channels
- Headwalls
- Walkways
- Noise Barrier Walls

9.4 Grading Notes

The following notes are to be included on the Grading Drawings:

- Existing drainage of abutting lands is not to be disturbed
- Localized surface drainage from abutting properties to be developed in future may be discharged onto the proposed lots in this subdivision.
- Basement openings to be minimum 300mm above the centreline of road unless otherwise approved by the Town Engineer.
- Ground elevations at houses abutting overland flow routes are to be 225mm above overland flow route elevations.
- Retaining walls, 1.0m high or greater, are to be designed by and constructed to the specifications of a registered professional engineer in accordance with the Ontario Building Code.
- For Subdivisions: Sump pump discharge must be directed to the storm sewer via the storm PDC.
- OR -
- For Other Cases: Sump pump discharge must be directed away from driveways and sidewalks.

9.5 Retaining Walls

Retaining walls may be required where a slope is greater than 3 horizontal to 1 vertical to make up the grade change between the two elevations. All design and specifications for retaining walls shall be in accordance with the Ontario Building Code.

All retaining walls 1.0m in height and greater shall be designed by a Registered Professional Engineer as per the Ontario Building Code, and shall have railing or fencing installed along the top of the retaining wall.

All retaining walls within or adjacent to a road allowance shall be constructed of concrete or masonry material, have fastened cap stone, and be approved by the Town of Ingersoll.

9.6 Sediment and Erosion Control

The Town of Ingersoll requires an Erosion Sediment Control Plan (ESCP) be designed for all Development Projects. The drawing requirements are located in Section 2 of the Drawing and Drafting Standards.

The complexity of the ESPC is determined by the sensitivity of the area that is to be protected.

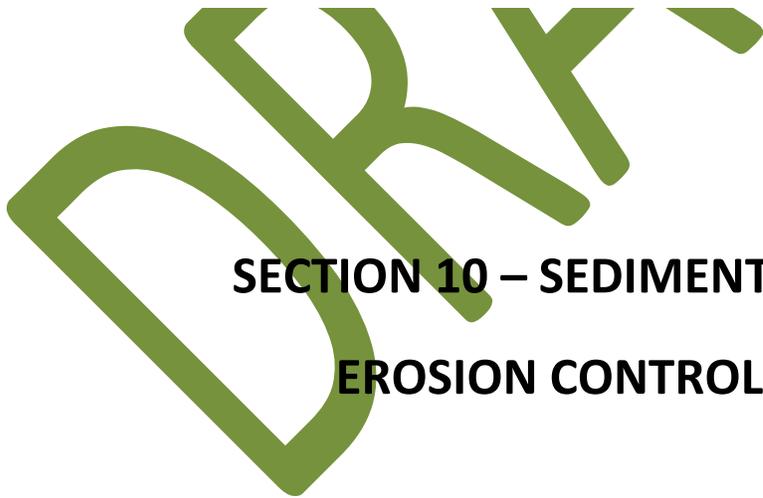
9.6 Sediment and Erosion Control (cont`d)

Where an ESCP is not required, all reasonable protective measures must be taken during construction to control sediment and prevent erosion from occurring.

For Capital and Operational works, (ie. reconstruction or resurfacing of existing roads) that are not in close proximity to an open watercourse, woodlands, ESA's, steep slopes or other natural area; an ESCP is not required, unless otherwise directed by the Town Engineer.

For further information on the requirements of the ESCP, please refer to Section 10 - Sediment & Erosion Control, within this manual.

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**SECTION 10 – SEDIMENT and
EROSION CONTROL**

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10.0 Introduction

Construction Sites by their nature result in the disturbance of the on-site natural materials as well as impacting on the surrounding areas. Sediment and erosion control measures are to be used on ALL construction sites to limit the effect of the proposed construction on the surrounding areas and infrastructure.

The Town of Ingersoll requires an Erosion Sediment Control Plan (ESCP) be designed for all Development Projects. The drawing requirements are located in Section 2 of the Drawing and Drafting Standards.

The complexity of the ESCP is determined by the sensitivity of the area that is to be protected.

10.1 Reference

The Town of Ingersoll relies on the Ministry of Natural Resources Guidelines on Erosion and Sediment Control for urban construction sites, unless otherwise noted.

10.2 General Information Requirements

ESC Plan

An ESC Plan for all Development Projects is to be designed, addressing all the requirements identified in the General Requirements for Erosion Sediment Control Plan (ESCP) chart (See Figure 10.1).

i) For Development related projects, the ESCP is to form part of the Functional SWM Servicing Report or the Servicing Report for the project.

The ESCP should address all potential issues including, but not limited to:

- close proximity to an open watercourse;
- close proximity to woodlands, ESA's and other natural areas;
- steep slopes; and
- high groundwater levels

The complexity of the project will determine the required complexity of the ESCP.

10.2 General Information Requirements

ESC Plan (cont'd)

ii) For Capital and Operational works (ie. reconstruction or resurfacing of existing roads) that are not in close proximity to an open watercourse, woodlands, ESA's, steep slopes or other natural area, an ESCP is not required, unless otherwise directed by the Town Engineer.

Where an ESCP is not required, all reasonable protective measures must be taken during construction to control sediment and prevent erosion from occurring.

Servicing Drawings

Sediment and Erosion Control measures are to be identified on all lot grading plans, stormwater management ponds, channels and, where applicable, plan and profile drawings, and on detailed drawings. If extensive measures are required, or the scale of the drawing is such that the measures are not clear, then the sediment and erosion control measures must be identified on a separate plan. (See Section 2 - Engineering Drawing Submission) The measures shown on the servicing drawings are to reflect the requirements identified in the ESCP.

The complexity of the project will determine the required complexity of the ESCP.

10.3 Review and Acceptance

The Town of Ingersoll and the UTRCA are responsible for reviewing and accepting the ESCP and will ensure that the measures identified in the accepted ESCP are implemented, and that the ESCP addresses all the necessary areas of concern with respect to sediment and erosion control measures.

At the final servicing drawings review stage for various land development applications, all required ESC measures and procedures are identified on these drawings, and are to be in compliance with the approved ESCP and applicable standards, all to the specifications and satisfaction of the Town Engineer.

10.4 UTRCA

Approvals are to be obtained from the UTRCA for works which are in or adjacent to flood lines, fill lines and hazardous slopes, prior to the construction of services and approval of the engineering plan.

10.5 Parks and Open Spaces

Approvals are to be obtained from the Town and UTRCA for sediment and erosion control measures adjacent to any open space areas – flood plain, Environmentally Significant Areas, natural areas, ravines, parks, etc, prior to “Site Alteration”, construction of services or approval of engineering plans.

10.6 Sediment Control Measure Notes

The following sediment control measure notes are to be shown on the construction drawings, either on the plan that details the sediment and erosion control measures, or on the notes and details drawing.

Please note that the following sediment control measure notes are examples only, and may vary to suit the individual project:

- Protect all exposed surfaces and control all runoff during construction.
- All erosion control measures are to be in place before starting construction and remain in place until restoration is complete.
- Maintain erosion control measures during construction.
- All collected sediment must be disposed of at an approved location.
- Minimize area disturbed during construction. All dewatering must be disposed of in an approved sedimentation basin.
- Protect all catch basins, maintenance holes and pipe ends from sediment intrusion with geotextile (Terrafix 270R).
- Keep all sumps clean during construction.
- Prevent wind-blown dust.
- Straw bales to be used in localized areas as shown and as directed by the engineer during construction for works which are in or adjacent to floodlines, fill lines and hazardous slopes.
- Straw bales to be terminated by rounding bales to contain and filter runoff.
- Obtain approval from UTRCA prior to construction for works which are in, or adjacent to floodlines, fill lines and hazardous slopes.
- All silt fencing and details are at the minimum to be constructed in accordance with the Ministry of Natural Resources Guidelines on Erosion and Sediment Control for Urban Construction Sites.
- All of the above notes and any sediment & erosion control measures are at the minimum to be in accordance with the Ministry of Natural Resources Guidelines on Erosion and Sediment Control for Urban Construction Sites.

10.7 Site Alteration

At the site alteration agreement stage, the site alteration agreement shall include:

- A proposed temporary site grading and drainage design that identifies site alteration parameters and any impacts on the adjacent lands and must be reviewed and accepted by the Town and UTRCA, prior to the agreement being finalized.
- The proposed site grading and drainage design that will incorporate the hydrogeotechnical study recommendations;
- The proposed site alteration activities that will be in compliance with hydrogeotechnical study recommendations; and The Consulting Engineer provides formal “certification” that ESC measures were properly installed and were regularly maintained.

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**SECTION 10 – SEDIMENT
and EROSION CONTROL**

Figure 10.1		Requirements for Erosion Sediment Control Plan (ESCP)
Proposed Measures and Site Conditions	Timing	Comments
Identify all types of “erosion/sediment control (ESC) devices” that are selected for the proposed construction activities.	<ul style="list-style-type: none"> • For Development Projects with a Functional SWM Report – the ESCP is to be included in the Functional SWM Servicing Works Report. • For Development Projects with no Functional SWM Report component – the ESCP is to be included in the Servicing Report for the Project • For Operational & Capital Works Projects – the ESCP is to be submitted prior to detailed design 	<p>ESC devices/measures have to be listed and identified in detail including, but not be limited to:</p> <ul style="list-style-type: none"> • the type of silt fences and/or link silt fences (silt/robust/heavy duty or others), • the proposed berms in relation to the identified areas <p>All this information is required to be identified on the ESC’s attached plan of the section of the storm/drainage and SWM Functional Design Report.</p>
Identify the land slopes and proposed land alterations.	Same	The relation of these recommended control devices to the proposed storm/drainage flow routes and grading on the attached plan shall be clearly established. All temporary fencing, rock check dams, and swales, where appropriate, are intended to attenuate flows and to provide sediment depositing. All these measures should be identified and attached to the ESCP in order to ensure that the ecological health of the system will be well protected and not compromised. During construction activities, any proposed diversion swales/channels, berms or silt fencing must direct all surface runoffs to the temporary sedimentation/settling basins or perimeter ditches in order to minimize sediment loading to the open watercourses or municipal system.
Identify when and where these devices are to be installed.	Same	The relation of these identified control devices to the proposed storm/drainage flow routes and grading on the attached plan shall be clearly established. All recommended temporary swales shall be identified on the plan and the detailed information should be included in the report (locations, elevations, geotechnical conditions and separation distances should be identified).

**SECTION 10 – SEDIMENT
and EROSION CONTROL**

Figure 10.1		Requirements for Erosion Sediment Control Plan (ESCP)
Proposed Measures and Site Conditions	Timing	Comments
Identify the potential downstream sensitivity of water resources.	Same	All applicable and relevant background information related to the Official Plan (OP) Natural Heritage System (NHS) requirements, the Subwatershed Studies, Environmental Impact Studies, the Town's Design Standards and Requirements and the MOE and the UTRCA's requirements must be identified.
Identify the proximity to Environmental Significant/Sensitive Areas	Same	All applicable and relevant background information related to the Official Plan (OP) Natural Heritage System requirements (NHS), the Subwatershed Study, Environmental Impact Studies, the Town's Design Standards and Requirements and the UTRCA requirements must be identified.
Identify the proposed infiltration measures and the existing groundwater levels, the relation to the surface flows, flood lines, base flows and provide all required calculations to support the recommended approach if it is warranted.	Same	Compliance with the Hydrogeotechnical report recommendations for the subject lands
Identify dewatering requirements, the type of permits and existing groundwater and open watercourses levels.	Same	Compliance with the Hydrogeotechnical report recommendations for the subject lands and the MOE's C of A for the Permit to Take Water (if it is applicable).
Identify the type(s) and predominant characteristics of the soils within the area (e.g. particle size/structure, moisture content and compactness).	Same	Compliance with the Geotechnical report recommendations for the subject lands.

**SECTION 10 – SEDIMENT
and EROSION CONTROL**

Figure 10.1		Requirements for Erosion Sediment Control Plan (ESCP)
Proposed Measures and Site Conditions	Timing	Comments
Provide specific provisions for all disturbed areas that are left inactive for 30 days or more. These areas must be re-vegetated in order to minimize the soil to be exposed and washed out by the storm flows.	Same	The areas where the vegetation was removed for the proposed construction activities should be minimized and the phasing approach should be considered and discussed. The time period between the initial vegetation removal and final grading/seeding should be kept to a minimum.
Identify the need for enhanced ESC measures that may be warranted by the site conditions and/or the proximity to Environmental Significant/Sensitive Areas and/or open watercourses.	Same	The requirement to provide various levels of the enhanced ESC measures that encompass: a multi-barrier approach that will collect the sediment at the source first rather than through conveyance; and end-of-pipe controls that will collect the sediment within the proposed perimeter ditches and settling/contingency detention basins to protect ecological health of the system.
A Contingency Plan must be included in the ESCP and is required to address potential non-typical site and weather conditions, the efficient reporting system and the emergency contact list including all applicable agencies.	Same	The need for enhanced and sustainable ESC measures using the multi-barrier approach should be implemented. The main objectives of these measures are to provide the required control and containment of the sediment at the source within the proposed perimeter ditches and settling/contingency detention basins. The by-pass channels must be designed for a minimum of the 10 year storm event unless otherwise agreed to in writing.
The Owner's Engineer will be responsible to develop and obtain all approvals for the proposed ESC Plan (including a Contingency Plan) for any construction sites/subdivisions.	Same	The commencing of any construction activity at the subject lands is not allowed to proceed without all approvals being in place including the ESC Plan and the dewatering permits
A cost estimate for the ESCP's security allocations for potential remediation works is required to be calculated based on approximately 15% of the total projected cost for the Storm/Drainage and SWM Servicing Works.	Same	It is required that the ESCP's security allocations for potential restoration works be collected independently from the Subdivision security and should the Owner fail to provide the adequate implementation of the approved ESC Plan, the City would undertake remediation works.

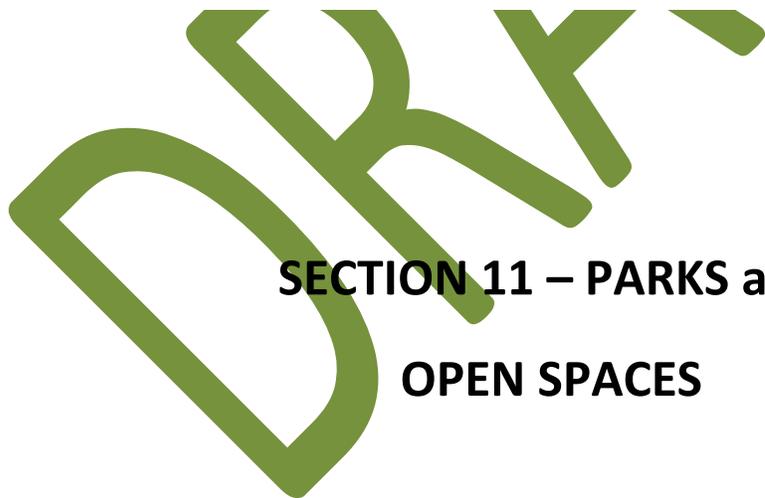
**SECTION 10 – SEDIMENT
and EROSION CONTROL**

Figure 10.1		Requirements for Erosion Sediment Control Plan (ESCP)
Proposed Measures and Site Conditions	Timing	Comments
The Owner’s Engineer will be required to obtain all required approvals for any proposed modifications that will compromise the effectiveness of the originally of the approved ESCP and obtain the acceptance by the Contractor.	Same	The Owner’s Engineer will be required to discuss the recommended modifications and obtain approval from EESD staff. These suggested changes must be supported by the presented justification merits and required to include, but not be limited to: the subject site conditions, sensitivity and proximity to watercourses and/or Environmental Significant Areas (ESA) well the acceptance of by Contractor to implement the suggested modifications. Should these recommended modifications be considered: Minor changes- Upon discussing the presented justifications, and if the Town agrees with the Engineer’s definition, the ESCP’s recommended modifications may be implemented by Contractor; Major changes-The Owner’s Engineer must submit the ESCP’s recommended modifications for review and acceptance by the Town Engineer and implemented by the Contractor, all to the specification of the Town Engineer.
The Owner’s Engineer will be required to ensure the implementation of the ESCP and to assign inspection throughout all construction stages, as well as to undertake decommissioning of these ESC measures upon completion of construction activities on these sites.	Same	Control features that fail should be repaired and evaluated as to whether or not additional measures are required, and prior to removal of ESC measures, joint inspection is required to be conducted with the Town’s staff.
The Owner’s Engineer will be required to incorporate the following main components of the ESCP’s reporting system: Inspection on all days of the construction (failure of any ESCP shall be reported immediately within a period of 2-3 hours), Inspect if the precipitation exceeds the 25 mm storm event; Inspection logs must be	Same	The Owner/Subdivider to implement, maintain and ultimately decommission the ESC measures contained in the approved ESC Plan and their Consulting Engineer will be required to comply with the following requirements: “Certify” that all ESC measures were installed prior to construction; “Certify” that all ESC measures are being maintained and operating as intended; Submit ESC monitoring reports. They are to be submitted by April 1, July 1, and November 1 of each year until all works and services of the plan are assumed;

**SECTION 10 – SEDIMENT
and EROSION CONTROL**

Figure 10.1		Requirements for Erosion Sediment Control Plan (ESCP)
Proposed Measures and Site Conditions	Timing	Comments
reviewed on a regular monthly basis; The semi-annual summary status reports are required to be provided to the Town; and The inspection reports shall be submitted to the Town every three months		Submit semi-annual SWM monitoring reports for a minimum period of two years and ensure that ESC measures are decommissioned at the various stages of the project.

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**SECTION 11 – PARKS and
OPEN SPACES**

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11.0 Definitions

Neighbourhood Parks - parks that are intended to serve a local neighbourhood population and should be designed to support unorganized activity along with some organized youth activities and programs.

Typical features include: play structures, pathways, unlit sports fields, multi-use pads, and basketball courts.

Town Parks - parks that are intended to serve groups of neighbourhoods and are designed with an emphasis on facilities for organized sports and unorganized activities.

Facilities may include lit sports fields, spray pads, tennis courts, skateboard parks, parking lots, community centers, arenas, pools, and major play structures.

Natural Areas - areas that can include Open Space Blocks, Woodlands, portions of larger Park Blocks and Environmentally Significant Areas (ESA).

Generally, they have been set aside for their environmental significance and may have been identified by the Town through a previous study or have a development-related Environmental Impact Statement (EIS) with recommendations for their protection, management and enhancement.

Stormwater Management Ponds - are facilities constructed as part of the servicing requirements for development. Often located adjacent to Open Space uses, they are to be integrated with the park design or natural landscape feature.

11.1 Layout

Neighbourhood Parks - should be centrally located within the service area radius of 0.8km and serve a population of up to 5,000 people. Parks should be located to be within a convenient and safe walking distance to the majority of residents and users should not have to cross arterial roads to access their neighbourhood park. Wherever practical, neighbourhood parks should be coordinated with school sites to maximize outdoor space for school use and hard surface/parking for park users. The parks should be from 1.5 – 4.0 ha in size and roughly rectangular to accommodate facilities with a minimum 15m setback to adjacent houses and to reduce “blind” corners. Typically, a 30-60m minimum frontage to suit block configuration is required, with at least one secondary entrance to the park.

Generally, a flat site is desirable for facility development, but some topography may provide for tobogganing, etc. Stands of vegetation should be retained where possible.

11.1 Layout (cont'd)

Park facilities should be separated by suitable buffers and designed to be visible from the street. Pathways should connect all points of entry into the park. All layout of pathways and facilities are to be reviewed and approved by the Town prior to proceeding with construction.

Town Parks - should be centrally located within the service area of the Town, and serve typically a 2km radius. They can be integrated with schools and should be located on primary collector or arterial roads for access by the public.

Some degree of topography is an asset to the park as it can provide buffers between facilities and adjacent houses. Stands of vegetation are desirable features and pathways are to connect all park facilities and park entrances. All layout of pathways and facilities are to be reviewed and approved by the Town prior to proceeding with construction.

Pathways and Facilities - The design and layout of pathways and facilities is to be reviewed and approved on site by the Town prior to proceeding with construction.

Storm Water Management Facilities - The technical requirements and design of storm water management facilities is approved under Section 5 of this manual. Through that process, integration with adjacent parks or open spaces may be desirable. Where storm facilities are located and designed to integrate with parks and open spaces, additional land around the pond may be required beyond the minimum technical setbacks to property lines to permit suitable pathway systems and/or EIS requirements that meet park planning & design approval. Appropriate compensation will be provided for additional land requirements.

Facilities located away from parks and open spaces and not intended to be used as a community amenity are not subject to these additional setback requirements.

11.2 Grading

Park grading shall integrate with the surrounding lands and provide positive flow from all facilities and adjacent private lands. Drainage from private lands may be directed to parkland if it can be accommodated within the park drainage design.

Pathways shall be set as high points through the park with positive drainage away from them. Limited amounts of sheet flow may be permitted to cross pathways in certain circumstances.

11.2 Grading (cont'd)

Park grading shall be smooth flowing and shown with contours, with spot elevations as required to demonstrate desired slopes, top-of-bank, field corners, and hard surface grades. Swales are to curve to suit facility layout, pathway alignments and natural topographical design.

Specific grading standards are:

- 1) Sports fields – 1.0%, directed to suit field layout and site conditions
- 2) Pathways – 1 – 2% cross slope, up to 8% linear (4% preferred)
- 3) Swales – 1.5 – 4%, for a maximum length of 150m
- 4) Topography – 3:1 maximum with undulating surfaces. 2:1 is permitted if an area is to be naturalized

Retaining walls are generally unacceptable within a park block unless they are required to maintain existing grades of adjacent facilities or for the protection of significant vegetation.

Grading plans for new subdivisions are to be included in engineering packages and meet all applicable requirements from the Town of Ingersoll. The completion of grading, servicing and seeding of park blocks is typically required prior to the issuance of building permits within the subdivision.

Grading for “natural areas” is to be kept to a minimum and subject to review on a case by case basis. There may be requirements to grade within “natural areas” to suit future pathways. Grading of parks and open spaces adjacent to natural areas and ESAs to be delineated by upgraded silt fencing and/or as directed by a site specific Environmental Impact Statement (EIS). There may be requirements to grade within “natural areas” to suit future pathways.

Grading within storm water management ponds is approved by the Town. If ponds are to be integrated with parks and open space areas, pathway grades (as above) and pond side-slope grades should mesh and compliment adjacent landforms.

All rough grading for parks and open spaces is to be reviewed and approved on site by the Town prior to proceeding with fine grading.

11.3 Servicing

Park and open space blocks generally require storm sewer systems and occasionally sanitary sewers and water lines to service community facilities such as field houses and pools.

For specific storm sewer design requirements, refer to Section 6 – of this manual.

For specific sanitary sewer or watermain design requirements, refer to the County of Oxford Design Guidelines and Supplemental Specifications - Section 4 - Sanitary and Section 3 - Watermain.

11.4 Fencing

All Parks and Open Space blocks shall require fencing adjacent to private owned lands. Fencing shall always be located on a common property line. Fencing shall conform to the current Town of Ingersoll fence by-law. Fencing shall not be located adjacent to a public right of way, School Block and any other Town Facility, except where fencing is required under another section of this document.

Fencing that is an integral part of a park recreational facility (ie: baseball diamonds, batting cages, etc...) are not subject to the above.

11.5 Boundary Monuments

Boundary Monuments shall only be used in substitution for fencing where it can be demonstrated that fencing will have a significant adverse impact on the site or fencing is not physically possible. Boundary Monuments shall always be located on a common property line. At minimum Boundary Monuments shall be located at every change in direction of the property line and at 30 metre intervals. Where site topography is such that the line-of-sight between the Boundary Monuments is obscured at above intervals, additional Boundary Monuments are required at these locations to the satisfaction of the Town.

11.6 Seeding

Seeding of park blocks is carried out in accordance with the OPSS specifications and approval of the Town Engineer.

Maintenance of the turf is the responsibility of the developer up to assumption. This includes mowing to maintain a height of no more than 50mm, weed control and over-seeding, if required. Inspections for assumption will only take place between May 30 and October 15. At assumption, the turf must be healthy and vigorous, cut to 50mm height with very few bare patches or weeds.

11.7 Tree Preservation

In many parks and open space blocks, existing vegetation is to be maintained as an amenity feature. Where this is the case, the following requirements apply:

- Grading alterations should be generally restricted to outside the “drip-line” of existing vegetation.
- The limits of grading where the slope is toward existing vegetation is to be fenced with upgraded silt fencing and/or as directed by a site specific environmental impact statement. Where grades slope away from existing vegetation, 1.2m high “construction fencing” is required.
- Hazard trees and or limbs are to be removed from the edges of woods and over existing or proposed pathway/trail locations.
- Additional requirements may be specified through a tree preservation plan produced to fulfill the conditions of a subdivision agreement.

11.8 Natural Areas

Natural areas, open space blocks, woodlands or environmentally significant areas have stringent design requirements, often specific to the area. Generally, through the land development process they have been set aside for their environmental/ecological significance and through the preparation of an EIS will have recommendations for their protection, management and enhancement that are to be accommodated in engineering plans.

Typically, standard grading, servicing and development requirements do not apply, but pathway/trail development is usually required and will require some level of design and construction as directed by the Town.

Prior to assumption of natural areas, all hazards such as tree forts, old fencing, construction materials and general debris must be removed from the block. Hazard trees along existing or proposed trails and pathways and abutting adjacent lands should be removed.

11.9 Bio-Engineering

Within parks, open spaces, natural areas and ESAs, bio-engineering is to be used as the preferred approach for slope stabilization, channel creation or restoration, storm outlet design and any other “engineered” feature. Limited use of rip-rap or other erosion control materials is permitted where the situation warrants if used in conjunction with other “natural” approaches.

Conveyance channels from storm water management facilities that outlet into parks and open spaces require suitable bio-engineered design to blend with the surrounding landscape.

11.9 Bio-Engineering (cont'd)

Bio-engineering design may require specialized consultants too successfully implement parks standards and /or EIS recommendations.

11.10 Tree Planting

Tree planting within parks, open spaces, linkages, natural areas and stormwater management facilities is to be carried out in compliance with Section 12 of this manual. More detailed planting and monitoring requirements for stormwater management ponds may be found in the engineer's report for the SWM design.

11.11 Sediment and Erosion Control

The Town of Ingersoll requires an Erosion Sediment Control Plan (ESCP) be designed for all Development Projects. The complexity of the ESCP is determined by the sensitivity of the area that is to be protected.

For Capital and Operational works (ie. reconstruction or resurfacing of existing roads) that are not in close proximity to an open watercourse, woodlands, ESA's, steep slopes or other natural area, an ESCP is not required, unless otherwise directed by the Town Engineer.

Where an ESCP is not required, all reasonable protective measures must be taken during construction to control sediment and prevent erosion from occurring.

For further information on the requirements of the ESCP please refer to Section 10 - Sediment & Erosion Control, within this manual.



**SECTION 12 – TREE PLANTING and
TREE PROTECTION**

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SECTION 12 – TREE PLANTING and TREE PROTECTION

12.0 Introduction

Tree planting on the public right-of-way is a long term initiative. What is done today can have a serious impact on street tree maintenance activities for years to come. It is therefore imperative that tree planting be done with care and planning. Planning is critical to ensure that the final product is sustainable and aesthetically pleasing. Trees of similar shape but different species, if carefully selected, will provide the desired effect of tree arch over the street. The mix of species is essential to reduce the chances of insect epidemics, to guard against the spread of disease as trees are trimmed in efficient block treatments, to prevent widespread neighbourhood complaints and to eliminate extensive tree removal programs when single species plantings die.

Designs should reflect patterns which show a use of random plantings of diversified species. Consideration should be given to adjacent lands where existing street trees may exist to ensure that continuous plantings are not created, in particular infill projects of limited frontage.

12.1 Policy

The purpose of this section is to outline the Town's policies for new development, not currently outlined in Section VI of the Town's Tree Policy XX-XXX.

1) Security

Security is required to ensure that funds are available in the event of default by the developer. Currently, this is a standard subdivision development requirement and should be calculated into the security deposit at Development Agreement Stage.

2) Planting Plan

The developer will submit a planting plan showing actual planting locations (with all site amenities known and shown on the plan) and proposed species of trees (common and Latin names shown). The services of an Ontario Registered Professional Forester or a member of the Ontario Association of Landscape Architects in good standing must be retained. This will ensure that an appropriate planting plan is in place which considers species diversity, tree form location and design. The planting plan must be stamped by the R.P.F. or L.A. and be shown on the standard plan of subdivision drawing or grading plan which shows lot dimensions (particularly frontages) as prepared by the consulting engineer. The plan will be reviewed and approved by Town staff.

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.1 Policy (cont'd)

3) Guidelines for Planting Plan Preparation

All trees are to be planted on Town property. Tree planting locations will be determined on a site specific basis. As a goal, no less than one tree should be planted for each lot. Larger lots and corner lots may have more than one tree.

Since large trees contribute more to the environment and the neighbourhood than small ones, the largest tree that is suitable for the location is to be planted, considering eventual size at maturity. The preferred location for trees will be in the boulevard between sidewalk and curb, where present.

Adjacently planted trees will be shown approximately every 3.0m – 12.0m o.c. where practical and where growing space is available, according to species. Ornamental trees will be spaced more closely than medium trees, and medium trees more closely than large trees.

Where no sidewalks exist or where sidewalk construction is not planned, trees are to be shown no closer than 1.0m to the private property boundary on Town property.

12.2 Planting Locations

Site Evaluations

- Site line issues
- Conflict with future maintenance needs (ie snow loading)
- Underground utility conflicts
- Overhead utilities to prevent or restrict planting

Minimum Planting Distances

- 10m between trees
- 2m from driveways
- 5m from street lights
- 15m from stop signs or traffic signal
- 3m from fire hydrants or underground vaults
- 2m from communication pedestals
- 20m from major intersections
- 10m from secondary intersections

Whenever possible, tree planting over existing sanitary and water services should be avoided.

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.3 Design Requirements

The developer will submit a planting plan showing actual planting locations (with all site amenities known and shown on the plan) and proposed species of trees (common and Latin names shown). The services of an Ontario Registered Professional Forester or a member of the Ontario Association of Landscape Architects in good standing must be retained. This will ensure that an appropriate planting plan is in place which considers species diversity, tree form location and design. The planting plan must be stamped by the R.P.F. or L.A. and be shown on the standard plan of subdivision drawing or grading plan which shows lot dimensions (particularly frontages) as prepared by the consulting engineer. The plan will be reviewed and approved by Town staff.

Where several phases make up the M-Plan, the plan should reflect the landscape character of plantings in adjacent phases. It is not necessary and may not be desirable to match species on adjacent phases, but consideration should be given to a neighbourhood identity with similar tree shape and size at maturity.

In order to integrate species diversity into each plan, the species mix shall provide no more than 15% of any one species (percentage of the entire number of trees within the plan). Individual phases may diverge from this percentage if deemed reasonable (e.g. cul-de-sac) so long as the overall object of 15% species mix is maintained within the plan of subdivision.

No species other than those listed in Appendix "A" in this document or in the Town Tree Policy are to be shown on the planting plan without prior consultation with Town Engineer. Other species may be considered for approval if it can be shown the proposed species are appropriate to the proposed planting locations or to permit trial plantings of new (to the Town) species or cultivars.

Ash (*Fraxinus*) species may not be shown or planted on any Town owned property until further notice – no exceptions.

12.4 Planting

Assumption

The developer will commit to planting all trees within one year of assumption. Any subdivisions assumed past November 1st of the current year will have to have the plantings completed before June 1st of the following year.

All trees planted 1 year prior to acceptance and post assumption must have a 24 month warranty that is transferable to the Town should an issue arise.

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.4 Planting (cont'd)

The Town or its representative shall have all planted trees inspected prior to final assumption.

Procedure Summary

The developer will include security amount to cover the Planting Plan at time of development agreement.

The developer will provide a planting plan for review and approval at time of assumption.

The developer will plant trees prior to Town assumption.

The Town or its representative shall have all planted trees inspected prior to final assumption.

Trees that fail inspection shall be replaced prior to November 1st of that calendar year.

12.5 Inspection

All trees planted shall have a 2-year warranty from time of planting. A tree warranty inspection shall be conducted prior to the expiry of the 2-year warranty period by the developer.

Trees that fail inspection shall be replaced within a suitable timeframe.

All trees planted prior to final acceptance shall be the responsibility of the developer. Trees planted prior or post assumption but are still under warranty shall have a transferable warranty to the Town of Ingersoll.

12.6 Protection

All new subdivisions require an accepted Tree Protection Plan.

For site plans, the Town will recommend at the site plan pre-consultation meeting whether a Tree Protection Plan is warranted for the specific site.

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.6 Protection (cont'd)

Requirement for Approved Tree Protection Plan

A tree protection plan shall be completed by a certified arborist or approved professional, such as a Landscape Architect, and submitted to the Town and UTRCA or designate for approval prior to the start of the construction or other works.

No on-site construction or other works that may cause damage to trees is permitted without an accepted tree protection plan.

The tree protection plan shall include, but is not limited to:

- a) Identification of specific trees (species, size and health) that are to be removed for safety, tree health, operational requirements or aesthetics. A detailed description of the condition of the trees and factors on which the recommendation to remove were based must be included in the report. Pictures of the trees showing pertinent condition are recommended.
- b) Identification of specific trees (species, size and health) that will be retained and protected during the operations as future forest cover. Pictures of the trees showing pertinent conditions are recommended.
- c) Identification of specific trees that will be dug up and relocated prior to the start of the operations and the locations where they will be replanted.
- d) Foreseeable remedial actions to ensure the health of the remaining trees such as but not limited to branch pruning, deep root fertilization, tree watering, soil replacement or amelioration, planting.
- e) Specification of good arboriculture practices for root and branch pruning.
- f) A map showing:
 - i) the location of all existing trees and the extent of their crowns;
 - ii) the location of all trees to be retained, removed, replaced or relocated;
 - iii) highlighted and labeled Tree Protection Zones and tree protection barriers.

Operational Constraints

Operational constraints as per Ontario Provincial Standards Specification (OPSS) 801.07.01 apply except during emergency situations.

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.6 Protection (cont'd)

Tree Protection Zones and Barriers

Tree Protection Zones (TPZ) shall be established surrounding all trees to be retained. The outside boundary of the TPZ shall be delineated by a tree protection barrier.

Barriers for Tree Protection Zones as per OPSS 801.07.02 apply except where;

- a) The tree is flanked by curb/sidewalk and/or an asphalt road the TPZ and barrier can be limited to furthest extent of the boulevard area; and
- b) A TPZ is not required or not feasible to establish beyond the main stem of the retained trees, banding boards shall be installed around the stems of the retained trees. The boards shall be installed in a vertical direction and remain in place for the duration of the project. Banding boards must not be nailed, or screwed onto the tree stem. Bark must not be broken or torn during the establishment of the banding boards. The banding boards must extend from ground level to a minimum height not of 1.2 metres.

Cutting and Repair

All trees identified in the approved tree protection plan for pruning must be pruned by a certified arborist before commencement of any on-site operations. The Ontario Standard Specification (OPSS) 801.07.03 for tree cutting and repair applies.

All trees identified in the tree protection plan for relocation or removal must be relocated or cut and removed prior to the commencement of the on-site operations.

12.7 Tree Damage and Remediation

“Damage” means to carry out any activity that may injure or kill any tree and including but not limited to:

- a) the topping or removal of branches from a tree other than in accordance with accepted arboricultural practices;
- b) the cutting or shattering of the roots of a tree within the drip line other than in accordance with accepted arboricultural practice;
- c) the scraping, gouging or denting of a tree’s drip line

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.7 Tree Damage and Remediation (cont'd)

- d) the compaction of the soil within the Tree Protection Zone by the placement of soil, fill, heavy equipment, vehicles, building or other materials thereon or by the movement of vehicles or equipment thereover;
- e) depositing within the tree's drip line any toxic or harmful substance;
- f) the removal of soil from within a tree's drip line.

No objects except approved tree protection barriers are permitted to be attached to trees protected by the Town by-law.

Costs associated with any remediation actions required as a result of damage to retained trees, as ordered by the Town, shall be borne solely by the developer or contractor.

Requirements for Post Construction Measures

A certified arborist, or other tree professional, approved by the Town or designate, shall inspect all retained trees and their rooting area to assess if any additional remediation work is required to ensure their future health and survival.

If the inspection specified in Section 5.7.1 indicates damage to retained trees, the certified arborist or approved professional shall prepare a post construction remediation plan for approval to the Town. The remediation plan may include but is not limited to: pruning; deep root fertilization; irrigation; aeration; tree planting either as a single activity or in combination.

A certified arborist, or other tree professional, approved by the Town or designate shall inspect the project site and certify that any and all measures specified in the tree protection plan or post construction remediation plan have been completed as per the plan. This certification is required before final acceptance and approval of the work by the Town.

12.8 Planting Detail and Notes

The Town of Ingersoll has typical detail drawings for planting, located in Section XX - Typical Details.

The following notes should be placed on submitted Planting Plans:

- All plant materials shall be #1 nursery stock meeting Canadian standards.
- All trees to be staked.

SECTION 12 – TREE PLANTING and TREE PROTECTION

12.8 Planting Detail and Notes (cont'd)

- Dig all tree pits 0.5m larger all around than the root ball and place tree centred in pit on undisturbed soil. Backfill with parent material and replace debris with screened topsoil.
- For grading and drainage, see engineering plans.
- Specific tree locations for each lot are to be approved by the Town of Ingersoll and as shown on Lot Grading Certification Plans.
- All dimensions are in millimetres unless otherwise noted.
- All plant materials to be guaranteed for two growing seasons.
- Plant materials to be installed as shown; substitutions allowed only after consultation with the Town of Ingersoll.
- Predominant soil type in the area.

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Appendix “A”

Approved Trees

Street Planting in Small Boulevard

SWEET GUM (Liquidambar Styraciflua)
SERVICEBERRY (Amerlanchier Canadensis)
IVORY SILK LILAC (Syringa ‘Ivory Silk’)
EASTERN REDBUD (Cercis Canadensis)
LITTLE LEAF LINDEN (Tilia Cordata)
GLENLEVEN LINDEN (Tilia ‘Glenleven’)
BLUE BEECH (Carpinus Caroliniana)

Street Planting in Large Boulevards

EUROPEAN BEECH (Fagus Sylvatica)
BASSWOOD (Tilia Americana)
TULIP TREE (LiriodendronTulipifera)
BLACK MAPLE (Acer Nigrum)
SUGAR MAPLE (Acer Saccharum)
RED MAPLE (Acer Rubrum)
WHITE OAK (Quercus Alba)
BUR OAK (Quercus Macrocarpa)
NORTHERN RED OAK (Quercus Rubra)
SCARLET OAK (Quercus Coccinea)

Street Planting in Town Core Area (Downtown)

PYRAMIDAL PYRUS
QUERCUS
FAGUS

SECTION 12 – TREE PLANTING
and TREE PROTECTION

APPENDIX "A"

Approved Trees

Ravine Margin and Upland Parks

ALL MAPLES LISTED ABOVE
ALL OAKS LISTED ABOVE
EASTERN REDBUD (Cercis Canadensis)
FLOWERING DOGWOOD (Cornus Florida)
COMMON SASSAFRAS (Sassafras)
AMERICAN BASSWOOD (Tilia Americana)
EASTERN WHITE PINE (Pinus Strobus)
AMERICAN BEECH (Fagus Grandifolia)
BLACK LOCUST (Robinia Pseudoacacia)
DOWNEY SERVICEBERRY (Amelanchier Arbor)
CHOKECHERRY (Prunus Virginiana)
CHINQUAPIN OAK (Quercus Muehlenberg)
PIN OAK (Quercus Palustris)
NORTHERN PIN OAK (Quercus Ellipsoidalis)
AMERICAN MOUNTAIN ASH (Sorbus American)

Ravine Bottoms and Stream Margins

WITCH HAZEL (Hamamelis)
COMMON SASSAFRAS (Sassafras)
HEMLOCK (Tsuga Canadensis)
OSAGE ORANGE (Maclura Pomifera)
AMERICAN SYCAMORE (Platanus Occidentali)
BLACK GUM OR TUPELO (Nyssa Sylvatica)
YELLOW BIRCH (Betula Alleghaniensis)
PAPER BIRCH (Betula Papyrifera)
SWAMP WHITE OAK (Quercus BiColor)
NORTHERN WHITE CEDAR (Thuja Occidentalis)
TAMARACK (Larix Laricina)
CUCUMBER TREE (Magnolia Acuminata)
PAWPAW (Asimina Triloba)
EASTERN REDBUD (Cercis Canadensis)
FLOWERING DOGWOOD (Cornus Florida)

**SECTION 12 – TREE PLANTING
and TREE PROTECTION**

APPENDIX "A"

Approved Trees

Windbreaks and Screens

EASTERN WHITE PINE (*Pinus Strobus*)
NORTHERNWHITE CEDAR (*Thuja Occidentalis*)
WHITE SPRUCE (*Picea Glauca*)
NORWAY SPRUCE (*Picea Abies*)

Prohibited Trees

NORWAY MAPLE (*Acer Platanoides*)
WILLOWS (*Salix*)
POPLARS (*Populus*)
AILANTHUS (*Ailanthus Altissima*)
CHINESE ELM (*Ulmus Parvifolia*)
HONEY LOCUST (*Gleditsia Triacanthos*)
MULBERRIES (*Morus*)
BOX ELDER/MANITOBA MAPLE (*Acer Negundo*)
ASH (*Fraxinus*)
RUSSIAN OLIVE (*Elaeagnus Angustifolia*)
CRIMSON KING
HORSE CHESTNUT (*Aesculus Hippocastanum*)
SILVER MAPLE (*Acer Saccharinum*)
AMERICAN ELM (*Ulmus Americana*)
GINKGO OR MAIDENHAIR TREE (*Ginkgo Biloba*) – Female Variety
BLACK WALNUT (*Junglans Nigra*)
AUSTRIAN PINE (*Pinus Nigra*)



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**SECTION 13 – CONTACT
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13.0 Engineering Services

Town of Ingersoll - Engineering Department 519-485-0120

Clerk	Ext 2222
Engineer	Ext 2236
Mapping	Ext 2233
Specifications	Ext 2242
Transportation	Ext 2242
Storm Sewers/SWM	Ext 2242
Roadway Lighting and Traffic Control	Ext 2241

Town of Ingersoll - Public Works Department

Roadside Operations 519-485-2931

County of Oxford – Public Works 519-539-9800

Director	Ext 3100
Water and Wastewater	Ext 3116
Pollution Control	Ext 3127
Transportation	Ext 3117
Operations	Ext 3102

13.1 Development/Planning and Building

County of Oxford 519-539-9800

Development and Planning Ext 3207

Town of Ingersoll 519-485-0120

Building Ext 2234

**SECTION 13 – CONTACT
INFORMATION**

13.2 Other Agencies

Upper Thames River Conservation Authority (UTRCA) 519-451-2800

Hydrology & Regulatory Services Unit Ext 228
Water Control Structures Ext 244
Land Use Regulations Ext 237

CRU Solutions 519-485-6038

Hydro Services Ext 228

Erie Thames Powerlines 519-485-1820

Operations Ext 239
Engineering Ext 230

13.3 Web Sites

Town of Ingersoll www.ingersoll.ca
County of Oxford www.oxfordcounty.ca
Upper Thames River Conservation Authority (UTRCA) www.thamesriver.on.ca
CRU Solutions www.erthcorp.com
Erie Thames Powerlines www.eriethamespower.com





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**SECTION 14 – INSPECTION of SEWER and WATER
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SECTION 14 – INSPECTION of SEWER and WATER WORKS

The following addresses specifications and requirements to be met by the Owner or Contractor for the installation and construction of sewer and water works.

14.0 Approvals of Sewer and Watermain

Prior to installation of sewers and watermains, the Owner must have obtained:

- Final Approval from the Town and County Engineers.
- The Environmental Compliance Approvals from the Ontario Ministry of the Environment for all sewer and watermain work not already authorized by the County of Oxford.
- The execution of all required agreements with the County of Oxford and the Town of Ingersoll.

Installation shall be in accordance with applicable OPSS, County of Oxford Design Guidelines and Supplemental Specification and the Town of Ingersoll Design Guidelines and Specifications.

14.1 Inspection of Sewer and Watermain

A County and/or Town Inspectors shall, at all times, have access to the work. At least 24 hours before commencing installation, the Owner or Contractor shall apply to the County and/or Town for inspection and the Engineer shall determine the extent of inspection required.

County of Oxford is responsible for the inspection of sanitary sewer and watermain.

Town of Ingersoll is responsible for SWM and storm sewers inspection.

14.2 Owner's Supervision

The provision of inspection by the Town is not to be considered a substitute for supervision by the Owner or Contractor.

A Consultant's Inspector engaged by the Owner to inspect the sewer and watermain installation must have successfully completed the five day OGRA & MEA Inspector's Course called "Sewer and Watermain Construction Inspection (TM43)" or a consultant may obtain approval from the Town Engineer upon written request for use of Inspectors with a minimum of ten (10) years related construction experience in lieu of MEA/MOE Inspector's Course.

SECTION 14 – INSPECTION of SEWER and WATER WORKS

14.2 Owner's Supervision (cont'd)

The Owner or Contractor shall provide and leave a competent and reliable agent or foreman in charge for him and such person shall be considered as acting in his place and all notices, communications, instructions or orders given, sent or served upon such person shall be taken as served upon the Owner or Contractor.

14.3 Revisions to Plans

Any changes required by the Owner to plans which have received final approval must be resubmitted to the Town Engineer for approval before the inspector will permit such changes to be made during installation.

14.4 Town Inspector's Authority

An Inspector may stop the work entirely if there is not a sufficient quantity of suitable and approved material on the site to carry out the work properly, if approved drawings and Specifications are not on the site, or if material or workmanship that is contrary to the plans or Specifications is being used.

If the Owner or Contractor covers or permits to be covered, work that has been designated for tests, inspections or approvals before such tests, inspections or approvals are made, given or completed, he shall, if so directed, uncover such work to have the inspections or tests satisfactorily completed and make good such work at his own expense.

14.5 Charges for Inspection

When an Owner or Contractor is required to have a Town Inspector on the job, he shall be charged at the Town's current charge out rate. In the event the Inspector is required during premium time periods the applicant shall be charged at current overtime rates.

If the work at any site is widespread to a point where an Inspector may not, in the opinion of the Town Engineer, give proper supervision to a job, then the Engineer shall determine whether extra Inspectors are required.

If required, the Engineer will place these extra Inspectors on the job and charge the Owner or Contractor for the services at the prescribed rate.

14.6 Emergency Repairs during Guarantee Period

During the guarantee period, where maintenance of services to the consumer or consumers is required, or where, in the opinion of the Engineer or his representative, a faulty or damaged installation may cause inconvenience or further damage, the Town will act immediately to make safe the condition for consumers after which the owner will be contacted and advised of the problem and given the opportunity to immediately affect repair.

If the owner chooses not to respond forthwith or cannot be contacted, immediate repairs will be undertaken by the Town. The cost of such repairs will be charged to the Owner. The decision of the Engineer or his representative will be final as to the necessity of repairs done or required and the amount expended for these repairs.

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**SECTION 15 – SPECIFICATIONS and
TYPICAL DETAIL DRAWINGS**

SPECIFICATIONS and TYPICAL DETAIL DRAWINGS

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- S – 20 Common Utility Trench – Industrial with Ditches (2008)
- S – 21 Removable Bollard (2015)
- S – 22 Permanent Bollard (2015)
- S – 23 Tee Drop Structure (2014)
- S – 24 Sewer Trench Insulation – Rigid Board Insulation (2014)
- S – 25 Sign Post Location Detail (2014)
- S – 26
- S – 27
- S – 28 Concrete Curb Setback (2012)
- S – 30 Hydrant Installation (2004)
- S – 31 Gutter Drain Installation (2012)
- S - 32 Lap Joint Detail (2012)
- S – 33 Denso Tape Installation (2012)
- S – 34 Standard Industrial Cul De Sac (2012)
- S – 35 Standard Residential Cul De Sac (2012)

CONCRETE SIDEWALK SPECIFICATIONS

The ESL for Concrete sidewalk in the Town of Ingersoll is 30 years, although according to the "Sidewalk Design, Construction, and Maintenance" section of "A Best Practice by the National Guide to Sustainable Municipal Infrastructure", with proper maintenance practices this could be extended to 50 to 80 years.

Concrete sidewalks shall be constructed in accordance with OPSD 310.010 (Concrete Sidewalk), 310.020 (Concrete sidewalk adjacent to curb and gutter), 310.030 (Concrete sidewalk ramps at intersections), 310.040 (Utility isolation in concrete sidewalks), 310.050 (Concrete sidewalk driveway entrance details), 310.060 (Concrete pedestrian crossover at signalized intersections) and 350.010 (Urban industrial, commercial, and apartment entrances).

Design Mix

The contractor will supply the concrete design mix, complete with petrographic analysis of the materials to be used, to the Town Engineer, one week prior to the commencement of construction.

Concrete Standard

Recommended concrete standard for sidewalk as per Town of Ingersoll Design mix or equivalent

A summary of the standard is as follows:

- minimum 28-day compressive strength of 32 MPa;
- air content based on maximum size aggregate of up to 20mm (recommend 5.0 to 7 percent)
- nominal maximum size of aggregate up to 20 mm;
- maximum water cementing ratio 0.40; and
- exposure classification C-2;

Concrete Forming and Placement

Sidewalks may be constructed using timber or metal forms. Concrete should not be placed on frozen sub grade or base. The granular material immediately ahead of the concrete-placing operation should be wetted down thoroughly, concrete should be placed continuously and consolidated. Concrete should be levelled and the appropriate surface finish applied before the concrete sets.

CONCRETE SIDEWALK SPECIFICATIONS

Concrete Thickness

The Town of Ingersoll requires that all new and replaced concrete sidewalk follows OPSD 310.010, with the exception of thickness to be minimum 150mm. Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways the thickness shall be 200 mm.

Granular Base depth

Granular base for sidewalks will be a minimum 100mm thick. Granular base at residential driveways will be a minimum 150mm.

Concrete Sidewalk Width

Sidewalk width will be a minimum of 1.5m.

Sidewalk width when adjacent to curb and gutter will be increased to a minimum of 2.0m on major roadways.

Sidewalk width shall be 2.0m where the Town deems as high pedestrian areas.

Joints

Full depth isolation joints should be placed adjacent to existing rigid structures such as poles, walls, hydrants and buildings. Isolation joints should also be located at the beginning and end of curved sections of sidewalk and at all intersections. Isolation joint material usually consists of approximately 12 mm of compressible material, which will allow adjacent sidewalk sections to move independently of each other.

Control joints are to be located at a maximum distance of 7.5m apart for 1.5m wide walks and 9.0m apart for 2.0m or greater width walks.

The transverse contraction joint should extend to a depth of one quarter to one third of the depth of the concrete sidewalk and be a maximum width of 5mm. If the sidewalk width is 2.5 metres or greater, a control joint should also be formed along the centre line of the walk. The Town of Ingersoll's control joints will be trowelled.

Concrete Sidewalk Ramps

Concrete sidewalk ramps at intersections should be constructed as per OPSD 310.030.

CONCRETE SIDEWALK SPECIFICATIONS

Concrete Sidewalk Ramps (cont'd)

Directional lines for the visually impaired shall be 10x10mm made with a grooving tool having a 15mm radius.

Ramp opening must be 1.5m wide and transition up to curb height over a 1m distance.

Test Area

The Contractor shall provide one test area for every 500 sq. m. of sidewalk placed.

Location against curb

Where sidewalk is to be poured against the curb, a 6mm poly sheet or equivalent is to be placed between the curb and the new sidewalk, by the contractor, and where sidewalk is to be poured against curb without a sidewalk key, extra excavation at the curb to the base of the curb is required.

Curing Compound

The curing compound shall be applied to ALL surfaces of the curbs and sidewalks (both sides and the top) and as specified in OPSS 1315 and applied at the rate stated in. The OPSS standard further requires that all curing methods be implemented within 2 to 4 metres of the finishing operation.

The current practice of placing an entire day's work of exterior concrete flatwork while leaving the curing/protection operation until the end of the day is in clear violation of the OPSS requirements and has an extremely detrimental effect on the surface of the concrete. The ultimate durability of the concrete surface is being reduced by the non-existent or incomplete application of the selected curing method. (See Also – RMACO BULLETIN T-023 May 26th, 2004)

Protection- Rain/Cold

Should weather conditions (e.g. rain) make it necessary to cover any concrete work, it shall be covered with burlap first and then plastic. Cold weather concreting (at temperatures less than 5 degrees Celsius) will require the placing of burlap, plastic and then insulation blankets. This process will be in effect for any concrete work. The blankets shall be in place for a minimum of five days.

The R value of the insulation shall be a minimum of 2.0.

CONCRETE CURB and GUTTER SPECIFICATIONS

The ESL for Concrete Curb and Gutter in the Town of Ingersoll is 30 years, although with proper maintenance practices this could be extended to 50 to 80 years.

Concrete curbs within the Town of Ingersoll shall be constructed in accordance with OPSD 600.04 (Concrete Barrier Curb with Standard Gutter) and/or 600.060 (Concrete Semi-Mountable Curb with Standard Gutter).

Design Mix

The contractor will supply the concrete design mix, complete with petrographic analysis of the materials to be used, to the Town Engineer, one week prior to the commencement of construction.

Concrete Standard

Recommended concrete standard for curb and gutter as per Town of Ingersoll Design mix or equivalent

A summary of the standard is as follows:

- minimum 28-day compressive strength of 32 MPa;
- air content based on maximum size aggregate of up to 20mm (recommend 5.0 to 7 percent)
- nominal maximum size of aggregate up to 20 mm;
- maximum water cementing ratio 0.40; and
- exposure classification C-2;

Concrete Forming and Placement

Curbs must be placed by machine unless otherwise approved by the Town Engineer.

Concrete should not be placed on frozen sub grade or base. The granular material immediately ahead of the concrete-placing operation should be wetted down thoroughly; concrete should be placed continuously and consolidated. Concrete should have the appropriate surface finish applied before the concrete sets.

Granular Base depth

Granular base for all curb and gutters shall be Granular 'A' (or equivalent if approved)

CONCRETE CURB and GUTTER SPECIFICATIONS

Joints

Control joints are to be located at a maximum distance of 7.5m apart.

Where sidewalk is to be placed against the curb then joints must follow the sidewalk specifications of:

- maximum distance of 7.5m apart for 1.5m wide walks
- maximum distance of 9.0m apart for 2.0m or greater width walks.

Concrete Ramps

Concrete curb ramps at intersections should be constructed as per OPSD 310.030 (Concrete Sidewalk Ramps at Intersections)

Where concrete curb meet a driveway entrance, ramps must follow:

- 0.5m slope where curb is against boulevard
- 1.5m slope where curb is against sidewalk

Transitions and Terminations

A transition of 3.0m is required between curb types.

Curb termination as per OPSD 608.010 shall be used within temporary turning circles and dead end streets or intersections which abut or are adjacent to a future phase of a subdivision.

At radii ramping transitions, refer to OPSD 3010.030.

For a transition of an outlet at an end of run, refer to OPSD 605.030.

Outlets

Should an outlet be required within a run of curb, refer to OPSD 604.010 or OPSD 605.010.

Should an outlet be required at the end of a run of curb, refer to OPSD 605.030 and OPSD 605.040.

Test Area

The Contractor shall provide one test area for every 900 l.m. of curb placed.

CONCRETE CURB and GUTTER SPECIFICATIONS

Curing Compound

The curing compound shall be applied to ALL surfaces of the curbs and sidewalks (both sides and the top) and as specified in OPSS 1315 and applied at the rate stated in. The OPSS standard further requires that all curing methods be implemented within 2 to 4 metres of the finishing operation.

The current practice of placing an entire day's work of exterior concrete flatwork while leaving the curing/protection operation until the end of the day is in clear violation of the OPSS requirements and has an extremely detrimental effect on the surface of the concrete. The ultimate durability of the concrete surface is being reduced by the non-existent or incomplete application of the selected curing method. (See Also – RMACO BULLETIN T-023 May 26th, 2004)

Protection- Rain/Cold

Should weather conditions (e.g. rain) make it necessary to cover any concrete work, it shall be covered with burlap first and then plastic. Cold weather concreting (at temperatures less than 5 degrees Celsius) will require the placing of burlap, plastic and then insulation blankets. This process will be in effect for any concrete work. The blankets shall be in place for a minimum of five days.

The R value of the insulation shall be a minimum of 2.0.

ASPHALT SURFACE SPECIFICATIONS

The ESL for Asphalt Surfaces within the Town of Ingersoll is 20 years, although with proper maintenance practices this could be extended to 30 to 40 years.

Asphalt Types

The following types of asphalt are currently being applied within the Town of Ingersoll.

Residential Roads	Basecoat	HL8
	Topcoat	HL3
Collectors and/or Arterial Roads	Basecoat	Superpave 19.0
	Topcoat	Superpave 12.5
Parking Lots	Basecoat	HL8
	Topcoat	HL3

Hot Laid (HL) asphalt mixes shall conform to OPSS 310, OPSS 1150 and all referenced specifications.

Superpave design mixes shall conform to OPSS 313.PROV and 1150.MUNI and all referenced specifications.

The Town of Ingersoll at their discretion may choose to use Superpave on a residential street, should a geotechnical report deem it necessary. It is the responsibility of the pavement designer to approach the Town in regards to this specification.

Design Mix

The contractor will supply the concrete design mix, complete with petrographic analysis of the materials to be used, to the Town Engineer, two weeks prior to the commencement of construction. These mixes will then be reviewed by the Town of Ingersoll or their assigned representative for approval.

The designer may choose to use recycled asphalt for the basecoat only. Should the designer choose to use the recycled asphalt, Subsection 310.05.01 Asphaltic Concrete, of OPSS 310, is amended by the deletion of the existing paragraph and its replacement with the following:

Asphaltic concrete shall conform to the requirements of OPSS 1150 and the following: the composition of all binder course pavements may be modified by the recycling of up to 25% by mass of reclaimed asphaltic concrete. Where the Contractor proposes to use reclaimed asphaltic concrete, they shall submit a detailed proposal in writing to the Town Engineer for approval.

Design Mix (cont'd)

Mix design shall not include any shingles as a modifier, as they do not conform to the physical quality of the aggregates.

The Town will not allow recycled material in the design mix for the HL3 item.

Additives

The Town of Ingersoll may choose to use a warm mix additive (WMA) in the design of their roads.

It is the responsibility of the pavement designer to approach the Town in regards to this specification and type of WMA they so choose to use.

Asphalt Thickness

Asphalt depth shall be determined from the geotechnical report. If the information is unavailable, the Town may approve the thickness from their typical detail information.

Standard thickness for residential street is:

- Basecoat 50mm
- Topcoat 50mm

Placement of Asphalt

All asphalt must be placed by a mechanical spreader unless otherwise approved by the Town Engineer.

Asphalt should only be placed on dry, unfrozen surfaces and only when weather conditions allow for proper production, placement, handling and compaction.

For basecoat, remove all loose materials from the compacted base.

Where topcoat is to be placed, sweeping and cleaning of the streets is a requirement, prior to the application tack coat. Tack coat shall be placed at the rate of 0.35kg/square metre as per OPSS 313.

Placement of Asphalt (cont'd)

Asphalt on Site:

1. The Town will not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C.

Temperature is to be recorded in a daily journal.

2. No asphaltic concrete materials shall be placed when the atmospheric temperature is below 5 degrees C.

Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 75mm or less, spread in one layer.
3. No basecoat thickness shall exceed 75mm per layer.

Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
 - a. No depressions which will retain standing water.
 - b. No deviation greater than 3mm in 1.8m.

Testing

The Town of Ingersoll requires that all asphalt testing be completed by a third party geotechnical engineering firm. QA samples shall be taken at the discretion of the Town, along with a Referee sample.

The following tests are required by the Town:

- % AC
- Gradation on control sieves
- Air Voids
- Lift thickness
- Marshall or Superpave properties
- Compaction

Testing (cont'd)

The Town reserves the right to take pavement cores to determine thickness of each lift for the purpose of payment.

All results must be received by the Town in a timely manner. Only an Ontario registered Geotechnical Engineer may sign off on these reports.

Test Area

Sampling should be taken every 500 tonne daily.

Acceptance and Rejection

In order for the Town to take acceptance of an asphalt surface, all components of testing must pass inspection and be noted on the geotechnical report, which is to be stamped and signed by a licensed engineer.

The Town may at their discretion reject any asphalt placed should the geotechnical report state an issue with the placement or that a deviation from the mix design has occurred (See above Testing).

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TOPSOIL, SOD and SEED SPECIFICATIONS

The Town of Ingersoll has developed the following guidelines for the placement of topsoil, seed and/or sod.

Topsoil

Topsoil shall be best quality fertile, loose, loamy material screened to be free from stones and weeds, to be placed and graded in the locations and to the depths specified by the Engineer. Topsoil must not contain any chemical contamination or material detrimental to plant growth.

Topsoil must meet the following requirements: Organic Matter 4% minimum, Clay 5-25%, Silt 25-50% , Sand 30-70%, and pH 6 – 7.5. PH levels above 7.5 may be considered, provided that a recommendation is provided by a Certified Agronomist stating that the high pH level is not detrimental to plant growth.

Testing

The Developer or Contractor shall, at their cost, submit to the Town Engineer a independent soil tests from an OMAFRA accredited laboratory. The date of analysis indicated on the topsoil report must be no later than ninety (90) days from the date of topsoil placement.

Topsoil shall be tested for phosphorous, potassium, calcium, magnesium, chloride, sodium, sodium adsorption ratio, cation exchange capacity, base saturation (K, Mg, CA, H), soil texture (% sand, % silt, % clay), organic matter and pH. The report from the OMAFRA accredited laboratory must clearly indicate that nothing within the tested parameters are detrimental to plant growth. The report should also include any recommendations with respect to the type of fertilizer and the rate at which it should be applied to the topsoil layer in advance of the placement of new sod. No topsoil shall be delivered to the site until the Town Engineer has received and reviewed the topsoil report.

The Town reserves the right to sample topsoil at the source or as placed on site. Sampling and testing of the topsoil will be as directed by the Engineer. Acceptance or rejection of the topsoil material will be based on the test results. Rejected material must be removed at the Developer or Contractor's expense.

Placement

Prior to placing topsoil, the sub-grade shall be graded to eliminate uneven areas and low spots ensuring positive drainage. All debris, branches or stones shall be removed. No topsoil shall be placed until the Engineer has inspected and approved the sub-grade condition. Care shall be taken when working around roots of live trees including hand excavation.

TOPSOIL, SOD and SEED SPECIFICATIONS

Placement (cont`d)

The topsoil surface shall be smooth with a fine loose texture prior to laying sod or seeding. The topsoil surface shall be free of lumps, hollows and deleterious materials.

Soil that has been compacted by equipment or other means is not suitable for sod/seed placement.

Unless otherwise permitted by the Engineer , the Contractor shall level topsoil delivered at the job site within 24 hours of delivery and sodding or seeding shall be carried out within 24 hours of leveling of topsoil.

Minimum Depths

Minimum depth of topsoil shall be 150 mm compacted upon completion of the sod. The Engineer prior to placing any sod/seed shall inspect topsoil depths. The Contractor must place a sufficient amount of topsoil to allow for the compaction and settlement of the topsoil.

Sod

Sod shall be Commercial Grade Kentucky Bluegrass Nursery Sod according to the Specifications, Classifications and Use of Turfgrass Sod for Nursery Sod Growers Association of Ontario.

Sod shall be seeded and established in nursery sod fields as a turfgrass sod. There shall be no more than 5 broadleaf weeds per 40 square metres of sod and up to 20% non-specified grass. Sod shall be of sufficient density that no surface soil is visible. The grass height shall be 30mm minimum and 70mm maximum.

The soil portion of the sod shall be well permeated with roots. It shall be a good mineral type soil with a thickness of 10mm minimum and 15mm maximum. Individual sod pieces shall be of a condition that each may be lifted, rolled, transported, and placed without breaking or tearing and without loss of soil under normal handling conditions.

Sod shall contain sufficient moisture to maintain its vitality during transportation and placement. The sod shall be fresh and shall not be cut earlier than the day previous to laying. If left overnight, it shall be stacked to prevent drying. The Contractor shall provide delivery slips confirming the date which the sod was cut.

Sod Stakes

Stakes for pegging shall be wooded stakes approximately 19 x 19 x 300mm in length. In locations where staking is required, every sod section shall be staked in the bottom three rows and every second row above.

Stakes shall be driven flush with the sod but not deeper.

Fertilizer

Fertilizer shall comply with the provisions of the Canada Fertilizers Act and Fertilizer Regulations. Fertilizer shall be supplied in bags bearing the manufacturer's label indicating mass and analysis. All fertilizer shall be in granular form: dry, free flowing, free from lumps, and with an analysis of 8-32-16.

Fertilizer shall be applied uniformly at a rate of 3.5kg/100m² unless a different application rate has been recommended in the topsoil test report. Apply fertilizer with a rotary spreader and work into topsoil to a depth of 50mm by raking. There shall be no separate payment for the supply or application of fertilizer.

Operational Constraints

The placement of topsoil or sod shall not commence until the Engineer has approved the surface preparation. A minimum of 24 hours notice is required for inspection prior to placement of topsoil or sod.

Sod shall not be laid when in a frozen condition, under adverse field conditions such as high wind, frozen soil, or soil covered with snow, ice or standing water.

Placement of Sod

Supply and place sod as shown on the Contract Drawings and specified in the Contract Documents or as specified by the Town Engineer. No voids shall be left between the soil portion of the sod and the underlying ground surface. Sod shall be securely placed lengthwise across the face of slopes and parallel to the centerline of ditches. End joints of adjacent sod pieces shall be staggered. The edges of adjacent sod pieces shall be placed tightly against one another without overlapping. Existing grass areas must be cut straight and trimmed to accommodate the placement of the new sod. Sod shall be placed to match the existing grade level at all edges. Joints shall be tamped to a uniform surface. Sod may need to be staked in sloped areas to avoid movement.

TOPSOIL, SOD and SEED SPECIFICATIONS

Placement of Sod (cont`d)

All sod shall be machine rolled over placement. Where site conditions do not permit machine rolling due to restricted working area or steepness of slope, the Developer/Contractor shall hand tamp or hand roll the laid sod as necessary.

Application of Seed

The Developer/Contractor may supply and place seed as directed by the Town Engineer. The primary seed mixture shall have the following composition:

- 40% Canada or Kentucky Blue Grass
- 30% Creeping Red Fescue
- 30% Perennial Rye Grass

Bags shall bear the seed supplier's label clearly indicating species content, grade and mass as well as the recommended seeding rate for the establishment of new lawn areas.

Apply seed with "Brilliant" seeder or other approved conventional dry seeder or spreader, in two applications at one half the rate with applications at 90 degrees to one another.

Lightly work seed into the topsoil after seeding with a fan rake or other approved method.

Care and Watering of New Sod/Seed

The Contractor shall be responsible for care and watering of newly laid sod. The frequency of the watering rests solely with the Contractor. Water shall be free of contaminants or impurities that would adversely affect the growth of the sod. Water shall be immediately applied to the sod to obtain moisture penetration through the sod and into 50mm of topsoil. Water shall be subsequently applied as necessitated by ground and weather conditions to ensure healthy and vigorous sod growth.

All sod and seed is to be maintained by watering for the first 30 days from date of placement.

Watering of sod shall not exceed 10mm per 1 square metre of new sod per day.

Only one application of water per day unless otherwise directed by the Engineer.

Care and Watering of New Sod/Seed (cont`d)

The Developer/Contractor must provide the Town with a schedule for watering the sod or seed. The Contractor may be required to provide proof to the Engineer with an invoice for the watering, and advance notification prior to the application of water.

The Town of Ingersoll prohibits direct water taking from the hydrants. Bulk water is now available in Oxford County from automatic dispensing stations using a key fob system and prepaid account. Bulk water key fobs can be purchased at the Oxford County Administration Building (OCAB) Customer Service, 21 Reeve Street, Woodstock; 519.539.9800.

The sod and seeded areas shall be inspected by the Engineer 15 days following its placement. All new sod/seeded areas shall be healthy, actively growing and green in leaf colour. All sod shall be in the same location as originally placed and shall not have moved, eroded, slipped or sloughed.

Sod shall show evidence of rooting in the underlying soil. The sod shall be of sufficient density that no surface soil is visible. There shall be no competitive growth emerging from the sod or from between the sod joints.

Seeded areas shall also consist of healthy, vigorous turf, free of weeds and of sufficient density that no soil surface is visible.

The Developer/Contractor shall replace any sod or seeded areas, which in the sole opinion of the Engineer does not meet these quality control criteria.

Warranty

The Developer/Contractor shall provide a full one-year warranty period for the sod/seed following its placement. The Contractor will be responsible to repair or replace dead or distressed sod/seed at a minimum during the spring or fall or in some cases as directed by the Engineer. The Contractor will not be expected to replace sod during very, hot and dry weather conditions.. The Contractor must comply with the Town's request to repair or replace dead sod within thirty (30) days. Any replaced sod/seed is also subject to a thirty day warranty period following placement. If the 30 day warranty period starts after or extends past October 1st, the warranty period will be in effect until May 31st of the following year. Failure to comply by the Developer/Contractor within this timeline will result in the Town undertaking any necessary repairs and recovering any costs from the maintenance holdback. This warranty provision will be strictly enforced.

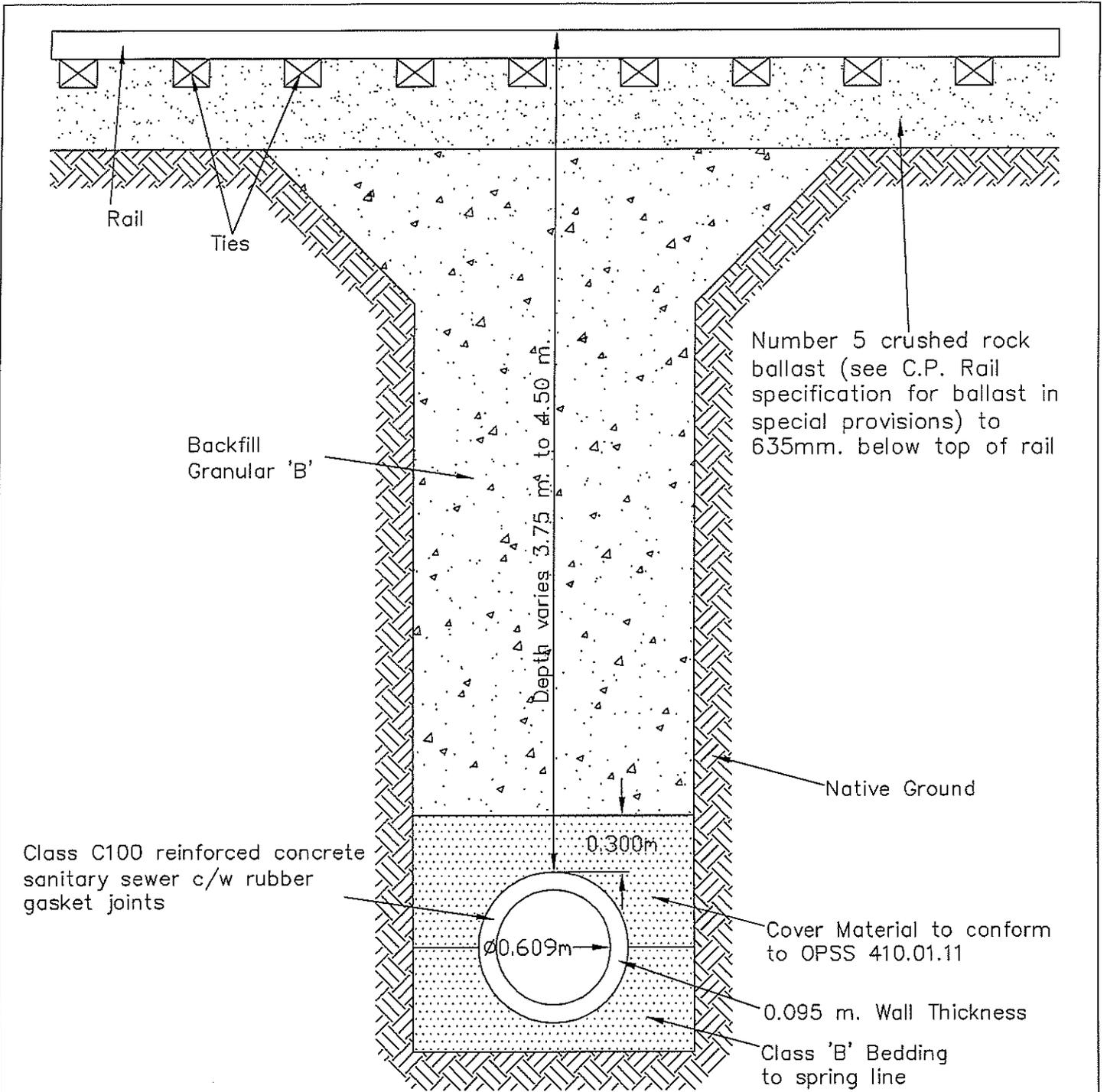
Warranty (cont`d)

The Town will inspect the new turf areas and notify the Developer/Contractor of any deficiencies at approximately the following intervals:

- 30 days following placement
- October 31 of the year in which the sod was placed
- May 15 of the year following placement of sod
- One year after placement of sod

The Town reserves the right to extend the warranty period in extenuating circumstances where the Developer/Contractor has been negligent in the care of the sod, beyond the normal one year expiry date to ensure that replacement sod/seed is healthy and actively growing.

DRAFT



METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

TYPICAL RAILWAY CROSSING
for SEWER AND WATER

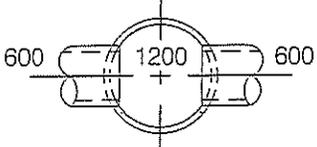
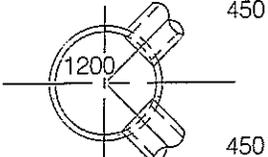
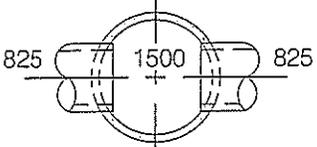
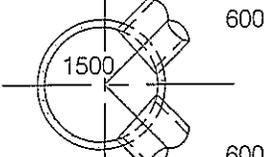
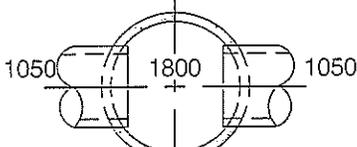
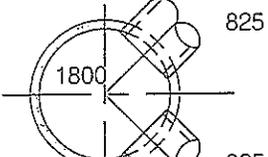
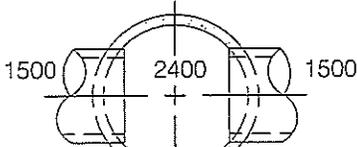
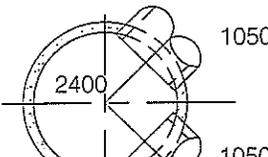
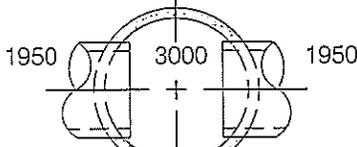
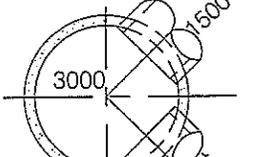
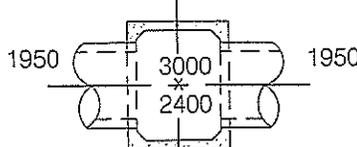
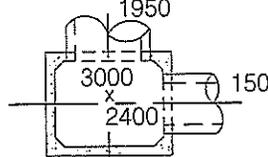
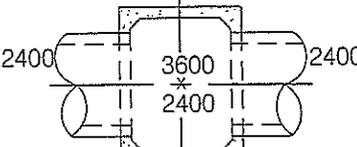
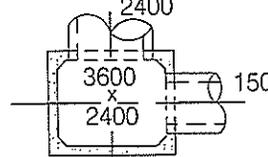
No.	BY	DATE	DESCRIPTION
REVISIONS			

DRAWN BY:
J.A.Y.

APPROVED BY:
E.R.M.

DATE:
July 23, 2007

STANDARD No.
S - 1

Maintenance Hole Inside Diameter (mm)	Max. Pipe Size for Straight Through Installation (mm)	Max. Pipe Size for Right Angle Installation (mm)	Remarks
1200			<p>ALL DIMENSIONS ARE FOR CONCRETE PIPE</p> <p>KNOCKOUTS FOR SMALL DIAMETER CATCHBASIN LEADS (250 & 300 mm) COULD BE PROVIDED IN ADDITION TO WHAT IS SHOWN</p>
1500			
1800			
2400			
3000			
3000 x 2400			
3600 x 2400			

NOTE : Saucer to be soaked with water and completely mulched immediately following planting.

Protection to a height of 150mm from grade to be installed prior to mulch.

Root ball modified as required.

Construct soil berm 100mm high x 200mm wide around perimeter of root ball

Bottom of root ball rests on existing or recompacted soil.

Excavate 0.5m larger than root ball

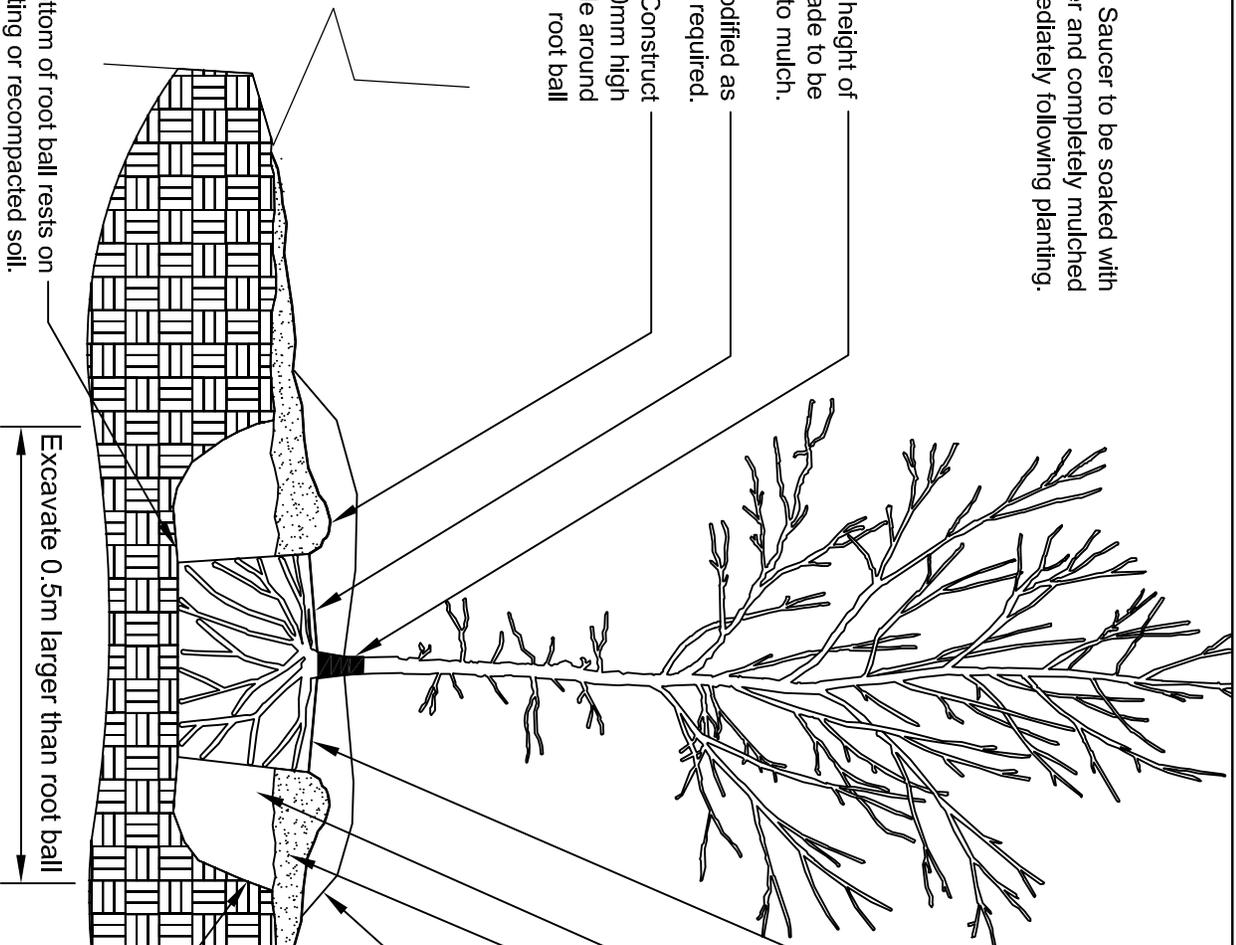
Backfill with native or approved topsoil.
Existing soil.

100mm layer of mulch (Shredded bark or wood) to cover entire excavated area.

Finished grade.

Trunk to have same elevation relative to finished grade or previously occupied prior to transplanting.
Prior to mulching, lightly tamp soil around the root ball in 150mm lifts to brace tree. Do not over compact. When the planting hole has been backfilled, pour water around root ball to settle the soil.

Existing site soil added to create a smooth transition from the top of the raised root ball to the finished grade at a 15% max. slope.



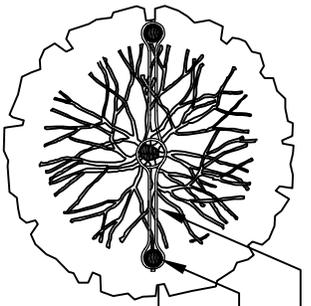
NOT TO SCALE

The Corporation of The Town of Ingersoll

TYPICAL TREE PLANTING DETAIL

No.	BY	DATE	DESCRIPTION

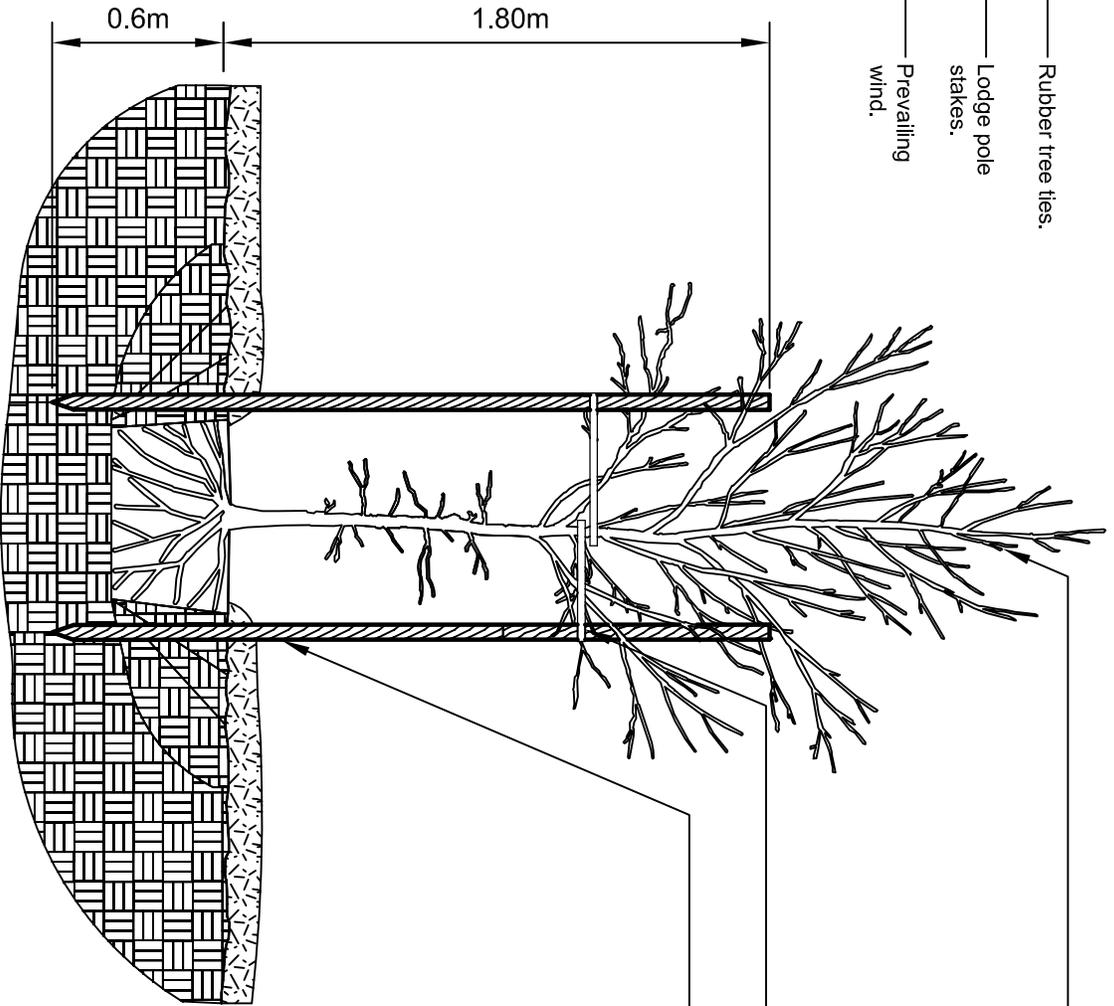
REVISIONS	DRAWN BY: T.W.E.	APPROVED BY:	DATE: JAN 2015	STANDARD NO. S-3
-----------	---------------------	--------------	-------------------	---------------------



Rubber tree ties.

Lodge pole stakes.

Prevailing wind.



Remove nursery stake. If central leader needs to be straightened or held erect, it is acceptable to attach a 12mm x 2.4m bamboo pole to the central leader and trunk.

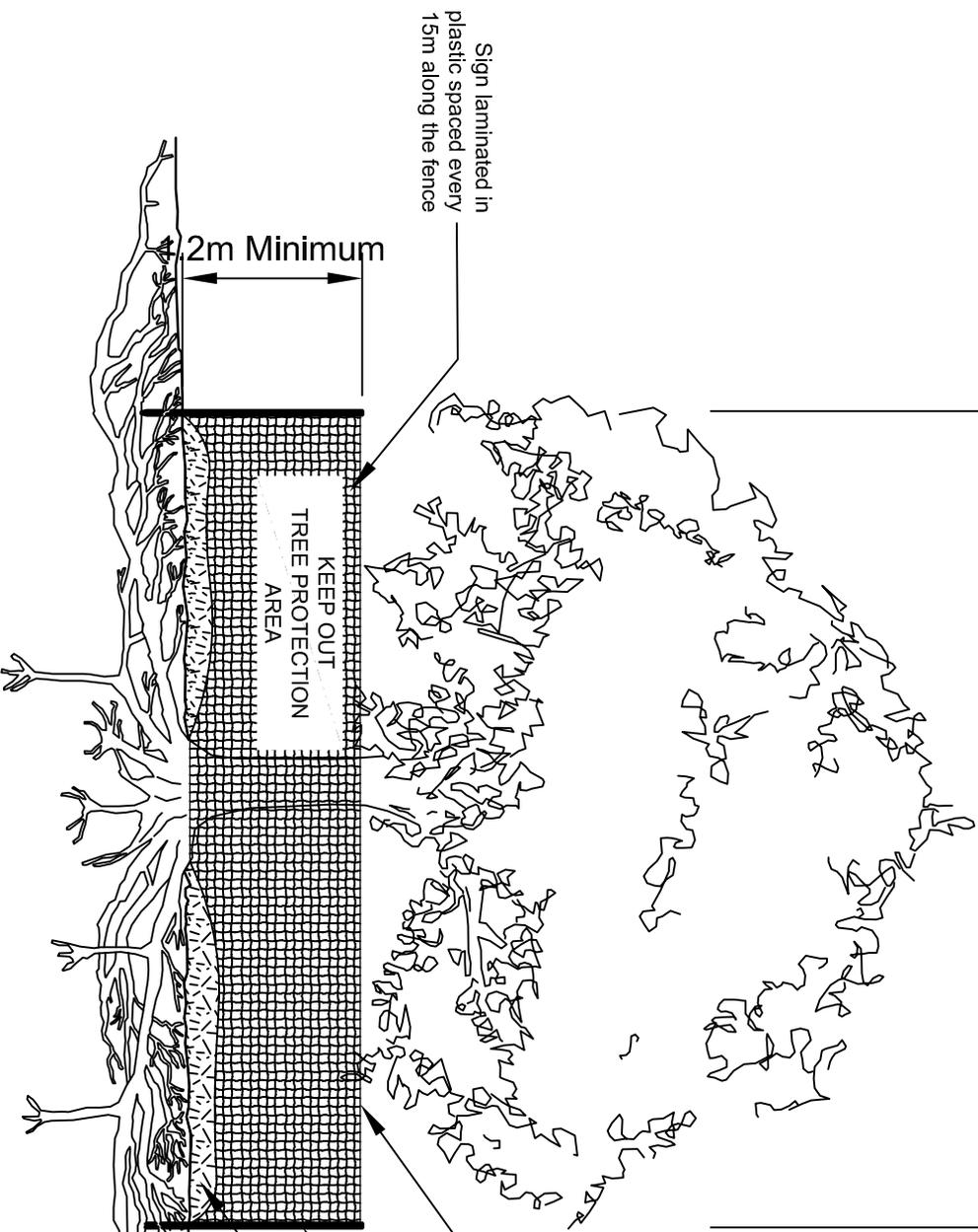
Non - abrasive rubber ties.

Two (2) three inch lodge pole pine stakes. Install approximately 50mm away from the edge of the root ball. Stake location shall not interfere with permanent branches.

NOT TO SCALE

			<i>The Corporation of The Town of Ingersoll</i>		
			TREE STAKING DETAIL		
No.	BY	DATE	REVISIONS		
			DRAWN BY:	APPROVED BY:	DATE:
			T.W.E.		JAN 2015
			STANDARD NO.		
			S-4		

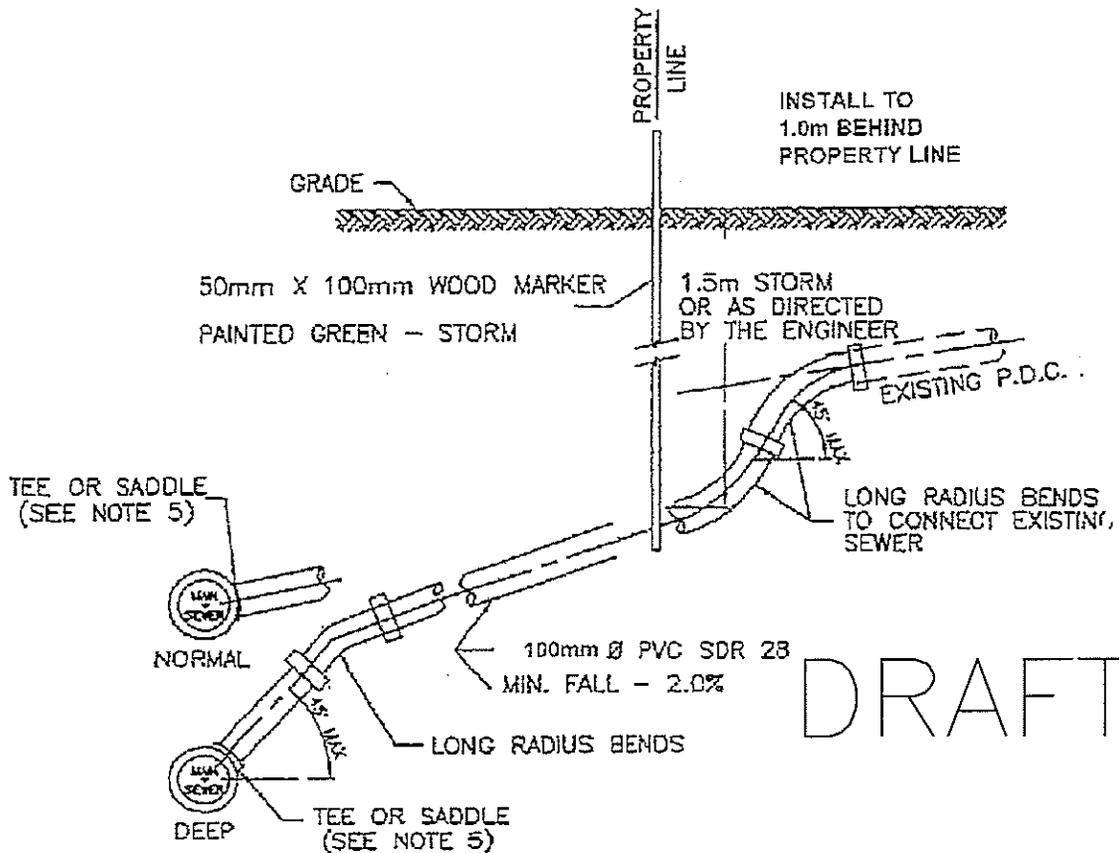
Crown drip line or other limit of Tree Protection area.



- Notes:
- 1- See specifications for additional tree protection requirements.
 - 2- No equipment shall operate inside the protective fencing including during fence installation and removal.

NOT TO SCALE

			<i>The Corporation of The Town of Ingersoll</i>			
			TREE PROTECTION DETAIL			
No.	BY	DATE			DRAWN BY: T.W.E. APPROVED BY: DATE: JAN 2015 STANDARD NO. S-5	
REVISIONS						

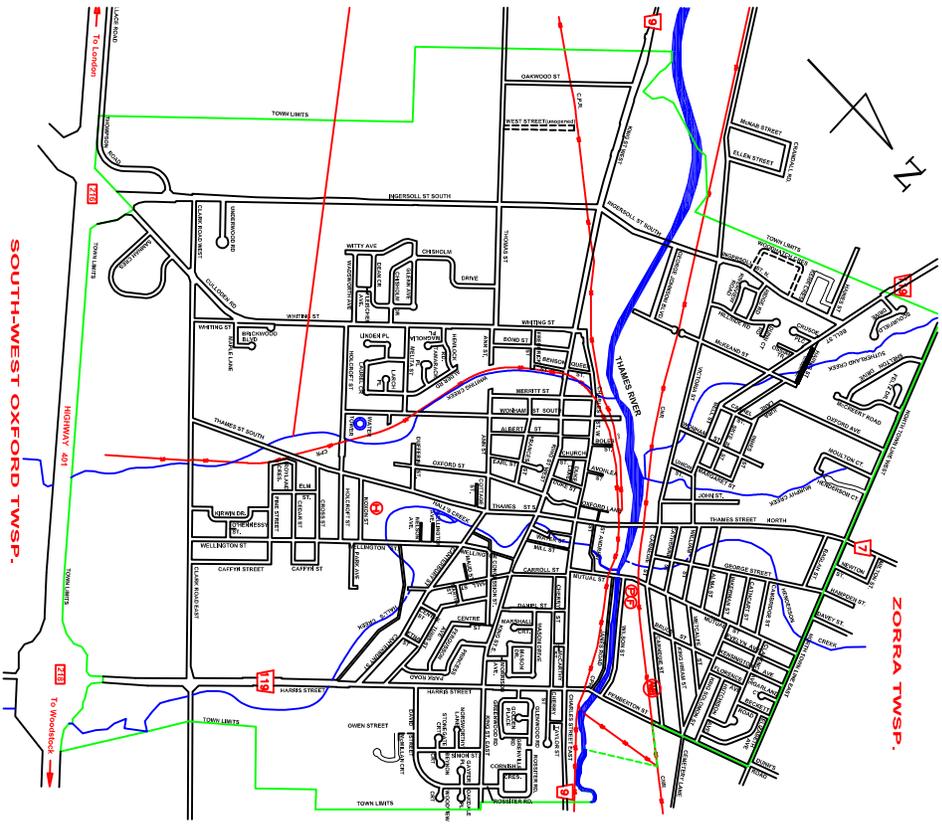


PDC NOTES:

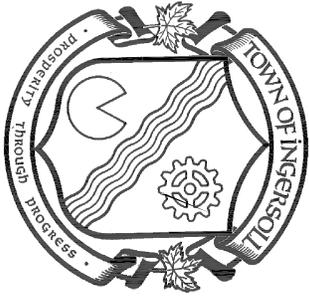
1. PDC'S SHALL BE 100mm SDR 28 UNLESS OTHERWISE APPROVED BY THE ENGINEER.
2. DEPTH AND LOCATION OF THE PDC SHALL BE AS SHOWN UNLESS OTHERWISE DIRECTED BY THE ENGINEER. THE NORMAL FLAT TEE IS PREFERRED. THE DEEP 45° INCLINED TEE MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
3. PDC'S SHALL BE LAID AT DESIGN GRADE TO 1.0m BEHIND PROPERTY LINE.
4. THE CONTRACTOR MUST SELECT A PDC GRADE TO AVOID CONFLICT WITH OTHER UTILITIES, AND HAVE MINIMUM CLEARANCE OF 0.3m. NO PDC MAY BE CONNECTED TO THE MAINTENANCE HOLE.
5. PRE-FABRICATED TEES SHALL BE USED FOR ALL PDC'S ON NEW SEWER MAIN CONNECTIONS. SADDLE CONNECTIONS MAY BE USED WHEN CONNECTING NEW SERVICES TO AN EXISTING SEWER MAIN WITH THE ENGINEER APPROVAL.

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

			<i>The Corporation of The Town of Ingersoll</i>		
			PRIVATE DRAIN CONNECTION		
	BY	DATE	DESCRIPTION		
REVISIONS			DRAWN BY: T.W.E.	APPROVED BY:	DATE: Jan 2015
					STANDARD No: S - 7



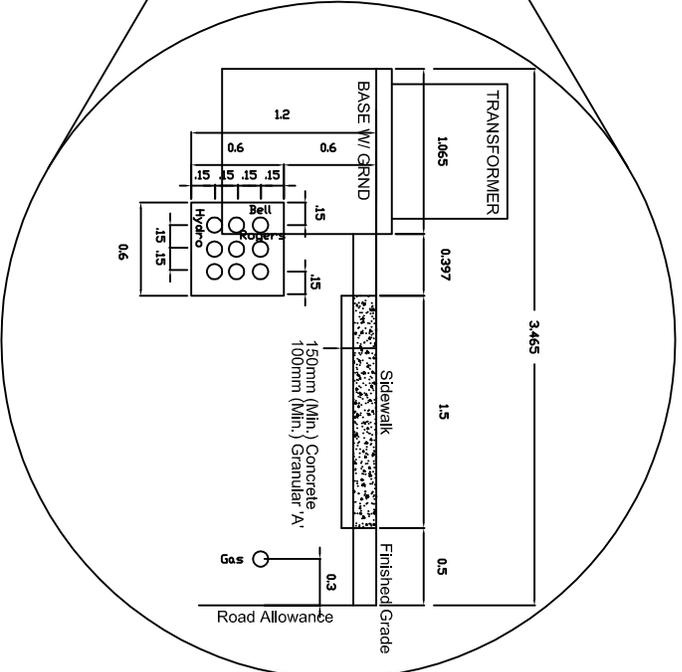
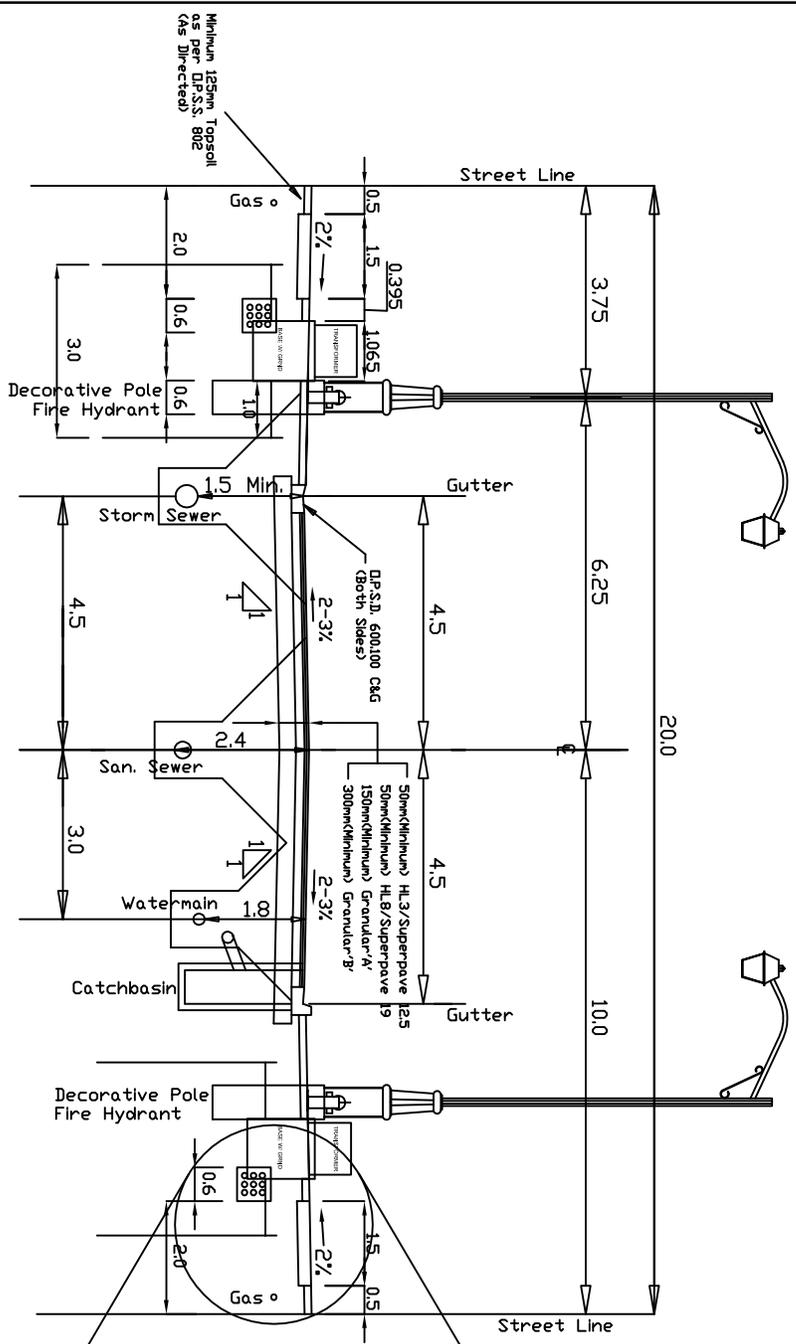
MAP of THE TOWN of INGERSOLL
 N.T.S.
 — JOB SITE



TOWN OF INGERSOLL
 &
 COUNTY OF OXFORD



CONTRACT NUMBER:
 PROJECT NUMBER:
 PROJECT NAME:



Typical 20m Cross-Section

N. T. S.
 Approved March, 2012
 Revised September, 2014

6.		2012	Approved by Council (May 14th)
----	--	------	--------------------------------

5.	WK	2012	Utility Change
----	----	------	----------------

4.	TWE	2009	Crossfall Change
----	-----	------	------------------

3.	JLA	01/04	Hydrant, S/W & Utilities Relocated
----	-----	-------	------------------------------------

2.	ERM	01/98	Sidewalk Width - Preferred & Min'm
----	-----	-------	------------------------------------

1.	EAB	01/93	Walks & Hydrants Relocated
----	-----	-------	----------------------------

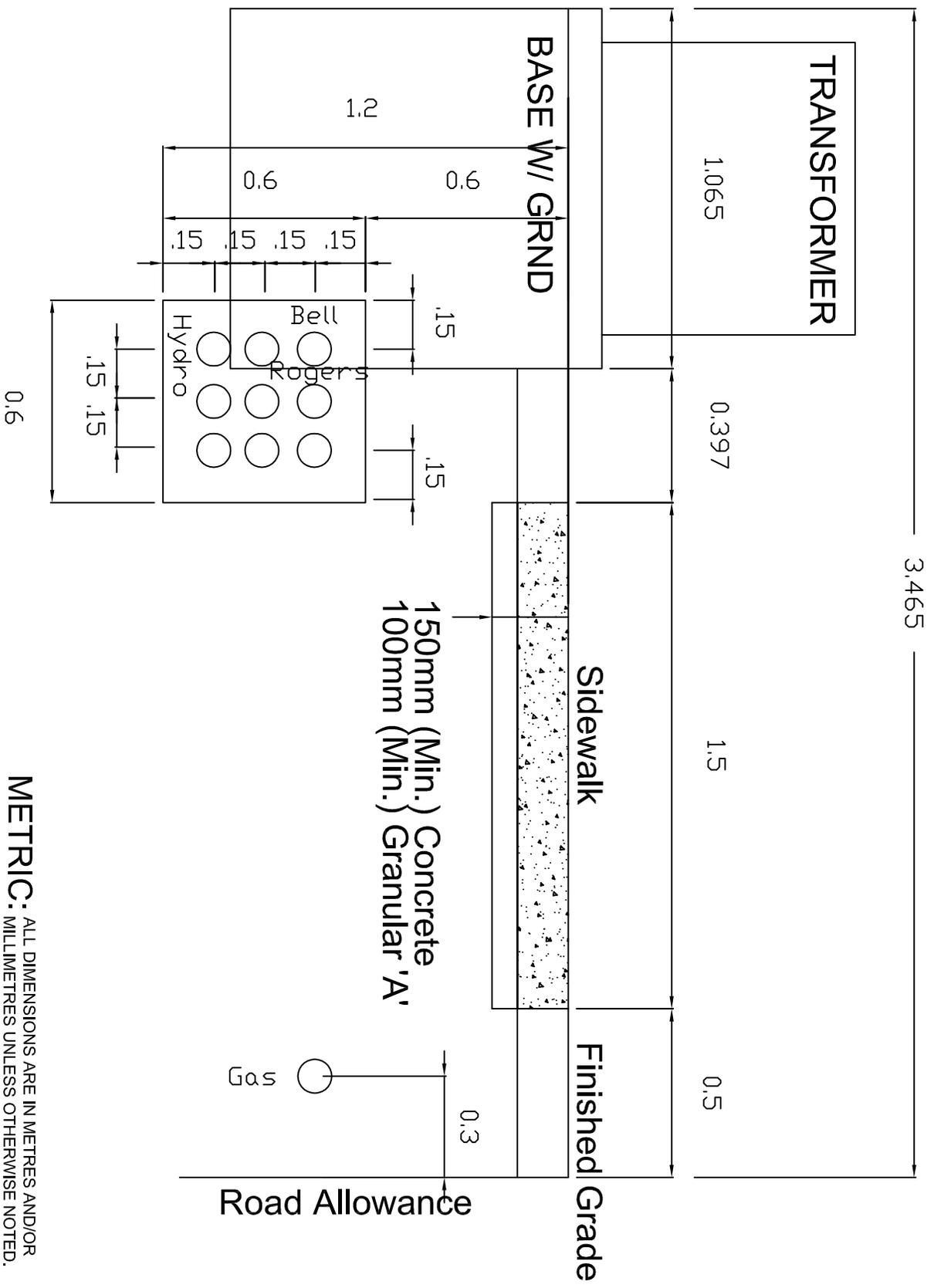
No.	BY	DATE	DESCRIPTION
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METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

Typical 20m - Residential Standard
 Local Cross Section

REVISIONS			
DRAWN BY:	J.L.A.	APPROVED BY:	E.R.M.
DATE:	JAN.2004	DATE:	JAN.2004
STANDARD NO.	S-14		



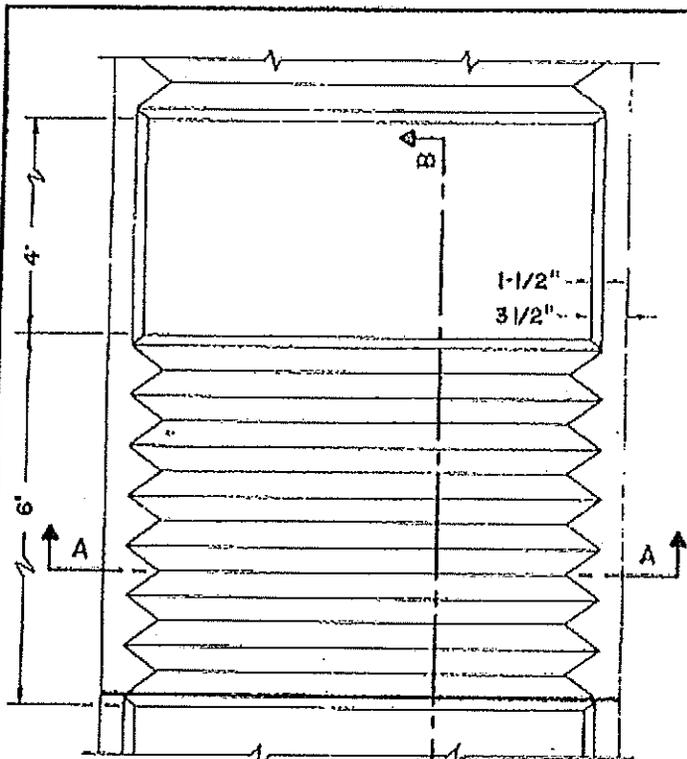
METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

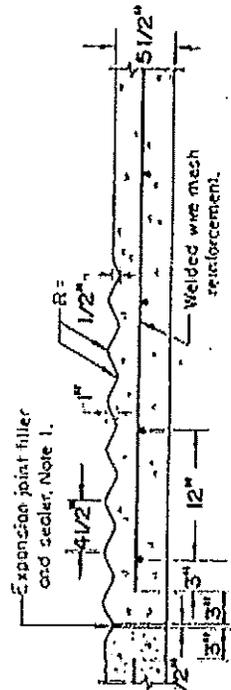
COMMON UTILITY TRENCH

No.	BY	DATE	DESCRIPTION

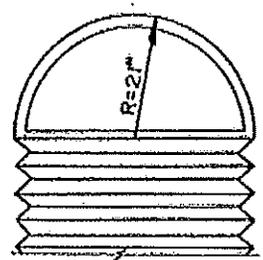
REVISIONS			
DRAWN BY:	APPROVED BY:	DATE:	STANDARD NO.
W.K.	E.R.M.	MAY 2012	S-17



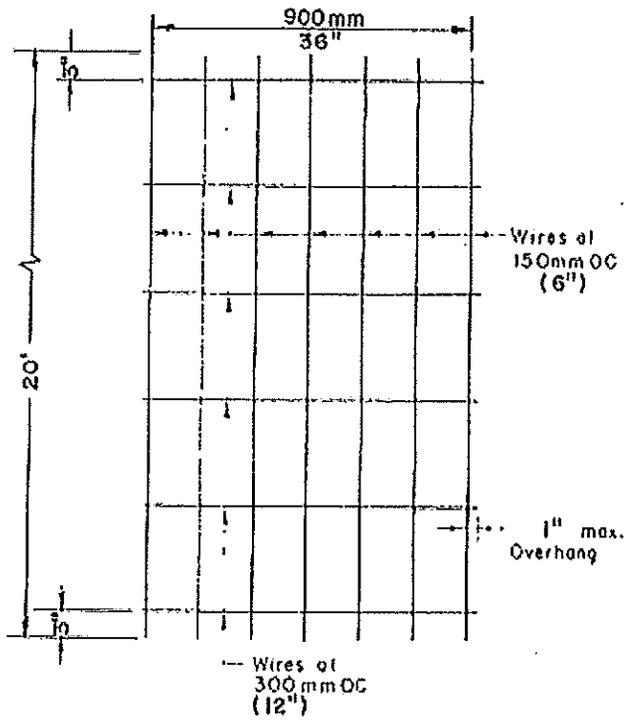
PLAN



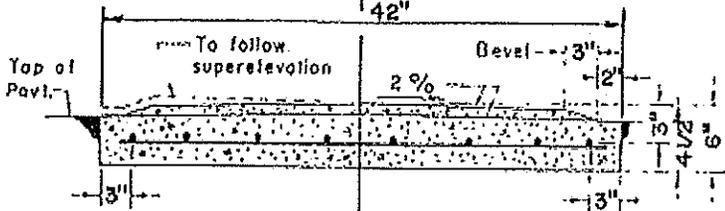
SECTION B - B



BULLNOSE PLAN



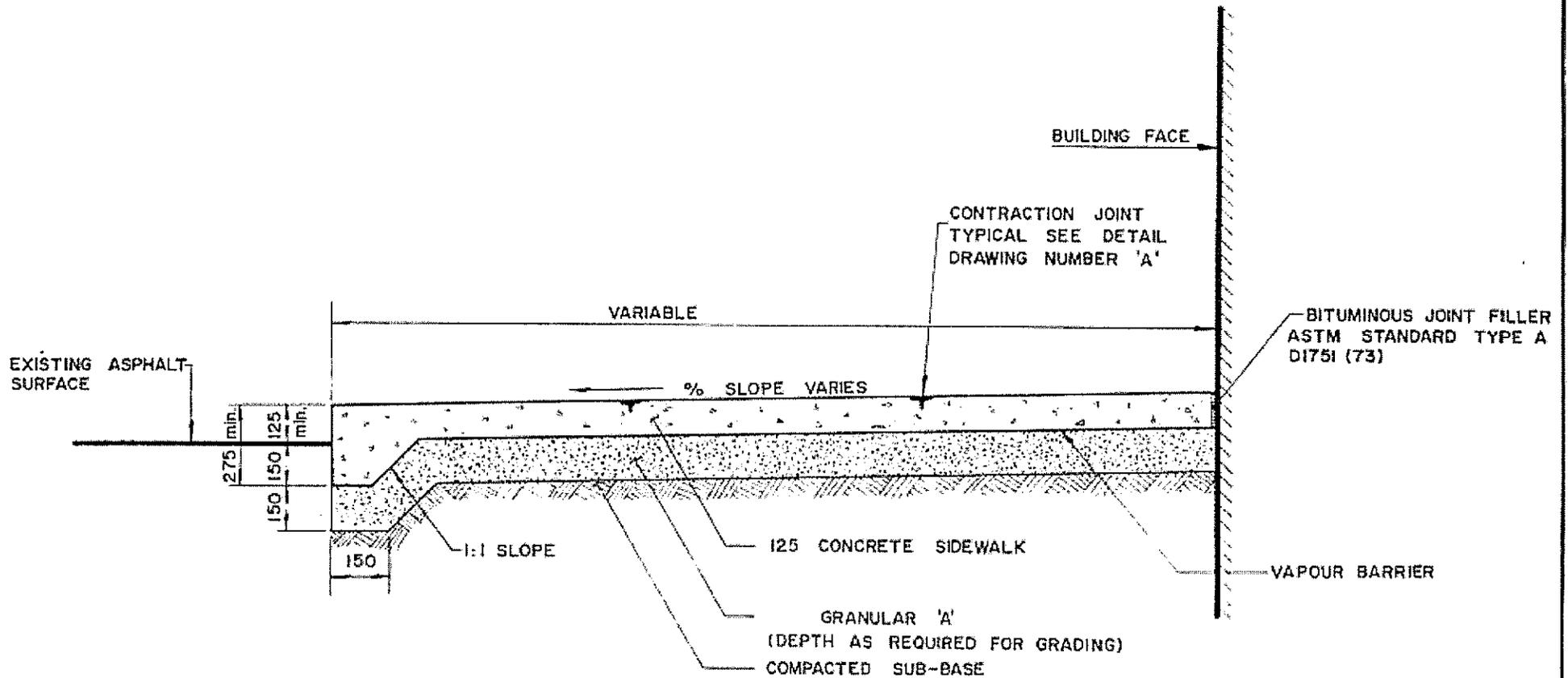
WELDED WIRE MESH REINFORCEMENT



SECTION A - A

- NOTES:
1. Expansion joints shall be formed every 20ft, with 1/2" x 4.5" sheets of plywood or non-extruding bituminous filler extending the full width of strip.
 - A. Class of concrete is to be 25 MPa at 28 days.
 - B. All dimensions are in feet and/or inches unless otherwise shown.

TOWN OF INGERSOLL		Date	JULY 26, 1980	Rev	
CONCRETE RIPPLE STRIP		APPROVED BY COUNCIL MAY 14TH, 2012			
		Standard No.	S-18		



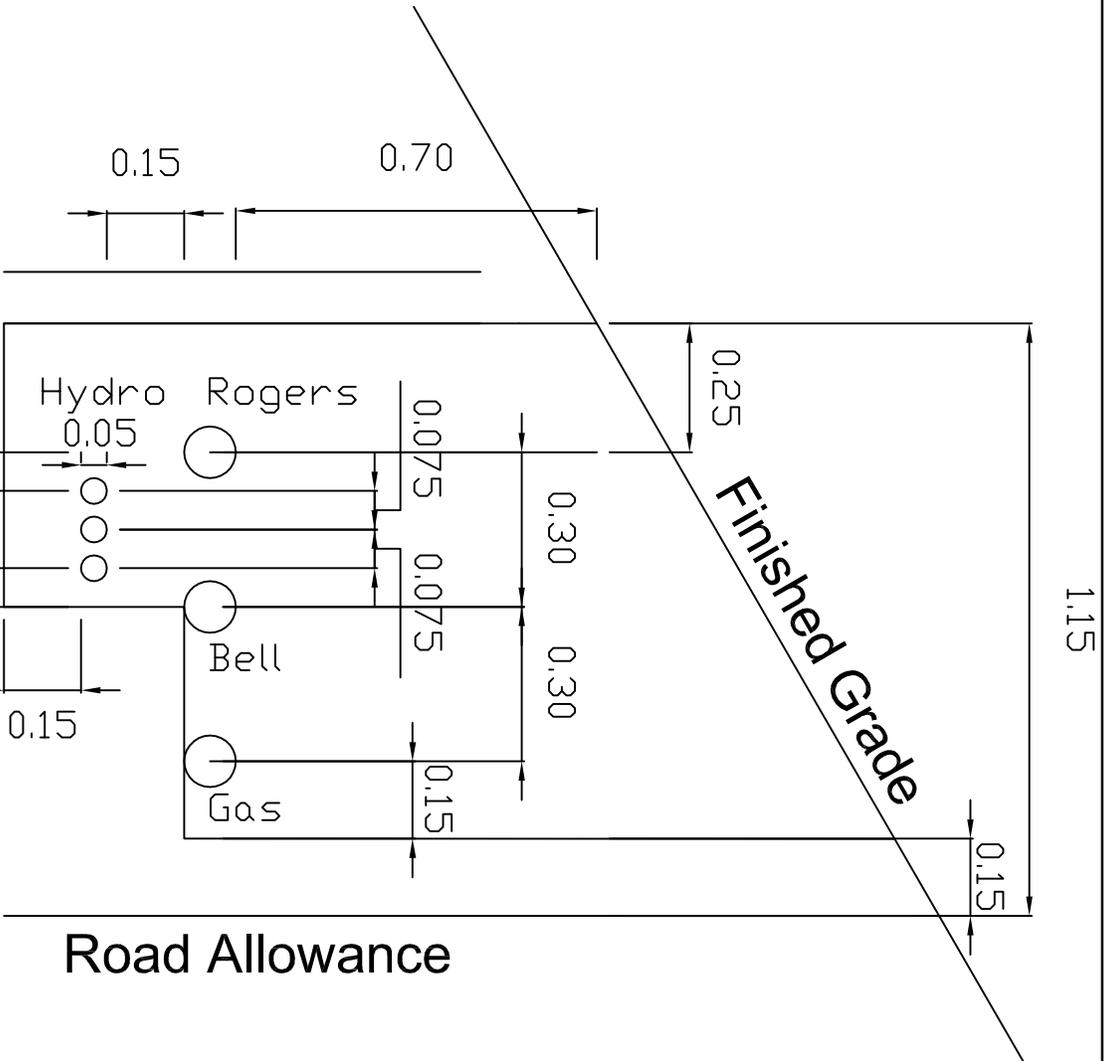
NOTES:

1. Concrete will be 32 MPa .
2. Bituminous Joint Filler ASTM Standard Type A D1751 (73). Full Depth.
3. Compact Granular 'A' to 95% Standard Proctor .
4. All exposed edges are to be tooled to minimum 12 radius.
5. Increase thickness to 150mm at driveways.

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES.

<i>The Corporation of The Town of Ingersoll</i>			
COMBINATION CURB & SIDEWALK			
DRAWN BY: E.R.M.	APPROVED BY: E.A.B.	DATE: MARCH, 1980	DRAWING NO. S-19

**APPROVED BY COUNCIL
MAY 14TH, 2012**



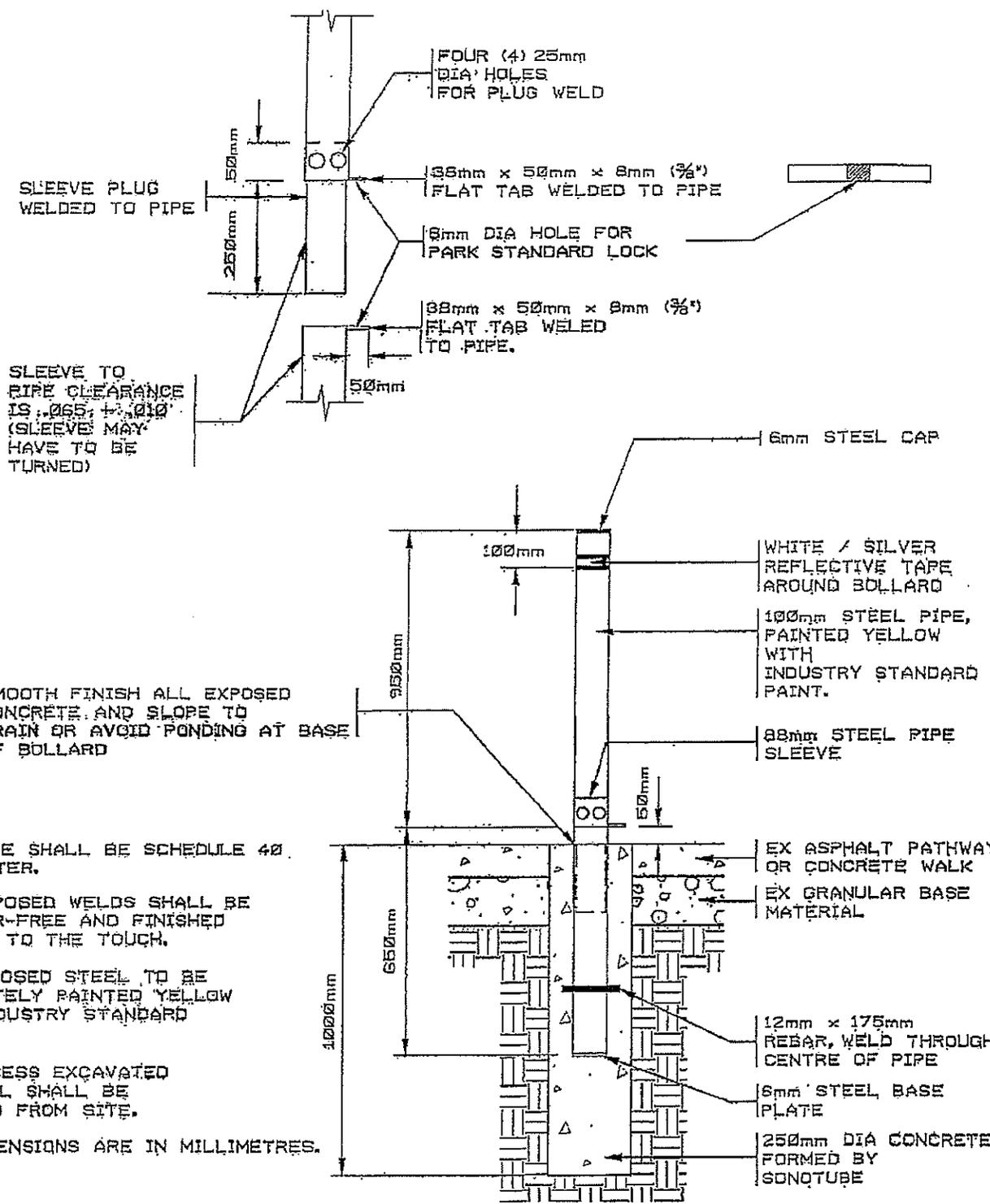
METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

**COMMON UTILITY TRENCH
FOR INDUSTRIAL WITH DITCHES**

No.	BY	DATE	DESCRIPTION

REVISIONS			
DRAWN BY:	APPROVED BY:	DATE:	STANDARD No.
J.A.Y.		FEB.2008	S-20



SMOOTH FINISH ALL EXPOSED CONCRETE AND SLOPE TO DRAIN OR AVOID PONDING AT BASE OF BOLLARD

NOTES:

1. ALL PIPE SHALL BE SCHEDULE 40 OR BETTER.
2. ALL EXPOSED WELDS SHALL BE SPATTER-FREE AND FINISHED SMOOTH TO THE TOUCH.
3. ALL EXPOSED STEEL TO BE COMPLETELY PAINTED YELLOW WITH INDUSTRY STANDARD PAINT.
4. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM SITE.
5. ALL DIMENSIONS ARE IN MILLIMETRES.

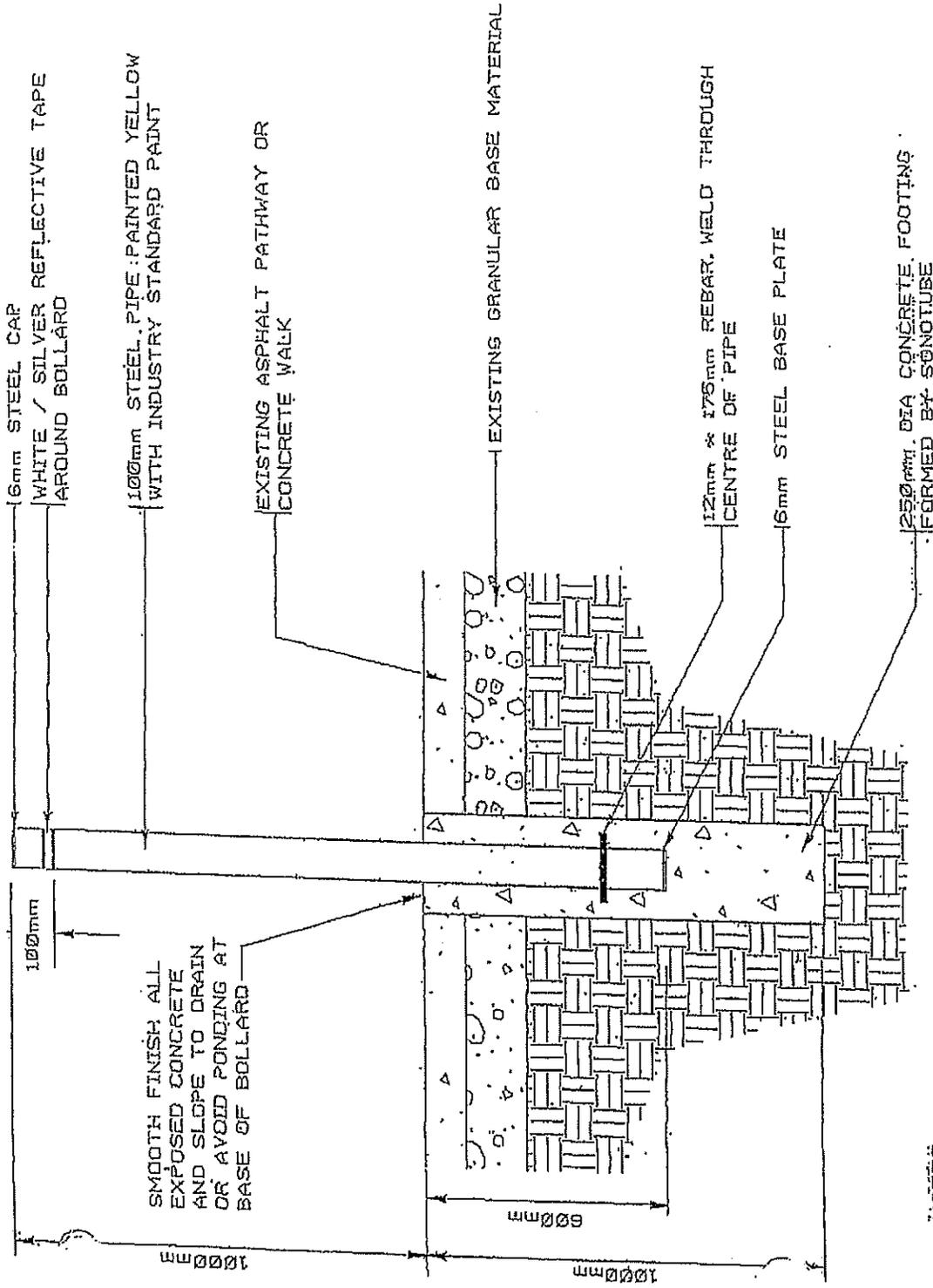
METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll
REMOVABLE BOLLARD

No.	BY	DATE	DESCRIPTION

REVISIONS

DRAWN BY: T.W.E.	APPROVED BY:	DATE: JAN. 2015	STANDARD No. S - 21
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NOTES

1. ALL PIPE SHALL BE SCHEDULE 40 OR BETTER
2. ALL EXPOSED WELDS SHALL BE SPATTER-FREE AND FINISHED SMOOTH TO THE TOUCH
3. ALL EXPOSED STEEL TO BE COMPLETELY PAINTED YELLOW WITH INDUSTRY STANDARD PAINT.
4. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM SITE.
5. ALL DIMENSIONS IN MILLIMETRES

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

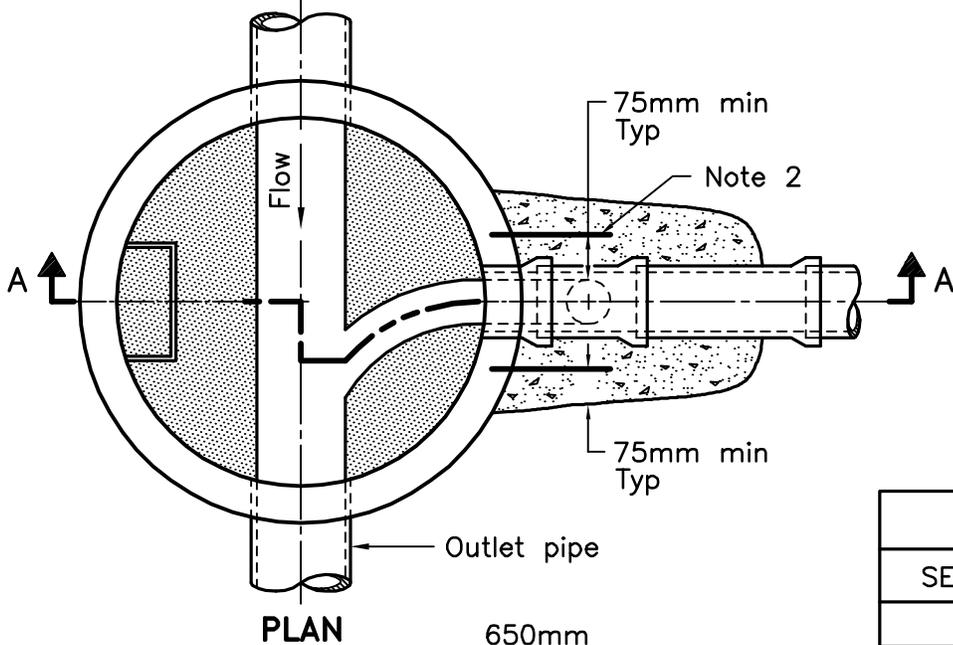
The Corporation of The Town of Ingersoll

PERMANENT BOLLARD

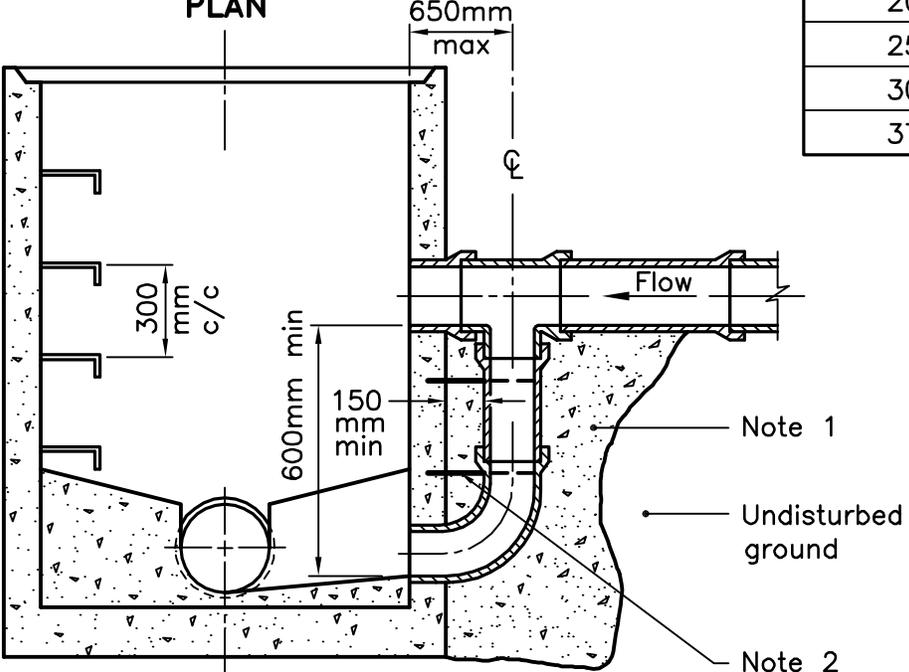
No.	BY	DATE	DESCRIPTION

REVISIONS

DRAWN BY: T.W.E.	APPROVED BY:	DATE: JAN. 2015	STANDARD No. S - 22
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SIZE OF DROP PIPE	
SEWER ID	DROP PIPE ID
200	200
250	200
300	250
375	300



SECTION A-A

NOTES:

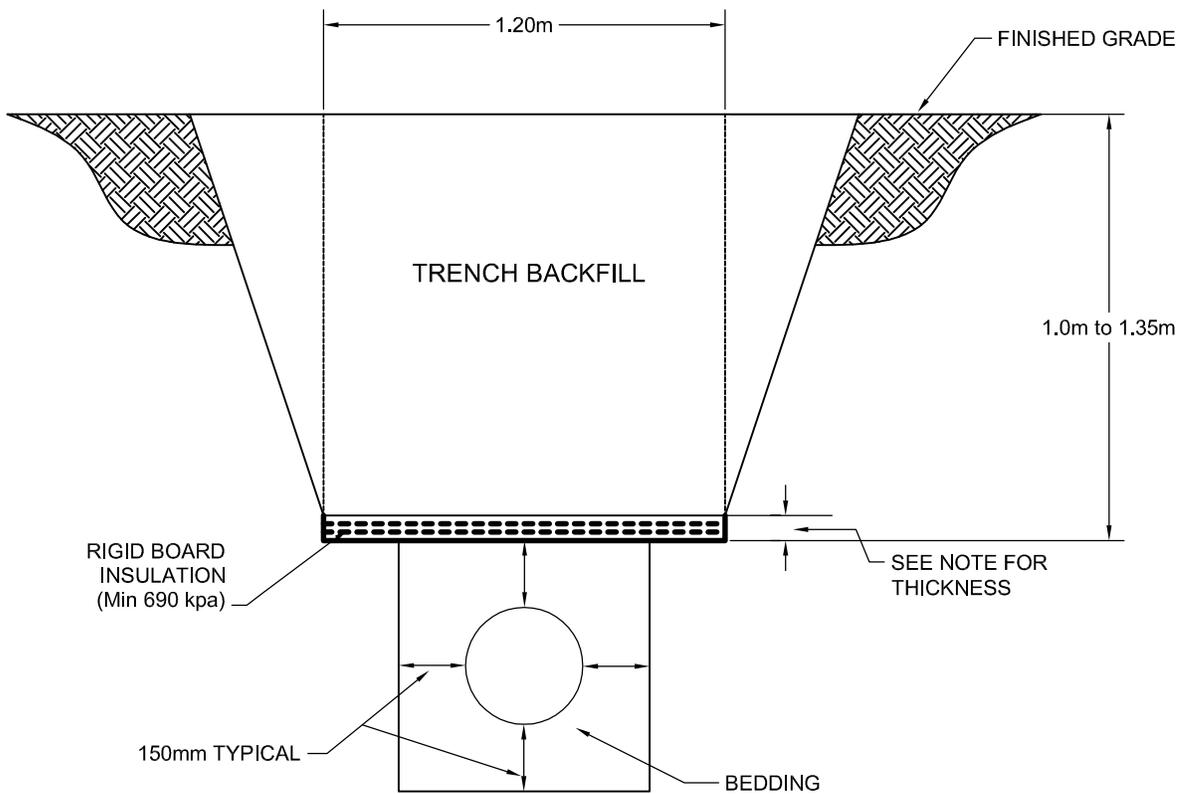
- 1 Concrete shall be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.
 - 2 Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.
- A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev 2	
CAST-IN-PLACE	S - 23		
MAINTENANCE HOLE DROP STRUCTURE TEE STORM SEWER	OPSD 1003.010		

NOTE:

- IF GROUND COVER IS 1.0m - 1.35m USE 50mm THICK INSULATION

PROVIDE 1200mm WIDE BY 50mm THICK INSULATION AT LOCATIONS WHERE THE SEPARATION BETWEEN OTHER INFRASTRUCTURE AND STORM SEWER IS LESS THAN 300mm.



METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

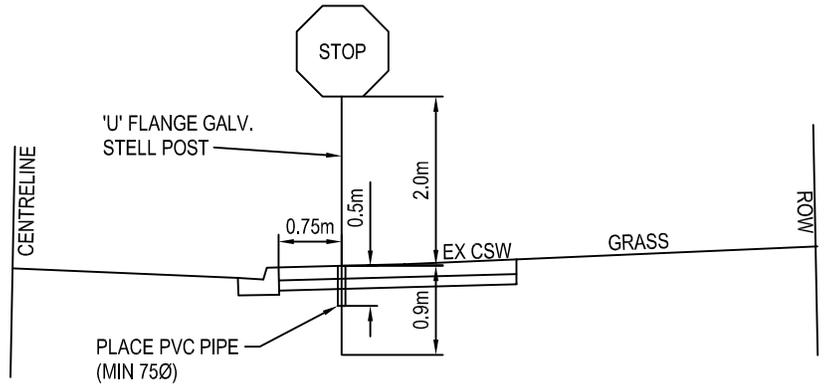
**SEWER TRENCH INSULATION
RIGID BOARD INSULATION-SLAB**

No.	BY	DATE	DESCRIPTION

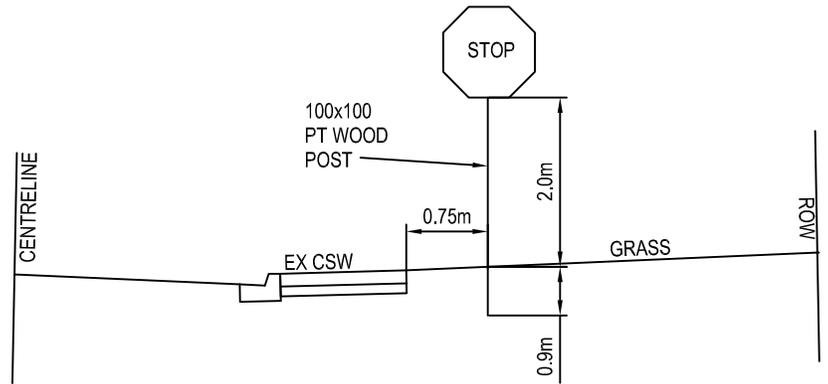
REVISIONS			DRAWN BY: T.W.E.	APPROVED BY:	DATE: Jan 2015	STANDARD No. S - 24
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NOTE:

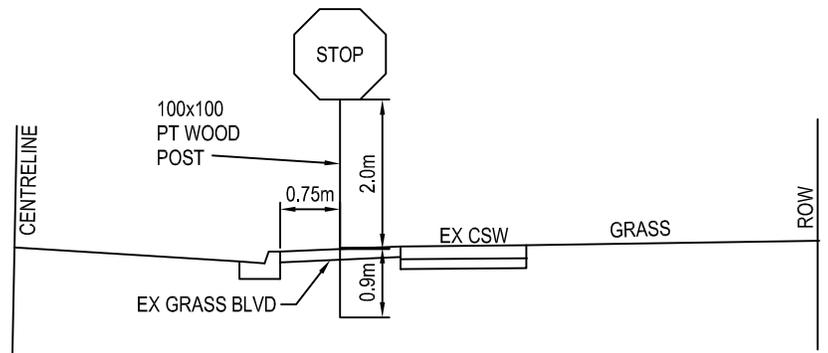
1. Sign location on posts are to be placed in accordance with the Ontario Traffic Manual.
2. All posts located within the landscaped ROW are to be constructed of 100x100 pressure treated wood.
3. Where post are to be placed within a concrete sidewalk or boulevard, steel U flange post are to be placed c/w 0.5m of PVC tubing and backfilled with grout.
4. No signs are to be place on utility poles without authorization from the Town Engineer.



POST IN CONCRETE SIDEWALK OR BOULEVARD



POST IN LANDSCAPED ROW BEHIND SIDEWALK



POST IN LANDSCAPED BOULEVARD

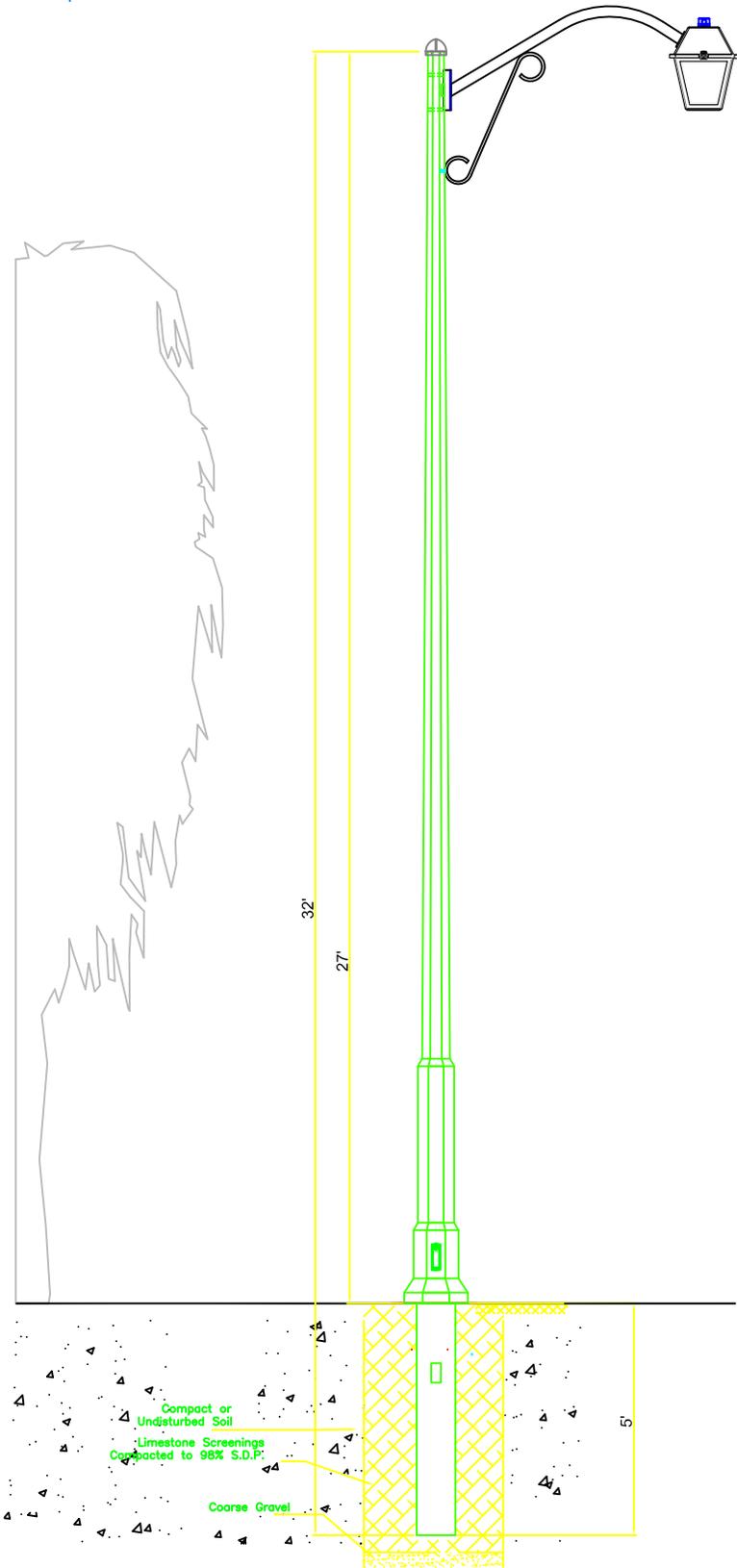
METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll
SIGN POST LOCATION DETAIL

No.	BY	DATE	DESCRIPTION
REVISIONS			

DRAWN BY: T.W.E.	APPROVED BY:	DATE: Jan. 2015	STANDARD No. S - 25
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Project: Town of Ingersoll
 Lumec fixture : L40U-STM-80W-48LED4KR-ACDR-C-LE3-VOLT-RC-BKTX
 Aluminous arm: NSB-5
 USI Concrete pole: CA320A3ML60F CAMBRIDGE



LUMINAIRE:

1. Head module: Mounting arm adaptor c/w cast aluminum hood (356 alloy). C/w integrated twist lock long life photocell c/w 20 Year warranty.
 2. Light engine : 80 W of power. TYPE 3, Cut-off. The light engine have 48 LED powered by an efficient LED driver which operates on 120 Volts. The light engine provides a (CRI) Color Rendering Index of 70 and 5480 lumens with 4000 K. All components are CSA/UL approved. Operating Lifespan 100,000 hours
 3. Opening System: provided by an hinged access door. The mechanism offers access to the lamp and ballast tray.
 4. Tool-free Driver module:
 LED Driver. Lamp starting capacity -30°C. Assembled on a removable stainless steel tray with quick disconnect Spun aluminum ballast cover. Quick disconnect connector. Single stainless steel retaining latch system. All components are UL approved.
 5. Surge Protector: 10KV surge protectors that protect Line-Ground, Line-Neutral and Neutral - Ground in accordance with IEEE/ANSI C62.41.2 guidelines.
 6. Base module: Four-sided cast aluminum body. Clear flat glass lens 1/8" thickness (#GGC) c/w gasketing.
 Wiring/hardware : Type TEW 14-7. 12" (30cm) minimum exceeding from luminaire. All electrical connections shall be made with quick-disconnect connectors. Neoprene and/or silicone gasketing is applied. All exposed hardware are stainless steel.
- ARM:**
1. Mounting plate mechanically secured by bolts. Pole diameter to be determined.
 2. Arm: 2-3/8"Ø bent aluminum tube.
 3. Decorative element, made of aluminum.
 4. Mounting plate to fix the luminaire.
 Wiring/hardware :All exposed hardware are stainless steel.
- Finish : #BKTX (BLACK).
 Textured finish. Electrostatically applied polyester powder coat paint (5 mils / 127 microns).

Dwg #:	INGCoachRev1
Scale/Ech:	
Designer:	BH
Date:	NOV 6, 2014

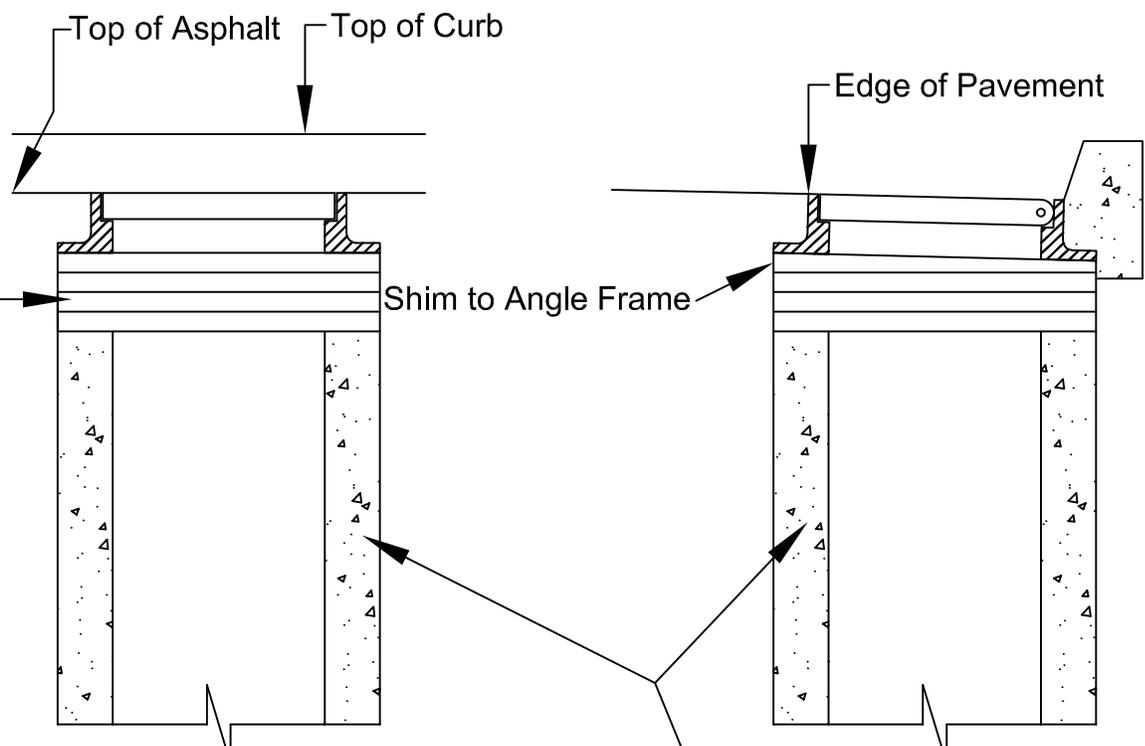
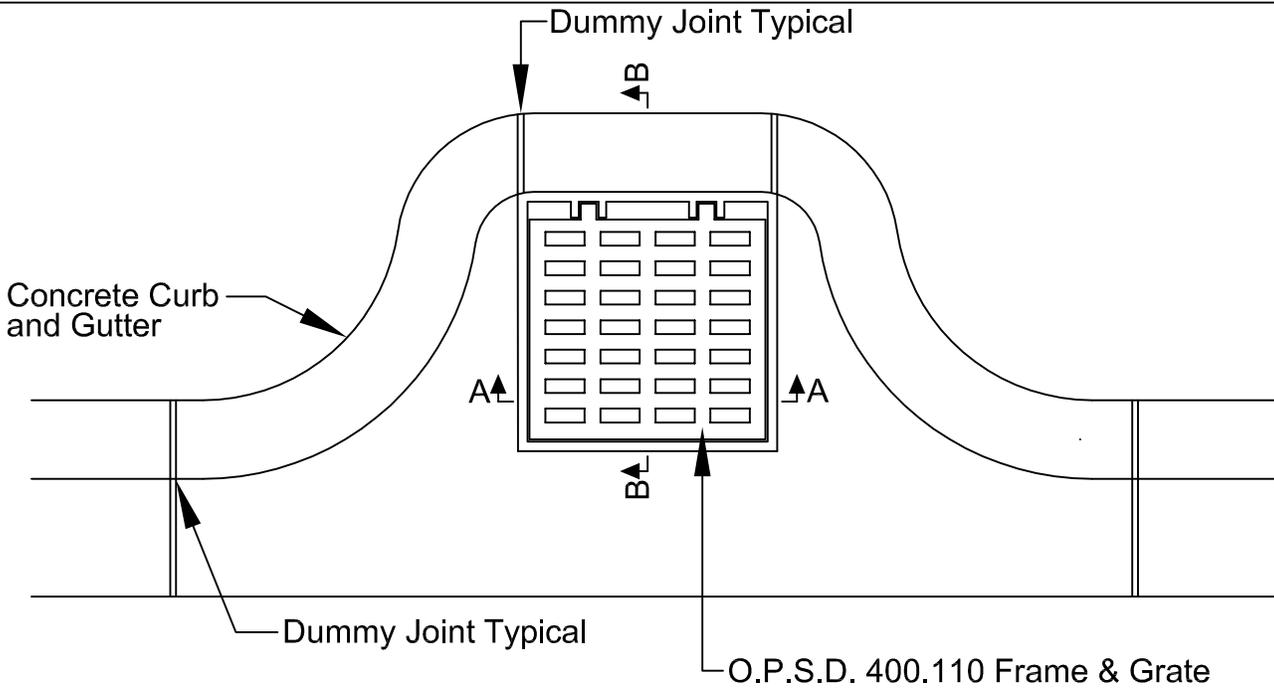
TOWN OF INGERSOLL SUBDIVISION SPECIFICATION

Project:

27'-0" MH Pole 5' Arm Coach Head LED Fixture

Description:

APPROVAL



O.P.S.D. 704.010
PRECAST CONCRETE ADJUSTMENT UNITS
 (MIN. 150mm / MAX. 300mm)

Standard Precast
 Concrete Catchbasin
 OPD 705.010 or
 705.020 (TICB)

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

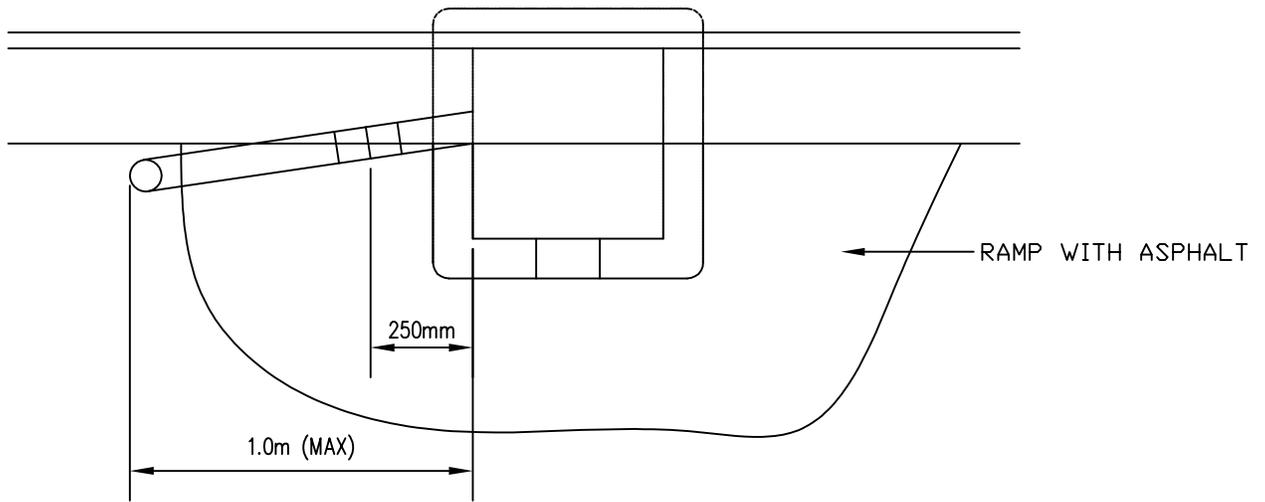
The Corporation of The Town of Ingersoll

CONCRETE CURB SETBACK

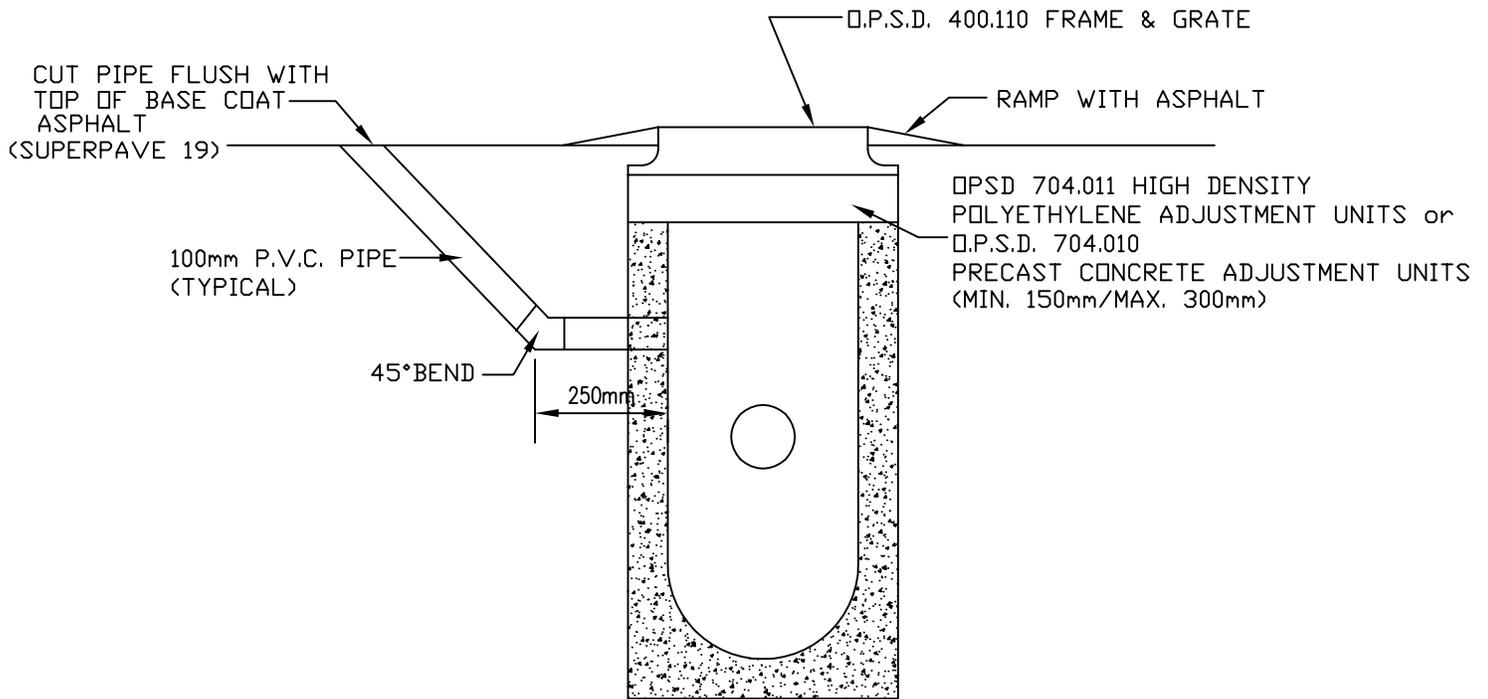
No.	BY	DATE	DESCRIPTION

REVISIONS

DRAWN BY: J.A.Y.	APPROVED BY: E.R.M.	DATE: MAY 2012	STANDARD No. S - 28
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PLAN VIEW



D.P.S.D. 705.010 - CATCHBASIN

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

GUTTER DRAIN INSTALLATION

1		May,2012	COUNCIL APPROVED
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No.	BY	DATE	DESCRIPTION
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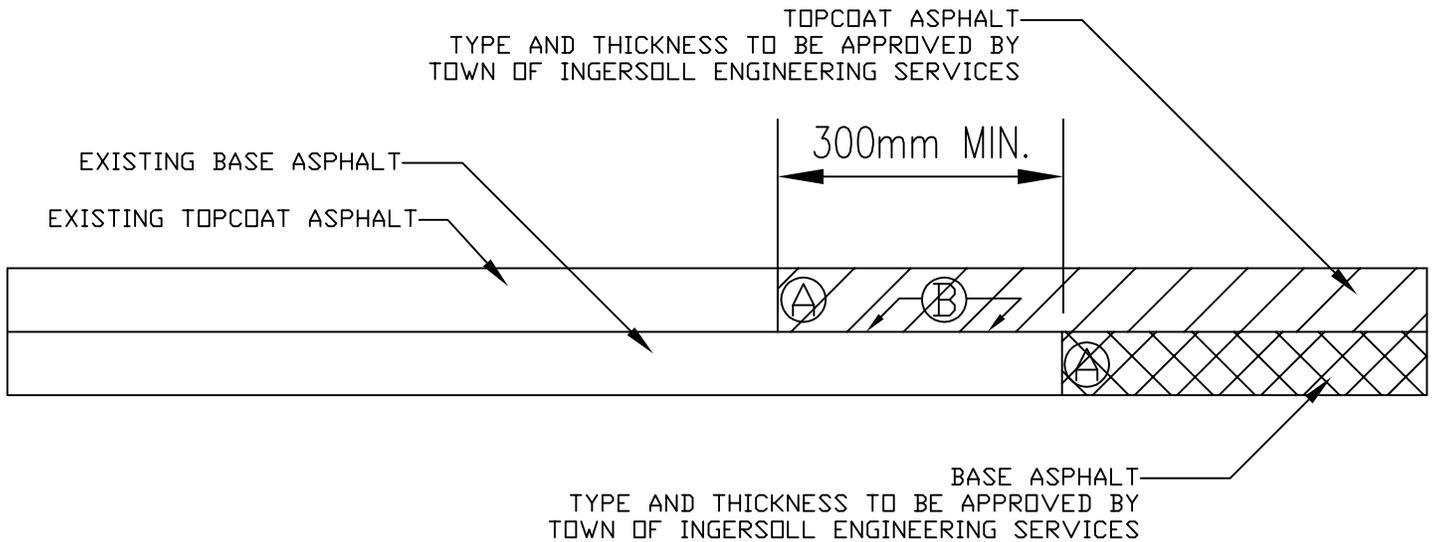
REVISIONS

DRAWN BY:
T.W.E.

APPROVED BY:
E.R.M.

DATE:
February 27/01

STANDARD No.
S - 31



- Ⓐ PLACE DENSOM REINSTATEMENT TAPE OR APPROVED EQUAL ON SAWCUTS AND MILLED SURFACES
- Ⓑ PLACE TACK COAT ON SURFACE (MINIMUM)

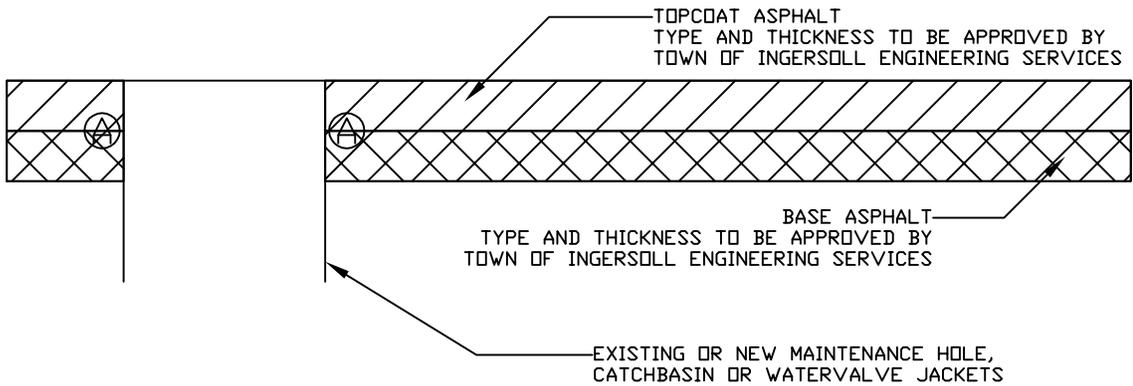
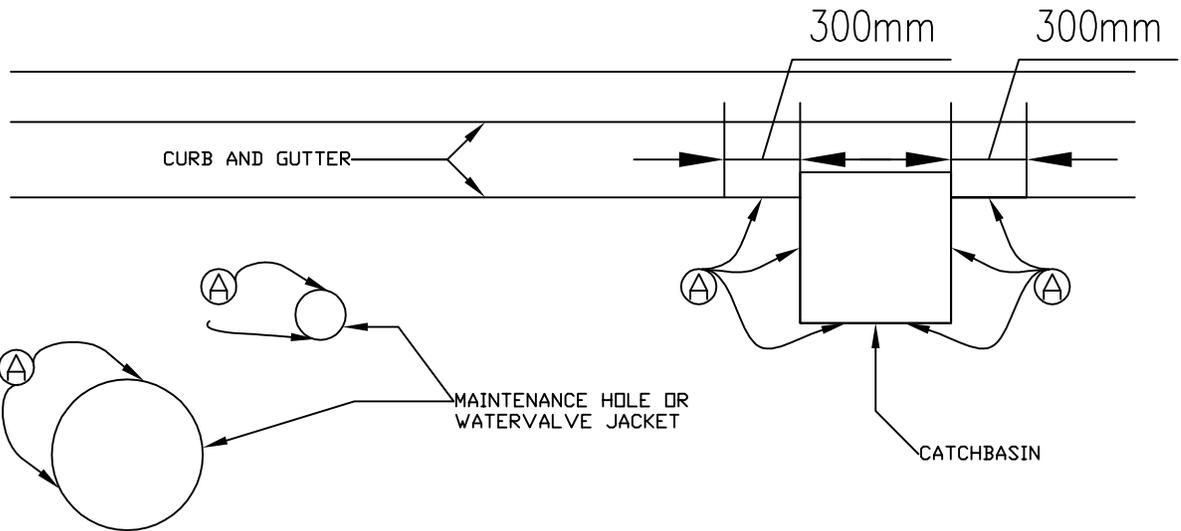
METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

TYPICAL LAP JOINT DETAIL

1		May,2012	COUNCIL APPROVED
No.	BY	DATE	DESCRIPTION

REVISIONS		DRAWN BY: R.J.G.	APPROVED BY: E.R.M.	DATE: February 27/01	STANDARD No. S - 32
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Ⓐ PLACE DENSO REINSTATEMENT TAPE OR APPROVED EQUAL AROUND MAINTENANCE HOLES, WATERVALVE JACKETS AND CATCHBASINS

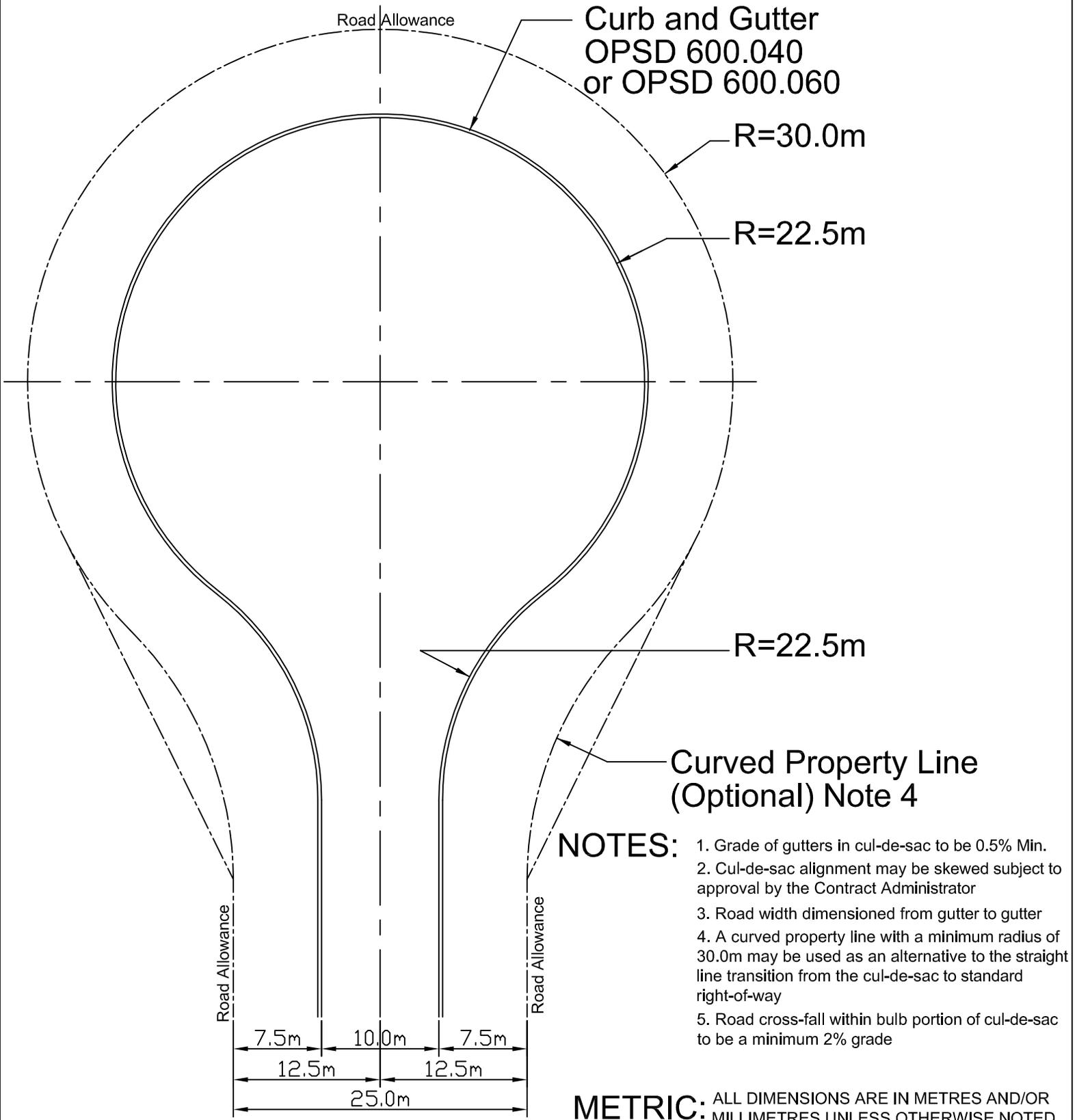
METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

DENSO TAPE INSTALLATION

No.	BY	DATE	DESCRIPTION
1		May, 2012	COUNCIL APPROVED

REVISIONS		DRAWN BY: R.J.G.	APPROVED BY: E.R.M.	DATE: February 27/01	STANDARD No. S - 33
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- NOTES:**
1. Grade of gutters in cul-de-sac to be 0.5% Min.
 2. Cul-de-sac alignment may be skewed subject to approval by the Contract Administrator
 3. Road width dimensioned from gutter to gutter
 4. A curved property line with a minimum radius of 30.0m may be used as an alternative to the straight line transition from the cul-de-sac to standard right-of-way
 5. Road cross-fall within bulb portion of cul-de-sac to be a minimum 2% grade

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

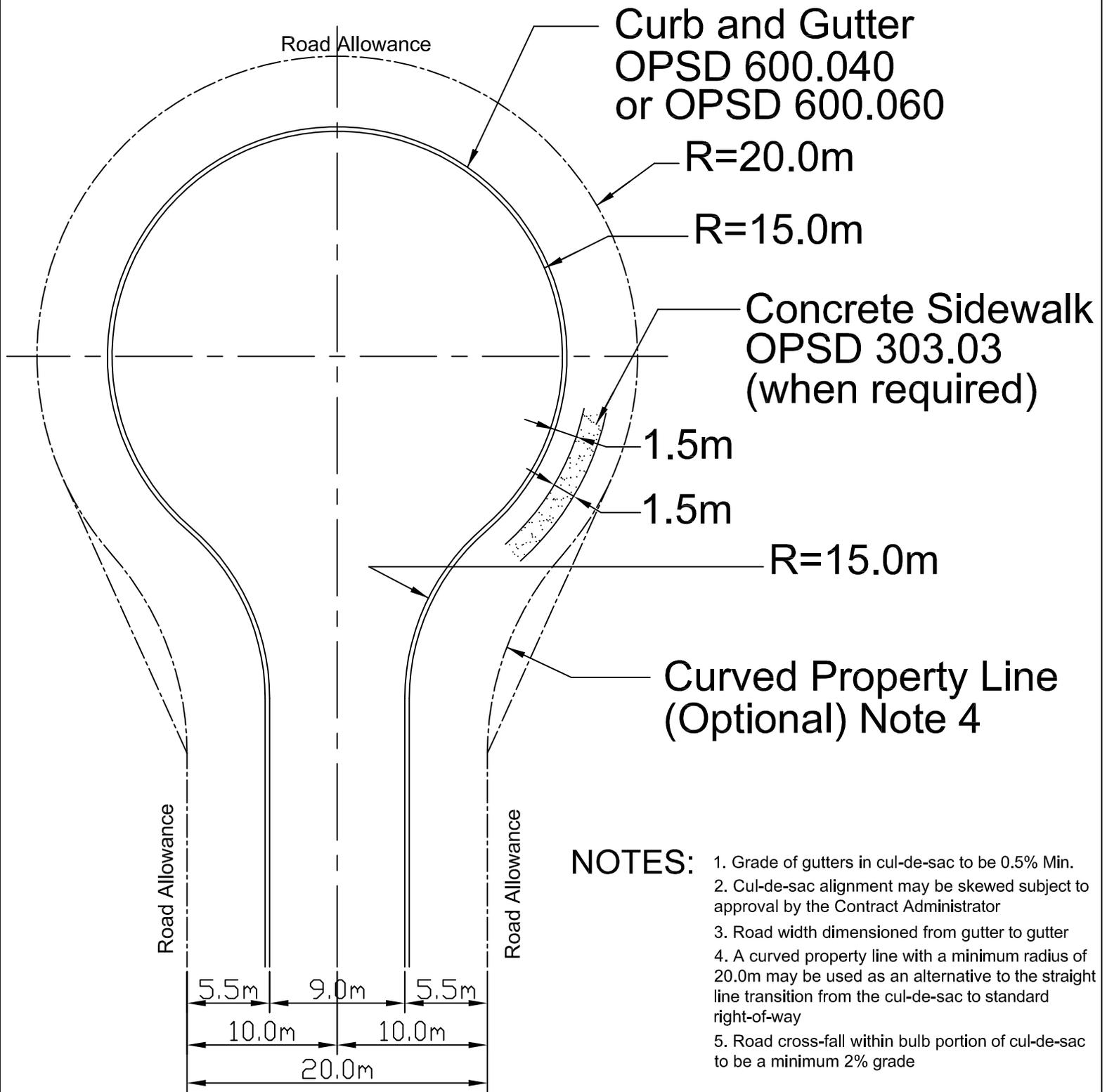
No.	BY	DATE	DESCRIPTION

The Corporation of The Town of Ingersoll

STANDARD FOR CIRCULAR CUL-DE-SAC INDUSTRIAL

REVISIONS

DRAWN BY: J.A.Y.	APPROVED BY: E.R.M.	DATE: MAY, 2012	STANDARD No. S - 34
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- NOTES:**
1. Grade of gutters in cul-de-sac to be 0.5% Min.
 2. Cul-de-sac alignment may be skewed subject to approval by the Contract Administrator
 3. Road width dimensioned from gutter to gutter
 4. A curved property line with a minimum radius of 20.0m may be used as an alternative to the straight line transition from the cul-de-sac to standard right-of-way
 5. Road cross-fall within bulb portion of cul-de-sac to be a minimum 2% grade

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

No.	BY	DATE	DESCRIPTION

The Corporation of The Town of Ingersoll

STANDARD FOR CIRCULAR CUL-DE-SAC RESIDENTIAL

REVISIONS		DRAWN BY: J.A.Y.	APPROVED BY: E.R.M.	DATE: MAY, 2012	STANDARD No. S - 35
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**SECTION 16 – PAVEMENT MANAGEMENT and
MAINTENANCE**

TABLE of CONTENTS

16.0	Overview	1
16.1	Evaluation	1
16.2	Inventory Data.....	1 – 2
16.3	Inventory Information	2 – 3
16.4	Type of Maintenance	
	Reconstruction	4
	Major Rehabilitation	4 – 5
	Minor Rehabilitation	5 – 8
16.5	Maintenance Schedule	9
16.6	Life Extension Schedule	9 – 10
16.7	Maintenance Based on Ride Condition (RDR).....	10
16.8	Glossary	11

DRAFT

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.0 Overview

The purpose for the Town of Ingersoll to establish a management and preventative maintenance policy is to ensure that the Town's given network of pavement provides a minimum level of service to the public at all times.

An effective preventive maintenance program has three components: identifying the most appropriate candidates for maintenance, doing the maintenance before problems get out of hand, and selecting the right maintenance technique.

One way of ensuring that pavement performs adequately is to monitor their condition using performance indicators and to forecast future pavement performance with reasonable accuracy so as to be able to plan future maintenance and rehabilitation needs cost effectively.

There are a number of preventive maintenance techniques, each of which has been specifically developed to treat specific types of distress at specific levels of severity. The decision as to which treatment to use typically depends on the type of pavement; the type, extent and severity of the pavement distress, and the type of road (its use, volume, and traffic speed).

16.1 Evaluation

Pavement preservation consists of an up to date pavement inventory and maintained on an annual or biennial basis to help with the minimum level of service. This is also done to document service life extension and to identify surfaces that would benefit from maintenance treatment.

The Town of Ingersoll's Engineering Department has to set up a data collection protocol to establish data uniformity by the use of an evaluation form. Refer to Appendix "A".

Once this evaluation has been completed, the data is transferred to the Town's Asset Management Department for review and recommendations.

Road evaluation should be completed between April and June each year, if possible.

16.2 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 Asset Management, Public Works and Engineering Departments.

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.2 Inventory Data (cont'd)

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

16.3 Inventory Information

Where possible, data information may be completed from existing engineering drawings (ie. width, length, depth and construction date).

Road Surface Condition

The three major distress factors that are to be monitored for condition are:

- Surface Defects
- Surface Deformation
- Cracking

These factors are to be given Severity Distress ratings of:

- Very Slight
- Slight
- Moderate
- Severe
- Very Severe

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.3 Inventory Information (cont'd)

Geotechnical Report

All geotechnical work will be completed by an outside independent geotechnical engineer.

The following information should be available for the inventory:

- Asphalt Type and depths
- Base Material and depths
- Rehabilitation recommendations
- Life Cycle Costing
- Pavement Maintenance recommendation
- Design Mixes
- Soils Report

Traffic Counts

The Town of Ingersoll is responsible for their own AADT counts within the town limits.

The following information is collected for traffic reports:

- Traffic counts – hourly and daily
- Truck counts – hourly and daily
- Speed

Financial

The town's Asset Management Department in conjunction with Treasury Department is responsible for all financial aspects of inventory data.

- initial and historical cost of projects
- estimated cost for preservation or betterment
- estimated cost for replacement
- useful life

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.4 Types of Maintenance

Upon completion of road evaluation and data imputing, the Asset Management Department will determine Life Expectancy of asphalt surfaces and if any type of rehabilitation for each surface is required.

The following are Types of Maintenance recommendations:

Reconstruction

Complete Reconstruction – Excavation and removal of existing road and municipal services, installation of Watermain, Storm and Sanitary Sewers, full road reconstruction including new Road Base, Asphalt, Sidewalk, Curb and Gutter. This recommendation is not calculated solely from Asset Management but from other departments and utility requests.

Service Life: 25 years

Major Rehabilitation

1) Major Resurfacing – Remove existing asphalt road, repair granular base and compact, and place base and surface asphalt.

Service Life: 25 years

2) Base and Surface – Removal of existing asphalt and removal of, or improvement too, existing road base, install new Road Base and Asphalt Surfaces.

Service Life: 25 years

3) Cold In-Place Resurface - reprocesses existing pavements in-situ to a depth of 100 mm, typically overlaid with 1 or 2 lifts of HMA to produce a sound pavement structure.

Benefits:

- uses 100% existing aggregates and asphalt
- mitigates reflective cracking
- corrects cross fall and longitudinal grades of existing pavements

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.4 Types of Maintenance (cont'd)

Major Rehabilitation (cont'd)

Selection and Application: use on stable pavements with a sound base showing surface distresses such as cracking, rutting, ravelling and roughness.

Service Life: 10- 12 years

4) Hot in Place Recycling - Heating the existing pavement and re-blending the asphalt. Rejuvenators and virgin hot mix may be added.

Typical thickness: 25 - 50 mm.

Benefits:

- provides new waterproof surface
- slows surface ravelling
- seals small cracks
- improves ride quality and corrects surface irregularities
- improves surface friction

Selection and Application: used on stable pavements with a sound base, when the surface exhibits minor surface distresses such as cracking, rutting, ravelling and roughness. It can be used to strengthen the pavement when applied in conjunction with an HMA overlay. Do not use on pavements showing structural distress or pavement failure.

Defects will quickly reflect through the new surface.

Service Life: 5 to 12 years

Minor Rehabilitation

1) Mill and Pave - placing a layer of hot mix over existing pavement. Thin overlays are at least 40mm thick if conventional asphalt is used but thinner overlays can be laid with specialized mixes. The most common rehabilitation technique (as opposed to preventive maintenance technique) is a similar form of hot mix overlay. Commonly known as “Shave and Pave”, this process involves the contractor milling and replacing up to 80mm of asphalt. Thicker overlays can extend the life of a pavement by between 15 and 20 years.

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.4 Types of Maintenance (cont'd)

Minor Rehabilitation (cont'd)

Benefits:

- provides new waterproof surface
- mitigates surface ravelling
- seals small cracks
- improves ride quality and corrects surface irregularities
- improves surface friction

Selection and Application: used on stable pavements with a sound base, but have a surface which exhibits minor surface distresses such as cracking, rutting, ravelling and roughness. It can be used to strengthen pavements. Do not use on pavements showing structural distress or pavement failure.

Defects will quickly reflect through the new surface.

Service Life: 5 to 15 years

2) Micro-Surfacing - the application of a cold mix of dense-graded aggregate, polymer modified asphalt emulsion, water, and mineral fillers. Capable of filling wheel ruts up to 40mm deep when the pavement has stabilized and is not subject to plastic deformation.

Benefits:

- improves surface friction
- slows surface ravelling, seals small cracks
- improves ride quality and corrects surface irregularities

Selection and Application: used on stable pavements with a sound base that have minor surface distresses such as cracking, rutting, ravelling and roughness. Used to correct rutting. Do not use on pavements showing structural distress or pavement failure.

Defects will quickly reflect through new surface

Service Life: 5-7 years

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.4 Types of Maintenance (cont'd)

Minor Rehabilitation (cont'd)

3) Slurry Seal - a cold mix paving technique using a mixture of densegraded aggregate, asphalt emulsion, water, and mineral fillers.

Benefits:

- improves surface friction
- slows surface ravelling, seals small cracks
- improves ride quality and corrects surface irregularities

Selection and Application: use on stable pavements with a sound base showing minor surface distresses such as cracking, rutting, ravelling and roughness. Do not use on pavements with structural distress, as cracks will quickly reflect through new surface. Minimum thickness is 9.5mm

Service Life: 5 years plus

4) Fog Seal - a light application of diluted slow-setting emulsion.

Benefits:

- rejuvenates dry and brittle asphalt surfaces
- seals very small cracks and surface voids
- slows the rate of weathering and oxidation

Selection and Application: Use on structurally sound pavements to improve surface conditions on pavements showing signs of minor cracking, weathering, segregation or ravelling.

Service Life: 1 - 2 years

5) Chip Seals - a uniform application of asphalt emulsion to a prepared pavement surface followed by a rolled aggregate cover (OPSS 304 Class 1-6 Surface Treatments). Can postpone the need for heavier surface treatments or resurfacing for 2 to 4 years.

SECTION 16 – PAVEMENT MANAGEMENT and MAINTENANCE

16.4 Types of Maintenance (cont'd)

Minor Rehabilitation (cont'd)

Benefits:

- improves surface friction
- slows surface ravelling and oxidation,
- corrects minor deformations and seals small cracks
- provide temporary cover for a base course until the final asphalt courses can be placed

Selection and Application: provides an economical allweather surface for light to medium traffic (polymer-modified emulsions and high quality aggregates should be for higher traffic volume applications). Must be applied to structurally sound pavements.

Service Life: 5 to 7 years

6) Crack Sealing - routing, cleaning and filling the crack with sealant. Moisture infiltration is the primary cause of pavement deterioration Crack sealing prevents water and debris from entering a crack.

‘Crack Filling’ does not involve routing and does not fully seal the crack.

Benefits:

- prevents moisture and debris from getting into cracks
- prevents water damage to the pavements structure

Selection and Application: use for cracks less than 25mm wide, spaced uniformly along the pavement and with limited edge deterioration. Use Crack Filling for older pavements with wider, more random cracking. Best applied during cool dry weather (0°C - 15°C) when cracks are almost fully open.

Service Life: 3- 5 years

**SECTION 16 – PAVEMENT MANAGEMENT
and MAINTENANCE**

16.5 Maintenance Schedule

The Town of Ingersoll has created the following protocol for the scheduling of maintenance for pavement to establish a minimum level of service to the general public.

The scheduling program shall evaluate and categorize the road sections into “Need” based time periods for identified deficiencies and recommended improvements.

The following are the Town’s categories for “Needs”.

- NOW** Where distress is noted in more than 20% of the road’s length.
- 1 to 5 Years** Where there distress is noted in 15% to 19% of the road’s length.
- 6 to 10 Years** Where there distress is noted in 11% to 15% of the road’s length.
- 10 to 20 Years** Where there distress is noted in 6% to 10% of the road’s length.
- ADEQUATE** Where distress is noted in less than 5% of the road’s length.

16.6 Life Extension Schedule

Table “A” shows the Town’s Life Expectancy of a road surface when the maintenance schedule is followed.

Table “A”

Type of Maintenance	Maintenance Schedule	Life Extension
Reconstruction		
Road Reconstruction		25
Major Rehabilitation		
Major Resurfacing	15	25
Base and Surface Replacement	15	25
Cold-in-Place Resurface	15	10-12
Hot-in-Place Recycling	15	5-12

**SECTION 16 – PAVEMENT MANAGEMENT
and MAINTENANCE**

16.6 Life Extension Schedule (cont'd)

Table “A”

Type of Maintenance	Maintenance Schedule	Life Extension
Minor Rehabilitation		
Mill and Pave (Shave and Pave)	10-15	5-15
Micro Surfacing	5-10	5-7
Slurry Seal	3-5	5-8
Fog Seal	3-5	1-2
Chip Seal or Spray Seal	3-5	8-10
Crack Seal	3-5	3-5

16.7 Maintenance Based on Ride Condition (RDR)

One major surface evaluation that determines the maintenance of any road is the Ride Condition Rating (RDR).

This is a quick and inexpensive way to evaluate any road surface at a posted speed. The Town includes the RDR in calculating their Pavement Condition Index. (See Appendix “A”)

Table “B” shows the Town’s rating categories for RDR.

RDR		Conditions	Recommended Maintenance
8 to 10	Very Good	Road with little or no potholes	Crack Seal
6 to 8	Good	Roads with isolated potholes	Slurry Seal Spot Patching
4 to 6	Fair	Roads with significant areas of Potholes	Patch Paving/ Minor Base Repair
2 to 4	Poor	Roads with Major Potholes	Base Repair/Overlay
0 to 2	Very Poor	Roads with a large number of major potholes	Total Replacement

**SECTION 16 – PAVEMENT MANAGEMENT
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16.8 Glossary

Ontario Provincial Standards:

OPSS 303 (2009)	CONSTRUCTION SPECIFICATION FOR DOUBLE CHIP SEAL
OPSS 304 (2006)	CONSTRUCTION SPECIFICATION FOR SINGLE AND DOUBLE SURFACE TREATMENT
OPSS 332 (2004)	CONSTRUCTION SPECIFICATION FOR HOT IN-PLACE RECYCLING AND HOT IN-PLACE RECYCLING WITH INTEGRAL OVERLAY
OPSS 333 (2011)	CONSTRUCTION SPECIFICATION FOR COLD IN-PLACE RECYCLED MIX
OPSS 336 (2009)	CONSTRUCTION SPECIFICATION FOR MICRO-SURFACING
OPSS 337 (2008)	CONSTRUCTION SPECIFICATION FOR SLURRY SEAL
OPSS 341 (2004)	CONSTRUCTION SPECIFICATION FOR ROUTING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT

Ministry of Transportation

SP-024 Manual for Condition Rating of Flexible Pavements



DRY

SECTION 17 – CONSTRUCTION SPECIFICATION

For UTILITY CUTS and RESTORATION

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**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.0 Scope

This Specification covers the requirements for utility cutting, excavating, backfilling, and repair to Town of Ingersoll streets.

17.1 References

This specification refers to the latest version of the following standards, specifications or publications:

MCR Municipal Consent Requirements
Ontario Provincial Standard Specifications
OPSS 180 - Management and Disposal of Excess Material
Ontario Traffic Manual
Book 7 Temporary Conditions

17.2 Definitions

For the purpose of this specification, the following definitions apply:

Applicant: means a person applying for a permit or other consent to cut a street. This shall be extended, where applicable, to include the Applicant's direct employees and its agents, consultants and contractors.

Boulevard: means that part of a public street that is not used, or intended to be used, for vehicle travel by the general public, and that is situated between the travelled portion of the road and the adjoining Property line.

Contraction Joint: means a cut or formed joint to regulate the location and degree of cracking in the plane of the pavement.

Deep trench: means a trench deeper than 1.2 m

Engineer: means the Engineer for the Town of Ingersoll and his or her designate or successor.

Emergency Work: means work within a street that must be completed immediately due to health or safety concerns or because the provision of essential services is endangered.

Essential Services: means energy (including, but not limited to, natural gas and electricity), water, sanitary sewage, traffic control, and the following communication services: 911 service, communications for financial transactions, business networks, and Internet.

**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.2 Definitions (cont'd)

Excavating: means the breaking, digging up, tearing up, tunnelling, boring, coring, cutting into or removing any portion of the surface or subsurface of the street, including pavement, sidewalk, curb, gutter or landscaping.

Expansion Joint: means a physical separation between the concrete and appurtenances, or between parts of the sidewalk or raised median, which allows both horizontal and vertical movement.

Municipal Consent (MC): means the document specifying the requirements for the installation of plant within the Town of Ingersoll streets.

Narrow trench: means the width of a trench is less than or equal to 350 mm

Native Material: means excavated material for placement into the exact location from which it was removed.

Permanent Repair: means the process whereby a cut and/or excavation is reinstated to a condition which requires no further repair.

Plant: means any poles, cables, pipes, conduits, ducts, pedestals, regulators, towers, wires, vaults, maintenance holes, hand holes, support structures and or other appurtenances or ancillary facilities or structures used for the provision of telecommunications, internet, energy, water, waste water, fuel and/or other materials. Any encasement, steel plating or other non-excavatable material shall be considered to be part of the plant.

Road: means the portion of the street designed, improved and ordinarily used by vehicle traffic. The terms pavement and roadway shall have the same meaning as road.

Shallow trench: means the depth of trench is less than or equal to 1.2 m

Sidewalk: means that part of a public street located within the Boulevard that is improved for the exclusive use of pedestrians.

Street: means a common and public highway, street, avenue, parkway, driveway, square, bridge, any part of which is intended for or used by the general public for the passage of vehicle and includes the area between the lateral property lines thereof. The term Town's public road allowance or right-of-way shall have the same meaning as street.

**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.2 Definitions (cont'd)

Suitable Backfill Material: means the native materials or imported granular materials that can be used as utility trench backfill materials in lieu of unshrinkable fill as defined in this specification.

Temporary Repair: means the process whereby a cut and/or excavation is reinstated as a temporary measure pending completion of a permanent repair.

Town: means the Town of Ingersoll

Unshrinkable Fill: means a mixture of aggregates, cementing material and water, with or without chemical admixtures.

Utility Company: means a company owning, operating and maintaining plant in the public Right-of- Way.

Wide trench: means a trench wider than 350 mm

17.3 Submission and Permit Requirements

For submission and permit requirements to make an installation within the Town of Ingersoll streets please refer to the Town's current Municipal Consent policy.

17.4 Materials

Supply of Materials

Unless otherwise specified, the Applicant / Contractor shall supply all materials necessary for the execution and completion of the work.

Unshrinkable Fill

The materials for the production of Unshrinkable Fill shall meet the Town's minimum standards and may be tested, and any material that does not meet the requirements will be removed and replaced at the Contractor's expense. All costs associated with the removal and replacement of deficient Unshrinkable Fill shall be borne by the Applicant / Contractor, including the cost of administration and retesting.

Traffic shall not be permitted to travel directly onto the surface of the Unshrinkable Fill. Detours must be set up until the fill has cured.

17.4 Materials (cont'd)

Suitable Backfill Materials

Imported Granular Materials

Granular materials may be imported for use as trench backfill provided the imported materials meet the requirements of OPSS MUNI 1010.

Existing Material in Trench

Materials excavated during trench construction may be considered for reuse as trench backfill where permitted by the Town Engineer. The materials shall have suitable physical and environmental properties; and the materials should be properly managed during construction. The excavated materials that may be considered for reuse as backfill include either a suitable existing granular material or a suitable existing cohesive material. The physical properties of the materials shall meet the following requirements:

- the material is free of any obvious objectionable or deleterious materials such as topsoil, organics, wood chips and metal pieces if the material is to be used in trenches located under a pavement
Note: material containing topsoil or organics, is acceptable when backfilling within sodded or soil surfaces in the boulevard.
- the material is free of large pieces of rock or boulders
- the material is free of shale pieces
- the compaction equipment deployed on site is able to compact the material to its required density
- the material is not considered to be frost susceptible
- the material is not wet, frozen or lumpy

All excavated materials to be reused as trench backfill shall be managed to prevent contamination, and shall be protected to preserve or maintain its moisture condition.

Where the excavated material has been identified to be contaminated, the Contractor shall comply with all applicable legislation. Contaminated soil must not be used as backfill and must be disposed of off-site according to the applicable requirements.

When the suitability of excavated material for reuse is in dispute, the Town, in its sole discretion, shall determine the suitability of the material based on the physical properties mentioned in this section and as recommended in a report, submitted by the Applicant, from a geotechnical consultant for Unshrinkable Fill.

**SECTION 17 –
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UTILITY CUTS and RESTORATION**

17.5 Construction

Repair Responsibility According to Surface Types

Surface Type	Material	Repair Responsibility	
		Temporary Repair	Permanent Repair
Road Pavement	Asphalt	Applicant	Town
	Concrete	Applicant	Town
Sidewalk	Asphalt	Applicant	Town
	Concrete	Applicant	Town
Curb	Asphalt	Applicant	Town
	Concrete	Applicant	Town
Boulevard	Asphalt	Applicant	Town
	Concrete	Applicant	Town
	Interlock Brick/Stone	Applicant	Applicant
	Sod	Applicant	Applicant
	Landscaped	Applicant	Applicant
Driveway	Asphalt	Applicant	Town
	Concrete	Applicant	Town
	Pressed / Colour Concrete	Applicant	Applicant
	Interlock Brick/Stone	Applicant	Applicant
	Sod	Applicant	Applicant

Notes:

Any repairs on private property shall be the responsibility of the Applicant, unless directed by the Town.

All work performed by the Applicant or its contractor shall be carried out in accordance with the Town's standards and applicable specifications.

Restoration of areas with decorative or specialized surfaces, landscaping, and subsurface treatments such as snow melting systems, sprinkler systems, granite pavers, etc. shall be the responsibility of the Applicant.

**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.6 Installation of Plant

Sawcutting of Pavement, Sidewalk, Curb and Driveway

Unless judged unfeasible, the sawcut area shall have a maximum of four sides that are all parallel or perpendicular to the direction of travel. Sawcuts shall be straight and vertical to the full depth of the asphalt and concrete layers of the pavement.

Sawcutting operations shall be performed with suitable equipment and methods and not with heavy machinery or jackhammers that may cause damage to the surrounding road.

Saw cutting shall stop at, or just short of, corners to avoid overcutting. After sawcutting the edges, removal of pavement materials shall be performed with care to avoid lifting and breaking the road pavement beyond the sawcut borders.

Excavation

During the installation of any Plant, excavation equipment with stabilizers shall be suitably outfitted to prevent damage to the pavement surface or else wood or rubber pads shall be placed on the road to support the stabilizers. Any damage to the street attributable to the Applicant's work shall be repaired, at the Applicant's expense, in conjunction with the utility cut.

Excavation shall not extend beyond the limits of the sawcut area. Care is to be taken to ensure that undermining of the adjacent pavement, curb and sidewalk is minimized. Where the pavement, curb and/or sidewalk are undermined by construction activities or from other causes, these undermined areas shall be filled and the settled structures shall be restored to their original grades at the expense of the Applicant.

Where necessary, bracing, shoring and/or sheeting shall be used in accordance with the Occupational Health and Safety Regulations, to support the sides of the excavation and to prevent any movement that could damage other services, adjacent pavements, sidewalks, etc. This excavation support system shall be removed as backfilling proceeds to eliminate voids between the fill and adjacent soils. Appropriate restoration of all displaced services to their original positions is the responsibility of the Applicant. The Applicant / contractor shall, at its own expense, provide adequate support and protection of the underground and above ground plant and structures that exist inside the excavation and in the vicinity of the excavated area. Any damage to plant or structures attributable to the Applicant / contractor's work shall be repaired to the satisfaction of the Town and/or the owner(s) of the damaged plant or structures, at the Applicant / contractor's expense, in conjunction with the utility cut.

**SECTION 17 –
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17.6 Installation of Plant (cont'd)

Except where native cohesive material is to be used for backfill, as permitted by the Town and/or under the conditions of this specification, stockpiling of excavated material within Town Streets is not permitted under any circumstances for any length of time. All excavated material shall be loaded directly into appropriate haulage trucks and disposed of off-site immediately upon removal. The Applicant shall remove, transport and dispose of all excavated materials in accordance with the latest Ontario Environment Protection Acts and, where appropriate, the Occupational Health and Safety Act.

Inspection of Excavation

Prior to backfilling, the Applicant shall inspect the utility cut excavation to ensure the following minimum requirements are met:

- the edges of the pavement have been saw cut in a straight line and to the full depth of the pavement, or if permitted, to partial depth in composite pavement
- the bottom of the trench has been compacted and is free of water before the bedding material is placed
- all loose or wet material at the bottom of the trench has been removed and replaced with suitable bedding materials
- pipe bedding, pipe cover and compaction to the bedding and cover have been carried out to Town's or utility agency's requirements
- necessary shoring/bracing meeting Ontario Health and Safety Acts and Regulations has been used to prevent the trench from cave-in and to protect adjacent services, pavement and sidewalk
- undermining of the adjacent pavement and sidewalk has been prevented /repaired

Protection of Excavation

All excavations must be backfilled to match the adjacent grade or properly protected at the end of each working day.

This will include all signage, fencing and delineation required if not completely backfilled for overnight or more than a 24hr period, and supplied by the Applicant.

The Town of Ingersoll will not supply protection for the applicant or their contractors. If the Town deems the protection unsafe or not to Town standards, the applicant will be notified and given proper time to rectify.

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17.6 Installation of Plant (cont'd)

If the Town is unable to contact the applicant or the applicant denies the requested work, the Town will complete the required work and the applicant will be charged accordingly.

Backfilling

Bedding and covering material shall be compacted to at least 95% of its Standard Proctor Maximum Dry Density, or in accordance with the Applicant's installation requirements, whichever is greater.

If Unshrinkable Fill is used, backfill trench with Unshrinkable Fill to within 75 mm of the top of the existing surface.

If temporary shoring/bracing has been used to support adjacent infrastructure, it shall be removed in a safe manner continuously as backfilling proceeds.

Backfilling in Pavements

If suitable backfill material is to be used, backfilling shall be carried out in uniform lifts not exceeding 150 mm loose thickness.

Each lift of suitable backfill material shall be compacted to a minimum of 95% of its Standard Proctor Maximum Dry Density, or in accordance with the Applicant's utility agency installation requirements, whichever is greater.

For temporary restoration of pavements, suitable backfill materials shall be brought to within 75 mm of the top of the existing surface.

The type of backfilling required in utility cuts made in road pavements shall be as follows:

- Where suitable native backfill is used, compacted to 95% of its Standard Proctor maximum dry density, shall be placed immediately to existing sub-grade level. The sub-grade material must be replaced in thicknesses that meet existing conditions. The Applicant is to contact the Town to verify sub-grade thickness pertaining to cut.
- The use of Unshrinkable Fill shall be used in roadways where deemed necessary by the Town.

**SECTION 17 –
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17.6 Installation of Plant (cont'd)

Backfilling in Boulevards

For all boulevard areas, only suitable native material or Granular B shall be used. Backfill material shall be placed in lifts not exceeding 200 mm loose thickness and each lift shall be compacted to 95% of its Standard Proctor Maximum Dry Density.

17.7 Temporary Repair

Unless otherwise specified, backfill material shall be brought to within 50mm below the existing surface. The remainder of the trench shall be filled with compacted cold mix asphalt meeting OPSS 309.04.01 as a mean for temporary pavement restoration.

Unless otherwise specified, all temporary repairs shall be CL mix asphalt. The mix shall be mechanically compacted and neatly match the finished grade of the existing pavement or sidewalk.

It is the Applicant's or their contractor's responsibility to maintain the temporary repair until a permanent repair can be made.

17.8 Permanent Repair

Extent of Permanent Restoration

Notwithstanding the following, the nature and extent of the required reinstatement of the cuts will be at the sole discretion of the Town based upon field assessment of the section of roadway prior to the permanent reinstatement.

Pavement

Wherever a utility cut is parallel to and coincides with a wheel path, the cut shall be extended to include the wheel path.

If a utility cut is located within 1.0 m of a curb or construction joint, such that the integrity of the adjacent pavement/base may be compromised, the permanent restoration will include the removal of the adjacent road base to the edge of the curb or construction joint. In all cases, the permanent repairs shall match the cross-section of the adjacent pavement.

**SECTION 17 –
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17.8 Permanent Repair (cont'd)

Pavements with extensive trenching or numerous cuts may require milling and paving to address one or more of the following issues: to restore the quality of the driving surface; to eliminate visual impact of significant road cutting; and/or to better preserve the service-life of a pavement that has experienced excessive cutting.

For longitudinal trenches, whether in the wheel path or otherwise, the affected lane will be milled and paved for the length of the trench plus an additional 1.5 metres at either end of the trench. If however, the total length of all trenches within a street block is: equal to or greater than 75% of the block's length (*for block lengths exceeding 250 metres*) or equal to or greater than 60% (*for block lengths less than or equal to 250 metres*), then the total length of the block will be milled and paved (i.e., between block intersections).

Milling of the surface course, in any of the aforementioned cases, will be a minimum of 3.0 metre width in order to accommodate the placement of the asphalt surface course with a mechanical spreader.

If the longitudinal trench affects two lanes, then both lanes will be milled and paved for lengths defined above.

Where a series of transverse cuts, pits or shafts occur in close proximity along a roadway (i.e., within 12 metres of each other or less) with a flexible pavement structure, the permanent restoration will include milling of the asphalt surface to a depth of 50mm for the full width of the lane (or to a minimum width of 3.0 metres) to accommodate the placement of hot-mix asphalt using a mechanical spreader.

Where a series of transverse cuts, pits or shafts occur in close proximity along a roadway (i.e., within 12 metres of each other or less) with a composite pavement structure, the concrete road base shall be restored and the asphalt surface shall be milled to a depth of 50mm for the full width of the lane or lanes, as the case may be, (or to a minimum width of 3.0 metres) to accommodate the placement of hot-mix asphalt using a mechanical spreader.

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CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.8 Permanent Repair (cont'd)

Sidewalk and Curb

Wherever a side of a cut falls between expansion joints, the removal and subsequent restoration shall be extended to the nearest expansion joint.

Where the concrete sidewalk is monolithic with the curb, the sidewalk and the curb shall be cut and removed as a unit.

Wherever space for concrete forms are required to perform sidewalk or curb repairs adjacent to an existing driveway or pavement, the Contractor shall sawcut the driveway or pavement neatly parallel to the sidewalk or curb.

Driveway

Whenever a cut of any size is made in an existing driveway, the Applicant must cut the entire width of the driveway parallel to either existing sidewalk or curb and gutter and repave the entire area.

The surface asphalt restoration shall be extended 300mm beyond the repair area.

Whenever a cut of any size is made in a driveway apron – the entire apron area is to be removed and repaved from the back of curb to the sidewalk.

The Applicant may request an exemption from either requirement by demonstrating that site-specific existing conditions warrant a reduced level of restoration. Any exemption shall be at the sole discretion of the Town

Utility Cut Surfaces

All permanent repairs to utility cut surfaces that include sidewalks, curbs, boulevards, and driveways shall be constructed to meet the current Town standards and to match the material and thickness design of the structure.

The permanent reinstatement for a roadway pavement structure that consists of asphalt over granular base/sub-base (flexible pavement structure) and asphalt over concrete road base (composite pavement structure) shall also be constructed to match the material and thickness design of the structure.

All hot-mix asphalt materials shall be supplied and placed in accordance with OPSS 310 and OPSS 1150 and [Section 15](#) of the Town Specifications.

**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.8 Permanent Repair (cont'd)

Placing Asphalt for Permanent Repair

Prior to placement of any Hot Mix Asphalt, the following shall be adhered to:

Before asphalt is laid, the aggregate base shall be inspected and locations with loose material shall be re-compacted to the recommended density level. Whenever space permits, a steel roller with vibration capability shall be used on the final surface of the aggregate base. Caution shall be exercised in moving the equipment into the trench to avoid damage to the edges of the road.

Prior to placement of the asphalt, the vertical faces of the saw cut shall be tack coated using emulsified asphalt or equivalent.

The hot mix asphalt delivered to site shall be visually inspected.

The temperature of the hot mix asphalt delivered to site shall be checked with an appropriate temperature measuring device. Any hot mix asphalt with temperature that has fallen below 130 degree C at the point of discharge before spreading shall be rejected.

Asphalt shall be laid in lifts of a minimum 75mm. Each lift shall be thoroughly compacted by the suitable compaction method and allowed to cool to 50 degree C before the next lift is laid on top.

At the request of the Town, sampling and a Density check shall be carried out using a nuclear gauge device. Coring is to be used only in case of doubt and/or disagreement about the accuracy of measurements made by the nuclear gauge.

After compaction, the hot asphalt surface shall be protected from the potential for accumulating excessive deformation. Cuts restored using hot mix asphalt should be protected from direct traffic for enough time to gain adequate strength before allowing traffic on the restored cut.

Lanes affected by the cut are kept closed to traffic until the temperature of the air-cooled asphalt drops below 40 degree C.

Regardless of the thickness of the asphalt found in the existing road, proper asphalt thickness shall be re-laid without compromising drainage requirements of the road.

All construction joints of the cut shall be lap jointed and taped as per Town Standard S-32.

**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.8 Permanent Repair (cont'd)

Where there is the presence of existing maintenance hole lids, catchbasins and watervalve jackets the Applicant must use the Town Standard S-33.

Restoration of Cuts in Sodded Areas

All topsoiling and sodding shall take place in accordance to OPSS 802 and OPSS803.

Sod shall not be laid when ground is in a frozen condition or when the site is in adverse conditions such as high wind, frozen soil or soil covered with snow, ice or standing water.

All surface areas designated for sodding shall be fine graded to a uniform surface.

The Applicant or its contractor shall:

Be responsible for the watering of the sod for 30 days from placement.

Warranty any public or private cut where topsoil and sod has been placed for a period of one (1) year.

Immediately correct any and all settlements during the 1-year maintenance warranty period.

At the end of the 1-year warranty period, all sod placed by the Applicant shall be in as good, or better, health and at the same grade as the surrounding sodded area.

The Town shall:

Periodically monitor the utility cut areas and notify the Applicant of any such warranty issues.

17.9 Traffic Control

Compliance with the latest editions of the Ontario Traffic Manual (OTM) Book 7 and the Municipal Consent Requirements is required.

17.10 Management and Disposal of Excess

Management and disposal of excess material shall be according to OPSS 180.

**SECTION 17 –
CONSTRUCTION SPECIFICATIONS for
UTILITY CUTS and RESTORATION**

17.11 Warranty

The Applicant will warrant the utility cut repairs it undertakes in with the Town's Policy of 24 months. The Town will keep the Road Allowance Excavation Permit open for the same 24 month period, and do a final inspection on the utility cut and notify the Applicant prior to closing permit.

The Applicant shall maintain a rigorous control and assurance program such that each utility cut repair will be inspected once every 12 months.

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**SECTION 18 – ASSUMPTION
SUBDIVISIONS, CONSTRUCTION and SITE PLAN**

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18.0 Overview

The Town of Ingersoll will only take assumption of any new or replaced infrastructure and lands once the Owner, Developer or Contractor have complied with all facets of this section of the guidelines.

18.1 Assumption of Subdivisions

The Town of Ingersoll’s Engineer may issue to the Owner or Developer, a Certificate of Substantial Completion (herein called an Assumption Certificate) once the Owner/Developer has provided the following information:

The Town of Ingersoll and the County of Oxford must be notified in writing by the Owner or Developer that the subdivision or that phase of the subdivision is ready for assumption. The Town/County must be given ample time to review the field work and complete a final deficiency list of outstanding work. All outstanding deficiencies must be completed to the satisfaction of the Town and County.

All underground work must be completed and a CCTV inspection and report submitted by the Owner/Developer, as per Section 6.5.

The Town will require all As Built information to be georeferenced as per Section 2.3 of this Guideline and submitted in both hardcopy and digital cad format.

As Built Subdivision Drawings are to be submitted within nine (9) months of the date of assumption certificate and are to follow the guidelines laid out in Section 2.2.2. If the owner fails to produce the required drawings within the nine month period, then the assumption certificate is deemed revoked to the extent that the owner may be declared in default of any agreement. The Town will review and comment before the drawings can be stamped approved. Drawings are to be engineer stamped, signed and dated.

The owner shall guarantee each and every one of the works and services in good condition for a twenty four (24) month period

All information and forms required by the Town’s Engineering and Asset Department must be completed.

The Town of Ingersoll may, at its opinion, assume the underground infrastructure prior to completion of a subdivision. A separate Substantial Completion Certificate (Assumption Certificate) may be produced.

18.1 Assumption of Subdivisions (cont'd)

The following is required of the Owner and/or Developer for underground assumption.

- Submission of all geotechnical reports, tests and results for sewer trenches.
- Set of CCTV inspection as per Section 6.5.
- A copy of the project diaries from the Consulting Engineer for all underground and any and all field drawing mark-ups.
- Supply As Built georeferenced drawings in CAD.
- Supply As Built hardcopy set.
- Show and Label all As Built SWM and storm sewer - structures, pipes, measurement and inverts for placed infrastructure.
- Complete Private Drain Connection drawing and all pertinent information required (if installed).
- Complete all required Asset Management Forms for Underground components. (See Asset Forms - back of this section)

At Final Assumption, the following is required:

- Submission of all geotechnical reports, tests and results for trenches, roads, concrete and asphalt.
- A second set of CCTV inspection as per Section 6.5.
- A copy of the project diaries from the Consulting Engineer is submitted and any and all field drawing mark-ups.
- Supply complete As Built georeferenced drawings in CAD.
- Supply complete As Built hardcopy set.
- Show and Label all surface information (ie. curb, sidewalk etc.)
- Complete all required Asset Management Forms for All Surface components. (See Asset Forms - back of this section)

Prior to assumption of any works or services by the Town, the Owner shall have its Consulting Engineer certify to the Town in the form as set out in Schedule "K" to the Agreement, regarding each and every Lot and Block in the subdivision that is fully developed or still vacant, bearing the signature and seal of an Ontario Professional Engineer authorized by the Association of Professional Engineers of Ontario or who is employed by a partnership or corporation authorized by the Association to offer Professional Engineering services to the public, that the actual finished elevations and grading of each such Lot and Block generally conform to the accepted subdivision grading plan. Further, the Owner's Professional Engineer's certification must identify all Lots and Blocks under construction at the time of assumption and that they will be final graded in general conformity to the accepted subdivision grading plan upon completion.

18.1 Assumption of Subdivisions (cont'd)

The Owner further covenants and agrees to deliver to the Town Engineer a certificate signed by an Ontario Land Surveyor certifying that the survey monumentation shown on the registered plan of subdivision that defines the exterior boundary of the subdivision, the streets, lanes, walkways, street widenings, reserves, park blocks, open space blocks, storm water management blocks, and any other block or parcel of land that has been dedicated or transferred to the Town or that will ultimately be owned by the Town, is either physically in place or appropriately witnessed as a condition precedent to the assumption of the public services by the Town.

Upon the assumption of any of the works or services, the same shall wholly vest in the Town without payment therefor, and the Owner shall have no right, title or interest therein. Notwithstanding that the services, or any of them, have been so assumed by the Town, the Owner undertakes and guarantees that the work, labour and materials are in compliance with the specifications therein provided and the requirements of the town Engineer. In default, the Town may carry out any required reconstruction or repair and in default of repayment therefor by the Owner forthwith the Town shall be entitled to resort to the security as provided by Clause 14 of the Agreement. If pursuant to the Agreement and in the opinion of the Engineer, the Town finds it necessary to enter upon the lands covered by the Agreement to perform any work, including maintenance, which the Owner should have completed, the Town shall be deemed to be acting as agent of the Owner and shall not be deemed to have assumed any work or service by so doing and the cost of such work shall be borne by the Owner; provided, however, that the Town may, at its option assume any or all of the said works and services at any time, but the Town shall not be deemed to have assumed any work or service unless such assumption is evidenced by an assumption certificate and the enactment of a specific by-law assuming such work or service and it is hereby understood and agreed that the passing of any other by-law whether regulating traffic, parking or any other matter affecting lands within the subject Plan of subdivision, shall not be deemed to be a by-law effecting assumption by the Town.

18.2 Assumption of Construction Projects

The Town of Ingersoll Engineer may issue to the contractor, a Certificate of Substantial Completion (herein called an Assumption Certificate) once the Owner/Developer has provided the following information:

The Town must be notified in writing by the contractor that the project is ready for assumption. The Town must be given ample time to review the field work and complete a final deficiency list of outstanding work. All outstanding deficiencies must be completed to the satisfaction of the Town.

18.2 Assumption of Construction Projects (cont'd)

The Town will keep a 2% holdback, (value of the completed project cost) for a period of 24 months, from the date of Reduction of Holdback.

The Town's Engineering and Asset Management Department requires that all information and forms pertaining to the project must be completed and submitted within six (6) months of the date of issuance of the Certificate of Substantial Completion. See Section XX for Asset Management Forms.

The Town will notify the contractor, 60 days prior to Release of Holdback that they will be completing a final deficiency inspection of the project. The contractor shall be responsible for a final CCTV inspection and report, which is to be submitted to the Town as per Section 6.5.

All inspections and deficiencies of the project must be approved by the Town, or the contractor must extend their warranty to cover the period to complete said deficiencies.

As Built information is to be georeferenced as per Section 2.3 of this Guideline and submitted in both hardcopy and digital cad format.

The as built construction or re-construction drawings are to follow the guidelines laid out in Section 2.2.1.

The Town will review and comment before the drawings can be stamped approved. Drawings are to be engineer stamped, signed and dated.

In order for the Town of Ingersoll to take assumption of the project, the following is also a requirement of the Engineer and/or Contractor.

Fieldwork:

- Submission of all geotechnical reports, tests and results for trenches, roads, concrete and asphalt.
- A copy of the project diaries from the Consulting Engineer is submitted and any and all field drawing mark-ups.

18.2 Assumption of Construction Projects (cont'd)

Drawings:

- Show and Label all As Built SWM and storm sewer - structures, pipes, measurement and inverts.
- Show and Label all As Built utilities.
- Show and Label all surface information (ie. curb, sidewalk etc.)
- Complete Private Drain Connection drawing and all pertinent information required (if installed).

18.3 Assumption of Site/Development Plan

Security

The Town collects a security (in the form of cash or a irrevocable letter of credit) from the Applicant to secure against potential failure on the part of the applicant to complete the works on the site plan and comply with the clauses of the Development Agreement. The security is calculated based on the engineer's report of the total cost of the project. The required security is outlined in the Development Agreement – Section 15 and must be provided before the Development Agreement is executed by the Town. If the Applicant defaults on the agreement, the Town can utilize the securities to obtain compliance with the provisions of the agreement as it sees fit.

Performance Guarantee

If applicable, the Owner agrees with the Town that fifty percent (50%) of the work has been completed and certified by the consulting engineer, in writing, to the satisfaction of the Town, the amount of the security may be progressively reduced for any completed work, plus twenty percent (20%), as determined by the Town Engineer. The reduction will only be made after the receipt of the progress certificate from the consulting engineer, proof that the contractor has been paid, and approved by the Town. However, the said security will not be allowed to be reduced below twenty five percent (25%) of the estimated cost of all works until all of the work has been completed to the satisfaction of the Town. The existing Letter of Credit or cash will continue in place as the Maintenance Guarantee. The maintenance guarantee will guarantee all workmanship and materials for a period of two years from the date of satisfactory completion of the work.

Release of Securities

The applicant shall submit a written request for release of Securities ninety (90) days prior to completion of Maintenance Guarantee to the Town of Ingersoll, giving the property address and the site plan number.

18.3 Assumption of Site/Development Plan (cont'd)

Site Inspection and Approval

Upon receiving the written request for Release of Securities, the engineering and building departments will begin their inspection for confirmation that all engineering and construction requirements have been satisfied. It is highly recommended that the applicant ensure that the requirements for the respective development are fulfilled prior to application for inspection. If deficiencies are found, a deficiency form is submitted to the Site Planner. Depending on the extent of deficiencies, a specified security holdback will be requested of the applicant's security.

Final Submission Requirements

All As Built drawings should be completed in accordance with the Town of Ingersoll – Drawing and Drafting Standards – Section 2.2.3 of this manual.

The final submission should be submitted with a set of hardcopy drawings, a PDF image of the set and all DWG files. Incomplete packages will not be accepted for review. Preparing complete quality submissions will expedite the review for final release of securities.

Clearance of Certificates

Site plans may require Ministry of the Environment (MOE) approvals known as Certificates of Approval. These certificates are needed for works such as wastewater and storm management facilities such as ponds, drywells or where services are being extended to a site such as a watermain or a sanitary sewer.

The MOE must be contacted prior to the request for Release of Securities by the Site Planner. A clearance letter informing the Town that the required works has been accepted by the MOE must be submitted to the Town before they will issue any release of final securities.

Building Permits

Any building permit taken out for the site plan must have been completed and signed off by the Chief Building Official before the final securities are released.

The Owner or Developer agrees that no building shall be occupied or used for any purpose in the development until sewer; water and electricity are in operation, and in the opinion of the Town, capable of providing adequate service.

18.3 Assumption of Site/Development Plan (cont'd)

Building Permits (cont'd)

The Owner or Developer further agrees that no building shall be occupied or used for any purpose in the development, until base asphalt has been laid on the road immediately in front of the building and extending to an existing Town road, and to maintain vehicular access to the said building.

Landscape Plans

The Owner/Developer will commit to completing all landscaping and planting prior to release of the maintenance guarantee.

Should the Town assume the site past November 1st of the current year, the Owner/Developer will have to have the landscaping and plantings completed before June 1st of the following year. The Town may at their discretion choose to holdback monies in this situation.

All trees planted 1 year prior to assumption must have a 24 month warranty. The Town or its representative shall have all planted trees inspected prior to final assumption.

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SECTION 19 – ASSET MANAGEMENT

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19.0 Provincial Requirements for Asset Management Plans

The province of Ontario, through the Ministry of Infrastructure, released in June 2011 *Building Together*, a long-term infrastructure plan for Ontario. The plan sets out a strategic framework that will guide future investments in ways that support economic growth and respond to changing needs. A key element of this framework is ensuring good stewardship through proper asset management. Municipalities deliver many of the services that are critical to Ontarians and these services rely on well planned, well-built and well-maintained infrastructure. The Province views asset management as a prerequisite for productive discussions about funding for municipal infrastructure.

The International Infrastructure Management Manual, Version 4, 2011, defines the goal of asset management as “meeting a required level of service, in the most cost-effective manner, through the management of assets for present and future customers”. The key elements of asset management are:

- Providing a defined level of service and monitoring performance;
- Managing the impact of growth through demand management and infrastructure investment;
- Taking a lifecycle approach to developing cost-effective management strategies for the long-term that meet defined level of service;
- Identifying, assessing and appropriately controlling risks; and
- Having a long-term financial plan that identifies required expenditures and how the plan will be funded.

A formal approach to the management of infrastructure assets is essential in order to provide services in the most cost-effective manner and to demonstrate this to council, citizens, and other stakeholders.

19.1 Town Asset Management Plan

In 2013 the Town of Ingersoll created an asset management plan, compiling a comprehensive list (inventory) of all the organization’s assets. These assets have been assigned their age, replacement value and condition.

Key benefits of asset management include:

- Prolonging asset life and aiding in making informed decisions regarding rehabilitation, repair and replacement concerns;
- Meeting community demands with a focus on system sustainability;
- Setting rates based on sound operational and financial planning;
- Budgeting focused on activities critical to sustained performance;
- Meeting service expectations and regulatory requirements;
- Improving response to emergencies; and
- Improving the security and safety of assets.

SECTION 19 – ASSET MANAGEMENT

19.2 Assets

The Town of Ingersoll has outlined in their Asset Management Plan the following assets that all Owner, Developers and Contractors must supply to the town. These assets must be identified and all information completed and submitted to the town before any acceptance of work by the town can be assumed.

Assets:

- Roads (Asphalt, Granular A, Granular B and Curb and Gutter)
- Sidewalks
- Bridges and Culverts
- Retaining Walls, Fencing and Hand or Guardrail
- Street Lighting and Traffic Signals
- Traffic and Street Signs
- Stormwater Management
- Storm Sewers including Catchbasins and Leads
- Erosion Controls

19.3 Asset Information and Requirements

The following is a detailed list of assets and the information required by the town. The will supply the forms within their Development Package or they may be obtained upon written request.

Roads

Asphalt Surface - Top and Base: Length, Width, Type, Depth, Date Placed, Asphalt Supplier, Contractor and all costing. See Form AM - 1 and 2.

Granular - Length, Width, Type, Depth, Date Placed, Supplier, Contractor and all costing. See Form AM - 3 and 4.

Curb and Gutter - OPS Type, Length, Material, Date Installed, Supplier, Contractor and all costing. See Form AM 5.

Sidewalks

Width, Length, Depth, Material, Date Installed and all costing. See Form AM – 6.

Bridges and Culverts

Watercourse Name, Road width, Number of Spans, Span Length (m), Fill, Rise, Deck Length, Deck Width, Deck Area, Deck Surface Material, Bridge Structure

SECTION 19 – ASSET MANAGEMENT

19.3 Asset Information and Requirements (cont'd)

Type, Structure Material, Structure Installation date, and all installation costs. See Form AM – 7 and 8.

Retaining Walls

Length, Height, Material, Date Built, all installation costs. See Form AM 9.

Fencing

Length, Height, Material, Date Built, all installation costs. See Form AM 10.

Guardrails

OPS Type, Post Type, Height, Length, Number of Post, Number of Rails, Date Built, all installation costs. See Form AM – 11.

Street Lights and Traffic Signals

Pole Type, Heads and Arm Type, Manufacturer, Date Installed and all costing. See Form AM – 12 and 13.

Street and Traffic Signs

Type, Category, Dimension, Support Type, Date Installed and all costing. See Form AM – 14.

Stormwater Management

Area, Depth, Description, Date Installed, Matting and/or Gabions, Headwalls and all costing. See Form AM – 15.

Storm Sewers

Maintenance Holes – Diameter, Depth, Material, Inverts, Top Lid Elevation, Frame and Lid, Lift Ring, Date Installed and all costing. See Form AM - 16.

Pipe – Length, Diameter, Inverts, Slope/Grade, Depth, Material, Manufacturer, Date Installed and all costing. See Form AM - 17.

Cathbasins - Size, Material, Inverts, Top Lid Elevation, Depth, Frame and Grate, Sub Drains, Date Installed and all costing. See Form AM - 18.

Leads - Length, Diameter, Inverts, Slope/Grade, Depth, Material, Manufacturer, Date Installed and all costing. See Form AM – 19.

19.3 Asset Information and Requirements (cont'd)

Erosion Control – Type, Length, Width, Size, Material, Manufacturer and all costing. See Form AM – 20.

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