

Design Criteria and Engineering Standards

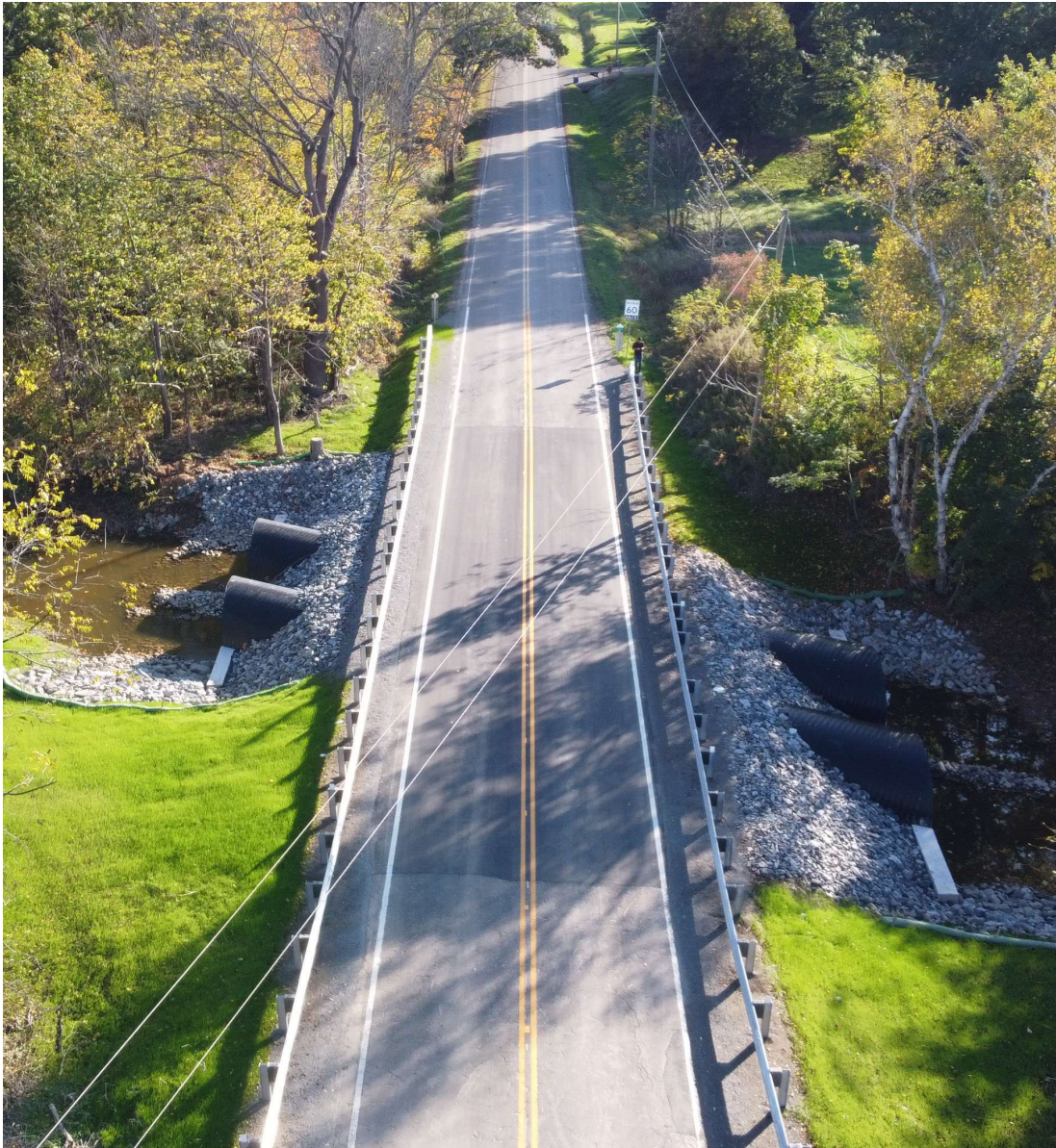


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Section A – General Information

A1.00 Preamble

The Town of Pelham (“the Town”) is centrally situated within the Niagara Region and comprises five historic communities: Fonthill, North Pelham, Ridgeville, Effingham, and Fenwick. Operating within a two-tier municipal government framework, the Town has responsibility for its road networks and streetscaping, water distribution mains, sanitary collection systems, and stormwater systems and facilities.

Given the Town’s ongoing role in the operation, maintenance, and expansion of this infrastructure, consistent quality in design from all Proponents is imperative. To facilitate this, the Municipal Engineering Design Manual (“the manual”) has been developed to clearly articulate the Town’s standards and objectives for future growth and development.

A1.01 Introduction

The following design criteria and engineering standards serve as a comprehensive guide for the Town, Consulting Engineers, Contractors, Developers, and members of the public. This document provides a unified reference to promote consistent infrastructure design for proposed developments—both subdivisions and individual sites—as well as the retrofitting of existing systems. For specific construction requirements, Proponents are directed to consult the Niagara Peninsula Standard Contract Document along with the Town’s supplemental provisions, where applicable.

Utilization of this manual does not exempt the Proponent from their professional duty to apply sound engineering judgment and industry best practices, ensuring that solutions are practical, efficient, safe, and sustainable for operation and maintenance by the Town.

This manual is not intended to supersede or replace any legislative requirements governing the design and construction of linear municipal infrastructure. Proponents must be thoroughly familiar with all pertinent legislation, including but not limited to the following:

- Municipal Act
- Environmental Assessment Act
- Ontario Highway Traffic Act
- Safe Water Drinking Act
- Ontario Water Resources Act
- Accessibility for Ontarians with Disabilities Act
- Construction Lien Act
- Environmental Protection Act

Periodic reviews and updates of this manual will be undertaken to ensure alignment with the Town’s Strategic Plan, evolving industry standards, best practices, and regulatory

requirements. It is the responsibility of the Proponent to confirm they are referencing the current version of this manual.

A1.02 Other Reference Documents

The Proponent is required to design infrastructure in compliance with the most current version of this manual, as well as the latest applicable plans, policies, industry standards, and best practices. This includes, but is not limited to, the following:

- Town of Pelham Strategic Plan
- Town of Pelham Planning Policy
- Town of Pelham Official Plan and Secondary Plans
- Niagara Region Official Plan
- Niagara Region Master Plans
- Town of Pelham Community Improvement Plan
- Town of Pelham Cultural Master Plan
- Town of Pelham Downtown Master Plan for Fenwick and Fonthill
- Town of Pelham Applicable Policies and By-laws
- Niagara Region Applicable Policies and By-laws
- Niagara Region Project Design Manual
- Ontario Provincial Standard Specifications and Drawings
- Ministry of Environment, Conservation and Parks (MECP) Design Guidelines for Sewage Works
- MECP Regulations and Design Guidelines for Drinking Water
- MECP Stormwater Management Planning and Design Manual
- MTO Highway Drainage Design Standards
- Niagara Peninsula Conservation Authority Guidelines and Policies
- Geometric Design Guide for Canadian Roads, prepared by the Transportation Association of Canada
- Ontario Traffic Manual, prepared by the Ministry of Transportation
- Roadway Lighting ANSI / IES RP-8, prepared by the Illuminating Engineering Society of North America (IESNA)
- Guideline for Security Lighting for People, Property and Public Spaces, G-1-03, prepared by IESNA
- Ontario Regional Common Ground Alliance

- Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data
- Urban Tree Foundation Specifications

Furthermore, all linear infrastructure must adhere to the latest versions of applicable industry standards and specifications relating to quality management and quality control, including but not limited to:

- American Association of Transportation Highways Officials
- American Standard and Testing Materials
- American Water Works Association
- Canadian Standards Association
- Electrical Safety Authority
- Factory Mutual
- Fire Underwriters Survey
- NSF International
- Underwriters Laboratory

Note:

The Town of Pelham reserves the right to exercise discretion in interpreting these Design Criteria and Engineering Standards documents and may require the use of additional relevant design guidelines and standards, such as OPSD's and OPSS MUNI's, during the review of each project.

Glossary of Acronyms and Abbreviations

AODA – *Accessibility for Ontarians with Disabilities Act*

Provincial legislation governing accessibility requirements in Ontario.

ANSI – *American National Standards Institute*

An organization that oversees the development of voluntary consensus standards.

AWWA – *American Water Works Association*

An industry organization providing standards and guidelines for water infrastructure.

BC – *Binder Course*

An intermediate asphalt layer used in pavement structure.

CAD – *Computer-Aided Design*

Software used for the preparation of engineering drawings.

CLF – *Chain Link Fence*

A metal fencing system is commonly used for municipal and safety applications.

CMB – *Community Mailbox*

Centralized mail delivery unit installed within public rights-of-way.

CSA – *Canadian Standards Association*

A national organization that develops standards for safety and performance.

DFO – *Department of Fisheries and Oceans (Canada)*

Federal authority responsible for fish habitat and aquatic resources.

DR / SDR – *Dimension Ratio / Standard Dimension Ratio*

Ratio of pipe diameter to wall thickness used in pipe design.

ESA – *Electrical Safety Authority*

The Ontario authority responsible for electrical safety and inspections.

FCC – *Foundation Control Certification*

Certification verifying foundation elevations and compliance with approved grading.

HGL – *Hydraulic Grade Line*

Elevation of water pressure head within a pipe or drainage system.

HL3 / HL8 / HL3A – *Hot-Laid Asphalt Mix Types*

Ontario Provincial Standard asphalt mixes used in pavement construction.

ICD – *Inlet Control Device*

A device used to restrict stormwater flow entering the minor system.

IDF – *Intensity-Duration-Frequency*

Rainfall relationship used for hydrologic and storm sewer design.

IES / IESNA – *Illuminating Engineering Society (of North America)*

Organization responsible for lighting design standards.

LID – *Low Impact Development*

Stormwater management practices that mimic natural hydrology.

MBE – *Minimum Basement Elevation*

Minimum allowable basement elevation relative to hydraulic conditions.

MECP – *Ministry of the Environment, Conservation and Parks*

The Ontario ministry is responsible for environmental regulation.

(Formerly MOECC – Ministry of the Environment and Climate Change)

MOECC – *Ministry of the Environment and Climate Change*

Former name of MECP; referenced where applicable to legacy documents.

MNR – *Ministry of Natural Resources*

The Ontario Ministry is responsible for natural resources and hazard lands.

MUTCD – *Manual of Uniform Traffic Control Devices*

Standard governing traffic signs, signals, and pavement markings.

NPCA – *Niagara Peninsula Conservation Authority*

Watershed authority regulating floodplains and environmental features.

NPCS – *Niagara Peninsula CAD Standard*

Standard governing digital drawing submissions.

NSF – *NSF International*

An organization that certifies materials for potable water use.

OGS – *Oil-Grit Separator*

A stormwater treatment device used to remove sediment and hydrocarbons.

OLS – *Ontario Land Surveyor*

Licensed professional responsible for legal and engineering surveys.

OPSD – *Ontario Provincial Standard Drawings*

Standard construction drawings referenced for municipal works.

OPSS MUNI – *Ontario Provincial Standard Specifications for Municipalities*

Standard construction specifications for public infrastructure.

PCSWMM / DDSWMM / INFOSWMM – *Stormwater Modelling Software*

Computer models used for hydrologic and hydraulic analysis.

PEO – *Professional Engineers Ontario*

The regulatory body governing professional engineering in Ontario.

PRV – *Pressure Reducing Valve*

Valve used to control water distribution system pressures.

PVC – *Polyvinyl Chloride*

Plastic pipe material commonly used for water, sanitary, and storm sewers.

R-Plan – *Reference Plan*

Survey plan used for easements and land registration.

ROW / R.O.W. – *Right-of-Way*

Public land reserved for transportation and municipal services.

RP-8 – *ANSI/IES Recommended Practice 8*

Standard for roadway and pedestrian lighting design.

SWM – *Stormwater Management*

System for controlling stormwater quantity and quality.

TAC – *Transportation Association of Canada*

National organization providing roadway design guidance.

TMIP – *Traffic Management Implementation Plan*

Plan detailing signage, markings, and traffic controls during operations.

TSS – *Total Suspended Solids*

Measure of particulate matter in stormwater runoff.

UTM – *Universal Transverse Mercator*

Coordinate system used for geodetic control.

WB-20 – *WB-20 Design Vehicle*

Standard tractor-trailer used for geometric road design.

A2.00 Engineering Drawings

A2.01 General

Section J outlines the engineering drawing requirements for site plans, while Section D specifies the requirements for individual house-siting plans.

A standard subdivision drawing set utilizing metric scales typically comprises the following documents:

- Cover Sheet featuring Key Plan and Drawing Index
- General Notes
- General Plan of Services (Scale: 1:1000)
- Utility Coordination Plans with Proposed Tree Locations (Scale: 1:500)
- Photometric Plans illustrating new lighting levels within rights-of-way (Scale: 1:500)
- Plan and Profile Drawings of all proposed roads and sewers on easements (Horizontal Scale: 1:500, Vertical Scale: 1:50)
- Typical Cross Sections (Horizontal Scale: 1:100)
- Detail Drawings (Minimum Scale: 1:50)
- Grading Plans (Scale: 1:500)
- Erosion and Sedimentation Control Plans (Scale: 1:500)
- Storm Drainage Plans with detailed overland flow routing (Scale: 1:1000)
- Storm Water Management Facilities Plans, if applicable (Scale: 1:500)
- Sanitary Drainage Plans (Scale: 1:1000)
- Watermain Plans (Scale: 1:1000)
- Subdivision Phasing Plan, provided phasing of development is proposed (Scale: 1:1000)
- Traffic Management Implementation Plans (Scale: 1:1000)
- Pavement Markings and Signage Plan (Scale: 1:1000)

Additional documentation includes:

- Storm Sewer Design Sheets for minor systems (presented in 12 pt text) and Hydraulic Grade Line Calculations (in 12 pt text)
- Overland Flow Calculations for major systems (in 12 pt text), with drawings submitted separately
- Parking Management Plan as required by Draft Plan Comments, detailing all available parking areas within private property (Scale: As Required)

A2.02 Drawing Requirements

- a) All drawings shall adhere to ARCH "D" dimensions (604 mm x 914 mm). Each plan must include a "North" arrow and a key plan for orientation.
- b) Drawings are required to incorporate vertical and horizontal control grid lines based on 6-degree UTM coordinates, NAD 83 datum (GRS80 Ellipsoid) coordinate system. Any benchmarks or horizontal control monuments established within project boundaries should be added prior to submitting as-built drawings.
- c) Plans and profiles must be arranged so that each street is individually filed.
- d) If multiple plans are necessary for a single street, match lines must be provided, ensuring no overlap of information occurs.
- e) The lot and block numbers shown on engineering drawings shall match those identified on the Registered Plan.
- f) All drawings must be neat, legible, and produced using the current version of AutoCAD.
- g) Stamps, tapes, and stick-on labels are prohibited, except for the Professional Engineer's stamp, which must be signed and dated before final submission.
- h) Details required on plan and profile drawings are specified in Appendix B.
- i) The Town of Pelham will assign maintenance holes, catchbasins, ditch inlets and any other municipal assets with identification numbers during the review of the second submission; these identifiers must be reflected on all subsequent drawings and sewer design sheets.
- j) Traffic Management Implementation Plans must include, at minimum: streetlight locations, potential street trees, hydrants, proposed signage accompanied by Ontario Traffic Manual codes and colour graphic depictions, and all recommended pavement markings.
- k) Coordinated Utility Plans shall display all proposed utility infrastructure above ground and below grade. Typical structure sizes should be presented in the legend; deviations for larger structures (e.g., switchgears, OPI cabinets) must be graphically represented and accurately dimensioned. Both temporary and permanent Community Mailboxes should also be shown.
- l) Issued for Tender and Issued for Construction drawings, in electronic formats, must be transferred to the Town prior to the start of construction.

A3.00 Submissions and Approvals - New Development

A3.01 General

All submission materials, including drawings, reports, and calculations, must be clearly marked with the corresponding submission number (e.g., 1st submission) and the submission date. Please be advised that drawing sets should not be stamped/labelled as "FINAL

Submission"; only numeric references are permitted. The Town reserves the right to request additional submission materials as necessary for the development application process.

A3.02 First Submission

PDF versions of the following plans and documents are required for submission to the Town for Engineering review:

1. Proposed Registration Plan.
2. General Plan of Services detailing all services to be constructed.
3. Lot Grading Plans.
4. Plan and Profile Drawings for all streets and easements.
5. Storm Drainage Plans, including comprehensive Overland Flow Routing (refer to Section B).
6. Detail Drawings.
7. Sanitary Drainage Plans, including catchment areas.
8. Watermain Commissioning Plan.
9. Storm Water Management Facilities Plans, if applicable.
10. Stormwater Management Report, Operation and Maintenance Manual, and digital modelling files, where relevant.
11. Erosion and Sedimentation Control Plans.
12. Storm Sewer Design Sheets (for 5-year and 100-year events), and calculations of the 100-year Hydraulic Grade Line.
13. Soils Consultant Report covering road pavement structure design, underground service bedding, construction recommendations, house foundation recommendations, and any engineered fill requirements.
14. Slope Stability Assessment, if warranted.
15. A letter, signed and stamped by the consulting engineer, confirming their engagement for the design, contract administration, and on-site supervision of the subdivision, in accordance with the requirements stipulated in the subdivision agreement.
16. Pre-Screening Application per the Town's CLI ECA process. This allows the Town to be aware of what infrastructure is associated with new development, if applicable.

A3.03 Second and Subsequent Submissions

The following plans and documents are required to be submitted to the Town for review by the Engineering Department:

1. Digital copies of all plans and documents listed under "First Submission", revised to incorporate feedback from the Engineering Department and other approving authorities.

2. One separate copy of the General Plan of Services (for second submission only).
3. A formal submission letter that includes the Town's previous written comments and a detailed, point-by-point response from the Consultant.
4. Marked-up Previous Submission drawings and storm sewer design sheets as annotated by Town of Pelham Staff.
5. A digital copy of the Ministry of the Environment, Conservation and Parks Application for Storm Sewers and Storm Water Management Facilities (if required, included in the second submission).
6. A digital copy of the Ministry of Environment, Conservation and Parks Application for Sanitary Sewer and applicable appurtenances (if required, included in the second submission)
7. A digital copy of the General Plan of Services, along with all related plans and profiles, to accompany the Ministry of the Environment, Conservation and Parks Form (where applicable).
8. Streetlight Layout and Photometric Design Plans, inclusive of base plan information.
9. Utility Coordination Plan.
10. Parking Management Plan indicating all available parking on private property (to be provided as a separate plan).
11. Traffic Calming Plan.
12. Construction Management Report/Plan(s).
13. Subdivision Phasing Plan (if applicable).
14. Traffic Management Implementation Plan.
15. Engineer's Cost Estimate, presented in a format acceptable to the Engineering Department, including an .xls/.xlsx file. The cost estimate should use the following categories:

Primary:

Erosion Control and Earthworks
 Servicing
 Watermain
 Sanitary Sewer
 Stormwater Management
 Roads (Base Works)
 Structures
 Streetlights

Secondary:

Roads (Top Works)
 Sidewalks
 Landscaping

A3.04 Final Submission for Town Approval

After all comments from the Town of Pelham, the Niagara Region, and relevant agencies and utilities have been satisfactorily addressed, the consultant will be required to submit the

original drawings—stamped and signed by a Professional Engineer (P.Eng.) to the Engineering Department for approval.

Plan and profile drawings will not be approved by the Town of Pelham until an acceptable Utility Coordination Plan has been received and all CLI ECA approvals have been obtained. (Refer to Section N)

A3.05 Issued for Construction Submission

Once the original drawings have been reviewed and approved by the Engineering Department and subsequently returned to the Consulting Engineer, the following documentation must be submitted to the Engineering Department prior to the initiation of construction:

- 1) A comprehensive set of approved engineering drawings, including a thoroughly coordinated Utility Coordination Plan.
- 2) An individual copy of both the General Plan of Service and the Storm Drainage Plan.
- 3) Electronic files (.PDF format) of all Town-approved “Issued for Construction” drawings, or CAD-generated PDFs containing typed Town approval details and “Issued for Construction” clearly noted within the title block.
- 4) Approved engineering drawings in digital format must be provided in AutoCAD.
 - a) AutoCAD drawings are required to include all layers and object data as specified in Niagara Peninsula CAD Standard - NPCCS.
 - b) In exceptional circumstances, at the discretion of the Engineering Department, Object Data may be accepted in Excel format in place of an AutoCAD file with Object Data.
- 5) Digital copies of all finalized revised reports, including but not limited to the Stormwater Management Report and the Operation & Maintenance Manuals.
- 6) A digital copy of the R-Plan intended for registration of easements.
- 7) Executed deeds for all grants of easement and properties to be conveyed to the Town of Pelham, properly signed by the Owner and Mortgagees where applicable.

After the execution of the Subdivision Agreement and before the commencement of municipal services construction, the developer is required to provide a complete set of contract documents to the Town of Pelham.

A4.00 Engineering Drawings – Capital Projects

A4.01 General

An engineering drawing set typically comprises the following documents:

- 1) Cover Sheet, including Key Plan, Drawing Index, and Project Description
- 2) General Notes and Legend

- 3) Horizontal Control Plan (Scale: 1:1000)
- 4) Plan and Profile Drawings for all proposed roadways and sewer systems (Horizontal Scale: 1:250; Vertical Scale: 1:50)
- 5) Typical Cross-Sections and Detail Drawings (Horizontal Scale: 1:100)
- 6) Design Cross Sections and Entrance Profiles (Scale: 1:100)
- 7) Erosion and Sedimentation Control Plans (Scale: 1:1000)
- 8) Line Marking Plans (Scale: 1:1000)
- 9) Additional Drawings as Required, such as Traffic Management, Staging, and Landscaping (Scale: 1:50)
- 10) Regional Drawings, if applicable (Scale: 1:250)
- 11) Photometric Plans detailing new lighting levels for rights of way (Scale: 1:500)

A4.02 Drawing Requirements

- 1) Drawings shall be produced in ARCH "D" format (609 mm x 914 mm). Each plan must include a "North" arrow and a key plan.
- 2) Vertical and horizontal control grid lines, based on the 6-degree UTM coordinates and NAD 83 datum (GRS80 Ellipsoid), are required for all drawings. Any new benchmarks or horizontal control monuments established within the project boundaries must be added before submitting the as-built drawings.
- 3) Plans and profiles should be organized so each street can be filed individually.
- 4) Match lines must be provided where streets necessitate multiple plans, ensuring that no information overlaps.
- 5) All drawings are to be completed using AutoCAD and must comply with the latest Niagara Peninsula CAD Standards.
- 6) The use of stamps, tapes, and stick-on labels is prohibited except for the Professional Engineer's stamp, which must be signed and dated prior to final submission.
- 7) Details to be included on plan and profile drawings are specified in Appendix B.

A5.00 Submissions and Approvals - Municipal Projects

A5.01 General

Submissions must be provided to the Town of Pelham upon reaching 30%, 60% and at 90% design completion, and during the final pre-tender review stage.

A6.00 Construction

A6.01 General

The developer is responsible for directly arranging new development construction with a contractor possessing the requisite experience. The contractor must provide Worker's Compensation Board clearance certificates at the outset, upon request throughout the project, and prior to the release of holdbacks. Additionally, the developer shall engage a consulting engineer and qualified inspection and testing consultants to supervise construction and ensure compliance with applicable standards.

Municipal works shall be constructed by a qualified contractor retained by the Town of Pelham. Inspection services will be performed either by Town of Pelham staff or by a consulting engineer appointed by the Town.

All construction within the Town of Pelham must adhere to the current Occupational Health and Safety Act and Regulations for Construction Projects, as well as all other relevant legislation, including the Traffic Control Manual for Roadway Work Operations.

Generally, construction shall comply with the Ontario Provincial Standard Specifications, the Town of Pelham, and the Ontario Provincial Standard Drawings, as well as any specific contract specifications and drawings approved by the Town.

The construction of sanitary sewers, storm sewers and watermains within the Town should follow Section K for Sanitary, Section B for Storm and Section L for Watermains, along with the latest edition of the Niagara Peninsula Standard Contract Document. Section N outlines the requirements for Environmental Compliance Approvals under the CLI ECA. Additional specifications and standards may apply as stipulated within individual contract documents.

A6.02 Project Meetings – Capital Projects

The consulting engineer, contractor, and Town of Pelham inspection staff will convene at the construction site at intervals specified by the inspection staff throughout the construction period. These meetings will serve to monitor progress, review upcoming activities and address any anticipated challenges, resolve outstanding questions or issues concerning the work, and discuss matters related to payments, change notices, and other relevant business.

A6.03 Construction Layout

For both new developments and municipal projects, the construction layout shall be provided by the contractor and verified by the consulting engineer in accordance with the contract-specific documentation. The construction layout must be executed to minimize public disruption while enabling efficient construction operations and precise installation of the designed works.

The consulting engineer is responsible for obtaining record inverts and ties for all underground services, tees, and lateral connections. This record information must be cross-checked against the design as construction progresses, enabling early identification and rectification

of any discrepancies. Sufficient record data should be collected to facilitate the preparation of record drawings, as described in Section A7.00.

The engineering consultant's on-site or resident inspector is required to keep one set of contract drawings at the project site solely for documenting record information. This information will be updated throughout the project and made continuously available for review by the Town of Pelham's inspection staff.

A6.04 Materials Testing

A qualified testing and inspection consultant shall be engaged by the developer for new developments, and by the Town of Pelham for municipal projects, to deliver the following testing and inspection services:

- a) Soils, compaction, and asphalt: This includes bedding, pipe cover, trench backfill, road subgrade, and granular and asphalt pavement materials.
- b) Concrete: Testing for slump, air entrainment, and compressive strength.
- c) Reinforcing steel: Assessment of material strength and placement compliance.
- d) Excess soils: Tracking and recording through SoilFlo technology.

Submit copies of all laboratory and field test results weekly to the Town of Pelham inspector, accompanied by a cover letter highlighting any deficiencies identified during testing and recommending corrective actions undertaken or required. All testing must comply with OPSS standards and procedures.

A6.05 CCTV Inspection of Sewers

- a) Each maintenance hole that is accessed shall undergo a visual inspection, with all observed structural deficiencies duly documented. Examples of such deficiencies include, but are not limited to: missing or deteriorating Moduloc, defective ladder rungs, and damaged lids.
- b) Sewer CCTV inspections shall be carried out using approved equipment. Typically, this equipment includes a monitoring unit and a camera featuring pan, tilt, and zoom capabilities, specifically engineered for inspection purposes. The camera should be mounted on a crawler or adjustable skids, with a height adjustment suitable for various pipe sizes.
- c) The camera must incorporate a remote-controlled, self-contained lighting system that provides adequate illumination to inspect pipes of all diameters. This lighting system should effectively illuminate the entire periphery of the pipe. All equipment must deliver full-colour, high-quality digital recordings of sewer interiors.
- d) Submitted videos must be in colour, formatted as approved, and available to the Town via an electronic format that is accessible by the Town. Contractors must ensure all text overlays in the videos are legible (e.g., white text with black halo) and minimize inactive periods by pausing recording when the crawler or camera is stationary. Recorded video quality and definition are subject to the Town's approval.

- e) Inspection reports must detail the location of all service connections, with an accompanying opinion regarding joint infiltration and the extent of blockages caused by calcification or sediment. Any intrusions of service connections into the main line must be documented, referencing the degree of intrusion observed.
- f) Full-colour photographs of 2.0 megapixels resolution or greater must be taken to document sewer defects and service connections. These images shall be systematically coordinated with the written report using reference numbers. At least one photograph per pipe segment or maintenance hole-to-maintenance hole section is required to demonstrate representative workmanship.
- g) Each pipe section between maintenance holes must be clearly identified in the report form. Identification details should include street names, maintenance hole numbers, pipe type, joint length, flow direction, pipe diameter, and inspection date. The Town will provide the necessary location information for all sewers.
- h) All digital media must be numbered and cross-referenced to the written report. Video footage must specify the sewer size, maintenance hole-to-maintenance hole segment inspected, segment ID, street address or location, and inspection date.

A6.06 Approved Materials

All construction activities within the Town of Pelham must use materials that comply with the standards defined in the contract drawings and specifications.

A6.07 Erosion and Sediment Control Plan

General

Before any on-site activities commence, the developer of the subdivision or the contractor for the municipal project is required to implement a comprehensive site control and management plan designed to effectively mitigate on-site erosion and minimize the off-site transport of silt, whether by overland flow, through the municipal storm sewer system, or into treed and environmentally sensitive areas within the development or project boundaries. The plan must also incorporate measures to reduce wind-borne dust and prevent mud tracking onto adjacent roadways.

The consulting engineer shall prepare detailed plans and drawings as part of this site control plan, which are to be submitted with the engineering documentation for approval by the Town. For municipal projects, equivalent plans are mandated where applicable, with erosion and sediment control drawings included in the contract documents.

All erosion control measures are to be inspected weekly and following any rainfall event, with immediate repairs carried out as necessary. Throughout all active phases of construction, such as servicing, roadworks, and home building, all roads within the project area must remain clean and free from debris. This requires, at a minimum, daily sweeping and weekly flushing (every Friday), or as otherwise directed by the Town of Pelham. The Developer/Contractor bears responsibility for maintaining open public roads in a safe condition, ensuring accessibility for emergency services at all times.

Erosion and Sedimentation Control Plan(s)

This plan shall address detailed requirements for each phase of construction as outlined below:

- Clearing and grubbing
- Rough grading and servicing
- Street and building construction

Approved erosion mitigation measures during construction are determined by the Director of Public Works or their designate and may include: silt fencing, mud mats, interceptor swales, rock check dams, catchbasin buffers, sediment traps, and sediment ponds equipped with emergency spillways and extended detention outflow devices.

Additional requirements may be imposed for activities involving creek or stream crossings for sewer and water main installations; bridge or culvert construction over active streams; channel diversions; and outfalls to active streams. Construction plans must specify strategies to mitigate impacts on streams, including scheduling work to minimize disruption in accordance with regulations from relevant agencies.

Subdivision development and municipal project phasing must be considered when designing temporary erosion and sediment control measures, including the placement of topsoil stockpiles. The primary objective is to minimize both the extent and duration of land exposure to erosion.

A6.08 Construction Management Report/Plan(s)

All development applications must include a Construction Management Strategy, comprising a report and associated plans, to ensure the organized construction of services, roads, and housing. Approval from the Town of Pelham is required prior to commencing any construction activities.

Applicants are advised to consult the Construction Management Report Guidelines for Developers, Consultants, and General Contractors applicable to both Subdivision and Site Plan Applications. These guidelines are available from the Engineering Department.

A7.00 Record Drawings

Upon completion of construction and prior to the commencement of services by the Town of Pelham, the Engineering Department must be provided with a digital copy of the original engineering drawings revised to reflect "record" conditions. These drawings are required in the current version of AutoCAD and are provided as greyscale CAD-generated PDF files for each drawing, supplementing the CAD files issued at IFC. Any additional files or specifications necessary for plotting should be included with the submission. Furthermore, "record" storm and sanitary sewer design sheets shall be supplied in digital spreadsheet format.

All drawings must be produced using AutoCAD and adhere to the latest Niagara Peninsula CAD Standards.

In addition to "record" drawings, consultants are required to provide "record" service connection records, including Locate Cards, which document the location and invert elevations of all buried service connection stubs.

Plan drawings must use true 6-degree UTM coordinates, the NAD 83 datum (GRS80 Ellipsoid), and indicate the "record" positions of new benchmarks and horizontal control monuments.

Preparation of "record" engineering drawings shall be based on the final survey of subdivision services and construction documentation.

Required information for "record" engineering drawings includes:

- a) Verification and survey of invert elevations for all sewers, maintenance holes, catchbasins, and rear yard catchbasins; rim elevation is also needed for maintenance holes located in easements, ditch inlet catchbasins, rear yard catchbasins, and sodded areas.
- b) Measurement of the distance between sewer maintenance holes, including pipe sizes and calculated grades. Sewer lengths must be presented to the nearest 0.1m, and grades calculated to two decimal places. As-built inverts, lengths, and grades are to be displayed in boxed text beside the original design information, which shall appear in clearly legible strikeout text.
- c) Record of all Watermain Shut-off valves, curb stops, lengths, materials, hydrants, including separation distances from other infrastructure, where applicable.
- d) Confirmation of locations for all curbs, sidewalks, light poles, and tree planting, where applicable.
- e) Recording of transformer locations, utility pedestals, super mailboxes (if provided), transit pads, and utility crossings within the utility coordination plan(s).
- f) Verification of invert elevations and widths for overland flow routes, and assessment of outlet capacities, including curb heights, sidewalk elevations, boulevard gradients, and unobstructed widths.

Please refer to Section B5.00, "As-Constructed Sewer Requirements," for criteria regarding "record" acceptance.

Within five years following final acceptance, the Town of Pelham may request that the Consultant revise and re-examine the "record" drawings should discrepancies between these documents and actual field conditions be identified.

A8.00 Development with Private Services

A8.01 General

As outlined in Section A1.00 - Preamble, these engineering design criteria pertain specifically to matters within the jurisdiction of the Engineering Department. Developments involving private services may also be subject to oversight by other agencies and organizations; it is

recommended that applicants consult the Town of Pelham Planning Department regarding site plan approval requirements.

The Engineering Department will conduct reviews of site plans and any supporting reports related to the development. For additional information, please refer to Section J - General Conditions of Site Plan Approval.

A8.02 Private Water Supply and Sewage Disposal

When development is proposed on privately serviced lots, developers are required to engage qualified consultants with expertise in the design of private wells and sewage systems.

Private water supply systems (wells) must be constructed in compliance with the Ontario Water Resources Act, Niagara Region Department of Health guidelines, and all relevant Ontario Regulations. Similarly, all private waste disposal systems shall adhere to the requirements outlined in the Ontario Environmental Protection Act, the Niagara Region Department of Health, and applicable Ontario Regulations.

A8.03 Rural Driveways and Culverts

For developers servicing lots adjacent to an existing ditched roadway, appropriate arrangements must be coordinated with the relevant road authority (Town of Pelham, Niagara Region) to obtain approval for driveway locations and to ensure installation of driveway culverts within the roadside ditch.

The design of each driveway must conform to the grade at the rear of the existing shoulder and provide a level platform, measuring at least 6.0 meters in length with a slope between -1% and +3%, directly behind the shoulder.

A8.04 Lot Grading

Grading design must comply with Section D - Residential Lot Grading, as applicable, and adhere to the Planning and Development Department's standards for the preservation of trees and the natural environment. Additionally, all requirements for the design of the sewage disposal system must be met.

The developer's Consulting Engineer and/or sewage system consultant is responsible for providing lot grading certification, confirming that the "as-constructed" grading aligns with the approved site plan and that the sewage disposal system has been properly installed in accordance with the approved design. If "as-constructed" conditions differ from the approved design, the Consulting Engineer shall submit a detailed letter describing the discrepancies, underlying reasons, and any associated impacts.

Lot grading specifications for 'Infill' lots are outlined in Section D5.0.

A8.05 Easements

If there is any linear Municipally Owned Infrastructure (such as storm, sanitary, or water) located on private property, where the Town would require access for future inspections or maintenance, an easement with sufficient width may be required to accommodate the

equipment needed to carry out the maintenance. The easement width will be at the Town's discretion, with a minimum width requirement of 3 meters. This easement will be registered on Title for future homeowners to adhere to.

Section B – Storm Design and Storm Water Management

B1.00 General

Storm drainage design and stormwater management are complex and evolving fields within engineering. This section offers guidance to designers but does not preclude the adoption of updated standard practices or well-considered innovations. It is recommended that designers consult with the Town at an early stage in the design process to ensure efficient and effective collaboration.

B2.00 Watershed Planning/Storm Water Management

The Town of Pelham primarily lies within three distinct drainage watersheds: Sixteen Mile Creek, Twelve Mile Creek, and Coyle Creek. When designing storm drainage systems that discharge into these watercourses, it is essential to consult with both the Niagara Peninsula Conservation Authority and the Town in advance. Stormwater management facilities within these catchment areas must incorporate watershed considerations throughout the design process.

For all new developments, a comprehensive Storm Water Management (SWM) report is required, addressing the following core elements:

- a) Stormwater quantity
- b) Stormwater quality
- c) Erosion potential (including new outfalls, channels, and existing stream banks)
- d) Base flow maintenance (water balance/budget)

Where applicable, the SWM report should align with the existing sub-watershed plan. In the absence of such a plan, the Storm Water Management Practices – Planning and Design Manual (MECP; March 2003 or latest edition) serves as the guiding document for selecting appropriate SWM strategies. The SWM plan must also satisfy the requirements of relevant regulatory agencies (e.g., MECP, MNR, NPCA, DFO, MTO).

Furthermore, the SWM plan must comprehensively address the matters specified in Sections B2.01 through B2.04.

B2.01 Lot Level Controls

- a) Minimum lot grades shall be 2.0%.
- b) The use of rainwater harvesting (e.g. rain barrels, cisterns, etc.) where the roof leaders are allowed to be disconnected shall be encouraged wherever feasible to not only reduce storm water runoff but to conserve the potable water supply, as the captured rainwater can be used for irrigation purposes. Refer to Section B3.13.1 – General, for roof leader requirements.

- c) Roof top and parking lot storage shall be provided on non-residential developments so that post-development flows do not exceed pre-development flows up to the 5 year storm. If downstream SWM controls are in place (e.g. end of pipe controls) and the receiving storm sewers have been sized appropriately, then it shall be demonstrated that the 100 year storm does not exceed the allotted minor system flows for the site (e.g. major system control). Note that for specific sites with downstream constraints, more stringent requirements may be established by the Town.
- d) Underground storage shall be permitted to achieve quantity control of post-development flows. Only roof top flows and pre-treated flows shall be permitted to infiltrate from underground storage chambers.

B2.02 Conveyance Controls

- a) Grassed swales shall be used wherever practical. Flow velocities shall be considered, and appropriate erosion control measures shall be implemented.
- b) Foundation drains shall drain via gravity to the storm sewers wherever practical.
- c) Overland flow resulting from a 100 year storm shall be contained within the road right-of-way and conveyance routes that are designed for this purpose. Refer to Section B3.02.2 – Major/Minor System Design, for design criteria.
- d) Required infiltration/exfiltration galleries shall be provided with effective pretreatment of incoming storm water flows (if applicable) to limit the potential clogging of the galleries.
- e) Oil-Grit Separators (OGS) are required on sites where there is potential for hazardous spills (e.g. fuel filling areas). On other site plans, OGSs will be assessed on a site-by-site basis as deemed not feasible based on the watershed constraints. Where OGSs are deemed unwarranted, a cash-in-lieu contribution may be considered, subject to the approval of the Town. (Cash value to be determined by the Town)

B2.03 End-of-Pipe Storm Water Management Facilities

The Storm Water Management Practices - Planning and Design Manual (MECP; March 2003 or latest edition) prescribes various alternative end-of-pipe stormwater management (SWM) facilities. Wet ponds are identified as the preferred approach for both stormwater quality and quantity control.

The determination of required storage volume for stormwater quality control shall be based on enhanced protection standards (previously Level 1 protection) and the provision for 24-hour extended detention of runoff generated by a short-duration, four-hour, 25 mm storm event. For stream bank erosion protection, these extended detention criteria will be applied, unless the Town or Niagara Peninsula Conservation Authority (NPCA) mandates supplementary analysis.

The calculation of required storage volume for stormwater quantity control is to be based on limiting peak post-development runoff rates to pre-development values for design storms ranging from two to one hundred years, unless otherwise approved by the Town and/or NPCA.

Analysis must encompass multiple design storms (e.g., with return periods from 2 to 100 years) to ensure proper assessment of system performance under varying flows.

Analyses shall adhere to the following methodologies:

- Sites ≤ 5 ha: Modified Rational Method.
- Sites ≥ 5 ha: Visual OTTHYMO, SWMHYMO, DDSWMM, INFOSWMM, or PCSWMM.

The SWM report must also address the following elements:

- Landscaping,
- Operation and maintenance,
- Erosion and sediment control (during and post-construction),
- Safety considerations.

B2.04 Storm Water Quality Treatment Facility Requirements

Stormwater quality facilities must incorporate, at a minimum, the design and maintenance enhancements specified in 'The Storm Water Management Practices Planning and Design Manual' (MECP; March 2003 or latest edition), as well as the following provisions:

- a) Access: Maintenance roads, with a width of 4.0 m, shall be constructed to access pond inlet and outlet structures, by-pass maintenance holes, the bottom of forebays, and the main cell. These roads must not exceed an 8.0% longitudinal slope or a 2.0% crossfall, and should accommodate heavy equipment used for sediment removal. Depending on site grading, surfacing may include asphalt, granular material, or open cell concrete blocks. Special consideration is required for sections above and below the normal water level (permanent pool) to account for freeze/thaw effects. Turnaround areas must be provided as necessary, with a minimum centerline radius of 12.0 m. Removable bollards are to be installed at the maintenance access point from the public right-of-way.
- b) Maintenance access roads must enable vehicles, such as cube vans, to reach the furthest points of the sediment forebay. Additionally, provision for a larger turnaround area suitable for a tri-axle vehicle, allowing minimal reversing, is required within the block for efficient pond cleanout.
- c) Forebay: A forebay shall be provided to concentrate sedimentation near the pond inlet, facilitating maintenance. It should have a length-to-width ratio exceeding 2, a depth greater than 1.0 m to minimize bottom scouring, constitute less than one third of the total pond area, comprise less than 20% of the permanent pool, and be capable of accommodating ten years' worth of sediment accumulation. The forebay berm shall match the normal water level, be at least 2.0 m wide, and feature flow-through culverts and inverts set at the predicted 10-year sediment elevation, or 0.6 m, whichever is greater, with a minimum cover of 0.3 m to the berm's top.
- d) Sediment drying area: Locate this adjacent to the forebay and maintenance road to facilitate sediment dewatering prior to off-site disposal. Size the area based on the

predicted 10-year sediment volume (piled 1.0 m high) and ensure a crossfall between 2.0% and 5.0% directed back into the facility.

- e) Maintenance/draw down pipe: Install a pipe with valve control to allow gravity draining to within 0.5 m of the pond bottom for routine maintenance. Where gravity drainage is not feasible, design an appropriate pumping protocol and associated infrastructure, detailing these on facility drawings.
- f) Inlet Structure: Design storm sewer inlets so that their inverts are at or above the normal water (permanent pool) level; submerged inlets will only be considered where no reasonable alternative exists.
- g) Outlet structures: Bottom draw outlet structures must be utilized in all instances and positioned at least 1.0 m above the facility floor.
- h) Shut off capability: Include mechanisms to halt extended detention outflows in the event of a spill in the drainage area, if practical.
- i) Winter drainage outlet: Consider incorporating a winter drainage outlet to permit runoff above the facility ice level during significant thaws. Elements (e), (g), and (h) are to be housed within a precast concrete maintenance hole.
- j) Maintenance bypass: Provide details describing the methodology for bypassing flows, ensuring diversion of all facility flows during maintenance and sediment removal activities.
- k) Pond bottom: Provide a stable, hard-bottomed surface if native soils are inadequate to support maintenance equipment. Confirmation by a qualified Soils Consultant is required, and documentation should be submitted to the Town.
- l) Pond liner: Conduct a geotechnical investigation to determine the necessity of liners or alternate construction methodologies should groundwater be encountered.
- m) Side slopes: For safety, establish a 2.0 m wide platform above the normal water level with a maximum 5% crossfall. Side slopes (above and below the platform) should not exceed 4:1 and require geotechnical support.
- n) Top of berm: Perimeter berms without trails or maintenance routes must be at least 3.0 m wide; narrower berms require justification by a Soils Consultant. Berms 3.0 m high or more must comply with dam engineering standards.
- o) Overflow spillway: Incorporate a spillway to relieve the system during major storm events or drainage blockages. Overflow design should be based on the 100-year or maximum facility storm flows, assuming full facility storage and complete outlet blockage. Maintain a 0.15 m freeboard from the emergency water level to the top of perimeter slopes. The spillway invert must be at or above the 100-year water level.
- p) Warning signage: Install warning signs near pedestrian pathways adjacent to or within the stormwater management block, with quantity determined by the Town. Signage must meet municipal standards and be supplied by the developer.

- q) Pond outlets: Design outlets discharging to creeks to minimize potential beaver interference.
- r) As-built certification: Prior to subdivision assumption, the consulting engineer must certify all facility design aspects, including storage volumes, elevations, control structure sizes/inverts, storm pipe dimensions/inverts, etc. Hydrologic models must be updated per as-built conditions for Town review. Remove accumulated sediments to restore original design volumes and dispose of them at approved locations. An updated stormwater management report reflecting as-built conditions is required, supported by an OLS-conducted topographic survey provided:
 - Immediately after construction, before facility operation, and
 - Immediately prior to municipal assumption of the subdivision.

B2.05 Stormwater Management Facility Operations and Maintenance Manual

An Operations and Maintenance (O&M) Manual shall be submitted to the Town, prepared in accordance with the Ministry of the Environment Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (March 2003, or as amended).

At a minimum, the following components must be included:

- **Background Information:** Provide location details, a key map, municipal address, Facility Identification, drainage area contributing to the facility, and other relevant data.
- **Facility Characteristics Description:** Outline water quality, erosion control, and quantity control features.
- **Design Parameters:** Detail the sediment forebay, permanent pool volume, extended pool volume, normal water level elevation, highest water surface elevation, drawdown time, design storm treated, drainage area, specifics of diversion structures, and outlet control features such as orifice, maintenance by-pass valve, and emergency spillway.
- **Inspection Checklists:**
 - 1) Determine frequency of inspections.
 - 2) Inspect inlet and outlet structures.
 - 3) Assess for unusually prolonged extended detention drawdown times, indicating potential outlet structure blockages.
 - 4) Examine sediment accumulation in both the forebay and downstream sections.
 - 5) Investigate for vandalism, illegal access (e.g., gates), or perimeter encroachment.
 - 6) Confirm functionality of safety and security measures.
 - 7) Observe for unusual erosion around berms and inlet/outlet structures.
 - 8) Conduct visual assessments to verify healthy vegetation.
 - 9) Ensure no oil sheen is present on water surfaces and that there are no visible contaminants or odors.

10) Test drawdown valve operation.

11) Include recommended maintenance procedures addressing, but not limited to:

- Grass cutting
- Weed control
- Upland and fringe plantings
- Shoreline fringe plantings
- Aquatic vegetation replanting
- Outlet adjustments
- Bathymetric surveys to determine sediment removal requirements
- Trash removal
- Winter maintenance

- **Sediment Removal Guidelines:**

- 1) Describe procedures for dewatering the permanent pool prior to sediment extraction and diverting storm flows during maintenance.
- 2) Provide a comprehensive plan for sediment handling, removal, disposal, and outline any permitting needs.
- 3) Specify identified maintenance activities and expected durations.
- 4) Supply an erosion and sediment control plan to prevent total suspended solids (TSS) release downstream; detail treatment, sediment dewatering and drying methods.
- 5) Identify chemical analyses required under Ontario Regulation 558/00 before disposal.

- **Anticipated Annual Maintenance Costs:** Present calculations of estimated annual operation and maintenance costs, including sediment accumulation and cleanout frequency for the SWM facility. Cost analysis should encompass:

- Debris and litter removal; grass cutting and weed control (if applicable)
- Maintenance of aquatic/shoreline fringe and upland/flood fringe vegetation
- Sediment testing, removal, and disposal; repairs to inlet/outlet structures
- Repairs to side slopes, access roads, and retaining walls

- **Facility Design Drawings (Full Size and Half Size):**

- 1) SWM facility location plan
- 2) Post-development drainage area plan contributing to the SWM facility
- 3) Stage-storage-discharge relationship and corresponding curve for the SWM facility

- 4) General layout of the SWM facility
- 5) Detailed drawings of significant elements (e.g., inlet, outlet control structure, maintenance valve, spillway)

A final, approved Operations and Maintenance (O&M) Manual must be delivered to the Town prior to the commencement of facility operations.

B3.00 Hydrology and Design Flows

B3.01 Sub-Watershed Drainage Areas

The sub-watershed area shall be determined from contour plans and verified in the field where necessary and shall include all areas that naturally drain into the system and any fringe areas not provided for in adjacent storm drainage areas, as well as other areas which may become tributary by reason of re-grading.

A plan of the sub-watershed area shall be prepared, to scale 1:1000 or as appropriate, depending on the size of the area, and shall show all streets, lots and watercourses affected. The intended storm sewer system shall be shown on this plan, including each maintenance hole numbered consecutively* for design reference. Maintenance holes shall be located at each change of pipe size, grade, and alignment.

*Refer to A2.02(i) for Town maintenance hole numbering.

Maintenance holes shall be the tributary points in design, and areas tributary to each maintenance hole shall be clearly outlined on the storm drainage area plan, and the area in hectares (to two decimal places) shall be clearly shown, preferably in a circle 15 mm in diameter, with the runoff coefficient also shown.

for example: $\frac{4.67 \text{ ha}}{0.5}$

Town maintenance hole numbering shall comply with A2.02(i) in this document.

In cases where areas of different runoff coefficients may be tributary to one maintenance hole, the areas tributary to the maintenance hole shall be individually outlined with small arrows from the boundary line of the area showing the direction to the maintenance hole.

In determining tributary areas to maintenance holes, the proposed grading of lots must be considered and taken into account in order to maintain consistency in design.

Catchment areas tributary to catchbasins and other inlets shall also be used where the detailed interaction of the major and minor system flows is being analyzed.

In the case of large areas under single ownership, such as shopping centres, apartment developments, schools, etc., the design shall be prepared on the basis of the whole area being tributary to a maintenance hole in an abutting storm sewer unless more than one sewer connection will be necessary to serve the property in question, in which case the appropriate area tributary to each sewer connection shall be clearly shown and taken into account in the design of the storm sewer.

In lieu of precise information on development on the whole or any part of a watershed area, reference shall be made to the latest zoning plan issued by the Planning Department in order to select the correct values of runoff coefficient to be used in the design and the areas to which they shall be applied.

B3.02 Major/Minor System

B3.02.1 Overland Flow Routing Plan

A detailed plan shall be provided that shows the overland flow routing, including major system maximum flow rates, maximum depths of flow in the gutter, maximum extents of flows, maximum velocities on landscaped areas and direction of flows. These values shall be shown for all significant changes in direction or slope and at all outlets for combinations of overland flows. The capacity of the overland flow routes shall be demonstrated by calculations acceptable to Engineering Services.

Overland flow shall be designed to be on public property or dedicated easements. Overland flow shall be contained within the right of way and shall discharge to public parks and open space blocks wherever possible. Where it is not possible to contain the overland flow on public property, easements for overland flow inundation on private property shall be provided.

B3.02.2 Major/Minor System Design

The storm drainage system shall be designed with the minor, or storm sewer system sized to convey the 1:5 year storm and the major or overland system designed to convey the 100 year storm. To account for a decrease in the imperviousness during major storms, the recommended safety factors as identified within MTO's Drainage Design Standards 2008 as amended shall be used. For the 100 year storm, the factor shall be 1.25 times the calculated peak flow using the peak intensity factor of the 100 year storm. The design flow of the major system shall not be less than the difference between 1.25 times the 100 year design flow and the 5 year design flow (assumed to be captured by the minor system).

$$Q(\text{major}) = 1.25 * Q(100) - Q(5)$$

All overland flow calculations shall be based on this flow rate.

B3.02.3 Maximum Depth and Velocity of Overland Flow

For all Town of Pelham roads, the maximum gutter depth from the overland flow depth or static ponding shall not be more than 0.40m. The maximum centre line depth of overland flow on the Town of Pelham roads shall be as per the following:

- Local Streets: 0.20 m
- Collector Roads: 0.15 m
- Arterial Roads: 0.10 m

Under no circumstances shall the maximum centre line depth of an overland flow exceed 0.30 m on routes determined to be Emergency Accesses.

The maximum depth of flow and the maximum velocity on other roads shall be as directed by the road authority having jurisdiction. Static ponding depth shall be either to the minimum spill elevation or the calculated depth for the ponding volume for the worst case storm event duration and intensity plus 0.05 m. Flow depth shall be based on accepted hydraulic principles such as Manning's open channel calculations or weir flow depth.

Downstream flow depths during peak events may be reduced to account for upstream storage in the overland flow route.

As per the MNR Technical Guide – River and Streams System: Flooding Hazard Limit, Appendix 6:

- Roadway overland flow velocities, perpendicular to the roadway, shall not exceed 4.5m/s
- The product of velocity and depth ($v \cdot d$) shall not exceed 0.8.

B3.02.4 Sanitary Sewer Infiltration

Sanitary sewer maintenance hole covers in the overland flow route shall be protected from infiltration in accordance with regional standards.

B3.02.5 Inlet Protection

To determine if inlet protection is required, the unrestricted capacity of a catchbasin or ditch inlet in the 1:100-year design flow shall be compared to the maximum 1:5 year design flow for the local inlet catchment area. The unrestricted capacity of the inlet at the calculated depth of flow shall be based on the MTO Drainage Management Manual Design Charts. Where the minor system is not designed to handle the 1:100-year design flow, the inlets shall be protected against surcharge by inlet control devices wherever the unrestricted inlet capacity exceeds the 1:5-year design flow for the inlet.

The allowable 1:5-year design flow for the inlet must be adjusted to account for flows from directly connected downspouts and other inlets in the local inlet catchment area. Inlet control devices used for inlet protection to the 1:5-year design flow on public property shall have framed inlet controls with removable orifice plates to permit maintenance and cleaning.

All inlet control devices used for quantity control on private property that restrict flows to less than the 1:5-year design flow shall be tamper-proof.

Orifices smaller than 75 mm in diameter (or equivalent area) shall be protected from blockage as a result of the possible accumulation of debris.

B3.03 Runoff Quantity

The design of the storm sewers shall be computed on the Storm Sewer Design Sheets, Standard Drawing No. 513 format. All storm sewers draining tributary areas less than 5 hectares shall be designed according to the Modified Rational Formula, where:

$$Q = 2.78 * A * I * R$$

A = Area (hectares)
 I = Average rainfall intensity - (mm/hr)
 R = Runoff coefficient
 Q = Runoff quantity (litres/sec.)

Equation: $i = A/(t+B)^c$			
Return Period	A	Constants B	C
2	499.72	6.5	0.7499
5	700.16	5.6	0.7500
10	899.50	5.5	0.7499
25	1100.35	5.0	0.7501
50	1299.87	4.9	0.7500
100	1500.25	4.6	0.7500

The values of rainfall intensity shall be taken from the Town of Pelham Rainfall Intensity Duration Curve, using a storm return period of 5 years.

Standard values for the runoff coefficient "R" are listed below:

- 0.20 Parks, Cemeteries & Playgrounds
- 0.65 Single Family Residential
- 0.65 Semi-detached Residential
- 0.75 Street Town Houses
- 0.85 Laneway Towns
- 0.90 Back to Back Towns
- 0.85 Industrial Areas
- 0.90 Commercial
- 0.85 Apartments, Medium density, Condo Townhouses, Schools & Churches

The sewer designer shall provide calculations to demonstrate that the actual runoff coefficient "R" used is appropriate for tributary areas.

Storm sewers for tributary areas larger than 5 hectares shall be designed using computer modelling techniques such as those referenced in the MTO Drainage Management Technical Guidelines (1989 or latest revision).

B3.04 Pipe Capacity

Manning's Formula shall be used to compute the capacity of storm sewers such that

$$Q_{\text{peak flow}} < 0.8 Q_{\text{pipe flowing full}}$$

Time of Concentration shall be shown as follows:

- Urbanized residential areas, a 15-minute entry time shall be used at the upstream end of the system.
- Urbanized commercial and industrial areas, a 5-minute entry time shall be used.
- In the existing core areas, a 10-minute entry time shall be used.

If another entry time is more appropriate, this may be proposed to the Town, who shall make a final determination. Refer to Table B3.04 for Discharge and Velocity Pipe Capacity Charts.

Critical Slope criteria shall be met such that $Q_{\text{peak flow}} < Q$ at S_c , where S_c is the critical slope determined by the formula.

$$S_c = 9 / (D^{1/3}) \times (n/0.013)^2 \quad D = \text{pipe diameter in mm}$$

Adjustments to design pipe slope and/or diameter shall be made, if necessary, in order to satisfy this criteria, refer to Table B3.05.

100 Year Hydraulic Grade Line calculations shall be performed and adjustments to the five (5) year design pipe slope and/or diameter shall be made, if necessary, in order to satisfy the criteria that all basement floor elevations will be a minimum of 0.50 m above the 100 year hydraulic grade line. While it is recognized that storm sewers and catchbasin spacing designed using the Town's criteria may not capture the 100-year event, the onus is on the consultant to demonstrate the actual flow capture within the proposed storm sewer system using the Town's 100-year design event. Dual drainage analysis computer models (DDSWMM, PCSWMM, INFOSWMM) shall be used to generate the inflow captured by the minor system during the 100-yr storm event. The Chicago type distribution shall be used to derive the design storm hyetograph from the Town's IDF curve with 10-minute or less intervals. Alternatively, the 100-year design flow can be assumed to be captured. These flows shall then be used in the HGL calculations. Inlet Control Devices (ICD's) will be considered to limit the flows into the storm sewer system if necessary. The starting elevation for the HGL calculation shall be the higher of: the 100-year water surface elevation within the receiving system (downstream SWM facility, floodplain, etc.) or the obvert of the outlet pipe from the system. The HGL is to be plotted on all plan and profile drawings and calculations provided.

Where external drainage is captured, the peak flow used on the storm sewer design sheet shall be the maximum peak flow for the combined theoretical hydrographs for the external and

internal system. External entry time and contributing area for the peak flow shall be calculated using industry standard equations (i.e. Uplands, Airport or Bransby Williams equations for instance).

The **minimum design slopes** for storm sewers shall be as follows:

<u>Sewer Size</u>	<u>Minimum Slope</u>
300 - 450 mm	0.5%
525 – 825 mm	0.4%
900 mm and over	0.3%

Slopes less than the minimum must be approved by the Town.

B3.05 Roughness Coefficients

The roughness coefficients to be used for storm sewer pipes shall be:

- a) Concrete pipe: $n = 0.013$ for all sizes of pipes.
- b) Vitrified Tile: $n = 0.013$ for all sizes of pipes.
- c) Polyvinyl Chloride (PVC) pipe: $n = 0.013$ for all sizes of pipe.
- d) Corrugated Metal: According to the manufacturer's specifications.

B3.06 Velocity

The velocity in storm sewers shall be limited to:

- minimum value of 0.75 m/s; and,
- maximum value of 4.5m/s.

TABLE B3.04

SEWER CAPACITY

Slope (%)	Sewer Diameter (mm)																		Slope (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Notes: 1. Q = Capacity (m³/s), V = Velocity (m/s)
2. Actual Pipe Diameter used to calculate Capacity and Velocity.
3. All values represent pipes flowing 100% full.

Table B3.05 Critical Slope and Flow by Pipe Size			
Nominal Dia. (mm)	Critical Slope (%)	Critical Velocity (m/s)	Critical Capacity @ Slope (l/s)
150	1.69%	1.13	21
200	1.54%	1.31	42
250	1.43%	1.46	74
300	1.34%	1.60	117
375	1.25%	1.79	204
450	1.17%	1.96	322
525	1.12%	2.12	474
600	1.07%	2.27	662
675	1.03%	2.40	888
750	0.99%	2.53	1156
825	0.96%	2.66	1467
900	0.93%	2.78	1823
975	0.91%	2.89	2227
1050	0.89%	3.00	2681
1200	0.85%	3.21	3743
1350	0.81%	3.40	5025
1500	0.79%	3.58	6539
1650	0.76%	3.76	8298
1800	0.74%	3.93	10315
1950	0.72%	4.09	12600
2100	0.70%	4.24	15164
2250	0.69%	4.39	18019
2400	0.67%	4.53	21174
2550	0.66%	4.67	24639
2700	0.65%	4.81	28424
3000	0.62%	5.07	36990

B3.07 Minimum Sizes of Pipe

Sewer Mains -	300 mm
<u>Catchbasin Connections</u>	
- Single Catchbasin -	250 mm
- Double Catchbasin -	300 mm
- Rear Yard Catchbasin Leads -	300 mm

B3.08 Minimum Depth

The depth as measured from the final centerline road elevation to the sewer invert shall be a minimum of 1.8 m or sufficient to provide a suitable outlet for the building foundation weeping tile, with provision for the 100 year hydraulic grade line to be a minimum of 0.5 m below basement floor elevations (see Section B4.00 Minimum Basement Elevation). The minimum cover to the pipe obverts shall be 1.2 m.

B3.09 Maintenance Holes

- a) Standard Maintenance Holes designs are detailed in the Ontario Provincial Standard Drawings OPSD 700 series, OPSD 401.010 for Standard Maintenance Hole, Cast Iron, Cover and Circular Frame, OPSD 404.020/404.022 for Safety platform requirements for deep maintenance holes (often required for depths exceeding 5.0m), OPSD 405.020: Maintenance Hole Steps (Solid) and OPSD 701.011/701.012 for details for 1200mm, 1500mm, and 1800mm diameter precast maintenance holes.
- b) Key Related Specifications include OPSS.MUNI 407: Construction Specification for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers, OPSS.MUNI 408: Construction Specification for Adjusting or Rebuilding Maintenance Holes and OPSS 1351: Precast concrete components requirement
- c) Maintenance holes shall be provided at each change in alignment, grade, material and at all junctions with un-painted/ un-coated maintenance hole covers.
- d) Maintenance holes shall be spaced at a maximum of 100 m; for sewers 1200 mm diameter and greater, the spacing may be increased to 150 m at the Town's discretion.
- e) Type and size of maintenance hole shall be specified on the profiles, and a detail of the benching to be shown on the plan portion of the drawing for cases where the benching differs from the Standard Drawing No. 100.
- f) Maximum pipe sizes for typical inlet and outlet pipe configuration for precast maintenance holes of 1200, 1500, 1800, and 2400 mm diameter are shown on Standard Drawing No.100.
- g) The maximum change in direction of flow in maintenance holes for sewer sizes 1200 mm diameter and over shall be 45°.
- h) The change in direction of flow in any maintenance hole will not be permitted at acute interior angles.

- i) Maintenance holes shall be designed with sufficient drop to compensate for energy loss due to changes in direction, velocity and depth of flow. The minimum drop across the maintenance hole for all straight runs is – 30 mm, and for all other runs, it is – 60 mm.
- j) The velocity change across a maintenance hole, in the direction of flow, shall not exceed 0.6 m/s.
- k) Where the difference in invert elevation between the inlet and outlet pipes exceeds 0.9 m, a drop structure shall be provided as detailed in Standard Drawing No. 101.
- l) In any maintenance hole the inlet pipe obverts shall be higher than or equal to the obvert of the outlet pipe.
- m) All maintenance holes shall be benched to the spring line of all pipes.
- n) All benching inside maintenance holes shall be a minimum of 225 mm in width.
- o) No maintenance hole shall be located closer than 1.5 m from any curb face or other utility to outside of barrel of 1200 mm diameter chimney portion 2m to center.
- p) Although the Standard Drawings provide details for maintenance holes up to certain maximum depths; the Consulting Engineer shall analyze individually each application of the standards related to soil conditions, loading and other pertinent factors to determine structure stability. In all cases where the standards are not applicable, maintenance holes must be individually designed and detailed.
- q) When any horizontal dimension of a maintenance hole exceeds 3.6 m, the maintenance hole must be individually designed and sufficiently detailed to permit poured-in-place construction.
- r) A minimum clearance of 0.2 m shall be provided between the outside of all pipe barrels at all points of pipe crossings. Concrete encasement may be required.
- s) Safety gratings shall be required on all maintenance holes when their depth exceeds 5.0 m. Maximum spacing between safety grates is 5.0 m as per OPSD 404.020. Platforms to be installed at the half way point.
- t) Blank (solid) removable orifice plate shall be used in maintenance holes to isolate HGL interactions when warranted (i.e. starting run of a storm sewer share a common MH with another storm sewer run).

B3.10 Catchbasins

- a) Standard catchbasin designs are detailed in the Ontario Provincial Standard Drawings OPSD 705.010, 705.020 and grate 400.010 for roads and OPSD 705.030 and grate 400.020 for rear yards.
- b) Special catchbasins and inlet structures shall be fully designed and detailed.
- c) Catchbasins shall be selected, located and spaced in accordance with the conditions of design. The design of catchbasin location and type shall take into consideration the

contributing drainage areas, lot grades, pavement widths, road grades and intersection locations. The acceptable spacing requirements shall be as follows:

Pavement Width	Maximum Spacing	
	4% Grade or Less	Greater than 4%
8.5 m	90 m	60 m
11.0 m	80 m	55 m
Over 15.0 m	60 m	40 m

- d) The catchbasin spacing may be altered for grades over 4.0% for special cases by using side inlet catchbasins or special grates. Double catchbasins are required where drainage is received from more than one direction.
- e) Catchbasins shall be located immediately upstream of sidewalk crossings at intersections and upstream of all pedestrian crossings. Where possible, catchbasins shall not be located in driveway curb depressions.
- f) Catchbasin grate and connection shall provide for the expected maximum minor system (5-year return period storm) flow.
- g) For Single Catchbasins - the connection shall not be less than 250 mm diameter pipe laid at 1.0% minimum grade.
- h) For Double Catchbasins - the connection shall not be less than 300 mm diameter pipe laid at 1.0% minimum grade.
- i) Catchbasin leads shall be installed in accordance with Standard Drawing No. 107. Rear-yard catchbasin leads shall be installed entirely on one lot, offset by 0.5 m from the lot line. A 3.0 m wide easement centered on the lot line and containing the lead and catchbasin shall be dedicated to the Town of Pelham. Concrete encasement (15-20 MPa) shall be utilized as per Standard Drawing No. 107.10.
- j) Road subdrain as per Standard Drawings No. 108 and No. 109 shall be connected to catchbasins as outlined in these drawings.
- k) Notwithstanding any requirements for spacing of inlets, the maximum impervious area calculated by multiplying the area times the runoff coefficient to be connected to a single catchbasin inlet shall be 0.18 impervious hectares (example 0.2 ha at 0.9 runoff coefficient). Similarly, the maximum impervious area for a double catchbasin shall be 0.36 impervious hectares.

B3.11 Pipe

- a) Pipe bedding and class shall be designed to suit loading conditions. The class or strength, size and bedding shall be shown on the profiles.
- b) All storm sewers shall be located as shown on the appropriate road cross-section standard. Refer to 400 series Standard Drawings.
- c) All storm sewers shall be laid in a straight line between maintenance holes except where radius pipe is permitted (see (e) below).

- d) The pipe size shall not decrease from a larger size upstream to a smaller size downstream regardless of any increase in grade. A decrease in pipe size from upstream to downstream will only be permitted where the larger pipe is designed for storm water detention.
- e) Radius pipe will be permitted in sizes 1050 mm diameter and over. The minimum radius shall be in accordance with the pipe manufacturer. Radius pipe sections shall be designed with at least one maintenance hole at one end of the section.

B3.12 Inlet and Outfall Structures

- a) Inlet and outfall structures, including head walls, shall be fully designed and submitted in detail. Where possible, structures shall conform to applicable Ontario Provincial Standard Drawings. In each case, existing topography should be shown as well as the protective works necessary to prevent erosion of the site around the structures, including erosion from the outfall flows.
- b) In general, inlet grates shall consist of inclined parallel bars or rods set in a plane sloping approximately 45° away from and in the direction of the flow. Outfall grates shall consist of horizontal bars or rods. Spacing of bars or rods shall not exceed 150 mm clear. All metal parts shall be hot dip galvanized or stainless steel. When the vertical face of any structure exceeds 0.60 m high it shall be fitted with a handrail in accordance with Standard Drawing No. 103.

B3.13 Storm Drain Connections

B3.13.1 General

- a) Storm service connections shall be installed to service each lot, block and unit in the subdivision and shall extend 1.5 m to 3.0 m inside the property line.
- b) The services shall be installed in accordance with Standard Drawings.
- c) Service connections shall not, in general, be made to a trunk sewer.
- d) Risers shall be constructed when the invert of a sewer exceeds 4.5 m in depth. No riser shall exceed 3.0 m in height unless approved by the Town.
- e) Front roof leaders shall connect directly to the storm system. Single family and semi-detached rear roof leaders must discharge to the ground surface via a splash pad. Townhouse (freehold or condominium) roof leaders shall connect to the storm system unless otherwise directed. Refer to standard drawing No.106.10 for storm drain under basement floor if needed.
- f) All roof leaders (front and rear) for any public laneway housing type, shall be directly connected to the municipal storm sewer within the fronting right-of-way, unless otherwise approved by the Town.
- g) PVC pipe for storm drain connections is to be white in colour.

B3.13.2 Single Family, Semi-detached and Street Townhouses

- a) Storm drain connections may be designed in accordance with Standard Drawings No's. 104, 105 and 106. The designer shall confirm that pipe loading conditions and soil conditions are suitable for standard strength pipe and standard bedding details.
- b) The connection to the main sewer shall be made with an approved manufacturer's tee for main sewer sizes up to and including 375 mm diameter and in accordance with the details on Standard Drawings for larger sizes.
- c) Storm connections for Single Family, Semi-Detached & Street Townhouse Units shall be PVC SDR 28 with a minimum 2.0% grade. A 50 mm x 100 mm wooden marker shall be placed at the end of the connection and shall have the top 600 mm painted green and above the lot grade.
- d) The minimum depth at the street line shall be 1.8 m and the maximum depth 3.1m, measured from the final centerline road elevation. Risers shall be used when the invert depth of the sewer main exceeds 4.5m. Risers shall not exceed 3.0m in height without approval of the Town.
- e) Service connections shall not connect into a catchbasin, or maintenance hole.
- f) Joints and bedding for connections shall be equivalent to joints and bedding on the main sewer.

B3.13.3 Multi- Family Blocks and Non-residential Storm Connection

- a) Parking lots, driveways and/or other hard surfaced areas servicing multiple family, commercial and other blocks, shall be drained by a properly designed internal drainage system (including catchbasins, maintenance holes and pipe) which shall connect to the storm sewer system or other suitable outfall as determined by the Town.
- b) On private property (subject to the Ontario Building Code):
 - 1. A maintenance hole shall be required at either a location within 1.5m of the property line on private property or on the sewer main.
 - 2. Maximum maintenance hole spacing shall be 100 m.
 - 3. No change in grade or direction of pipe shall be permitted between maintenance holes or catchbasins.
 - 4. Catchbasin type maintenance holes will be permitted.
 - 5. Storm connections for multiple family and other blocks shall be designed individually for the intended use. Minimum pipe grade shall be 0.5%. Minimum size shall be 300 mm diameter concrete or PVC SDR28 (or ribbed) pipe.
 - Minimum velocity - 0.75 m/s
 - Maximum velocity - 4.50 m/s

B3.14 Construction

Construction of all connections shall be in accordance with the current and appropriate Design Criteria and Standard Drawings.

Service connections shall not, in general, be made to existing trunk sewers.

B3.15 Materials

- a) Storm sewers shall be constructed of concrete pipe or polyvinyl chloride (PVC) pipe. Corrugated steel pipe shall only be used in special cases with approval from the Town. PVC pipe shall only be used on storm sewer mains up to and including 375 mm diameter and may be used for service connections and catchbasin leads. Concrete or PVC pipe shall be used for 450mm storm sewer mains. HDPE pipe may be used for underground storage in sizes up to and including 750 mm.
- b) Pipe size, classification and bedding type shall be clearly indicated on all the profile drawings for each sewer length.
- c) Concrete sewer pipe shall conform to the following C.S.A. requirements for classes shown below.
 - Non-reinforced concrete pipe Class 1, 2 and 3 CAN/CSA A257.1- M92.
 - Reinforced concrete pipe with strength classifications 50-D, 65-D, 100-D and 140-D. CAN/CSA A257.2-M92.
- d) Polyvinyl Chloride (PVC) pipe shall conform to the fabrication requirements of CSA B182.2 - B182.4, as well as ASTM D 3034, F 679, F794 and UNI-B-5, B-6, and B-9.
- e) Corrugated steel pipe shall conform to the requirements of CAN 3-G401. For pipe diameter less than 900 mm, Aluminized Steel Type 2 with 1.6 mm wall thickness to be used. For pipe diameter from 900 mm to 1200 mm, Polymer Laminated Steel with 2.0 mm wall thickness to be used. For pipe greater than 1200 mm, Polymer Laminated Steel with 2.8 mm wall thickness to be used.
- f) Maintenance holes shall be constructed of poured or precast concrete according to Ontario Provincial Standard Drawings or approved specific design drawings.
- g) Maintenance hole covers and frames shall be as detailed in Ontario Provincial Standard Drawings. Bolt down covers are to be used in all park and open space areas.
- h) Catchbasin covers and frames shall be as detailed in Ontario Provincial Standard Drawings. Roadway and walkway catchbasin grates shall be "bicycle proof".
- i) Pipes shall be jointed by means of approved rubber gaskets, conforming to A.S.T.M. Specification C-443-60T or latest amendment.
- j) Road subdrains shall be 100 mm diameter perforated polyethylene plastic pipe with factory installed filter fabric and conform to the requirements of OPSS 405.

B4.00 Minimum Basement Elevation

Minimum Basement Elevation (MBE) for typical lots shall be determined based on the highest of the following:

- 1.0m above San obvert;
- 0.5m above 100-yr HGL (see Sect. B3.04);
- 0.7m above STM obvert; or,
- 1.2m above STM obvert if SAN service lateral is required to cross over the storm sewer.

B5.00 As-Constructed Storm Sewer Requirements

Category I

As-constructed storm sewers are considered acceptable when the as-constructed storm sewer design sheets submitted in the approved format indicate the following:

1. Peak flow is less than 90% of the as-constructed capacity of pipe flowing full;
2. As-constructed pipe grade is no less than the minimum design slope (as per Design Criteria B3.04) and less than the critical slope, unless approved otherwise by original design; and,
3. The Minimum/maximum flow velocity within the pipe (velocity) is within the Design Criteria B3.06.

Category II

When as-constructed storm sewers design sheets indicate that Category I parameters cannot be met, the storm sewer installation is not acceptable and corrective measures are required as follows:

1. The storm sewer system is to be re-laid accordingly if:
 - i. Peak flow is greater than 120% of as-constructed capacity of pipe flowing full; or,
 - ii. Velocities are less than the minimum allowable as per the Design Criteria B3.06.

Otherwise:

2. (a) If peak flow is less than 120% of the as-constructed capacity of pipe flowing full, the Engineering Consultant responsible for the installation is required to submit the as-constructed 100 year hydraulic grade line (H.G.L.) information for the Development.
 - i. The as-constructed H.G.L will be considered acceptable if it is at a minimum of 0.5m below the respective basement floor elevation.
 - ii. In isolated areas, where the as-constructed H.G.L. is between 0.3m to 0.5m below the respective basement floor elevation. The Town will consider backflow preventers as acceptable mitigation measures.

- iii. In cases where the as-constructed H.G.L. does not conform to the above noted criteria i. or ii., the storm sewer system is to be re-laid accordingly.

And

b) If the as-constructed pipe slope is less than the minimum design slope (as per Design Criteria B3.04) and/or greater than the critical slope, if not by approved design, the Engineering Consultant responsible for the installation is required to review the as-constructed velocity within the sewer system.

- i. Where the as-constructed velocity is within the acceptable limits per the Design Criteria B3.06, the as-constructed pipe slope shall be deemed acceptable.
- ii. Where the as-constructed velocity is greater than the maximum as per Design Criteria B3.06, the Engineering Consultant shall flag the velocity to the Town for review. Acceptable mitigation measures shall be determined on a case-by-case basis.

Prior to the placement of base asphalt, the Engineering Consultant shall provide the Town with an acceptable updated SSDS reflecting the as-constructed “record” sewer information.

B6.00 Water Course Protection

In as much as is possible, existing water courses shall be left in their natural state. Their banks shall be able to contain the flow of the regional storm or the 100-year storm, whichever is the governing criterion, as prescribed by Niagara Peninsula Conservation Area (NPCA).

The watercourse invert and banks shall be protected from excessive erosion as defined by the NPCA. Alterations to watercourses will be in accordance with the NPCA, the Ministry of Natural Resources (MNR), and any other government agencies that may have jurisdiction in the specific location. Work that may disturb the aquatic environment shall be carried out in accordance with the Department of Fisheries and the MNR guidelines and approvals.

A pre-design consultation is recommended in all cases, allowing the designer to understand the specific concerns each agency has prior to proceeding with any design.

B7.00 Groundwater Pumping

The below criteria shall apply for any development proposal that impacts groundwater tables:

1. Permanent groundwater pumping into municipal storm sewers is prohibited. During the construction phase, temporary dewatering may be permitted at an approved release rate.

2. A Hydrological Report shall be submitted in support of any proposed groundwater pumping. The Hydrogeological Report shall identify the following in addition to all other requirements:
 - i. Anticipated dewatering volumes and release rates;
 - ii. Groundwater treatment requirements and criteria.
3. A Well Interference Report (separately or as a part of a Hydrogeological Report) shall be provided to the satisfaction of the Director of Public Works. The Report shall review the potential impacts of development activities on existing water wells, within the zone of influence, as determined by the Qualified Person, with a minimum distance of 250m from development limits. The Water Well Interference Report shall include, but is not limited to, a pre-construction survey of the existing water wells, a potential impact analysis throughout the construction phase, and recommendations/remediation plans to address any concerns that may arise as a result of the construction stage works.
4. A Geotechnical report shall be provided and shall identify the following, in addition to all other requirements:
 - i. Anticipated ground settlement, as a result of proposed dewatering and mitigation measures, including a monitoring program;
 - ii. Analysis of soil infiltration capacities for any potential water recharge proposals.

Section C – Roadways

C1.00 General

All roadway designs must comply with the Town of Pelham Design Criteria and Engineering Standards, as well as the Transportation Association of Canada's Geometric Design Guide for Canadian Roads. Before initiating detailed design, a Design Criteria form (Appendix B) must be approved by the Town of Pelham.

C2.00 Road Classification, Pavement Design and Construction

C2.01 Road Classification

Roadways must be designed in compliance with the road classification outlined in the Transportation Schedule of the Town of Pelham Official Plan. The classification shall be verified with the Town of Pelham prior to initiating the design process.

C2.02 Minimum Pavement Design

Minimum pavement design thicknesses are given according to street classifications in Table C2.02. These are minimum requirements only and may require additional depths subject to specific design considerations.

Table C2.02 – Minimum Pavement Design			
Class	Type	Asphalt	Granular
Local/ Laneway	Residential/ Public Laneway	40 mm – HL3 50 mm – HL8	450
Collector	Residential	40 mm – HL3 80 mm – HL8 BC	525
Arterial	Type C	40 mm – HL3 100 mm – HL8 BC	550

NOTE:

- 1) The pavement design thickness assumes adequate positive drainage of the subbase.
- 2) Minimum 10:1 taper at transitions in road make-up.

C2.03 Geotechnical Report

Pavement design for local, collector and arterial roads will be considered on an individual basis. Minimum pavement design thickness for different road classifications are shown on Table C2.02. The composition and construction thickness of the road pavement shall be designed based upon the following factors:

- a) Mechanical analysis of the sub-grade soil;
- b) Drainage;
- c) Frost susceptibility;
- d) Future volume and class of traffic expected to use the pavement and,
- e) Construction loading considerations.

Sub-grade samples for mechanical analysis laboratory testing shall be taken at a maximum of 50 m intervals along all road alignments and at any locations judged to be lower in bearing capacity. California Bearing Ratio (C.B.R.) tests shall be performed for each representative soils type. All tests must be conducted by a qualified soils consultant. Copies of all tests and the road design proposed by the soils consultant shall be submitted for the approval of Engineering Services.

Where the construction will involve trenching for installation of sewers and water mains, the soils report shall comment on trenching, pipe bedding, cover, backfill and compaction requirements. It shall provide recommendations with respect to construction methods to be employed to reduce risk of settlement occurring.

For reconstruction projects, the report shall include analysis of existing granular and asphalt materials and include recommendations regarding reuse.

C2.04 Pavement Construction (Paving in Echelon)

Echelon paving with a shuttle buggy materials transfer vehicle shall be used for paving base and top asphalt on all collector and arterial roads. If paving in echelon is not feasible, infrared joint treatment or other treatments shall be used with prior approval from the Town.

C3.00 Geometric Design

C3.01 Design Criteria

Table C3.01 - Design Criteria					
Item		Laneway	Local Road (Note 1)	Collector	Arterial
Right-of-Way Width (Notes 2 and 3)		7.5 – 9m	18 - 20m (Note 4)	18 - 20m	20 - 28m
	Pavement width (measured to face of curb)	7.5m	(Note 5)		
	Design speed (km/hr)	50	50 / 60	50 / 60	50 / 60
	Minimum K values for sag	6	6	6 / 9	12 / 16

Geometric Design	curves on illuminated roads				
	Minimum K values for sag curves on unilluminated roads	12	12	12 / 18	25 / 32
	Minimum K values for crest curves	7	7	7 / 13	23 / 36
	Maximum grade for through roads at intersection	3.0%	3.0%	3.0%	2.5%
	Maximum grade for stop roads at intersection	2.5%	2.5%	1.5%	1.5%
	Minimum centerline radius (m)	60 (Note 7)	60 (Note 7)	As per TAC	
	Minimum tangent length for intersection approaches from street line (m)	45	45	60	75
	Minimum intersection spacing along roadway between closest pavement edges (Excl. roundabout and laneway) (m)	34	80	120	250
	Minimum boulevard width from curb to sidewalk/MUP (m)	Varies	Varies	Varies	
	Typical lane width (m)	3 – 3.75	4.2 – 4.5	3.5	
	Width of turn lane (m)	As per TAC			
	Minimum sight distance (m)	As per TAC			
	Minimum grade for urban roads	0.5%			
	Maximum grade	5.0%			
	Standard crossfall	2.0%			
	Minimum crossfall through the intersection	1.0%			
	Minimum curb radius at intersection	See Table C3.03			
	Intersection angle	80 - 100°			
	Minimum intersection offset for local roads (m)	40 (Note 9)			

Notes

- 1) Local Roads criteria shall generally be applied to the design of Public Laneways. All deviations shall be approved by the Town.
- 2) Right-of-Way widths are based on Pelham's Official Plan as approved by Town Council.
- 3) Additional right-of-way width may be required for operational needs, roundabouts, turn lanes and the accommodation of active transportation.
- 4) 18m R.O.W may be considered, at the discretion of the Director of Public Works.
- 5) Pavement width to be determined based on operational needs, roundabouts, turn lanes and the accommodation of active transportation.
- 6) Minimum K value of 8 for industrial local roads with illumination.
- 7) Minimum centerline radius to be 15m for 90-degree turns on local roads.
- 8) Based on a reversed crown cross-section - to be approved through detailed design submission.
- 9) Intersection offset for collector and arterial roads to be determined based on traffic requirements.

C3.01.1 Minimum Visibility Triangle Requirements

Table C3.02 indicates the minimum visibility triangle requirements for various intersecting roadway situations under ideal conditions. Visibility triangles shall otherwise be sized according to safe sight distance requirements when conditions dictate.

Table C3.02 Minimum Visibility Triangle Requirements		
Right-of-Way Width	Intersecting Right of Way (m)	Minimum Visibility Triangle Requirements (m)
Public Laneway (7.5)	18-23	5x5
18	18-20	5x5
20	20	8x8
20	23	8x8
23	23	8x8
23	23	8x8
23	30	8x8
30	30	5x13
30	36	5x13
36	36	5x13

C3.01.2 Minimum Curb radius Requirements

The following Table C3.03 indicates the minimum curb radius requirements for various intersecting roadways at 90° intersections. On routes with truck traffic or buses, and for all industrial roadways and for intersections meeting at other than 90°, the intersection design shall be checked with truck turning templates and the curb radii modified if necessary.

Table C3.03 Minimum Curb Radius Requirements		
Intersecting Road Types	Residential (m)	Industrial (m)
Public Laneway Local/Collector	7.5	15*
Local – Local	9.0	
Local –Collector	10	
Local –Arterial		
Collector –Collector		
Collector – Arterial		
Arterial - Arterial	13	

* Based on the assumption that WB-20 turning vehicles will not encroach onto opposing traffic on collector and arterial roads.

C3.02 Horizontal Alignment (Refer to Table C3.01)

Where a 15 m radius is used on a 90° bend on a local road, the right of way and pavement shall be widened with an eyebrow as detailed on Town of Pelham 400 series Standard Drawings. Such eyebrows are not required where access to the land is not required, on single-loaded service roads, and where residential frontage widths are sufficient to accommodate driveway spacing in accordance with Town of Pelham Standard Drawing No.411.

The radius of curvature shall be labelled on the centerline of the proposed road on the plan, and curb radii shall be indicated adjacent to the curb.

C3.03 Vertical Alignment (Refer to Table C3.01)

C3.03.1 Vertical Curves

All grade changes in excess of 1.0% shall be designed with vertical curves. Vertical curves shall be used at all intersections, generally, with a minimum K-value of 4 permitted when under stop control.

Vertical curve designs shall consider/show the following:

- K Value to be rounded to a whole number wherever possible.
- At intersections, sags should be designed to minimize ponding/flooding limits.
- Intermediate grade points shall be calculated every 10.0 m and shown on the profile.
- Vertical curve data such as K-value, length, station of tangent intersection, station for beginning and end of vertical curve (BVC/EVC) stations shall be shown on the plan, and
- Vertical curves shall not encroach into the driving lane of any abutting roads.

C3.03.2 Minimum/Maximum Grades

Vertical alignment requirements are shown in Table C3.01. Minimum grades are to be avoided in superelevated urban roadways.

C3.03.3 Minimum Gutter Grades

The minimum gutter grade shall be 0.5% except for eyebrows and cul-de-sacs, where it shall be 1.0%. Where 1.0% cannot be achieved, catchbasins shall be placed at the direction of the Engineering Department.

C3.03.4 Gutter Grade Details for Intersections, Eyebrows and Cul-de-Sacs

All intersections, eyebrows and cul-de-sacs shall be detailed at a larger scale than the road plan. The details shall show crossfall and gutter, crown and other grades sufficient to determine that the road will properly drain and to be used as a basis for layout. Refer to Section C3.03.3 for minimum gutter grade requirements.

C3.04 Temporary Cul-De-Sac

Temporary cul-de-sacs are required where a road will be continued for future phasing of development, but currently dead ends. Land easements within the subdivision must be dedicated to the Town of Pelham to facilitate installation of temporary cul-de-sacs.

Requirements

- R.O.W. radius as dictated by temporary grading requirements
- Curb radius 13.25 m

Permanent sidewalk shall terminate short of the temporary cul-de-sac with a temporary asphalt ramp connecting the sidewalk to the bulb.

Where Appropriate, permanent stage 1 of 2-stage curb and gutter shall be installed through the temporary bulb, and the permanent portion of roadway paved with normal crown elevation and crossfall. Temporary asphalt curb or concrete barrier curb (no gutter) may be utilized for the bulb portion. The Engineering Department will approve the final temporary bulb configuration and construction elements after taking into consideration all variables, constraints and opportunities associated with each individual site.

C3.05 Intersections

Minimum Curb radii requirements for intersecting pavements are shown in section C3.01.2. At the intersection of two roads, the transition of the minor classification road shall not interfere with the normal cross-fall of the major road, unless otherwise required by the overland flow route design.

A 1.0% to 2.0% backfall shall be provided on all road profiles. This requirement will not necessarily require the use of a double catchbasin. A larger scale splining (gutter grade) detail showing crossfall, gutter, crown and other grades, sufficient to determine that the intersection will drain properly and sufficient for layout, shall be provided. Catchbasins shall generally be located upstream of pedestrian crosswalks.

Intersection design for Collector/Collector, Collector/Arterial and Arterial/Arterial shall be designed according to TAC Section 2.3.2.3, Vertical Alignment and Cross-Slope.

C3.06 Roadside Ditches

All new urban roads shall be curb and gutter unless approved by the Engineering Department.

Rural roads shall conform to Town of Pelham Standard Drawing No. 403 unless otherwise approved by the Engineering Department. Rural roadside ditches shall be designed as follows:

- 3:1 front slope and minimum 2:1 backslope (3:1 desirable).
- Inverts shall be a minimum of 150 mm below the granular/sub-grade interface where it daylight into the ditch unless an invert subdrain is designed to pick up subgrade drainage.
- Desirable minimum longitudinal ditch grade shall be 1.0% with an absolute minimum being 0.3%.
- Ditch grades greater than 3.0% shall have staked sod protection; and
- Ditches greater than 5.0% shall have hand-laid rip rap protection.

C3.07 Subdivision Emergency Access

1. The following criteria shall be used for the approval of urban subdivision developments:
 - a) Cul-de-sacs shall not exceed 230 metres in length;
 - b) The entrance portion to P-Loops and B-Loops shall not exceed 90 metres;
 - c) Where the circumference of a P-Loop (or one half of a B-Loop) exceeds 490 metres, the entrance portion shall have a minimum road width of 12 metres, exclusive of any median required or incorporated;
 - d) The maximum circumference of a P-Loop (or one half of a B-Loop), or any combination of street pattern, shall not exceed 700 metres; and,

- e) For the purpose of the Subdivision Emergency Access policy it is assumed that in the case of items (b), (c) and (d) that any P-Loop or B- Loop shall include a service lane adjacent to a collector or arterial road. Where a service lane is not included in the design of a P-Loop or B-Loop, a permanent walkway providing emergency access shall be required where a P-Loop or B-Loop exceeds 430 metres, subject to the minimum design standards.
2. Where the limits of the items in C3.07, Item 1 are exceeded, a second means of access shall be provided.
 3. Where an emergency access or a temporary access is to be installed then the following design criteria shall be used:
 - Minimum width of 4.0 metres;
 - Maximum slope of 5.0%;
 - 12.0 metres minimum centerline turning radius;
 - 5.0 metre minimum overhead clearance from grade;
 - Asphalt or other permanent surface;
 - For emergency access, barrier consisting of bollards and chain or other acceptable measures; and,
 - Adherence to the Ontario Building Code.
 4. Prior to the issuance of a building permit the emergency access will be required to be fully constructed and operational.

NOTE: Circumference is measured at centre line of road.
Road width – face of curb to face of curb.

C4.00 Boulevards, Sidewalks and Walkways

C4.01 Sidewalk

Sidewalks are required on all roadways (Local, Collector and Arterial) including courts, cul-de-sacs and crescents. All local roadways adjacent to parks, schools and commercial areas shall have at least a sidewalk on the adjacent side and on the opposite side.

All sidewalks are to be designed in accordance with the Town of Pelham Standard Drawing No. 208 and shall be installed at locations shown on the typical road cross-sections. All longitudinal slopes at sidewalk ramps shall meet the Accessibility for Ontarians with Disabilities Act (AODA) guidelines.

At all driveway locations, the sidewalk thickness shall be increased to 175mm for both residential and commercial driveways. On commercial driveways, a 150mm x 150mm wire mesh shall also be placed in accordance with Town of Pelham Standard Drawing No. 208.

A curb keyway shall be incorporated into the curb where sidewalks are constructed adjacent to curbs as detailed on Town of Pelham Standard Drawing No. 206 and OPSD 600.404.

Requirements for temporary asphalt sidewalks are shown in the Town of Pelham Standard Drawing No. 210.

C4.02 Boulevards

Boulevards are to be graded according to the Town of Pelham Standard Drawing No. 208. On new construction the grade of the boulevard shall be constant from the back of the curb to the street limit or sidewalk.

C4.03 Walkways

Walkways shall be constructed in accordance with Town of Pelham Standard Drawing No. 209 to promote proper circulation of pedestrian traffic and also to provide an overland flow route for storm flows.

C4.04 Multi-use Pathways

Multi-use Asphalt Pathways shall be constructed in accordance with Town of Pelham Standard Drawing No. 214.

C5.00 Utilities

C5.01 Location of Utilities

The location of utilities within the road allowance shall be as detailed in the Town of Pelham Standard Drawings No. 400 to 404.30. Utility pedestals shall be paired with streetlights if possible or with other utilities. If pairing is not possible, the Consultant shall provide justification to the Town of Pelham's satisfaction. A minimum of 1.0m clearance is required between the edge of a driveway and any proposed above ground utility.

C5.02 Locations of Community Mailboxes

Community mailboxes (CMB) shall be placed according to the Canada Post Corporation requirements. Design locations for mailboxes should incorporate factors such as pedestrian safety, lighting, driveway locations, traffic flow, drainage and aesthetics.

Community mailbox locations shall be indicated on the Utility Coordination Plans and Plan & Profile drawings. Where possible, a streetlight will be placed adjacent to a CMB location to ensure appropriate lighting levels are met. The required width of the curb depressions shall be dimensioned on both the UCP and the appropriate Plan and Profile drawings.

C6.00 Driveways and Entrances

C6.01 Driveways

C6.01.1 Residential Driveways

Where paved driveways are installed within either the public right of way or on private property, between the curb and garage floor, the top of the driveway shall be flush with the curb, sidewalk and garage floor. The minimum construction depth for a residential driveway shall be:

- 50 mm hot-mix, hot-laid asphalt HL3A to be placed in one lift only.
- 300 mm Granular "A".

The maximum design grade for an access driveway shall be 6.0%. The maximum as-built grade shall be 8.0%. The minimum grade shall be 2.0%. Refer to Town of Pelham Standard Drawing No.'s 304 and 305 for driveway profile and layout.

Within the public right-of-way, the driveway (D/W) opening shall be designed to accommodate the following widths without conflict to other street furniture. The final design driveway width will be determined at the time of the house sitting.

	<u>D/W Min.</u>	<u>D/W Max.</u>
Single	3.0m	4.3m
Single & Half	5.0m	5.6m
Double	6.0m	7.3m

In accordance with OPSD 351.010

C6.01.2 Industrial, Commercial and Institutional Driveways

Paved driveway entrances are required between the curb and sidewalk. The following are minimum depth requirements:

a) Light Industrial, Commercial and Apartment Driveways

- 50 mm hot mix, hot laid HL3 to be placed in one lift.
- 50 mm hot mix, hot laid HL8 to be placed in one lift.
- 150 mm Granular "A" and 225 mm Granular 'B'.

b) Heavy Industrial Driveways

- 50 mm hot mix, hot laid HL3 to be placed in one lift.
- 75 mm hot mix, hot laid HL8.
- 150 mm Granular "A" and 300 mm Granular "B".

Equivalent depths of "deep" strength asphalt will be permitted as a substitute for the pavement specified above, provided frost susceptibility is addressed in the design.

In accordance with OPSD 350.010

C6.01.3 Rural Driveways

On rural roads where sidewalks are not required, driveway entrances are to be minimum 150 mm of Granular 'A' or 19 mm crusher run limestone.

Where appropriate, the Town of Pelham may require asphalt within the boulevard portion of the driveway.

C6.02 Driveway Entrances

Driveway entrances shall be designed in accordance with the following:

- Residential driveways shall be as detailed on Town of Pelham Standard Drawing No. 305;
- Residential driveways on cul-de-sacs shall be in accordance with Town of Pelham Standard Drawing No. 411;
- Mutual driveways between two adjoining properties shall have continuous curb depression; and,
- Apartment, commercial and industrial driveways shall consider the basic width of the driveway and radius of curvature as further outlined below.

The radius of curvature from the road into apartment, commercial and industrial driveways shall be designed to accommodate the anticipated vehicular traffic without causing undue interference with the traffic flow on the street. The minimum curb radius shall be;

- 7.5m for apartment and residential block developments,
- 15.2 m for heavy industrial and commercial entrances off 2-lane roads and 4-lane roads.
- Or as approved by the Engineering Department.

Details for apartment, commercial and industrial entrances shall be shown on the plans.

All apartments, commercial and industrial driveways shall be provided with curb constructed in accordance with details as outlined on Town of Pelham Standard Drawing No. 410.

C6.03 Concrete Curb and Gutter

C6.03.1 Curb Standard – Development

The following curb standards shall be used:

- For local urban roads with pavement widths of 8.5 m and Public Laneways with a pavement width of 7.5m, curb and gutter as per OPSD Drawing No. 600.04 is required and may be of two-stage construction as per Town of Pelham Standard Drawing No. 206;

- For temporary turning circles where a gutter is not required, barrier curb as per OPSD Drawing No. 600.110 may be used for the bulb portion, and for site plans associated with building permits as outlined in Section J, and,
- Any deviation from these standards must be approved by the Town of Pelham.

C6.03.2 Curb Standard - Reconstruction

Concrete curb and gutter as per OPSD Drawing No. 600.040 to be used on Reconstruction Capital Projects unless approved otherwise by the Engineering Department. Concrete curb and gutter on the high side of superelevated urban roadways to be according to OPSD 600.040 Tangent.

C7.00 Traffic Calming

With the Town of Pelham's continued focus on developing holistic, safe and people centric neighborhoods, traffic calming plans that include traffic calming measures (i.e. area specific 40km/h speed limits, speed humps, raised intersections, bump outs, pedestrian crossovers, etc) shall be required in accordance with the Town of Pelham's Traffic Calming Policy.

C8.00 Active Transportation Facilities

Active Transportation Facilities should be incorporated in accordance with the Town of Pelham Official Plan and Active Transportation Plan. In general, Active Transportation facilities are to follow guidance found in OTM Book 15 (Pedestrian Crossing Treatments) and Book 18 (Cycling Facilities).

C8.01 In-Boulevard Multi-Use Paths

In-boulevard multi-use paths are typically 3.0m-wide concrete paths located within the boulevard or in a dedicated right-of-way. Often, these paths are located parallel to the road and separated from it by a grassed or landscaped buffer. Refer to Town of Pelham Standard Drawing No. 214.20 and 214.30.

Multi-use paths are intended to accommodate a wide spectrum of active transportation users including cyclists, pedestrians, other human powered transportation and accessibility devices.

C8.02 Shared Use Lanes

Shared-use lanes are traffic lanes marked with Shared Use symbols (Sharrows) and Wc-19 (OTM) or Wc-24 (OTM) Share the Road signs indicate a shared lane environment for bicycles and automobiles. Shared-use lanes are recommended for low speed/low volume roadways and where there is insufficient pavement width for dedicated bike lanes. Share the Road signs are generally placed every 200m to 300m. Sharrows are placed every 75m - to 150m as needed.

C8.03 Paved Shoulder Bike Routes

Paved shoulder bike routes are provided on higher speed/volume roadways to accommodate stopped and emergency vehicles, pedestrians, and cyclists. Paved shoulder bike routes are 1.8m wide and are separated from traffic lanes by a 100mm solid white line.

C8.04 Bicycle Lane (Conventional)

Reserved bike lanes are provided on core commuter cycling routes to ensure safe and efficient utility cycling routes to recreational, employment, and commercial lands where a strong cycling culture is desired or present.

Conventional Bicycle Lanes are 1.8 m wide and are separated by a 100mm solid white line.

C8.05 Bicycle Lane (Separated)

Separated bicycle lanes are similar in function and design to conventional bicycle lanes however they differ in that a protective buffer of 0.5m - 1.2m separates the bicycle lane from auto traffic.

C9.00 Construction

The construction of all roads in the Town of Pelham shall be in accordance with current Town of Pelham and Ontario Provincial Standard Drawings and Ontario Provincial Standard Specifications unless otherwise outlined in the contract drawings and specifications and approved by the Town.

C10.00 Roundabout

A roundabout is an intersection at which all traffic circulates counterclockwise, to the right of a central island. Entering drivers must yield to traffic already in the roundabout. A roundabout should be considered in the Town of Pelham under the following conditions:

- At any new intersection.
- At an existing intersection where an all-way stop or traffic signals are warranted or projected to be warranted within 10 years.
- At an existing intersection where capacity or safety problems are being experienced or reported.

There are two processes for implementing a roundabout, depending on whether an intersection is new or existing.

New Intersections

A roundabout should be considered when a new intersection is to be created, either on an individual basis, for instance, when a road is planned to be extended, or on an area-wide basis, for example, when a development application is received. If a road is planned to be extended, the Town should decide whether any of the newly created intersections might be significant

enough to warrant more than a side-street stop control, in which case they would be potential candidates for roundabouts. Once a new intersection is identified as a potential candidate for a roundabout, it is subjected to an Intersection Control Study (ICS).

Existing Intersections

A roundabout should be considered at an existing intersection where an all-way stop or traffic signals are warranted or projected to be warranted within 10 years, or where capacity or safety problems are being experienced at an existing all-way stop or signalized intersection. Capacity and safety issues should be quantified through an Initial Roundabout Screening. If two or more of the Initial Roundabout Screening conditions are met, then the existing intersection is subjected to an ICS.

Intersection Control Study (ICS)

An Intersection Control Study (ICS) is a comparison of intersection types (i.e. stop control, traffic signals or a roundabout). The study is conducted using a decision matrix that incorporates up to 12 criteria. A brief description of how roundabouts compare to signalized intersections under these criteria is as follows:

- Construction cost. Roundabouts typically cost considerably more to retrofit than adding traffic signals to a stop-controlled intersection, but can be comparable to signalized intersections in new developments.
- Property impacts. Roundabouts tend to require more property at an intersection.
- Safety for all users. Roundabouts are statistically safer for motorists and pedestrians, but results are mixed for cyclists.
- Pedestrian accommodation. Although pedestrians are statistically safer because of shorter crossing distances and having to look for traffic in only one direction at a time, some do not feel as safe because of the lack of a pedestrian signal. This also makes roundabouts less accessible to people who are visually impaired. Pedestrian convenience is higher because wait times are shorter.
- Cyclist accommodation. Cyclists can navigate a roundabout by claiming the lane and using it as a motor vehicle, or by using the sidewalks as a pedestrian. Sometimes, cycle tracks or multi-use paths are provided, in which case cyclists must legally dismount when crossing the roundabout's entries and exits, unless a traffic signal is in place.
- Peak period traffic operations. Roundabouts are generally more efficient than traditional intersections for the same number of lanes, especially when there are heavy left-turn flows.
- Off-peak traffic operations. Roundabouts are more efficient.
- Speed control. Roundabouts control traffic speeds within a certain distance upstream and downstream.

- Access management. Roundabouts facilitate U-turns, and one at either end of a road section can allow driveways in between to be right-turns-only with no loss of access.
- Environmental considerations. Through lower and more uniform traffic speeds, roundabouts reduce vehicle noise, fuel consumption and emissions. They usually result in fewer impermeable pavement areas.
- Streetscaping/gateway potential. Roundabout central islands offer an opportunity to add landscaping and create a sense of community.

An example Decision Matrix incorporating all 12 criteria is shown below:

Criteria	Weight	Signalized Intersection	Roundabout
1. Construction cost	1	4	2
2. Property impacts	4	5	1
3. Safety for all users	4	2	4
4. Pedestrian accommodation	3	4	2
5. Cyclist accommodation	2	4	2
6. Transit accommodation	2	4	2
7. Peak period traffic operations	1	2	4
8. Off-peak traffic operations	1	1	5
9. Speed control	3	1	5
10. Access management	1	1	5
11. Environmental considerations	2	2	4
12. Streetscaping/gateway potential	3	1	5
Total		74	88

The ICS process shall consist of the following steps:

1. Determine which of the criteria apply to the subject intersection or study area and eliminate the irrelevant rows in the Decision Matrix.
2. At the start of the ICS, assign a weight to each criterion from 1 to 4, based on its subjective importance to the subject intersection, with 1 being “important enough for the criterion to be considered” to 4 being “very important for intersection control selection”.
3. During the course of the ICS, assign a score for each alternative of 1 to 5. Scores should be reflective of the relative differences between alternatives, and should be based on actual quantitative calculations where possible (i.e. cost estimates, Synchro analyses, etc.). The total score for each criterion should add to 6 if there are two alternatives being evaluated, and the total score should add to 9 if there are three alternatives being evaluated.
4. Document the rationales and assumptions used for the assigned weights and scores.

Initial Roundabout Screening

The intent of an Initial Roundabout Screening is to provide an assessment of whether it would be worthwhile to pursue converting an existing intersection to a roundabout. If “Yes” is indicated for two or more of the following Initial Roundabout Screening conditions, then such an endeavor may be worthwhile:

1. Is the current collision frequency high at the intersection? (Annual Review or based on per 1 million vehicles entering.)
2. If yes to the above, are the current collision types experienced at the existing intersection related to left-turns or non-adherence to traffic control (i.e. right- angle, turning movement and head-on collisions)?
3. Is an all-way stop or traffic signals warranted, projected to be warranted within 10 years or being requested?
4. Does the intersection have more than 4 legs?
5. Does the intersection have unusual geometry?
6. Will planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate turning lanes)?
7. Is the intersection located at a transition between rural and urban environments such that a roundabout could act as a means of speed transition?
8. Is the location a gateway to a neighbourhood or community destination?
9. Is there sufficient property at the intersection?

If the Initial Roundabout Screening indicates that it may be worthwhile to pursue converting an existing intersection to a roundabout, then an ICS should be conducted to determine whether a roundabout or another alternative (i.e. converting stop control to signal control, widening the existing signalized intersection) is preferred at the subject location.

Detailed Design and Submission Requirements

Roundabouts in new developments shall be based on Transportation Association of Canada (TAC) Canadian Roundabout Design Guide (January 2017). Prior justification must be provided if another diameter of the roundabout is planned. At the 30% stage of design, a Design Checks Package shall be provided that contains drawings showing the design vehicle accommodation and entry path radii for each proposed roundabout. The package should be approved by the Town before proceeding to the next stages of the roundabout design.

Roundabouts at existing intersections will need to be more flexible in terms of diameter to best accommodate existing site constraints. However, a Design Checks Package is still required at the 30% stage of design. The package must be approved by the Town before proceeding to the next stages of roundabout design.

Additional detailed design and submission requirements:

1. Roundabout designs shall be based on Transportation Association of Canada (TAC) Canadian Roundabout Design Guide (January 2017) and good engineering design principles.
2. Signs and pavement markings shall conform to the latest edition of the TAC Manual of Uniform Traffic Control Devices (MUTCD). Pedestrian and cyclist accommodation shall follow Ontario Traffic Manual (OTM) Books 15 and 18, respectively.
3. All pedestrian crosswalks shall be a minimum width of 3.0 m unless approved otherwise.

C11.00 Public Laneways

The Town of Pelham has introduced Public Laneways to be responsive to development needs and desires for a more urban streetscape, and more pedestrian oriented corridor for higher density residential developments fronting high order roadways.

Public laneways can be used in new subdivisions provided that the following criteria are met:

- The use of public laneways shall be limited to narrow lot (8 m or less) residential developments fronting collector and arterial roads only.
- The alignment of public laneways shall be straight or with large radius curvature to accommodate existing maintenance equipment.
- Public laneways shall be connected to public streets but not other public laneways.
- Adequate space for snow storage shall be considered as part of the overall development design where public laneways are included.
- Hydrants are to be located at the end of laneways.

All other laneways or drive aisles shall be privately owned and operated. Refer to Section J – General Conditions for Site Plan Approval for Design Criteria pertaining to private sites.

C11.01 Public Laneway Design Alternatives

When a public laneway design is considered, the laneways could be either single or double loaded. The following three (3) public laneway design alternatives (i.e. all utilizing a 8.5 m right-of-way with 7.5 m wide pavement) can be considered which provide Developers/Home Builders with multiple housing design options.

- Alternative 1: Single Loaded Public Laneway
- Alternative 2: Double Loaded Public Laneway – Tandem Parking
- Alternative 3: Double Loaded Public Laneway – Side-by-Side Parking

See Standard Drawing Nos. 415, 415.10, 415.20 and 415.30 for typical design details, dimensions and notes.

C11.02 Laneway Drainage Design

Laneways shall be designed to minimize the need for additional storm sewers within laneways. With the placement of roadway catchbasins at or near the intersections of laneways and public streets, laneways shall be graded to drain toward these structures. If this design is not feasible due to grading or design constraints, sufficient space shall be provided for storm sewers within the proposed laneway design.

Section D – Residential Lot Grading

D1.00 General

Lot grading design criteria and engineering standards must be followed for all new urban residential developments, including infill lots where applicable. These criteria, covering surface drainage, overland flow routing, maximizing usable land, preserving existing trees, and considering impacts on neighbouring properties, are applied or exempted as needed. Infill housing lot grading requirements are found in Section D5.00. All sodded areas require at least 150 mm of topsoil and No. 1 nursery sod, though isolated spots may use 100 mm with Town approval.

D2.00 Design

D2.01 Lot Grading Design

All front yards within new residential developments shall be graded to direct surface drainage toward the street. The installation of front-yard catchbasins is prohibited, except in cases where explicit approval is granted by the Town.

Drainage for all lots must be routed away from houses using clearly defined swales. The lot grading design must adhere to the Town of Pelham Standard Drawings, specifically Section 300 Grading.

Lot Surface Grading Requirements

- A minimum lot grade of 2.0% must be maintained across all surfaces.
- The maximum lot grade allowed is 5.0%. Where this maximum is exceeded and no alternative design solution is available, the differential shall be addressed through the construction of embankments.

Embankment Design Criteria

- Whenever possible, embankments should be situated on the lower lot.
- The slope of any embankment shall not exceed a 3:1 ratio, unless otherwise approved by the Town.
- The maximum embankment height is set at 1.0 m.
- If multiple embankment tiers are necessary, a 1.0 m wide platform graded between 2.0% and 5.0% must separate each tier.
- The uppermost tier of an embankment may be increased to a height of 1.5 m to reduce the need for additional platforms on partial slopes.
- The maximum embankment height restriction does not apply to slopes located between building envelopes.

Retaining Wall Design Guidelines

The use of retaining walls to achieve proper lot grading should be minimized when possible. If retaining walls are required, the following standards apply:

- Retaining walls with a height of 0.6 m or greater must have a fence at least 1.2 m high installed at the top of the wall.
- The combined height of any wall and fence shall not exceed 3.0 m.
- Tiered retaining walls must feature a minimum platform of 1.0 m between the face of the lower wall and the toe of the higher wall.
- When the retaining wall is constructed between two private properties developed simultaneously or with permission from the adjacent property owner, it is recommended to locate the wall/fence on the common property line.
- A reciprocal easement for private access and shared ownership must be registered on both properties to accommodate the wall/fence structure, including footings, drainage backfill, and provisions for future maintenance or reconstruction.

Under circumstances where shared ownership is established, the recommended order of construction is as follows:

- Build on the property line with the fence integrated into the retaining wall.
- Install the retaining wall on the lower lot, placing the fence behind the wall at the property line.

If the retaining wall is located between properties developed separately or as infill, and permission is not obtained from the neighbour, the wall and fence (if applicable) must be entirely situated on the newly developed property, including all footings and drainage backfill.

In situations where the retaining wall borders hazard lands, open spaces, stormwater management blocks, parks, or other municipally owned properties, the wall, footings, and drainage backfill must be fully contained within private property, and the wall shall not exceed 0.6 m in height. The standard 1.2 m high chain link fence (CLF) on the property line should be increased to 1.8 m in height, with the design ensuring a minimum 1.2 m high continuous exposure from the private property side.

Reference Section E2.00 for detailed retaining wall structure requirements.

Rear Lot Catchbasin and Grading Details

- **All rear lot catchbasins and storm sewer leads shall be installed on a single lot, with the center of the catchbasin and storm sewer pipe positioned at least 0.5 m from the lot line.**

- **All rear lot catchbasin leads shall be directed to the front lot line and connect to the storm sewer fronting the lot.**
- **No rear lot catchbasin lead shall cross adjacent properties.**
- **Back-to-back catchbasins will not be supported by the Town. Each rear lot catchbasin has its own lead directed to the front lot line and connected to the storm sewer fronting the lot.**
- **A 0.6 m strip along the boundary of the new development adjacent to neighbouring properties must remain undisturbed until final grading is completed.**

Grading Plan Requirements

The lot grading plan must display interim contours (prior to development) and the final grading details for all blocks identified on the registered plan. Any blocks not developed when all other subdivision agreement obligations have been met must be graded to support the drainage patterns outlined in the lot grading plan before the final assumption of subdivision services.

D2.02 Drainage Swale Design

Rear Yard Drainage and Swale Design Criteria

All rear yard drainage must be directed away from houses using defined swales. These swales are required to convey stormwater safely around residential structures and are discharged at an appropriate outlet, such as a curb or sidewalk.

Swale Design Requirements

- **Longitudinal Slope:** Swales must have a minimum longitudinal slope of 2.0% to ensure adequate flow and avoid standing water.
- **Side Slopes:** The side slopes of drainage swales must not exceed a maximum ratio of 3:1 (horizontal to vertical) to maintain stability and ease of maintenance.
- **Depth:** Each swale should have a minimum depth of 150 mm and should not exceed a maximum depth of 450 mm.
- **Discharge Area Limits:** The area permitted to drain through a single swale directly onto a road allowance or into a single rear yard catchbasin (RYCB) must not exceed eight rear yards or a maximum aggregate area of 0.2 hectares.
- **Swale Length:** The maximum length of a swale between drainage outlets is limited to 100 meters. Drainage outlets must be designed to discharge at the earliest possible opportunity, and all swale outlet locations should be clearly shown on the lot grading plans.
- **Driveway Exclusion:** Driveways are not to be used as outlets for drainage swales under any circumstances.

Overflow Provisions and Foundation Protection

- **Overflow Outlet:** Grading must be designed so that, in the event of a blockage, each rear yard catchbasin (RYCB) has an identified overflow outlet. If a blockage occurs, the depth of ponded water must not exceed 0.4 meters.
- **Foundation and Opening Protection:** The top of any adjacent foundation wall or unprotected opening (such as a window without a window well) must be at least 0.1 meters above the overflow outlet elevation. Additionally, any potential ponding area must not be within 0.1 meters of any such adjacent top of foundation or unprotected window opening.

D3.00 Subdivision Lot Grading Plan Requirements

General Requirements for Lot Grading Plans

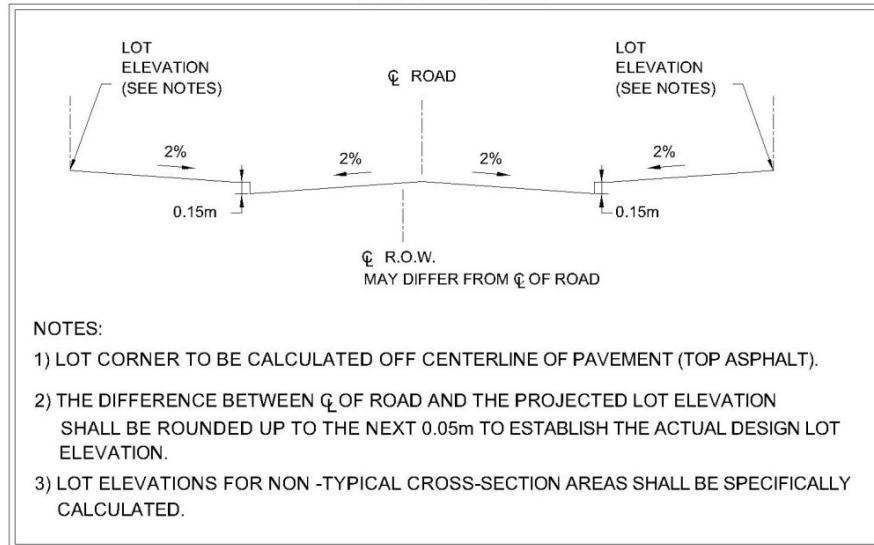
A comprehensive Lot Grading Plan must be developed at a scale of 1:500 or greater. This plan is to be submitted to the Town, along with the Engineering Drawings, for approval. All grading design elevations should reference a designated Town of Pelham geodetic benchmark, which must be clearly labelled on the plan.

Drawing and Information Standards

The plan must comply with all applicable drawing requirements specified in Section A2.00, in addition to the following details:

- Display all lot numbers, blocks, and proposed easements as identified in the Registered Plan for the Subdivision.
- Show existing topographical contours at intervals not exceeding 0.5 meters both within and beyond the subdivision boundaries, as necessary to demonstrate the prevailing drainage pattern.
- Indicate the locations of hydrants, utility poles, transformers, community mailboxes, and driveways, where applicable.
- Include proposed road grades, lengths, and elevations at 25-meter intervals on all streets, using symbols at points of grade change to show the direction of slope.
- Provide existing and proposed elevations for all lot corners and any intermediate points where grade changes occur, clearly illustrating the overall lot grading concept and drainage patterns. Property corner elevations at the street line must be consistent with Figure D3.1.

FIGURE D3.1



Building Envelope and Grading Details

- Specify the proposed house grade at both the front and rear of the nominal building envelope, as defined by zoning setbacks or intended construction, if known, and positioned at the center of the lot.
- Depict the direction of surface water runoff for each lot using arrows.
- Identify all terracing required, including the intermediate grades for each terrace.

Drainage Features and Special Designations

- Show all rear lot catchbasins, including the rim elevation and the invert elevation of the outlet pipe.
- Illustrate all drainage swales, including the percentage grade and elevations at regular intervals.
- Indicate all house types on the plans in accordance with Town of Pelham Standard Drawings Numbers 300, 301, and 302 (for example, walkout or backsplit).
- Include the Standard Notes for Lot Grading Plans as specified in Town of Pelham Standard Drawing Number 303.
- Mark, using an asterisk (*), all lots or blocks requiring Engineered Fill.
- If a lot or block involves special design requirements—such as the top of the foundation wall, the maximum underside of the footing, or unprotected openings—note these requirements directly on the lot. Reference Section D7.01 Foundation Control Certification for further details.
- Show the Minimum Basement Elevation (MBE) for each applicable lot where the MBE elevation is within 1.8 meters of the centerline of road elevation.

D4.00 Individual House Siting Plans

Individual House Siting Plans for each lot must be tailored to the specific house type under construction and prepared in accordance with the approved general grading plans.

Siting documents should be drafted at a scale of 1:200 or 1:250, selecting the largest scale that effectively utilizes the available space. If large lots of these types cannot be accommodated on legal paper at a scale of 1:250, applicants may use ledger paper size.

For townhouse blocks and estate lots, or large lots or blocks that do not fit on ledger paper at a scale of 1:250, a larger paper size may be used, provided that all information and layout is replicated exactly.

D4.01 Foundation Walls

Exposed foundation walls must extend at least 150mm above finished ground level and meet Ontario Building Code requirements.

D5.00 Lot Grading Requirements for Infill Housing

D5.01 Introduction

A grading plan demonstrating how each lot will be properly drained is required for all lots 1.0 ha or smaller prior to the issuance of a building permit. For lots larger than 1.0 ha, the requirement shall be applied at the discretion of the Town.

Outlined below are the Town of Pelham's requirements regarding the grading and drainage of infill lots for new single-family and semi-detached dwellings:

In accordance with the Ontario Building Code, each site must be graded so that water does not accumulate at or near the building and does not negatively impact adjacent properties.

It is the responsibility of the owner to engage a qualified Grading Consultant with expertise in site grading and drainage to:

1. Prepare and sign a site grading plan for inclusion in the building permit application;
2. Provide field review to confirm compliance with the approved site grading plan; and
3. Issue a final grading certificate to the Town upon completion of grading work.

The grading consultant is responsible for ensuring that construction does not result in new areas of ponding. Pre-existing drainage issues may persist, as the effects of the existing topography remain. Therefore, the grading consultant is required to preserve the intent of current grading unless directed otherwise by the Town.

A 'Grading Consultant' must be one of the following:

- A Professional Engineer registered in Ontario;
- An Architect registered in Ontario; or,
- An Ontario Land Surveyor.

For many projects requiring specialized stormwater controls, the Town recommends engaging a consultant with demonstrated expertise in both grading and stormwater management.

D5.02 Responsibility of the Grading Consultant

The following concerns must be addressed and included by the grading consultant, as a minimum, in preparing the grading plan:

- a) A north arrow shall be shown. If available, the Municipal Address shall be shown. All drawings received shall be to scale, 1:250 or 1:200 and drawn in ink. Freehand drawings are not acceptable.
- b) Grading must meet or exceed the minimum requirements set forth in the Lot Grading Criteria and the Town of Pelham Standards No. 300 to 304. Indicate both existing and proposed grade elevations at all corners of the house, property lines and lot corners.
- c) Note any concerns with respect to the overall performance of the existing drainage system in the neighbourhood.
- d) Show the location of downspouts, splash pads, area drains, and discharge from sump pumps, window wells, walkouts, etc., for both the infill and houses on adjacent lots.
- e) Show the location of hard surfaces such as driveways, walkways, porches, retaining walls, etc.
- f) Show the location and diameter of all trees on Town of Pelham property in front of, adjacent to and within 7.5 m either side of the subject lot.
- g) Provide the elevations of the crown of the road at the center line of the lot, proposed finished basement, first floor, garage floor, sufficient driveway elevations to establish the slope, as well as elevations of porches, decks, curbs and sidewalks and the number of steps or risers at all entrances. Invert elevations of Municipal Service connections are required.
- h) Indicate all existing and proposed work in the Town of Pelham's road allowance, such as existing/proposed driveways, curbs, sidewalks, culverts, all utilities, etc., on the Site Grading Plan.
- i) Show the location and dimensions of all structures on the lot, including their setbacks to all lot lines. The lot area and building length for irregularly shaped lots must be provided.
- j) A 0.6 m strip shall be left undisturbed along the boundary of the new lot next to adjacent properties until such time as final grading works are undertaken. All grades must meet existing on-lot lines unless written permission of the adjacent property owner is attached.

- k) Provide a field review as required and submit a Sealed Final Grading Certificate to the Town of Pelham. The form shall be as specified in Section D7.04 or an equivalent document.

D5.03 Lot Grading Criteria for Infill Housing

In general, lot grading of infill lots shall be in accordance with the criteria and standards set out in Section D2.01, with the following additional requirements:

- 1) The intent of the existing drainage pattern in the area of the site should be maintained.
- 2) Side yards should be drained at surface slopes not less than 2.0% to one or more existing positive drainage outlets connected to public drainage systems, or, if necessary, to proposed positive drainage outlets.
- 3) Rear yard slope should not exceed 5.0% except where existing grades are not being altered.
- 4) During construction, siltation control methods should be used around the lot perimeter or construction area for larger lots to prevent erosion or siltation on adjacent properties.
- 5) Where a storm sewer is not available to which downspouts may be connected, provisions shall be made to prevent soil erosion. ie: splash pads to a side yard swale.

D6.00 Construction Requirements

Prior to commencing rough grading, the Developer must implement an erosion control program to reduce on-site erosion and minimize the transport of silt off-site into treed or environmentally sensitive areas or into the Municipal storm sewer system, to the satisfaction of the Town.

The Developer and his Engineer shall control the placement of imported fill material on all registered lots, including those where private sewage disposal systems are required. Imported fill material placed on registered lots must meet or exceed the original ground's capability to support a private sewage disposal system as required by the Niagara Region Department of Health Services.

Where the proposed grading plan identifies fill over registered lots, "engineered fill" shall be placed according to the approved design and under the supervision of the qualified Geotechnical Engineer, who shall certify the fill's stability and load-bearing capacity and provide a copy of this certificate to the Town.

If required by the Town or Chief Building Official or by the builder's purchase and sales agreement, the Geotechnical Engineer shall provide footing inspection certificates for each house with engineered fill within the building envelope.

D7.00 Foundation Control and Lot Grading Certification

D7.01 Foundation Control Certification

Where lots are identified as requiring special Foundation Control Certification (FCC) by the Developer's Consulting Engineer on the engineering lot grading plans for the subdivision, and the Town of Pelham determines that the proposed foundation grades are close enough to the control elevations to warrant special attention by the builder, the following stamp shall be used on the individual lot grading:

Framing not to begin prior to certification of foundation control elevation for:	
☐	TFW
☐	MBE
☐	Max SF
As per Town of Pelham Design Criteria D7.01	

In the stamp, the abbreviations shall be interpreted as follows:

- TFW shall mean the minimum elevation of the top of foundation wall and may include minimum sill opening elevations;
- MBE shall mean the minimum basement elevations and shall be interpreted to mean the control elevation of the placement of foundation drains; and
- Max USF shall mean the maximum underside of footing and shall be interpreted to indicate the depth to which footings shall be extended.

The builder shall have the FCC prepared prior to beginning the framing of the unit for lots identified with the above stamp.

Where the TFW, MBE or Max USF has been identified as a critical elevation for a lot or block, either a partial building permit, a conditional building permit or a separate foundation building permit only shall be permitted to be issued and subject to the approval of the Chief Building Official, construction shall not continue until a satisfactory Foundation Control Certification (FCC) has been received. For this purpose, the FCC shall indicate that the required elevations are within permitted tolerances.

Foundation Control Certification shall be done only by a Professional Engineer Ontario, an Ontario Land Surveyor or a recognized equivalent acceptable to the Chief Building Official. The format of the Foundation Control Certificate shall be as shown in Section D7.02.

Prior to proceeding with framing of structures over registered lots, builders must provide the Town of Pelham Engineering Department and Developers Consulting Engineer with a Foundation Control Certification as per Town of Pelham Design Criteria Section D7.02, identifying "As-Built" underside of footing, top of foundation elevations (all locations), garage door sill elevations and actual setback distances as specified under the appropriate Zoning By-law. If a variance exists between these "As-Built" elevations and the approved house siting plan, the Consulting Engineer shall provide details of the variance from the approved plans and shall include his recommendations for rectification of the problem, if required.

The special FCC shall be provided prior to framing, all other as-built elevations shall be provided as part of the final lot grading certification.

D7.02 Foundation Control Certificate

The Town of Pelham Engineering Department Foundation Control Certificate

Dated: _____

Municipal Address (es): _____

Name of Subdivision: _____

Subdivision No.: _____

Phase: _____

Lot or Block No. (s): _____

Reg. Plan: _____

Attention: Director of Public Works or Chief Building Official

This is to certify that I have checked the as-constructed control elevations of the above noted lot(s) and confirm that the foundation:

- a) Critical Control Elevations listed below conform to the elevations shown on the approved engineering site grading plan:
 - TFW (top of foundation wall),
 - MBE (minimum basement elevation),
 - Max USF (maximum underside of footing);
- b) “As–Constructed” will not impede the completion of the lot grading in accordance with the approved Lot Grading Plan; and
- c) “As–Constructed” will permit the construction of the garage floor at an elevation to provide for grading of the driveway in conformity with Town of Pelham Design Criteria and Engineering Standards, including consideration of the proposed sidewalk and/or curbs abutting the lot.

Yours truly,

(Required: Name, Company, Stamp & Position Title) (Optional: Address & Phone Number)

Instructions:

- 1) The above is to be stamped and signed by the licensed grading consultant who shall be an Engineer, Ontario Land Surveyor or Architect licensed to practice in Ontario.
- 2) Initial the control elevations listed above that are confirmed to be within acceptable grading tolerances.
- 3) Where verification of control elevations is required prior to framing, submit a duplicate original of the above to the Chief Building Official with the request to begin framing.
- 4) Submit an original of the above to the Engineering Department.

D7.03 As-Constructed Certification

Before any lot is released from the requirements of the Subdivision Agreement, the Developer's Consulting Engineer must provide written certification to the Town of Pelham confirming that the lot's grading and drainage have been executed in accordance with the approved plans.

Should discrepancies arise between the "As-Constructed" elevations and the approved house siting plan, the Consulting Engineer is required to detail these variances and offer recommendations for rectification, if necessary.

Final certification of lot grading by the Consulting Engineer shall follow a pre-sodding site inspection conducted jointly by the Consulting Engineer and the builder. Together, they will assess which lots are eligible for certification and sodding based on visual appraisal, identify lots requiring survey confirmation to ensure compliance with the approved design, and determine those needing deficiency repairs, specifying the nature of such repairs. In all cases, "As-Constructed" geodetic elevations must be recorded on the Town's approved siting plan after sodding, typically consisting of 15 ground elevation points per lot as outlined in Town of Pelham Standard Drawings 300 to 302, and submitted to the Town alongside the lot grading certificate (refer to Section D7.04). The certificate must document any deviations from the original design elevations. Any submissions lacking the required minimum survey locations, as specified in Standards 300 to 302, will not be accepted and will be returned to the Consulting Engineer. Upon reviewing the certified lots, the Town of Pelham will proceed with releasing the security deposits, provided all criteria are satisfactorily met.

D7.04 Lot Grading Certificate

The Town of Pelham Engineering Department Lot Grading Certificate

WHEREAS, Sentence 9.14.6.1 of Ontario Regulation 413/90, made under the authority of the Building Code Act, requires that the building shall be located and the building site graded so that water will not accumulate at or near the building and will not adversely affect adjacent properties.

I, _____ hereby certify that I have conducted a field review of the site and find it to be in compliance with the approved Site Grading Plan submitted and reviewed by the Town of Pelham, Engineering Department.

Application Number: _____

Project Description: _____

Project Location: _____

Lot Number: _____ Plan Number: _____

Name of Owner (in full): _____

Owners Address: _____

Postal Code: _____ Telephone Number: _____

Consultant: _____

Signature of Grading Consultant: _____ Date: _____

Affix Seal Below



Section E – Structures

E1.00 General

All structures shall be comprehensively designed and detailed on engineering drawings, with appropriate protection measures implemented to prevent erosion both during and after construction. Where applicable, structures must comply with Ontario Provincial Standard Drawings.

Any other structures not specified herein may require certification by a qualified Engineer at the discretion of the Town.

For channels, culverts, bridges, or erosion control projects, the proponent is responsible for securing all necessary approvals from relevant regulatory agencies, including the Conservation Authority, Ministry of Natural Resources, Ministry of Environment and Energy, and Ministry of Transportation of Ontario.

E2.00 Retaining Walls

All retaining walls must be constructed from durable materials, such as stone or either cast-in-place or precast concrete. Recommended wall locations are referenced in Section D2.01. Retaining walls that are connected to or form part of a building are subject to the provisions of the Ontario Building Code and, therefore, are not included within the scope of this standard.

1. For retaining walls with a height less than 0.6 metres, shop drawings or standard details from the precast concrete manufacturer shall be submitted during siting approval prior to issuance of a building permit. Certification is not required for these walls.
2. For retaining walls exceeding 0.6 metres in height, a design—either engineered or pre-engineered—must be stamped and signed by a qualified Engineer with relevant experience in retaining wall design and construction. Additionally, a geotechnical review, including comprehensive calculations for both local and global stability analysis, is required.
3. If the retaining wall is adjacent to hazard lands or open space, these requirements apply regardless of wall height. The design must demonstrate compliance with the appropriate factor of safety, in accordance with the Ontario Ministry of Natural Resources (MNR) Technical Guide, River & Stream System: Erosion Hazard Limit, 2002 (or its amendments).

The necessary engineering design and geotechnical analysis must be provided to the Town of Pelham Engineering Department for approval during subdivision grading review. Submission may be deferred until siting approval, if permitted by the Engineering Department.

The submission package for departmental review must be stamped and signed by either the manufacturer or a structural engineer and must, at minimum, include:

- Cross-sectional details;
- Face of wall details;
- Details regarding fencing/railing, drainage, tie-backs, and end treatments, as applicable.

During construction, inspection of the retaining wall is mandatory. Upon completion, an Engineer experienced in the design and construction of retaining walls must certify the wall or any fence/wall combination.

For lot grading design and fencing specifications, refer to Section D2.01.

E3.00 Culverts and Bridges

E3.01 Roadway Culverts and Bridges

Comprehensive design drawings are required for all cast-in-place reinforced concrete structures, including headwalls, outfalls, maintenance holes, and culverts not specifically detailed by OPSS or OPSD. Bridges and other significant drainage structures necessitate specialized designs, which shall be determined by the Town in consultation with NPCA and MNR. Hydraulic calculations must be provided to demonstrate the hydraulic capacity of the proposed channel, as well as the corresponding level of service or flood frequency protection for the roadway.

Structures shall be designed according to the following criteria:

1. New roadway culverts and bridges must possess adequate capacity to convey the Regulatory Flood, thereby preventing adverse backwater effects.
2. Overland flow flooding shall not exceed the maximum depth specified in Section B3.02.3.

E3.02 Driveway Culverts

Culvert sizing must accommodate storm flows associated with a five-year return period, unless otherwise directed by the Town's Engineering Department. A minimum length of 6.0m is required for rural driveway culverts. For details on minimum cover requirements, refer to Standard Drawing No. 306.

In general, installation of driveway culverts on existing roads must be completed by, or in accordance with, the criteria and approvals established by the road authority having jurisdiction over the road allowance, such as Niagara Region or the Town of Pelham.

E4.00 Noise Fences and Walls

All noise fences and walls shall be constructed in accordance with Town of Pelham Standard Drawing No. 506, 506.10, or as otherwise approved. The design, along with all associated certification documentation, must be certified by a qualified Engineer and submitted to the

Town's Engineering Department prior to subdivision assumption. Certification must specify the section of fence being certified, materials utilized, construction methodology, structural integrity (including wind load considerations), and confirm that required noise abatement levels have been achieved for the noise fences and/or walls. In addition, a certificate and survey from an Ontario Land Surveyor are required to verify the as-built elevations (top and bottom) and the barrier's location relative to property boundaries.

Noise fences must be constructed entirely on private property. Before construction commences, any fences measuring 2m or more in height shall be designed and approved by a licensed Structural Engineer. Upon completion, a certification from a Structural Engineer must be submitted to the Town of Pelham prior to acceptance of the finished fence.

The maximum barrier wall height shall be 6.0 m, unless otherwise stated in a respective noise report. A greater height can be achieved using a combination of berm and wall to the satisfaction of the Town. Maximum height adjacent to rail lines shall be 6.0 m.

Barrier walls shall be located entirely on private property. Where the noise attenuation features include a berm and/or barrier wall, the noise attenuation feature shall be located entirely on private property.

Section F – Signs and Fencing

F1.00 General

The proposed location and type of sign or fence shall be shown on the plan drawings. A schedule of signs must be submitted to the Town of Pelham.

F2.00 Street Name Signs

F2.01 Location

A Pavement Markings and Signage Plan is to be prepared showing the location of all signs and markings to be installed on the road(s).

The location of all signs within the subdivision is to be included in the Pavement Markings and Signage Plan. A minimum of one interpretive sign is required for each stormwater facility and woodlot. Regulatory by-law signage is required at all open space frontages accessible by roads and trails, as well as all park entrances.

For signalized intersections, refer to Niagara Region Standard.

F2.02 Type

The street name sign shall be white reflective lettering on a reflective green background. All lettering shall be 90 mm on a 160 mm sign. Signs shall be anodized aluminum, minimum 1.6 mm thickness, with signs over 600 mm long being minimum 2.0 mm thick. The sign shall be fastened to a 51 mm square tubing post, with a 480mm anchor sleeve and a 57 mm square tubing anchor post

Signs shall conform to the Town of Pelham Standard Drawing No 501

Temporary or permanent street name signs shall be installed upon completion of the base course asphalt and must be maintained. Permanent street name signs shall be installed prior to final acceptance being given by the Town of Pelham.

F3.00 Traffic Control and Advisory Signs

The design, positioning and mounting of all traffic control and advisory signs shall conform to the latest Ontario Traffic Manuals.

The traffic and advisory signs shall be installed upon completion of the base course asphalt and maintained until the subdivision has final acceptance by the Town of Pelham.

All temporary and permanent traffic control and advisory signs shall be indicated on a separate drawing (Traffic Management Implementation Plan – TMIP), to be included with the engineering submission drawing set.

F4.00 Pavement Markings

Plastic pavement markings shall be provided in accordance with the latest Ontario Traffic Manuals. Pavement markings are required for lane separation, road centerline, turning lanes, stop lines, cross walks, turning arrows and island markings.

Pavement markings are to be shown on the TMIP plan(s) required for subdivision developments or Municipal works projects and shall be in accordance with the latest OPSS requirements.

F5.00 Fencing

Fencing, to be installed as part of a subdivision or development agreement, shall be located as outlined in the agreement and shall be designed and constructed in accordance with the approved landscape drawings and the following criteria.

- a) For acoustic fencing/barriers, refer to Section E4.00 Noise Fences and Walls.
- b) Black 1.2 m and 1.8 m chain link fencing shall be constructed in accordance with Town of Pelham Standard No 506.30 and 506.40, respectively
- c) All fences designed to enclose private swimming pools shall be in accordance with the relevant Town of Pelham By-laws.
- d) Entrance features and treatments will be allowed where approved. Features which are intended to be permanent structures shall be designed using vandal-proof, low-maintenance materials and finishes. Temporary features shall be removed by the developer prior to final acceptance or when requested by the Town of Pelham.
- e) All required fences shall be located using SIB's/property bars installed by an Ontario Land Surveyor (OLS).
- f) A certificate and survey from an Ontario Land Surveyor shall be required, confirming the as-built elevations (top and bottom) and location in relationship to property lines of all regulatory fencing installed.

Section G – Street Tree Planting/Protection

G1.00 General

Street trees in urban settings provide a significant aesthetic, environmental and even financial benefit. Mature trees that develop a full canopy provide shade and UV protection, improve air quality, moderate climate, store and sequester carbon, and can increase property values and reduce energy costs. Trees planted in open pits can also reduce stormwater run-off and need to be replaced less frequently than smaller trees in planters.

Trees shall be planted in accordance with “Urban Tree Foundation Specifications” for planting, staking and tree protection, found at :

http://www.urbantree.org/details_specs.shtml.

G2.00 Tree Health

For optimal tree health:

- Trees should be planted 1.5 to 2 m from the curb if space allows.
- A soil cell system may be recommended by the Town in hard-surfaced downtown areas.
- 1 tree per lot, 2 trees/corner lot.
- Where possible, 1 tree per 15m on the frontage.
- Bio-swales or infiltration swales should be used to allow for natural watering of plant material and to reduce stormwater run-off.
- If trees are planted in a hard surface boulevard, tree grates, tree guards and underground utility boxes are recommended.
- Location and design of utility infrastructure (overhead wire, etc.) should ensure that it does not interfere with mature tree growth. Coordination with utility providers is important to minimize root and crown pruning during utility maintenance and to maximize tree pit and canopy size.
- Ensure that placement of street trees does not interfere with vehicle sight lines or with utility, water, sewer or storm infrastructure.
- Acceptable species for planting are listed in Table 2.00 A and Table 2.00 B below. Final selection is to be determined by the Town, as factors such as availability, maturity, canopy size, functional area, overall species variety on site, nativity status, and maintenance are considerations for the Town.

TABLE 2.00 A – SPECIMEN AND FOUNDATION PLANTING STREET TREES

BOTANICAL NAME	COMMON NAME	NATIVE *	GROWTH HABIT	SIZE CLASS AT MATURITY	GROWTH RATE	CANOPY SIZE AT 20 YEARS
Acer x freemanii ‘Celzam’	Celebration Maple		Excurrent	Medium	Med-Fast	5.5 m
Acer x freemanii ‘Jeffersred’	Autumn Blaze Maple		Excurrent	Medium	Medium	9 m
Acer rubrum	Red Maple	*	Excurrent	Large	Fast	7.5 m
Acer saccharum ssp. nigrum	Black Maple	*	Decurrent	Large	Slow-Med	10 m
Acer saccharum	Sugar Maple	*	Decurrent	Large	Slow-Med	10.5 m
Amelanchier arborea	Common Serviceberry	*	Decurrent	Small	Slow-Med	4 m
Amelanchier laevis	Allegheny Serviceberry	*	Decurrent	Small	Slow-Med	3.75 m
Carya cordiformis	Bitternut Hickory	*	Excurrent	Large	Slow-Med	12 m
Carya ovata	Shagbark Hickory	*	Excurrent	Large	Slow	10 m
Celtis occidentalis	Hackberry	*	Decurrent	Medium	Med-Fast	11 m
Cercidiphyllum japonicum	Katsura Tree		Excurrent	Medium	Slow	4.3 m
Cercis Canadensis	Redbud	*	Decurrent	Small	Fast	9 m
Corylus colurna	Turkish Hazel		Decurrent	Medium	Medium	5.5 m
Gymnocladus dioicus	Kentucky Coffeetree	*	Decurrent	Large	Slow-Med	10 m
Juglans nigra	Black Walnut	*	Decurrent	Large	Med-Fast	14 m
Liriodendron tulipifera	Tulip tree	*	Excurrent	Large	Fast	12 m
Nyssa sylvatica	Blackgum tree	*	Excurrent	Large	Slow	10.6 m
Ostrya virginiana (Small understory tree good in a woodlot)	Ironwood	*	Excurrent	Small	Slow	5.4 m
Platanus occidentalis	American sycamore	*	Decurrent	Large	Fast	18 m
Platanus xacerifolia	London plane tree		Decurrent			

TABLE 2.00 A – SPECIMEN AND FOUNDATION PLANTING STREET TREES

BOTANICAL NAME	COMMON NAME	NATIVE *	GROWTH HABIT	SIZE CLASS AT MATURITY	GROWTH RATE	CANOPY SIZE AT 20 YEARS
Quercus species (Alba, Rubra, Velutina, Bicolour, Macrocarpa, Shumardii, Muehlenbergii)	Oak	*	Varies	Large	Med-Fast	varies
Tilia americana	Basswood	*	Excurrent	Large	Medium	10 m
Tilia cordata var.	Littleleaf Linden		Excurrent	Medium	Medium	6.4 m
Ulmus x ‘Pioneer’	Pioneer Elm		Decurrent	Large	Medium	9.5 m

Ornamental pear may also be considered.

TABLE 2.00 B – RECOMMENDED SPECIMEN & FOUNDATION PLANTING STREET TREES

BOTANICAL NAME	COMMON NAME	NATIVE *	GROWTH HABIT	SIZE CLASS AT MATURITY	GROWTH RATE	CANOPY SIZE AT 20 YEARS
Acer griseum	Paperbark maple		Decurrent	Small	Slow	7.6 m
Amelanchier Canadensis	Downy serviceberry	*	Decurrent	Small	Medium	6 m
Cornus alternifolia	Pagoda dogwood	*	Decurrent	Small	Slow-Medium	6m
Cornus florida	Flowering dogwood	*	Decurrent	Small	Medium	6m
Cornus Kousa	Kousa dogwood		Decurrent	Small	Slow-Medium	6m
Hammamelis mollis	Chinese witch-hazel		Decurrent	Small	Slow	5.4 m

TABLE 2.00 B – RECOMMENDED SPECIMEN & FOUNDATION PLANTING STREET TREES

BOTANICAL NAME	COMMON NAME	NATIVE *	GROWTH HABIT	SIZE CLASS AT MATURITY	GROWTH RATE	CANOPY SIZE AT 20 YEARS
Hammamelis vernalis	Vernal witch-hazel	*	Decurrent	Small	Slow	5.4 m
Hammamelis xintermedia ‘Arnold’s Promise’	Witch-hazel		Decurrent	Small	Slow	5.4 m
Prunus maackii	Amur Chokecherry		Decurrent	Small	Slow	7.5m
Sambucus Canadensis	Common elderberry	*	Decurrent	Small	Fast	3 m
Viburnum lentago	Nannyberry	*	Decurrent	Small	Medium	3.6 m

G3.00 Microclimate Factors/Site Design Factors

Every tree species and individual tree will affect their immediate microclimate in a unique way, based on characteristics such as height, shape, age, and canopy density.

Thus, considering tree siting through a spatial and temporal lens is crucial in optimizing the microclimate of any given site. The microclimate of a site either positively or negatively impacts many aspects of site experience and performance, specifically impacting pedestrian thermal comfort levels and building energy efficiency.

Logically and well sited trees positively impact pedestrian thermal comfort levels and building energy efficiency by moderating the microclimate via buffering extremes in temperature and windspeed.

To this end, whenever possible, trees should be sited in a manner that will maximize the benefits derived from their positive influences on the local microclimate.

G3.01 Tree Types and Impacts on Microclimate

Deciduous Trees

Deciduous trees cool the microclimate around them during the warm months via the shade their branches and leaves provide, as well as via the cooling associated with evapotranspiration processes. Shade cools the microclimate beneath it by decreasing the

amount of solar irradiance reaching and warming any given surface. Evapotranspiration (essentially the process of trees sweating) cools the microclimate via the water evaporating from tree leaf stomata absorbing heat/energy in the process of changing states of matter from a liquid to a gas, a process called latent heat absorption.

In the cooler months of the year, the net microclimatic cooling effect from deciduous trees is greatly reduced as evapotranspiration decreases dramatically once the leaves fall off the trees and the lack of leaves allows more solar irradiation through to warm the surfaces previously shaded by the leaves. This temporally dynamic nature of deciduous trees allows them to have a positive normalizing effect on the microclimate around them regardless of the season.

Evergreen Trees

Evergreen trees (mainly non-deciduous conifers) do not share the temporally dynamic nature of deciduous trees when it comes to microclimatic influence, as they retain their foliage year-round. These trees, however, are more effective windbreaks than deciduous trees due to their thicker and year-round foliage as well as their generally greater heights interrupting higher altitude winds. To this end, evergreens have a different role in microclimate regulation, decreasing wind-speed.

G3.02 Cardinality and Tree Siting Best Practices

The positive microclimatic impact from these different types of trees can be optimized by siting them with respect to cardinality and the site assets that would benefit from a moderated microclimate.

Deciduous trees are encouraged to be planted, whenever possible, to the South-West of the active transportation network, pedestrian spaces, buildings, and infrastructure assets seeking to have their microclimate enhanced. By being to the South-West of these assets, deciduous trees can maximize the quantity of solar irradiance intercepted in the summer, as the majority of intense solar irradiance comes from this direction in the afternoon.

Evergreen trees are encouraged to be planted, whenever possible, either to the North-West of, or in the direction of the prevailing localized winds, with respect to the active transportation network, pedestrian spaces, buildings, and infrastructure assets seeking to have their microclimate enhanced. Evergreen trees can maximize the amount of wind they buffer by being sited in between the assets looking to be sheltered and the local prevailing winds. Whilst the prevailing winds generally come from the North-West at a macro-scale, confounding factors can cause these winds to come from any direction, so site-specific assessment of prevailing winds is recommended.

Section H – Street Lighting

H1.00 General

Street lighting systems shall be designed in accordance with the latest edition of RP-8 American National Standard Practice for Roadway Lighting and Town-approved streetlight luminaires, brackets and poles.

The streetlight design plans shall be submitted by the owner/developer or their representatives and be included in the first submission of the engineering drawings. The streetlight design plans shall include the streetlight design layout, single-line diagram, and photometric design.

All Town-owned streetlights shown on the design plans shall be individually numbered based on the numbers provided by the Town. Each number on the plan shall match the number in the field.

All rights of way, including private roads within condominium developments, shall require a photometric plan to show the lighting levels provided by both the existing and proposed streetlights, as shown on the utility coordination plan.

The photometric plan shall include all specifications required for the installation of street lighting and ensure the proper level of lighting. This shall include the proper illumination for proposed building envelopes and future tree canopies. Lighting levels shall be shown either as point values with contours for all the proposed and existing surfaces of the rights of way, including entrances.

Supplier shop drawings for the streetlight materials shall be submitted to the Town of Pelham for approval prior to placing the material order.

Copies of the shop drawings shall be submitted to the Town for review and approval. A copy will be returned to the owner/developer or their representatives with approval or with revisions for resubmission.

Decorative street lighting shall only be considered in designated areas approved by the Town. Decorative street lighting shall only be installed on local roads. Installation of decorative street lighting on collector and arterial roads is not permitted.

H2.00 Design Approvals

All proposed lighting shall be reviewed and approved by the Town. Lighting design submissions must include:

- Design criteria used.

- Design calculations with photometric layouts utilizing approved computer lighting program AGI 32, AutoLux or equivalent.
- Contract drawings and specifications with cost estimate.

All drawings must be sealed by a registered qualified electrical Professional Engineer, licensed to practice in the Province of Ontario. Any attachments to hydro poles must have Hydro Authority approvals and comply with Regulation 22/04. All roadway lighting design and construction is subject to Electrical Safety Authority (ESA) inspection and approval.

H3.00 Design Criteria

The design criteria requirements for luminance and illuminance in Table 3.00a and Table 3.00b are derived from ANSI/IES RP-8-14.

Table 3.00a					
Luminance Method for Mid-Block Sections (Non-Intersection Areas)					
Road Classification	Average Maintained Luminance	Maximum Uniformity	Luminance Ratios	Maximum Veiling Luminance Ratios	Pedestrian Conflict Area Classification
	L_{avg} (cd/m ²)	L_{max} to L_{min}	L_{avg} to L_{min}	L_v to L_{avg}	
Arterial Roads (IES Major)	0.6	6.0 to 1	3.5 to 1	0.3 to 1	LOW
Arterial Roads (IES Major)	0.9	5.0 to 1	3.0 to 1	0.3 to 1	MEDIUM
Collector (Minor) Roads (IES Collector)	0.4	8.0 to 1	4.0 to 1	0.4 to 1	LOW
Collector (Major) Roads (IES Collector)	0.6	6.0 to 1	3.5 to 1	0.4 to 1	MEDIUM
Local (Rural) Roads (IES Local)	0.3	10.0 to 1	6.0 to 1	0.4 to 1	LOW
Local Roads (Urban/Industrial) (IES Local)	0.5	10.0 to 1	6.0 to 1	0.4 to 1	MEDIUM

Table 3.00b		
Illuminance Method for Intersection and Sidewalks		
Road and Pedestrian Conflict Area Classification	Minimum Average Maintained Illuminance (horizontal only) (R2 & R3 Pavements) E_{avg} in lux	Maximum Illuminance Uniformity Ration E_{avg} to E_{min}
Illuminance Design Criteria for Roadways at Intersections		
Arterial Roads (IES Major-Low)	9	3 to 1
Arterial Roads (IES Major-Medium)	13	3 to 1
Collector (Minor) Roads-Low (IES Collector-Low)	6	4 to 1
Collector (Major) Roads-Medium (IES Collector-Medium)	9	4 to 1
Local (Rural) Roads-Low (IES Local-Low)	4	6 to 1
Local Roads (Urban/Industrial)-Medium (IES Local-Medium)	7	6 to 1
Illuminance Design Criteria for Sidewalks		
Rural and Semi-Rural Areas	2	10 to 1
Pedestrian Areas-Low	3	6 to 1
Pedestrian Areas-Medium	5	4 to 1

Intersections shall have an illumination level equal to the sum of the recommended average illumination levels for each of the intersecting roadways. If it is not practical to achieve this level due to geometric constraints, then a minimum level of 50% higher than the recommended level for the main roadway may be acceptable, subject to the Town's approval.

Light levels shall be increased by 50% in school areas, railway crossings, and bridges. The streetlights shall typically be serviced with underground wiring in ducts between poles. The luminaires shall be alternated between circuits to maintain 50% illumination in the event of a loss of one circuit feeder.

H4.00 Street Lighting

Street lighting can contribute to the overall character of a street or neighbourhood, while also being an important element of creating safe and pedestrian-friendly streets. Street lighting within the boulevard should illuminate building entrances, pedestrian walkways and public spaces, while also considering sustainability and reduced energy consumption.

- Street lighting should be located in the Landscaping Zone or integrated into building design.
- Downcast pedestrian lighting should be provided in high-traffic pedestrian areas.
- Lighting on private property should ensure safe and well-lit entrances, parking areas and other pedestrian areas.
- In key areas, lighting can be used to accent special features or major destinations, with additional lighting in mixed-use or downtown areas, at intersections or trail crossings.

Design and location of lighting should consider sustainability and the impacts of light pollution. It should be 'dark sky' friendly, and consider energy efficiency, directional lighting, inductions lighting, solar power, street reflectors and sensors to regulate brightness.

H5.00 Recommended Lighting Configurations and Pole Offsets

- Roads with 3 lanes or less – single sided or staggered configuration with pole offset from EP as per TAC criteria or on shoulder rounding.
- Roads 4 lanes or greater – opposite configuration with poles offset as per TAC criteria.
- In urban areas behind the face or a barrier curb with design speed of 70 km/hr or less, pole offsets may be reduced to 1.5 m.
- Lights at signalized intersections should be combined with joint-use traffic signal poles wherever possible.
- On curved roads, position the light poles on the inside curve if possible. Alternatively, light pole locations in unprotected areas on the outside of curves should be kept out of the vehicle overrun areas.
- Lighting poles shall have a minimum clearance of 3 m from pad-mounted transformers, fire hydrants and trees.
- Street lights and power pedestals should be located on the extension side lot lines where possible. A minimum of 1 m clearance is required between light poles and driveways and a minimum offset of 0.5 m from sidewalks.

H6.00 Materials

All materials used for street lighting must be CSA approved.

H6.01 Electrical Handholes (Ground Mounted)

Precast concrete type complete with cover, 460 mm diameter, as per OPSD 2112.02.

H6.02 Ducts

- In boulevard, rigid PVC DB2 duct, CSA C22.2, No.211.1, 53 mm diameter.

- Below roadways, rigid PVC Thickwall duct, CSA C22.2, No.211.2, 53 mm diameter.
- Flexible duct (Polypipe CSA Standard B137.1, Series 75 or ENT CSA C22.2, No.227.1) to be used for the protection of cables entering the wiring aperture in the concrete poles.

H6.03 Cables

- Power supply cables shall be 3-#2 AWG copper RWU90 (no ground wire), with cross-linked polyethylene insulation rated 600 volt, CSA C22.2 No.38.
- Streetlight cables shall be 3-#6 AWG copper RWU90 as above with 1-#6 AWG standard copper green ground.
- Riser wires from pole handhole to luminaire shall be #12 AWG stranded copper type RWU90 insulation.
- Insulation colour for line conductors for 1-phase, 3-wire 240/120V system shall be “Red” and “Black” and for 1-phase, 2-wire 120V system shall be “Red”. Insulation colour of all neutral conductors shall be “White”.
- Cable connectors in pole handholes shall be compression connectors with insulating covers.

H6.04 Fuses

- Fuse holders in pole handholes shall be in-line break-away type rated 600V, complete with a 10 amp KTK fuse.

H6.05 Grounding

- Ground rods shall be solid steel, 19 mm diameter, 3.0 m long, copper clad for full length according to CSA C22.2 No.41. Ground plated may be used subject to soil conditions.

H6.06 Poles

Standard Road Lighting Poles:

Direct Buried, Class “B” spun concrete, to CSA A14-M1979, tapered round with natural concrete smooth mold finish, complete with handhole cover plate, nameplate and ground lug. Tamper-proof screws and a warning label are to be supplied with the handhole cover plate. Pole nameplate to indicate manufacturer's name, pole class and length, date of manufacture and CSA stamp.

- Arterial Roads – 12.2 m
- Collector Roads – 10.7 m or 12.2 m
- Local Roads – 7.6 m or 9.9 m or 10.7 m

Approved concrete pole manufacturers are StressCrete and U.S.I.

Decorative Road Lighting Poles:

Direct Buried, Class “B” spun concrete, to CSA A14-M1979, octagonal with black smooth mold finish, complete with handhole cover plate, nameplate and ground lug. Tamper-proof screws and a warning label are to be supplied with the handhole cover plate. Pole nameplate to indicate manufacturer's name, pole class and length, date of manufacture and CSA stamp.

- Arterial Roads – 12.2 m
- Collector Roads – 10.7 m or 12.2 m
- Local Roads – 7.6 m or 9.9 m or 10.7 m

Approved concrete pole manufacturers are StressCrete and U.S.I.

H6.07 Brackets

Standard Road Lighting Brackets:

Scroll arm aluminum brackets. The length of the bracket depends on the offset from the pavement and the pole height.

- Arterial Roads – 2.4 m preferred, 3.0 m maximum
- Collector Roads – 1.8 m preferred
- Local Roads – 1.2 m preferred

H6.08 Luminaires

LED Luminaires:

Luminaire – “Lantern” or “Pendant” style, type 2 or 3 distribution pattern, rugged die cast aluminum housing with surge and brown-out protection, LED drivers and electronic transfer switch.

Operating range from – 40 to +50 °C with light engines meeting the dust and moisture rating of IP-66. Luminaire design to meet CSA-C22.2 number 250 for 40C, wet location and to be ROHS compliant. Maximum total harmonic distortion to conform to AHSI C82.77 : 2002.

Solid state 120 volt 60 Hz electronic drivers with extended life to 100,000 hours minimum.

LED colour temperature 4,000 K nominal.

10 year limited warranty on LED light engine, LED drivers and all non-electrical components.

H6.09 Power Supply Disconnects

Pole-Mounted Disconnects

Pole-mounted power supply disconnects shall be outdoor weatherproof type 240/120 V rated 100 amps with a 60-amp 2-pole main breaker suitable for service entrance.

Approved manufacturer is Square ‘D’ (CQO) or approved equivalent.

Pedestal-Mounted Disconnects

The pedestal-mounted power supply disconnect shall be an outdoor, heavy-gauge, galvanized steel unit with a lockable, removable front cover, complete with a precast concrete base.

Colour to be equipment green with powder coat finish.

Interior power supply disconnect shall be 240/120 V rated 100 amps with 60 amp 2 pole main breaker suitable for service entrance. Branch breakers to be 30 amps 1 pole 120V.

H7.00 Installation

The installation of the street lighting system shall be in compliance with ESA, CSA and Hydro Supply Authority requirements and in accordance with the Town's specifications and standards and the manufacturer's installation instructions.

Shop drawing materials shall be reviewed by the Design Consultant prior to material order. The installation shall be inspected by the Design Consultant during stake-out and trenching, construction of footings prior to pouring concrete and at final installation completion. A final completion certificate shall be issued by the Design Consultant to verify that the installation is in compliance with the design and contract documentation.

1) Ducts

- Ducts shall be solvent welded together in trenches with minimum cover of 760 mm.
- Ducts shall be surrounded by 80 mm of brick sand and warning tape to cover width of trench.
- Road crossings to be carried out by directional bore method using thickwall rigid PVC duct.
- Where open-cut road crossings are necessary, ducts shall be concrete encased.
- Installation as per OPSD 2100.06.
- Installation Specifications as per OPSS 603.

2) Cables

- Cables to be continuous without splices and shall be installed after trenches are back-filled.
- Installation Specifications as per OPSS 604.

3) Fuses

- Fuses in pole handholes as per OPSD 2255.020.
- Installation Specifications as per OPSS 617.

4) Grounding

- Ground rods to be installed at power service disconnect (min. 2 rods) and at every 5th lighting pole and at the last lighting pole in each circuit.
- Installation Specifications as per OPSS 609.

5) Poles

- Refer to Standard Drawings
- Installation Specifications as per OPSS 615.

6) Brackets and Luminaires

- Refer to Standard Drawings
- Installation Specifications as per OPSS 617.

7) Power Service Disconnect

- Refer to Standard Drawings
- Installation Specifications as per OPSS 614.

Where possible, place pole:

- Opposite lot of property lot lines
- Adjacent to main cable trench
- 3.5m from property line
- Greater than 5m from a transformer

Section J – General Conditions of Site Plans Approval

J1.00 General

The general conditions specified below define the minimum standards for all site plan applications. Any additional requirements relevant to individual applications will be provided in the Planning Department Comments and shall take precedence should any inconsistencies arise with these general conditions.

It is important to note that the applicability of these general conditions may vary depending on the type of submission, such as new developments or existing structures, and will be determined at the Town's discretion.

All elements related to site grading, road construction, water supply, sanitary and stormwater drainage systems must conform to the Town of Pelham Design Criteria and Engineering Standards, unless expressly indicated otherwise.

Applicants must submit digital copies of site plans and grading or servicing plans, formatted at a metric scale not less than 1:500, along with their building permit application. These submissions are required to comply with the general conditions stated herein.

Additional details and requirements relevant to specific applications may be imposed, including but not limited to the following:

- Universal Transverse Mercator Projection System coordinates;
- Stormwater Drainage Plan(s);
- Stormwater Management information;
- Watermain Layout Plan;
- Sanitary Drainage Plans;
- Traffic Impact Study;
- Traffic Management Implementation Plan, including pedestrian routing and fire routes;
- Erosion Control Plan;
- Construction Management/Staging Plan; and,
- Parking Management Plan.

For further explanation or clarification, please contact the Town of Pelham Engineering Department or Email engineering@pelham.ca

J2.00 Engineering Drawings

J2.01 Site Plan

The site plan shall show the following;

- north arrow;
- key plan;
- legal boundary dimensions and bearings;
- easements and their details;
- existing public services such as sidewalk, curbing, sewers, watermain;
- all existing above-ground street furniture (ex. Street trees, street lights and utilities); and,
- site parking statistics.

J2.02 Grading and Servicing Plan(s)

Grading and servicing plan(s) shall be approved by the Town's Engineering Department before a building permit is issued.

The engineering plan(s) shall demonstrate that the surface drainage from the site will be contained on-site and that the proposed grading will not alter or obstruct the surface drainage pattern at the perimeter of this site.

The engineering plan(s) shall include:

- sufficient spot elevations on adjoining properties, based on a recent topographic survey (including curb and centerline of road elevations on adjacent streets);
- note the nearest Town of Pelham Geodetic Benchmark in the UTM NAD 83, Zone 17N coordinate system;
- north arrow;
- legend;
- finished floor elevation;
- all retaining walls and their details;
- storm and sanitary sewer sizes, length, and slopes;
- upstream and downstream inverts at all maintenance holes;
- stormwater management details (as required);
- watermain sizes, lengths and materials;
- meter pit, shut-off valves and curb stop locations and details;

- all existing and proposed underground services;
- all existing and proposed above ground street furniture.

All roof drainage shall be directly connected to the private storm sewer system unless otherwise approved.

All rear yard catch basins shall be constructed meeting Ontario Provincial Standard Drawings OPSD 705.030 and 400.020.

The following information shall be provided prior to the approval of the Site Servicing and Site Grading Plans:

- Where storm and sanitary sewers, watermain and/or streetlights will become the Town's assets and are proposed as part of the Development, the Applicant will be required to provide the storm and sanitary sewers, watermain and/or streetlight information in a digital format (AutoCAD file). In isolated cases, at the discretion of the Town, the required information may be accepted in Excel format (the template Excel file is available electronically upon request).

J2.03 Consulting Engineer

The applicant shall engage the services of a consultant who is a Registered Professional Engineer with the Professional Engineers Ontario (P.E.O.). This consultant shall be capable and experienced in designing storm and sanitary sewers, watermain, parking lots and site grading. This consultant shall design the private storm and sanitary sewer systems, the watermain system, supervise its construction and upon completion, test and certify that they are all constructed in accordance with the approved plans.

All works (on-site and off-site) are subject to inspection by the Town of Pelham. Upon satisfactory completion, the Town will consider release of financial securities being held for the works.

J3.00 Submissions and Approvals

J3.01 Temporary Works Permit

A Temporary Works Permit must be obtained from the Town of Pelham before any construction is initiated on a public road allowance under the jurisdiction of the Town. Payment of fees and securities for permanent restoration must be made to the Town before this permit is issued to a qualified contractor.

J3.02 Garbage and Recyclable Materials

The application shall provide sufficient storage of all waste streams within the subject property.

The applicant shall provide sufficient waste collection facilities within the subject property.

The applicant shall provide a waste collection vehicle turning template demonstrating the waste collection vehicle will not be backing out of the site into the public road allowance. Under no circumstances shall storage or collection of waste intrude or impact the public road allowance.

J3.03 Financial Securities

A Financial Security in a Town approved format, is required for all engineering works both on and off site in order to secure the acceptable performance and completion of all works detailed on the engineering plans.

The applicant's engineering consultant shall provide a detailed cost estimate and supporting information for the engineering portion of the financial security. Items to be included in the detailed cost estimate include, but are not limited to, the following;

- storm sewer system;
- sanitary sewer system;
- watermain system;
- concrete curbing;
- concrete transfer pad for a garbage/recycling bin enclosure;
- concrete sidewalks;
- granular base and sub-base materials;
- granular driving surface or pavement for parking areas and internal road system;
- retaining walls;
- regulatory fencing;
- erosion control measures;
- stormwater management works;
- road cleaning;
- road damage;
- road signage;
- street trees; and,
- Street Lights.

The supporting information shall include material quantities, unit prices, site plan, and a grading and site servicing plan.

The applicant shall be responsible for removing mud and other debris that accumulates on the public streets during construction. If the applicant does not comply with the Town of Pelham's notification to clean the affected streets within twenty-four (24) hours, then the Town shall have the right to clean the affected streets at the sole expense of the applicant by use of a corresponding portion of the aforementioned financial security.

J3.03.1 Internal Works

Fifty percent (50%) of an acceptable cost estimate will be included as the engineering portion of the financial security for on-site works.

This percentage shall be increased to seventy-five percent (75%) for residential site plans comprised of 25 residential units or less or as required by the Town.

In addition to the engineering financial security, the Planning Department requires financial securities for all landscaping works. Security will be returned by the Town after final inspection, and satisfactory completion of the secured works.

J3.03.2 Off-Site Works

Similar information is required for off-site services under the Town of Pelham's jurisdiction that may be required to service the proposed development. One hundred percent (100%) of an acceptable cost estimate will be included in this financial security. Ninety percent (90%) of this financial security will be returned after completion and acceptance by the Town. The remaining ten percent (10%) will be retained for maintenance purposes for a minimum period of one (1) year from the date of acceptance.

J3.03.3 Waiving of Financial Securities

The Town of Pelham may waive all financial security requirements for residential non-profit organizations and Boards of Education, on the condition that the developer assumes financial responsibility to ensure the restoration of any damage to the Town's Infrastructure and due compliance with the general servicing requirements of the Agreement.

J3.04 Building Section Requirements

Any proposed structure and/or addition to an existing structure shall comply with the requirements of the Ontario Building Code. A soils report regarding footing and foundation design shall be provided in accordance with the Ontario Building Code or when requested by the Chief Building Official for the Town of Pelham.

The site servicing plan showing storm and sanitary drainage, domestic water supply and fire protection services external to the proposed structure shall be prepared by a consultant who is a Registered Professional Engineer with P.E.O. This plan shall be prepared in accordance with the MECP guidelines for private sewage systems. Under other conditions, this plan shall conform to the Ontario Building Code, Part 7 - Plumbing. This plan shall include pipe sizes, pipe slope, invert and surface elevations to indicate depth of cover. Those works on private property shall also be inspected and accepted by the Town of Pelham Building Inspectors. The consultant shall verify fixture loads and water supply requirements for the proposed development.

J4.00 Design Guidelines

J4.01 Driveways and Parking Areas

Proposed driveways and parking areas shall include poured in place concrete curbing around the perimeter of the driving surface. Driveways and parking areas shall be constructed with a hard driving surface that prevents the raising of dust or loose particles. Pavement design shall be provided by a qualified geotechnical consultant.

Proposed driveways shall be located to provide a minimum separation of 1.0 m from the edge of the driveway and any above-ground utility, excluding fire hydrants. If necessary, all costs associated with relocating utilities to accommodate the proposed driveway shall be paid by the applicant.

On large sites, consideration should be given to safe pedestrian routes.

Large parking areas shall be designed to incorporate groups of parking into parking fields.

Parking fields shall be delineated and separated by concrete islands. Concrete islands at the end of aisles shall alternate with painted islands and, wherever possible, shall anchor signs and lighting standards. Entrances to and from aisles between parking fields shall provide for full two-way directional flow, making allowances for the turning template of the largest design vehicle.

The ends of concrete islands shall be rounded and should be pulled back from the end of the adjacent parking spot by at least 0.5 m or depressed to provide the full turning movement for vehicle parking. Curbs or other obstructions adjacent to parking areas shall not be more than 0.15m in height or additional buffer space of 0.2m, for each side that is obstructed, shall be required between the parking spot and the obstruction or curb.

The design of underground parking shall use the same principles as surface parking. Column locations within underground parking areas shall be designed to minimize conflicts with the turning movements of the design vehicles. All underground parking structures shall have a setback from the property line in accordance with the Zoning Requirements.

Entrance design shall give consideration to the required traffic demands and shall provide a two-way free flow of traffic from the municipal right of way, and may include turning lanes and queuing distances.

Drop-off areas shall be designed so as to provide smooth traffic circulation without impeding the flow of traffic at the entrances and circulation roads. Drop-off areas shall not be permitted within the municipal right-of-way.

Accessible parking shall be as per Town of Pelham Standard No 413 and the Town of Pelham Accessibility Plan. Where possible, the accessible parking shall be located next to the building.

J4.02 Maximum and Minimum Grades

- Residential driveways - refer to section C6.01.1.
- Driveway entrances - minimum 2.0% and maximum 8.0%.
- Service roads - minimum 0.5% and maximum 8.0% (cross fall required).
- Paved parking areas - minimum 0.5% and maximum 8.0%.
- Paved commercial parking areas (with possible use of shopping carts) – minimum 0.5% and maximum 3.0%.
- Sodded areas minimum 2.0% and maximum 3:1.

J4.03 Retaining Walls

Retaining walls shall be designed by a Professional Engineer. The applicant shall provide the following site specific details that have been prepared by the engineer before any building permit is issued:

- typical cross-section showing minimum and maximum heights,
- safety railing where exposed height is 0.6 meters or more,
- method of anchoring safety railing to retaining wall,
- engineering analysis that retaining walls will support earth loads and live loads,
- face of wall design requirement.

This Engineer shall certify that the retaining walls have been constructed in accordance with the accepted plans prior to the release of financial securities.

J4.04 Urban Standard for Private Internal Street

Any internal street shall be designed and constructed to the following minimum standards:

Road Width:

- 6.5 m (face of curb to face of curb)
- 8.5 m (on street parking allowed on one side, F/C to F/C)

Minimum Pavement Design:

- HL3 40 mm

- HL8 50 mm
- Granular 'A' 150 mm
- Granular 'B' 300 mm

The components of the pavement design shall be confirmed by or increased to suit the recommendation of the applicant's Geotechnical Engineer.

Garage:

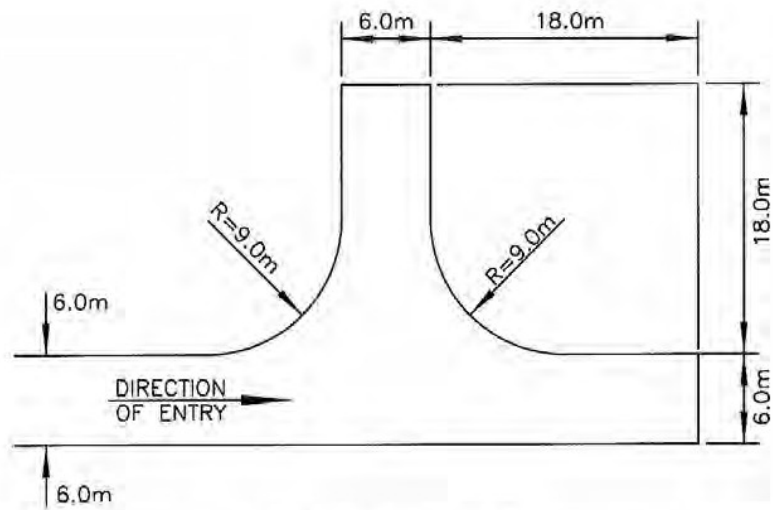
- Up to two garages may be paired together, provided an opening is present for pedestrian access adjacent to the garage on the opposite side of the lot.
- Garage aprons shall not be continuous along the length of the laneway.
- Landscaping shall be provided in line with the pedestrian access opening.
- Garage doors shall open vertically and not swing out beyond the garage structure.

Intersections:

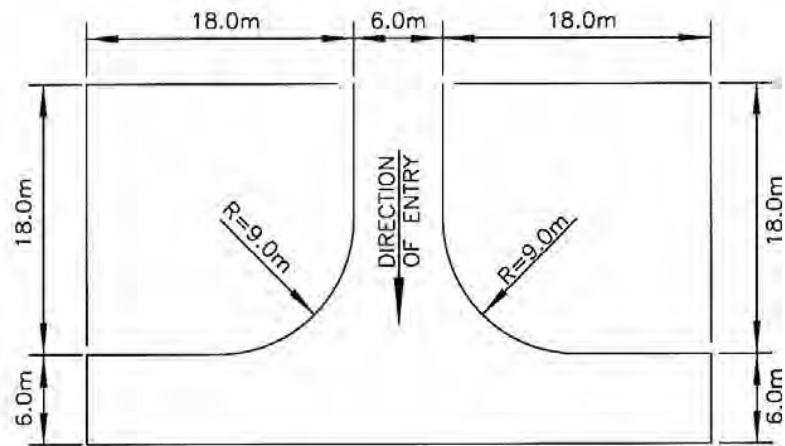
- A minimum of 3.0 m x 3.0 m visibility triangle shall be provided at all intersections. A sightline analysis shall be provided to confirm visibility triangle requirements.
- 9.0 m curb radius shall be provided at all intersections. The radius may be reduced to 7.5 m at intersections with public roads that have a minimum width of 8.5 m.

Cul-de-Sac:

- Private roadways should be designed to connect to other roads at both ends whenever possible.
- Should a cul-de-sac be unavoidable, the maximum length of cul-de-sac shall be 180 m.
- Hammerhead turnaround on a cul-de-sac for emergency vehicles shall be designed with a 9.0 m radius and 18.0 m turning area, refer to Figure 4.1.



SIDE ENTRY



FRONT ENTRY

FIGURE 4.1 SIDE AND FRONT ENTRY TURNAROUNDS

Fire Route Signage:

- Fire Route Signage to be provided as per Town of Pelham By-Law 4084-97, if required. Signage to be permanently fixed to building face or mounted on poles, only on rear laneway.

Miscellaneous:

- Street lighting for the private internal roadway(s) shall comply to the American National Standard Practice for Roadway Lighting, latest edition of RP-08 standard.
- Snow may not be pushed across any public road or placed within the public right of way.
- Snow may not be piled within the travel portion of any cul-de-sac turnaround.
- Adequate sightline shall be provided to the satisfaction of the Town.

J4.05 Private Rear Laneway

Any proposed private rear laneway providing access to the rear of a residential development that has frontage on another public or private street shall be designed and constructed to the following minimum standards:

Geometric Design:

- 7.5 m wide road width (F/C to F/C) for both one and two way operation.
- 2.75 m driveway apron to any sight obstruction.
- 1.0 m boulevard on non-driveway side of laneway, if applicable.
- 2.00% crossfall shall be provided to the curb line.
- The maximum length of a tangent section shall be 60m; otherwise, speed management features shall be incorporated to the satisfaction of the Town.

Parking:

- No Parking is permitted within the 7.5m road width of the laneway.
- Where there is sufficient additional pavement width, parallel or diagonal parking may be added on non-driveway side of any laneway.
- At all laneway access to intersecting roads, no parking is permitted on either side of the intersecting road within 30.0 m of either side of the laneway.

J4.06 Private Fire Hydrant(s)

Private fire hydrants shall be tested and certified to provide a minimum residual pressure at a specified flow rate as determined by the Fire Department's requirements.

Temporary access routes and hydrants, where required, shall be designated and shown on the site plan for use during construction until permanent fire access routes and hydrants are provided.

J5.00 Construction

J5.01 Tiebacks

Tiebacks shall not be permitted within the municipal right-of-way.

In instances where this is unavoidable, the proponent's engineer shall advise the Town as early as possible in the approval process. A written request for encroachment must be submitted, detailing the specific rationale for the exemption.

The following minimum criteria shall apply for any development proposal that includes tiebacks:

1. A Geotechnical Report shall be submitted detailing tieback and shoring Methodology.
2. An assessment letter/report signed and sealed by a qualified Professional Engineer to ensure there will be no anticipated negative impacts to either Municipal or third party utilities within the right-of-way.
3. Tieback and shoring design drawings stamped by a qualified Professional Engineer.
4. Provisions of a reasonable clearance window, both horizontally and vertically (i.e. 2.0m x 2.0m) from all underground utilities within the right-of-way, including utility pole bury depths, etc.
5. No tiebacks shown where the Town has planned future works which might conflict with proposed tiebacks.
6. Letters of Consent from impacted property owners.
7. A Construction & Licensing Agreement shall be registered on title to the subject lands with provision(s) which require the owner to remove, relocate or other upon demand, at the owner's expense. Applicable only when there is encroachment.

J5.02 Restoration Costs

The applicant will be responsible for all costs associated with restoring all areas within the Town of Pelham public road allowance that are disturbed during the construction process. Should restoration not be to the Town's satisfaction, financial securities may be drawn upon to complete the work. Charges for permanent restoration of the public road allowance will apply.

J5.03 Groundwater Pumping

See Section B7.00 for groundwater pumping requirements.

J6.00 Record Drawings

Where works are required within the Municipal right of way (beyond simple service connection), prior to the release of securities, the consultant shall provide the Town of Pelham with acceptable updated “record” plan and profile drawings for the road to be retained on file by the Town.

These drawings are to be submitted to the Town within 4 weeks of the completion of works within the municipal right of way and shall comply with the criteria outlined in Section A7.00 Record Drawings.

The drawings, including storm and sanitary sewer, watermain, and streetlight records, shall be provided in a digital format (AutoCAD file). In isolated cases, at the discretion of the Town, the required information may be accepted in Excel format.

All Storm sewer as-constructed acceptance shall be based on the criteria outlined in Section B5.00 As-Constructed Storm Sewer Requirements.

Where there is a major difference between the design and “record” data, the consultant is required, in writing, to explain the discrepancy and verify that the "record" discrepancy does not adversely affect the intent of the initial design. The final decision regarding deficiency correction or mitigation will be made by the Town.

Section K – Sanitary Waste Collection

K1.00 General

The design and construction of all sanitary sewers and service connections in the Town of Pelham shall be in accordance with this document and/or the latest revisions.

K2.00 Design Requirements

K2.01 Design Flows

Calculation of sewage design flows shall conform to the latest editions of the Regional Municipality of Niagara, Water and Wastewater Project Design Manual, latest version, and the Ontario Ministry of the Environment's "Design Guidelines for Sewage Works".

K3.00 Maintenance Holes

K3.01 General

All maintenance holes are to be supplied or constructed in accordance with OPSD 701 series. It is the designer's responsibility to analyze each application of the standard (i.e., soil conditions, loading, etc.).

In site plan applications, a 'service' maintenance hole, if required, shall be located on private property near the entrance of the service as close as possible to the property line as per the Niagara Regional Sewer Bylaw #2024-51.

K3.02 Purpose

Maintenance holes shall be provided at each change in alignment, grade, pipe material and at all junctions, and at the points of connections of sewer over 200 mm in diameter where the size of connection is equal to or one size smaller than the Town sewer.

K3.03 Spacing

Generally, maintenance holes shall be spaced at:

- a maximum of 100 m for pipe sizes 200 mm diameter to 750 mm diameter;
- a maximum of 120 m for pipe sizes greater than 750 mm diameter.

K3.04 Structures

Maintenance holes shall be constructed of poured or precast concrete as detailed in the OPSD 701 series with watertight connections KOR-N-SEAL type or approved equal.

K3.05 Benching

All sanitary maintenance holes shall be benched as per OPSD 701.021 and be completed to obvert.

K3.06 Diameter

The type and size of maintenance hole shall be specified on the profile and a detail of the benching is to be shown on the plan portion of the engineering drawing. The minimum maintenance hole sizes shall be determined using OPSD 701.021.

K3.07 Access

All maintenance hole chamber openings shall be located parallel to flow direction.

K3.08 Change in the Direction of Flow

The maximum change in the direction of flow in a sanitary sewer maintenance hole shall be 90°. A change of flow direction at acute interior angles shall not be permitted.

K3.09 Drop Across Maintenance Holes

When pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5 m/s, the following allowances shall be made to compensate for hydraulic losses.

	<u>Alignment Change</u>	<u>Drop Required</u>
a)	Straight run	0.03m or grade of sewer
b)	14° < 45°	0.03m
c)	45° to 90°	0.06 m

When the upstream flow velocity exceeds 1.5 m/s or for all junction and transition maintenance holes the drop shall be hydraulically designed.

K3.10 Drop Structures

The maximum drop allowed across a maintenance hole is 0.9 m. If the design of the sewer is such that the difference in elevation between inlet and outlet exceeds 900 mm, a drop structure is then required. The drop structure shall be in accordance with OPSD 1003.010 or 1003.031. The Town prefers to avoid the use of drop structures wherever possible.

K3.11 Safety Grates

Safety grates shall be required in all maintenance holes greater than 5.0 m in depth. Safety grates shall not be more than 5.0 m apart and constructed in accordance with OPSD 404 series.

K3.12 Matching Obverts

Obvert(s) on the upstream side of a maintenance hole shall in no case be lower than obvert(s) on the downstream side of the maintenance hole.

K4.00 Pipe Design and Materials

K4.01 General

The class, type of pipe and type of pipe bedding shall be shown on the profile for each section of sewer and shall be CSA approved.

In general, no decrease of pipe size from a larger size upstream to a smaller size downstream will be allowed regardless of increase in grade.

Pipe bedding and class of pipe shall be designed to suit ultimate loading conditions in accordance with OPS, latest version.

Generally, service connections shall not be permitted to sanitary sewers exceeding 7.60 m in depth. Depth is measured from the final centreline finished road elevation to the top of the sanitary sewer.

K4.02 Sewer Design Capacity

Sewer capacities shall be computed by using Manning's Formula on the basis of sewer pipe flowing full, however the actual flow depth and velocity at the design flow shall also be calculated and taken as the basis for design. Design flows should be in accordance with MECP guidelines (Design Guidelines for Sewage Works 2008).

K4.03 Roughness Coefficients

For all types of pipe, a roughness coefficient of $n = 0.013$ shall be used.

K4.04 Pipe Velocity

All sanitary sewers are to be designed with a minimum full flow velocity of 0.60 m/s and a maximum velocity of 3.0 m/s when flowing full. The minimum slope in the highest, or starting, leg of a sanitary sewer shall have a slope of no less than 1%.

K4.05 Minimum Depth

Depth is measured from the final centreline finished road elevation to the top of the sanitary sewer at standard location.

For residential, commercial and institutional areas, the minimum depth is 2.5 m unless approved by the Town.

In all cases, the proposed sanitary sewers shall be installed at sufficient depth to service lands external to the site as determined by the Town.

K4.06 Clearances

Horizontal and vertical separations between sanitary sewer and watermain shall be in accordance with MECP F-6-1 Guidelines, latest version.

A minimum of 0.25m clearance shall be obtained at storm and utility crossings, using outside pipe diameter.

Sanitary shall also be 0.5m below any crossing, and must be below watermain.

In the event the minimum clearances cannot be obtained, then the pipes at the crossing shall be concrete encased to ensure that the pipes are properly bedded.

K4.07 Location

Sanitary sewers shall be located within the road allowance as shown in Standard Drawings.

If common trenching is required for the storm and sanitary sewer, the Developer's consultant shall prepare special design standards and provide to the Town the specification for such requirements. Any non-standard design for locations will require the prior approval of the Town.

K4.08 Pipe Materials

Sanitary sewer shall be constructed of polyvinyl chloride or concrete pipes.

- a) Polyvinyl Chloride Pipe (PVC) - PVC pipe shall be solid wall manufactured in accordance with the latest revision of CSA B182.1 or B182.2 and green in colour.

The design of sanitary sewer systems using PVC pipe shall be based on the modified Spangler Equation for flexible pipe.

- b) Concrete - Reinforced concrete sewer pipe 300 mm in diameter and larger shall be steel reinforced and shall conform to CSA A257 Specification, and be designated as, Class 50D, 65D, 100D or 140D, as required.

Concrete and PVC pipes shall be jointed by means of approved rubber gaskets.

Note:

For main sewers, the Standard Dimension Ratio (SDR) of the PVC pipe shall not exceed SDR 35.

For service connections, the SDR of the PVC pipe shall not exceed SDR 28.

K5.00 Easement Requirements

The minimum width of easements for pipes shall be determined by the developer's consulting engineer and approved by the Town to account for number of pipes, pipe size, depth, excavation of open cut method and location of proposed building foundations. In no case shall the easement width be less than 3.0 m.

The developer must grant permanent easements for any drainage works which are not within the road allowance, to the Town or respective/impacted neighbouring property and a restriction of use clause shall be registered on title restricting landscaping and fencing activities.

K6.00 Sanitary Sewer Service Connections

All sanitary sewer service connections for single and semi-detached dwellings shall be individual services. The connection to the main sewer shall be made with an approved manufactured tee or approved saddle. In new developments, the service connections shall be installed in accordance with the Town Standard Drawings, terminating at the property line. Under no circumstances will roof water leaders or foundation weepers be permitted to be connected to the sanitary sewer.

K6.01 Pipe Size

- a) Service connections for single-family and semi-detached units shall be 125mm in diameter. Clean-outs shall be placed every 15 meters.
- b) Service connections for multiple family, commercial, and institutional areas are to be sized individually according to the intended use.

K6.02 Depth

The depth of the service connections for single-family units and semi-detached units, at the street line, measured from the final centerline road elevation shall be:

- a) Minimum - 2.50 meters
- b) Maximum - 3.30 meters

Risers shall be used when the invert depth of the sewer main exceeds 4.60 meters. The riser connection shall not exceed 3.0 meters in depth.

K6.03 Velocity and Grade

Minimum low flow velocity 0.60 m/sec

Minimum grade - 125mm dia. 2%

Maximum grade 8%

Minimum grade - 150mm dia. 1%

K6.04 Sanitary Sewer Connections to Multiple Family Blocks

Maintenance hole shall be required to be located either on private property, 1.50 metres from property line to centre of rim, or on the municipal main.

K6.05 Sanitary Sewer Connections to Commercial and Industrial Blocks

A maintenance hole shall be required to be located on private property 1.50 metres from property line to centre of rim.

K6.06 Materials for Sanitary Sewers Service Connections

- a) Sanitary sewer service connections may be constructed using any of the materials suitable for main.
- b) In order to avoid cross connections, all pipe used for residential sanitary laterals shall be the colour green.

K6.07 Location of Service Connections and Cleanouts

Sanitary connections shall be located in accordance with Town Standard Drawings. Clean out spacing shall not exceed 15m, where applicable, on Town property. For institutional and commercial properties, or as per Town request, a cleanout shall be provided at the property line, and the Regional Sewer by-law requirements also applies.

K6.08 Construction

Construction of all sanitary sewers and service connections shall be in accordance with the Niagara Peninsula Contract Documents.

K6.09 Sanitary Forcemains and Siphons

Forcemains and siphons are strongly discouraged and will only be considered in exceptional circumstances when no other feasible option exists, including pumping stations. Any proposed use must be supported by a functional report prepared by a consulting engineer with significant experience in the design of such systems.

The functional report is to be provided as part of the ECA Application Process to ensure compliance with the Towns CLI ECA requirements.

Section L – Drinking Water Distribution

L1.00 General

Infrastructure projects, including but not limited to the installation and repair of sewers and roadways, may necessitate the shutdown, disconnection, or reconnection of watermain. It is essential that these operations are overseen by a certified operator employed by the Town of Pelham, with all necessary precautions taken to prevent contamination of the drinking water system.

Departments and contractors engaged in capital projects, repairs, or any activities involving the operation of any component of the drinking water system must ensure that certified Town of Pelham personnel are present and on-site throughout the process.

All materials used shall meet specified requirements or be deemed equivalent by the Contract Administrator. **The use of lead or lead composite components is strictly prohibited.** All waterworks materials must comply with current AWWA quality standards and carry American National Standard ANSI/NSF Standard 61 no-lead certification for waterworks products.

Construction of watermain, appurtenances, and service connections within the Town of Pelham shall adhere to the latest Ontario Provincial Standard Specifications (OPSS) and Standard Drawings (OPSD), American Water Works Association (AWWA) Standards, Niagara Peninsula Standard Contract Documents, or modifications as stipulated herein. All materials must be as specified or approved as equivalent by the Town.

Determination of the watermain design and design flows will be prepared in accordance with MECP Guidelines:

- The maximum working pressure shall not exceed 690 kPa (100 psi). Pressure-reducing valves are required where localized areas exceed 690 kPa.
- The minimum working pressure shall not fall below 275 kPa (40 psi) under normal operating conditions nor fall below 150 kPa (22 psi) under fire flow and maximum day conditions. The water flow must support a minimum 'Bluetop Hydrant' with 5,675 lpm or 95 l/s (1,500 gpm) at 150 kPa. Any hydrant less than 5,675 lpm (1,500 gpm) must be approved by the Fire Chief and Director of Public Works.
- For new systems or for major upgrades, a minimum design flow of 80 L/s must be used.
- For new development adding 4 or more residential units, increases building height or should sub-standard flow or pressure be anticipated, a water distribution analysis may be required on the system. The result of such analysis, complete with drawings and calculations, shall be submitted to the Engineering Department for review and approval.
- Sizing a water distribution system shall be based on a uniform Pipe Friction Factor of 130 for any pipe size or pipe type. Field tests shall be made when calibrating the model of an existing system.

- Average consumption shall be based on Table 1.00 Unit Consumption Rates.

Table 1.00 Unit Consumption Rates		
Domestic	Average Day Maximum Day Peak Rate	320 lpcd 570 lpcd 860 lpcd
Fire Demand	Fire flow should be considered in accordance with the Insurer's Advisory Organization's (formerly Canadian Underwriters Association) requirements.	

L2.00 Hydraulic Design

L2.01 System Pressures

The maximum sustained operating pressures shall not exceed 690 kPa (100 psi). Where the pressures in localized areas are above this level, pressure-reducing valves shall be installed.

The distribution system shall be sized to meet normal peak demands. Under conditions of simultaneous maximum day and fire flow demands, the pressure shall not drop below 140 kPa (20 psi). Under normal operating conditions, the pressure shall not drop below 275 kPa (40 psi).

The Town may require the consulting engineer to verify that the existing distribution system is sufficient to supply the system pressure design requirement to the development. This includes new development and buildings that exceed three storeys. The Developer is responsible for all associated costs for verifying the above.

All watermains shall be designed to withstand a maximum design pressure of 1,035 kPa (150 psi) regardless of the working pressure in the system or the rating necessary to meet the structural requirements of the trench condition. (Design Pressure = maximum sustained internal hydrostatic pressure to which the pipe is to be subjected, excluding transient pressures.)

L2.02 Friction Factors

The following "C" values shall be used for the design of water distribution systems regardless of pipe materials:

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

The above C factors represent long-term values. A C factor of 130 shall be used to calculate maximum velocities for transient pressure estimations and for checking pump motor sizes for run-out conditions.

L3.00 Pipe Requirements

L3.01 Sizes

Sizes and looping of watermains will be determined at the preliminary stage of development. The following are the minimum size requirements.

a) Residential Areas

The minimum size for watermains shall be 150 mm in diameter, except beyond the last hydrant on cul-de-sacs, where a smaller diameter pipe may be used, designed for domestic and maximum hourly demands only.

b) Commercial and Institutional Areas

Sized according to anticipated demand for commercial and institutional developments.

The distribution system shall be designed to eliminate dead-end sections. Where dead-ends cannot be avoided, with the prior approval of the Town, they shall be provided with a fire hydrant or flushing hydrant.

Water distribution systems shall be designed so that no more than eighty (80) units with individual water services and meters shall be serviced from a single source of supply. If the looped watermain is connected to a single watermain, a valve must be installed in the watermain to permit isolation of supplies.

L3.02 Depth of Cover

The minimum depth of cover to watermains should not be less than the depth of frost penetration.

Generally, the depth cover shall not be less than 1.70 m measured in a vertical plane above the pipe from the top of the pipe to the finished ground elevation.

It will be the responsibility of the Consulting Engineer to justify any reduction in the depth of cover less than 1.70 m by submitting a report outlining the reasons for the reduction and alternative frost protection measures to be taken. Frost protection measures should include

the installation of a minimum of 50mm rigid foam insulation at least 0.6m wide, running along the length of the affected area. Spray foam insulation may also be considered by the Town. The design shall be in accordance with Niagara Peninsula Standard Contract Document, Special Provisions Contract Items, Watermain.

L3.03 Separation between Watermains and Sewers

Vertical Separation

Under normal conditions, watermains shall be installed above sewers with sufficient vertical separation to allow for proper bedding and structural support of both the watermain and the sewer main. As a minimum, the vertical separation between the crown of the sewer and the invert of the watermain should be 0.3m, with an absolute minimum of 0.15m.

When it is not possible for the watermain to cross above the sewer, the watermain shall be protected as follows:

- a) A vertical separation of at least 0.5m shall be provided between the invert of the sewer and the crown of the watermain.
- b) The sewer and watermain shall be adequately supported to prevent excessive deflection of joints and settings.
- c) The length of watermain shall be centred at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

Separation of Watermain and Sewers - Special Conditions

Under unusual conditions, where it is anticipated that severe dewatering problems will occur, or where congestion with other utilities will prevent a clear horizontal separation of 2.50 metres, a watermain may be laid closer to a sewer, provided that the elevation of the crown of the sewer is at least 0.50 metre below the invert of the watermain. Such separation shall be in-situ material or compacted backfill. Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to watermain standards of construction and shall be pressure tested to assure water tightness.

Horizontal Separation

Under normal conditions, watermains shall be laid with a horizontal separation of at least 2.50 metres from any sewer. The distance shall be measured from the nearest edges.

Utility Crossings

Where watermains cross over or under utilities other than sewers, the clearance and type of crossing provided shall conform to the requirements of the particular utility involved and provide proper bedding and structural support of the watermain and utility. Generally, where watermains cross over utilities, a 0.3m minimum clearance shall be provided, and where watermains cross under utilities, a 0.5m minimum clearance shall be provided.

L4.00 Materials

The following materials may be used for watermains:

- Polyvinyl Chloride (PVC) can be used for sizes up to 600mm diameter when installed under roadways. In other locations, this limit may be extended to 900mm diameter upon approval of the Town.
- Reinforced Concrete Pressure Pipe (RCPP) can be used for sizes 400mm and greater.

All pipe material and associated appurtenances must meet current American Water Works Association (AWWA) specifications and Ontario Provincial Specifications (OPSS). All watermain fittings, pipe and fixtures are to be “lead free” and shall comply with NSF/ANSI Standard 61: Drinking Water System Components – Health Effects (2007 as amended). All fittings must be certified as compliant by an industry-recognized and accredited third party, in accordance with the requirements of NSF/ANSI 61.

Allowable pipe material shall be 100mm – 400mm (4” – 16”) DR18 PVC conforming to AWWA C900 or approved equivalent. For Site Plan applications, the pipe material shall be in accordance with the Ontario Building Code and acceptable to the Chief Building Official.

L5.00 Tracer Wire

Watermain and Water Service Tracer Wire Specifications (refer to OPSD Standard Drawings)

General

All watermains shall include the installation of a continuous 10-gauge insulated wire, properly taped and fastened onto the pipe. All hydrants shall include the installation of a continuous 10-gauge wire connected to the wire at the watermain and brought to the surface along the hydrant lead and through the conduit at the hydrant, where it is to be connected to the next tracer wire length or connected to the hydrant flange bolts.

If unable to trace, the property must have a pit at the property line for staff to be able to access the location of the water service.

L6.00 Cathodic Protection

Zinc Anode DZP-1100-24 anodes to be used at each hydrant, multiple fittings (up to 3) and on cast iron and ductile iron pipe where connections are made to the watermain.

Zinc Anode DZP-550-12 anodes to be used at each fitting (bend, reducer, cross, tee) and each water service.

L7.00 Thrust Restraints

Thrust restraints are to be mechanical joint type:

- EBAA Iron Series 2000 PV
- Uni-Flange Series 1300
- Megalug
- Grip Ring Pipe Couplings
- Safety factor 2:1
- High strength ductile iron per ASTM A536, Grade 65-45-12 and ASTM 536-80
- Bolts and connecting hardware to be high-strength low-alloy per ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53. Per Uni-B-13-92, recommended Performance Specification for Joint Restraint Devices for use with PVC pipe.

Hydrants shall be equipped with both mechanical thrust restraints and thrust blocks, where allowed by the hydrant manufacturer.

L8.00 Valves

Line Valves

Gate valves shall be used on all watermains 350 mm in diameter or less in size.

All valves shall be of the approved type with a non-rising stem and a 20 mm square operating nut opening counterclockwise.

Sizes

Sizes of line valves shall be the same size as the watermain.

Number, Location and Spacing

Generally, a minimum of three valves is required at a tee intersection, and a minimum of four valves is required at a cross intersection.

Line valves shall be located with spacing approximately every 2 hydrants, and in no case shall the spacing exceed 300 m. Line valves on feeder mains shall be located in accordance with existing and future servicing requirements. The maximum distance between valves shall not exceed 750 m.

Air Release Valves

An attempt shall be made to locate hydrants at high points or at dead ends, thereby eliminating the need for vacuum-air relief valves and/or blow-offs.

Drain Valves

Drain valves shall be located at the low points of all watermains with a diameter of 600 mm or greater.

Valve Boxes and Chambers

All valves with a diameter of 350 mm or smaller shall have valve boxes, and specified direct-bury operators shall be used.

All valves with a diameter of 400 mm or larger shall be installed in valve chambers.

The tops of valve boxes and valve chamber maintenance hole covers shall be set flush with the finished grade. The top of the roof slab of valve chambers shall be at least 0.60 m below the profile of the finished pavement.

Chambers containing valves, blow-offs, meters or other such appurtenances to a distribution system shall not be connected directly to any sanitary or combined sewer, nor shall blow-offs or air-relief valves be connected directly to any such sewer.

To minimize the total number of chambers on any project, and to avoid intersections, care should be exercised in locating the line valves, air reliefs, drains, etc., with a view to combining these functions in a single chamber.

All connections through chamber walls shall be sealed with hydraulic cement.

Valve chambers must conform to OPSD 1101 Series.

Fittings

All pipe material and associated appurtenances must meet current American Water Works Association (AWWA) specifications and Ontario Provincial Specifications (OPSS). All watermain fittings, pipe and fixtures are to be “lead free” and shall comply with NSF/ANSI Standard 61: Drinking Water System Components – Health Effects (2007 as amended). All fittings must be certified as compliant by an industry recognized and accredited third party per the requirements of NSF/ANSI 61.

L9.00 Fire Hydrants

General

Fire protection for institutional and commercial development shall be reviewed upon application.

Hydrants

Hydrant installation shall be located at the extension of the side lot line, away from the driveway.

Number and Spacing

Hydrants shall be installed on all watermains 150 mm diameter and larger in accordance with the MECP Guidelines for the Design of Water Distribution Systems and/or with the following maximum allowable spacing:

- a) 150 m in residential areas, measured along the watermain or to provide for a maximum hose length of 75 m.
- b) 75 m in industrial and commercial areas measured along the watermain to provide for a maximum hose length of 37.5 m.
- c) 300 m in rural areas where applicable.

All hydrants, when installed in new subdivisions, shall have a clearance of at least one (1) metre away from any boulevard apron so as not to cause any conflict with ingress and egress of driveway access.

Branch Valves and Boxes

All hydrants installed on water mains shall be equipped with a 150 mm diameter anchor tee, secondary valve, and box.

Hydrant Types

Where hydrants do not conform to the finished ground grade, the proper length extension will be inserted either at the drain ring flange before backfilling or the ground line flange with proper rod extension. The extension must be installed in strict accordance with the manufacturer's specifications.

Should the hydrant require a shorter barrel due to a necessary grade change in the main, the proper length barrel will be installed before backfilling the hydrant trench.

Hydrant specifications:

- Hydrants shall be self-draining (unless otherwise specified), steamer port, 150mm branch valve and box, approved type.
- Manufactured in accordance with AWWA Standard C502, be of break flag traffic model type, and present a low profile with a modern design exterior;
- Depth of bury: 1.8m (6');
- Boot: to be epoxy coated internally and externally, 150mm (6") diameter mechanical joint;
- Colour: yellow with reflectors and caps or as approved;
- Boot to bottom flange with stainless steel bolts;
- Dry barrel, shall be epoxy coated in compliance with AWWA Standard C502;
- Pumper nozzle designation "SD" or 33B, thread detail 5-3/4 O.D. x 4.

- Drain ring bolts and nuts: stainless steel type 304
- Hydrant shall include pumper nozzle Storz connection

Secondary Valve Specifications:

- Opening size: 150 mm (6") diameter
- Joint: mechanical

Tee off watermain shall be anchor type. Secondary valve shall be bolted to the anchor tee. All piping required (from tee to valve to hydrant) shall be Class 150 PVC. Hydrant lead shall be less than 5.5m unless otherwise approved by the Town.

L10.00 Water Sampling Station

Placement of any water sampling stations shall be as approved by the Town. Placement of water sampling stations within any new development or watermain rehabilitation project will be determined by the Town and shall be based on establishing the most optimal water quality monitoring program.

The location and timing of installation are dependent on the most strategic location that will provide water quality data to efficiently monitor the distribution system based on the surrounding sampling stations. Consultation with the Town will be required for determining the need and location.

L11.00 Bedding, Cover Material and Backfill

Requirements of the Niagara Peninsula Contract Documents shall apply.

Backfill in roads and driveways shall be Granular A materials. Select native material, compacted to 100% SPD, can only be used at the Town's discretion, which may require Geotechnical input.

L12.00 Corrosion Protection

Requirements of the Niagara Peninsula Contract Documents shall apply.

L13.00 Concrete Blocking and Anchoring

All valves and fittings shall be supported independently with concrete blocking and anchoring so that vertical and thrust loads are not transmitted to connected pipes.

All concrete support (OPSD 1103.010 and 1103.020) shall be manufactured using Type 20 Portland cement, poured against undisturbed ground with bond-breaker provided against all pipe, joints, valves, bolts and fittings. It shall be the Contractor's responsibility to ensure that

all ground is suitable for pipe, valves and fittings support and shall bring to the Contract Administrator's attention any possible unsuitable conditions.

L14.00 Backflow Prevention

There shall be no physical connection between a public and a private potable water supply system, nor between either a water system and a sewer or appurtenance thereto, which would permit the passage of private water or any sewage or polluted water into the potable public supply. In addition, no pipe, valve or fitting which has been exposed to raw sewage shall thereafter be included in a potable water system, either temporarily or permanently.

L15.00 Water Service Connection

General

In new developments, the service connections shall be installed in accordance with the Standard Drawings, terminating at the property line. Curb stops shall be located at the property line.

It is recommended that the designer determine the water service sizing based on flow requirements for water services which service single family homes which are estate lots, larger homes, have deep setbacks or where automatic lawn sprinkler systems or fire sprinkler systems are to be used.

Each dwelling unit in a detached, semi-detached, townhouse or row house block, must be serviced with a separate water service connected to a watermain or private watermain. Water services must front the dwelling unit they service unless otherwise approved in writing by Public Works.

Each dwelling unit in a private block of condominium must be serviced with a separate water service connected to a private watermain. Water services must front the dwelling unit they service. Bulk metering of the site at the point(s) where the water service enters the property will be required. Individual metering of dwelling units by the Town will not be provided.

All unutilized services shall be removed or abandoned, plugged at the main with the valve or service box removed.

Installation of watermain stubs, or pre-servicing for future development, should be avoided unless confirmation can be made stating that these undeveloped lands will be developed in the near future, complete with an approved site plan.

Service Pipe Size

- The minimum size for service connections shall be 25 mm in diameter.
- Service connections for multiple family dwellings shall be sized to provide capacity equivalent to a 25 mm diameter connection to each dwelling unit.

- Service connections for blocks, commercial and industrial areas shall be sized according to the intended use and fire flow.
- Greenhouse or agricultural connections maximum size is 25mm.

Service Materials

Water service connections with a diameter of 50mm or less shall be of type "K" soft copper. Water service connections larger than 50mm diameter shall be in accordance with **Section 5.3**.

Service Location

Water service connections shall not be located under a driveway, if possible. The location of water service connections for single-family and semi-detached lots shall be in accordance with the house style as specified in the **Standard Drawings**.

Every effort shall be made to minimize the number of elbows, tees, valves, fittings, and other obstructions in the piping system, while minimizing the number and size of bends and simplifying the layout as much as possible.

Service Depth

Curb and Gutter Roads – Water service connections shall be installed a minimum of 1.70 m below the finished centreline road grade.

Open Ditch and Unimproved Roads – in no case shall the cover of the water service connection be less than 1.70 m.

Depth at the property line shall not be less than 1.7m minimum.

Service Mainstops

All domestic water service connections shall have mainstops installed at the watermain equal to the water service connection diameter.

Mainstops shall be the same size as the service line, bronze, round way. All mainstops consisting of or containing bronze or brass material must conform to AWWA Standard C800-05 and be ANSI/NSF61 compliant, with “LF” stamp clearly shown or appropriate documents available for inspection.

For 25 mm diameter:

- service saddle is required.
- tapping must not exceed 15° from horizontal centre line of main.

For sizes 38 mm diameter and 50 mm diameter:

- service saddle is required;
- must be tapped at horizontal to centre line of main;
- AWWA standard thread inlet and female iron pipe thread outlet;
- Plastic pipe to iron coupling or adaptor.

Service Curb Stops and Boxes

All service connections shall have curb stops and boxes installed at the property line or an approved location.

Curb stops are not to be located within the residential driveway unless approved by the Town; this reduces maintenance impacts on driveways, where the Town will only replace any excavated areas with asphalt or sod should a repair be required.

The curb valve must be compatible (same size) with the service.

All curb stops on the open end must be protected with a plastic cap or plug.

Curb valve to be compatible (same size) as the new service:

- bronze type shall be “0” ring type with both ends compression
- ball-type valve only.

All curb stops on the open end must be protected with a plastic cap or plug. All curb stops consisting of or containing bronze or brass material must conform to AWWA Standard C800-05 and be ANSI/NSF61 compliant, with “LF” stamp clearly shown or appropriate documents available for inspection.

Curb boxes are to be the extension type with a regular ribbed cover marked “WATER”, a hexagon plug, a 0.9m minimum height stainless steel operating rod, a stainless-steel cotter pin and suitable for a 1.5m (5') to 1.8m (6') trench.

For 25mm (1”) curb stops, the curb box, Series D1 Style #8.

For 38mm (1½”) and 50mm (2”) curb stops, the curb box, Series D-2 Style #8.

Tapping Sleeves for Services

All sleeves are to be stainless steel or epoxy-coated, both externally and internally, complete with stainless steel bolts.

All tapping sleeves shall be Robar 6606 stainless steel tapping sleeves with T 304 stainless steel bolts or approved equivalent for C.I., A.C. and PVC pipe. Sizes 100mm (4”) - 400mm (16”) I.D.

Service Saddles

Any residential services installed on a PVC watermain will require the use of an approved service saddle. Service saddles are required for all services connected to concrete pressure pipe manufactured to the latest edition of AWWA C301 and AWWA C303 specifications for all tap sizes.

Coupling and Adaptors - Services

All couplings and adaptors shall be as follows:

- a) For PE Tubing - Bronze with one piece combination nut and tail, compression type with stainless steel insert (heat flaring of tubing is not allowed).
- b) For PVC pipe: Bronze, brass or PVC with spigot, bell compression joint or iron pipe thread ends or any combination of these:
 - Bell to Bell - Johns-Manville PVC double bell coupling
 - Bell to Male Iron Pipe - Johns-Manville PVC male adaptor (threaded)
 - Spigot to Male Iron Pipe - 200mm (8") long schedule 80 grade 1 type 1
 - PVC. nipple, one end with standard iron pipe thread, other bevelled 8° x 3/8".

Compression joints for 38mm and 50mm (1½" and 2") PVC, I.P. size is acceptable in the following fittings: curb stops, PVC to PVC compression couplings, PVC to I.P. male couplings, and PVC to I.P. female couplings.

Note: Couplings and adaptors employing heat fusion on PE tubing or solvent weld on PVC pipe may only be used if factory-made. All couplings and adaptors consisting of or containing bronze or brass material must conform to AWWA Standard C800-05 and ANSI/NSF61 compliant.

Pipe Fittings and Nipples - Services

All pipe fittings and nipples must be brass, bronze, PVC or stainless steel as follows:

Fittings

- screwed PVC, Grade 1 type 1, schedule 80
- bronze with one piece combination nut and tail, compression type joint with stainless steel insert, Class 160
- bell and spigot joint PVC, class 160

Threaded Nipples

- PVC, grade 1 type 1, schedule 80

NOTE: Cast bronze solder fittings are not acceptable. Teflon pipe thread tape must be used on all threaded PVC joints.

All pipe fittings and nipples consisting or containing bronze or brass material must conform to AWWA Standard C800-05 and ANSI/NSF61 compliant.

Metering Pit / Chamber - Services

To be installed and located immediately inside the property line, shutoff valves for isolation. If the service is greater than 50m, a pit or chamber may be required.

Service Connections Outside Urban Boundary

1. Dedicated service connections for irrigation, spray mixing, hauling or filling shall not be permitted.
2. The maximum service length shall be 60 metres as measured from the property line to the building wall.
3. The maximum service sizes shall be as follows:
 - Single Detached Residential Dwellings - 25mm diameter
 - Multiple Unit Residential, Commercial, Institutional and Industrial Buildings – 100mm
 - Greenhouses and Other Agricultural Buildings – 50mm
4. Service lengths in excess of 30 metres shall only be allowed where an engineered design to the satisfaction of the Director of Public Works & Utilities demonstrates a residual pressure of 275 KPa under normal operating conditions and 140 Kpa under fire flow conditions can be maintained without mechanical aid.
5. The proponent shall provide all necessary testing, engineering calculations, design details and any other information as deemed necessary by the Director of Public Works & Utilities to assess a potential connection.

L16.00 Water Service Installation

Requirements of the Niagara Peninsula Contract Documents shall apply.

All exposed foundation cracks are to be caulked or grouted in addition to the entrance hole for the service entering the building, where applicable.

L17.00 Water Meters

Each municipal address shall have its own meter, and fire lines shall be metered. Water meters must be installed in all buildings prior to occupancy. Water meters must be purchased from the Town.

L18.00 Fire Lines

In general, private fire lines may be allowed connection to the municipal system subject to the following criteria:

- a) Properties requesting fire lines must have frontage on the watermain to which they are requesting connection.
- b) Within the urban areas, fire lines will be allowed to new developments and redevelopments, including residential, commercial, institutional and industrial.
- c) Outside of identified urban areas, fire lines will only be permitted to existing commercial, institutional or industrial operations or similar redevelopments.
- d) All technical details, inspection and testing pertaining to the design, construction and commissioning of the fire line shall be to the satisfaction of the Director of Public Works and the Fire Chief.
- e) In addition to the above, the proponent must obtain the necessary permit from the Public Works Department, which outlines additional restrictions on use, maintenance reporting requirements, fees, etc.

Section M – Fire Access and Emergency – Special Notes

M1.00 Emergency/Fire Access

- a) Minimum clear width of 6.5 m excluding on-street parking widths. A minimum travel width of 3.25 shall be provided to the satisfaction of the Fire Department.
- b) Centreline turning radius of no less than 12m
- c) Overhead clearance of 5m
- d) Maximum grade 8% (12.5:1) over 15m
- e) Designed to support the weight of all Emergency Response Vehicles
- f) Cul-de-sacs exceeding 90m in length shall provide an adequate turnaround facility

M2.00 Turnarounds

If the construction of the development is phased or abuts future development land, an adequate turnaround facility (such as a hammerhead or cul-de-sac) for fire vehicles at the applicable phase shall be provided, and the details shall be submitted in the Plan of Subdivision.

The Municipality shall determine, at its sole discretion, whether it will require ownership or a temporary easement for the turnaround.

M3.00 Firebreak Lots

The lots in a Plan of Subdivision shall indicate the location of designated firebreak lots. Lots shall be designated by the developer, and the final layout approved by the Fire Chief.

N.B. No building permit shall be issued for designated firebreak lots until such time as the exterior finish cladding, roofing and windows on the buildings abutting the said designated firebreak lots have been completed, unless otherwise approved in writing by the Fire Chief.

In addition, prior to receiving a conditional permit for the construction of a model home, there shall be adequate access to the property for the purpose of fire suppression, together with an adequate water supply for fire suppression, as may be determined in the sole and absolute discretion of the Fire Chief and Chief Building Official.

M4.00 Single Access Routes

A development with only one roadway as an access point and exceeding 90m in length shall have all units in the development sprinklered as per NFPA 13, 13R, or 13D, depending on

building classification. Designs shall meet or exceed this standard and shall be approved by the Chief Fire Official.

Section N – Environmental Compliance Approvals

N1.00 General

Environmental Compliance Approvals within the Town of Pelham pertain to all alterations, additions or modifications to the Sanitary Collection System, Stormwater Management System and Drinking Water Distribution System. This section is intended to provide guidance to designers and applicants when preparing to submit an application for approval from the Town. Designers are encouraged to discuss their design plans with the Town if they have questions regarding compliance requirements, so that all efforts can be productive.

Any Ministry of Environment, Conservation and Parks (MECP) compliance forms (Form 1 or 2, SS1, SS2, A1, SW1 and SW2) that are being used must have Part 1-3 completed **prior** to applying to the Town of Pelham. The Applicant **must** then receive Part 4 (Verification from Owner) prior to any construction commencing on any of the below-listed linear infrastructure systems.

N2.00 Drinking Water Distribution System

N2.01 General

The Town of Pelham owns and operates the Pelham Drinking Water Distribution System. The Pelham Drinking Water Distribution System consists of all municipal water mains, water services, fire hydrants, valves, water meters, and several pressure-reducing valves (PRVs).

For more specific design requirements, please refer to Section L - Water Distribution System.

N2.02 Purpose

Alterations within the Town of Pelham Drinking Water Distribution System fall under one of two forms. *Form 1 – Watermain Addition, Modifications, Replacements and Extensions* or *Form 2 – Minor Modification to the Drinking Water System*.

The Form 1 application is designed to ensure that the Town of Pelham, as the Owner, has verified in writing the alterations, modifications, replacements, or extensions to the Pelham Drinking Water Distribution System. These alterations are then communicated to the Ministry of Conservation, Environment and Parks to ensure the Town remains in compliance with its Drinking Water Works Permit (DWWP).

The design of the watermain addition, modification, replacement or extension includes but is not limited to:

- a) Has been prepared by a licensed engineering practitioner;

- b) Has been designed only to transmit water and has not been designed to treat water;
- c) Satisfied the design criteria set out in the Ministry publication “Watermain Design Criteria for Future Alterations Authorized under a Drinking Water Works Permit – June 2012”, as amended from time to time; and
- d) Is consistent with or otherwise addresses the design objectives contained within the Ministry publication “Design Guidelines for Drinking Water Systems, 2008”, as amended from time to time.

The full *Town of Pelham Drinking Water Works Permit 072-101* can be found on the Town of Pelham website.

Water Main Alteration

Documents required for submission of Alteration of Drinking Water Distribution System:

- Form 1 – Record of Watermains Authorized as a Future Alteration
- Town of Pelham Drinking Water Distribution System Alteration Application Form
- Plan and profile drawing stamped by a Professional Engineer

Minor Modification or Replacements to the Drinking Water Distribution System

Documents required for submission of Minor Modification or Replacement to the Drinking Water Distribution System:

- Form 2 – Record of Minor Modification or Replacement to the Drinking Water System
- Town of Pelham Drinking Water Distribution System Alteration Application Form
- Plan and profile drawing stamped by a Professional Engineer.

For a PDF of the Town’s full Drinking Water Works Permit (DWWP), please request it from the Environmental Compliance Analyst. Alternatively, the most up-to-date version can be found on the Town of Pelham website.

N3.00 Sanitary Collection System

N3.01 General

The Town of Pelham owns and operates the Town of Pelham Sanitary Collection System. This system comprises a gravity sanitary main, force mains, and system apparatus, all of which contribute to the Welland Wastewater Treatment Plant.

For more specific design requirements, please refer to Section K – Sanitary Waste Collection System

N3.02 Purpose

Wastewater (Sanitary) Infrastructure Alteration Projects – Additions, Modifications, Replacements and Extensions as defined under CLI ECA 072-W601

- Alterations for Separate Sewers, Nominally Separate Sewers and Forcemains
- Alterations for Combined Sewers, Partially Separated Sewers and Combined Sewage Storage Tanks and Structures
- Alterations to Components for the Municipal Sewage Collection System
- Alterations to Equipment with Emissions to the Air

According to *Schedule D, Section 4.0*, the following alterations have specific requirements that must be met to comply with the Town of Pelham's *CLI ECA 072-W601*.

All designs of the addition, modification, replacement or extension:

- a) Has been prepared by a Licensed Engineering Practitioner;
- b) Has been designed only to collect and transmit Sewage and has not been designed to treat Sewage;
- c) Satisfies the Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alteration Authorized under an Environmental Compliance Approval amended from time to time or any municipal criteria that have been established that exceed the minimum requirements set out in the Design Criteria.
- d) Includes design considerations to protect sources of drinking water, including those set out in the Standard Operating Policy for Sewage Works, and any applicable local Source Protection Plan policies.

Sanitary Pumping Station

Requirements for adding a new Sewage Pumping Station to the Town of Pelham Sanitary Collection System.

- a) Are designed to transmit a Peak Hourly Flow of no greater than 30L/s;
- b) Include emergency stand-by power, Spill containment, and emergency alarms (SCADA, if applicable);
- c) Include emergency storage designed to provide at a minimum two (2) hours of response time at peak design flow;
- d) Include odour and corrosion control, as applicable;
- e) Would serve a new residential development (or new phased residential development), which may include existing residential development that has no Combined or Partially Separated Sewers;
- f) Are designed to only collect sanitary Sewage and not Stormwater; and

- g) Do not include an emergency sanitary overflow or piping to a municipal Stormwater management system or a natural receiver to prevent the discharge to the Natural Environment.

Documents required for submission to a Sanitary Pumping Station:

- Form SS1 – Record of Future Alteration Authorized for Separate Sewers/Nominally Separate Sewers/Forcemains
- Form SS2 – Record of Future Alteration Authorized for Components of the Municipal Sewage Collection System
- Form A1 – Record of Future Alteration Authorized for Equipment Discharging a Contaminant of Concern to the Atmosphere from a Municipal Sewage Collection System
- Town of Pelham Sanitary Collection System Alteration Application Form
- Plan and Profile Drawings stamped by a Professional Engineer

Upon assumption by the Town, the Operations and Maintenance Manual(s), inspection and maintenance records must be provided to the Town of Pelham.

Sanitary Sewer Mains

Documents required for submission of Alterations of Sanitary Sewer Mains

- Form SS1 – Record of Future Alteration Authorized for Separate Sewers/Nominally Separated Sewers/Forcemains
- Town of Pelham Sanitary Collection System Alteration Application Form
- Plan and profile drawings stamped by a Professional Engineer

Forcemains

Forcemains shall not have a nominal diameter greater than 350mm.

Documents required for submission of Alterations of Sanitary Sewer Mains

- Form SS1 – Record of Future Alteration Authorized for Separate Sewers/Nominally Separated Sewers/Forcemains
- Town of Pelham Sanitary Collection System Alteration Application Form
- Plan and Profile Drawings stamped by a Professional Engineer

Upon the Town's assumption of any forcemain, the inspection and maintenance records must be provided to the Town of Pelham.

For a PDF of the Town's full Sanitary Collection System CLI ECA, please request it from the Environmental Compliance Analyst. Alternatively, the most up-to-date version can be found on the Town of Pelham website.

N4.00 Stormwater Management System

N4.01 General

The Town of Pelham owns, operates and maintains the Town of Pelham Stormwater Management System. The Stormwater Management System consists of gravity storm sewers, stormwater management facilities (SWM ponds and channels), and low-impact development infiltration trenches and system apparatuses.

For more specific design requirements, please refer to Section B – Storm Design and Stormwater Management.

N4.02 Purpose

Stormwater Infrastructure Alterations Projects – Additions, Modifications, Replacements and Extensions as defined under CLI-ECA 072-S701

- Alterations to Storm Sewers, Ditches or Culverts
- Alterations to Stormwater Management Facilities
- Alterations for Third Pipe Collection Systems

According to *Schedule D, Section 3.0*, alterations authorized under the CLI ECA 072-S701 are limited to stormwater works comprising the authorized system, which does not include municipally or Privately Owned Stormwater works:

- a) On industrial, commercial, or institutional land;
- b) Servicing a single parcel of land, unless the stormwater management facility is located on a municipally owned park or community center;
- c) Those that are operated as waste disposal sites defined under the EPA or snow dump/melt facilities, or
- d) That proposes to collect, store, treat, or discharge stormwater containing substances or pollutants (other than Total Suspended Solids, or oil and grease) detrimental to the environment or human health.

Storm Sewer Main

According to *Schedule D, Section 4.0*, alterations to the storm sewers within the authorized system are subject to the following conditions within the design:

- a) Has been prepared by a Licensed Engineering Practitioner;
- b) Has been designed only to collect and transmit Stormwater;
- c) Has not been designed to collect or treat any sanitary sewage;

- d) Has not been designed to collect, store, treat, control or manage groundwater, unless for the purposes of foundation drains, road subdrains, or LIDs;
- e) Satisfies the Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alteration Authorized under an Environmental Compliance Approval, amended from time to time any municipal criteria that have been established that exceed the minimum requirements set out in the Design Criteria;
- f) Satisfies the standards set out in Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard Drawing (OPSD), as applicable for ditches and culverts;
- g) Is consistent with or otherwise addresses the design objectives contained within the Design Guidelines for Sewage Works;
- h) Is planned, designed, and built to be consistent with the Stormwater Management Planning and Design Guidance Manual. If there is a conflict with Appendix A of this Approval, then Appendix A shall prevail; and
- i) Includes design considerations to protect sources of drinking water, including those set out in the Standard Operating Policy for Sewage Works, and any applicable local Source Protection Plan policies.

Documents required for submission of the addition, modification, replacement or extension of the Stormwater Management Sewers:

- SW1 – Record of Future Alteration Authorized for Storm Sewers/Ditches/Culverts
- Town of Pelham Stormwater Management System Alteration Application Form
- Plan and profile drawings stamped by a Professional Engineer.

Upon assumption by the Town, the Operations and Maintenance Manual(s), inspection, and maintenance records must be provided to the Town of Pelham.

Stormwater Management Facilities

According to Schedule D, Section 5.2, alterations to the stormwater management facilities within the authorized system are subject to the following conditions within the design:

- a) Be prepared by a Licensed Engineering Practitioner;
- b) Be designed only to collect, receive, treat, or control only Stormwater and had not been designed to collect, receive, treat, or control sanitary Sewage;
- c) Be planned, designed, and built to be consistent with the Stormwater Management Planning and Design Guidance Manual. If there is a conflict with Appendix A of this Approval, then Appendix A shall prevail;
- d) Satisfies the Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alteration Authorized under an Environmental Compliance Approval, amended from time to time, any municipal criteria that have been established that exceed the minimum requirements set out in the Design Criteria;

- e) Be part of the Stormwater Treatment Train approach that satisfies the requirements outlined in Appendix A, or transmit Stormwater to a Stormwater Management Facility that satisfies the requirements outlined in Appendix A.
- f) Include design considerations to protect sources of drinking water, including those set out in the Standard Operating Policy of Sewage Works and any applicable local Source Protection Plan policies.

Documents required for submission of the addition, modification, replacement or extension of a Stormwater Management Pond or Channel:

- SW1 – Record of Future Alteration Authorized for Storm Sewers/Ditches/Culverts
- SW2 – Record of Future Alteration Authorized for Stormwater Management Facilities
- Town of Pelham Stormwater Management System Alteration Application Form
- Plan and profile drawings stamped by a Professional Engineer.

Upon assumption by the Town, the Operations and Maintenance Manual(s), inspection, and maintenance records must be provided to the Town of Pelham.

Oil-Grit Separators & Low Impact Development

Documents required for submission of the Addition of an Oil-Grit Separator or Low Impact Development:

- SW1 – Record of Future Alteration Authorized for Storm Sewers/Ditches/Culverts
- SW2 – Record of Future Alteration Authorized for Stormwater Management Facilities
- Town of Pelham Stormwater Management System Alteration Application Form
- Plan and profile drawings stamped by a Professional Engineer.

Upon assumption by the Town, the Operations and Maintenance Manual(s), inspection, and maintenance records must be provided to the Town of Pelham.

N5.00 Approval Application Process

All applications for [Environmental Compliance Approvals](#) can be submitted through the Town of Pelham website.

All applications have system-specific forms, ensuring that all required documentation is submitted. These forms must be submitted through the Town's online application portal.

These forms include:

- Form 1 & Form 2
- Sanitary Collection System Application Form, SS1, SS2 & A1
- Stormwater Management System Application Form, SW1, SW2 & SW3

N6.00 Application Fees

All Town of Pelham Environmental Compliance Approvals are subject to application and review fees. These fees are dependent on the system for which the alteration is made and the type of application. Fees for application submission and review can be found online under the [Town of Pelham User Fees & Charges](#).

N7.00 Pre-Construction & Post-Construction Verification

Pre-Construction Verification

Pre-construction verification is required for all additions, alterations, and modifications to the Drinking Water Distribution System, Sanitary Collection System, and Stormwater Management System. This verification must be obtained from the Town of Pelham prior to the commencement of any construction work.

Parts 1 through 3 of Forms 1 or 2, SS1, SS2, A1, SW1 and SW2 are to be completed by a licensed professional engineer. Part 4, of Forms 1 or 2, SS1, SS2, A1, SW1 and SW2, will be completed by the Town's designate once the proposed works have been reviewed and confirmed to be in compliance with the applicable system approvals.

Post-Construction Verification

Post-construction verification (Part 5) is required for all additions, alterations, and modifications to the Sanitary Collection and Stormwater Management Systems. This verification is completed by the Town of Pelham at the time of subdivision assumption.

Prior to assumption, the Town will require the developer and/or consulting engineer to provide the following documentation, including but not limited to:

- All as-built drawings, including any easements, street names and sewer diameters
- All CCTV and Flushing Records
- All Daily Inspection Records for the entirety of the project, including any measures undertaken to maintain the temporary ESC Plan.
- Operations & Maintenance Manuals for any facilities or appurtenance(s)

Upon Council's resolution to assume the development and following submission of all required documentation to the Town, the Town's designate will complete Part 5 of the approval form(s).

Section O – Environment and Climate Change Notes

O1.00 Green Infrastructure

Wherever possible, the Town encourages the use of green infrastructure in site design and operation to maximize the ecosystem services a property can provide both on-site and to the broader community.

Green infrastructure is infrastructure defined by natural assets that deliver ecosystem services to the community through natural processes. These services include:

1. Provisioning services
 - a. provision of food, timber, medicine, etc.
2. Regulating services
 - a. management of stormwater, carbon sequestration, air purification, etc.
3. Cultural services
 - a. aesthetic value, educational value, recreational value, etc.
4. Supporting services
 - a. soil formation, nutrient cycling, habitat provision, etc.

Green infrastructure may consist of intentionally engineered or implemented assets, existing natural assets such as wetlands and woodlands, or naturalized features that emerge over time. It can function in tandem with traditional grey infrastructure or exist independently. While not always native, these systems generally incorporate indigenous species and avoid invasives. Green infrastructure is an ambiguous term overall, encompassing everything from a pre-development wetland to a constructed bioswale. The common and defining characteristic of all green infrastructure is the existence of a natural asset that delivers infrastructure-related services.

O1.01 Natural Asset Retention & Life Cycle Cost

Where feasible, development should prioritize the retention and integration of existing green infrastructure/natural assets into site design before considering the construction of new green infrastructure features. Existing assets such as mature trees, woodlands, wetlands, hedgerows, and naturalized drainage features can provide significant ecosystem services, including stormwater management, carbon sequestration, habitat provision, air quality improvement, and microclimate regulation.

The preservation and incorporation of existing natural assets can improve climate resilience, reduce lifecycle costs, and accelerate ecosystem service delivery compared to newly established features. Wherever possible, site layouts should be designed to protect and incorporate existing natural assets rather than requiring their removal and replacement.

O1.02 Resources/Tools

More information on green infrastructure in small cities and towns is available in the [Green Infrastructure Guide for Small Cities, Towns and Rural Communities](#) prepared by the Green Infrastructure Ontario Coalition and the Greenbelt Foundation. The City of Toronto has also developed several related resources and specifications, including:

1. [Green Infrastructure Construction Guide for Capital Works](#)
2. [Design Criteria in the Right-of-Way](#)
3. [Construction Specifications and Drawings for Green Infrastructure](#)

O2.00 Low Impact Development

Wherever possible, the Town encourages at-source, lot-level control through low impact development (LID) best management practices that mimic natural site hydrology and reduce runoff to the municipal stormwater system.

LID best management practices include green, grey, and hybrid systems designed to manage more precipitation on site through retention, evapotranspiration, filtration, infiltration, and percolation. Examples include rain gardens, permeable pavement, multi-purpose retention areas, infiltration chambers, green roofs, bioswales, rain barrels or greywater systems, and biofiltration systems.

Several external design guides provide detailed direction on the pre-design, design, construction, inspection, operation, and maintenance of LID and green infrastructure features. Where these features are proposed in a development application, the following documents should be referenced:

1. The [Sustainable Technologies Low Impact Development webpage](#) (a TRCA/CVC/LSRCA Resource): www.sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/low-impact-development/
 - a. LID Stormwater Management Planning and Design Guide (2010)
 - b. Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide (2016)
 - c. Low Impact Development Construction Guide (2012)
2. The Ontario Government's (currently in draft) [LID Stormwater Management Guidance Manual](#): <https://ero.ontario.ca/notice/019-4971>
3. Additional applicable technical standards:
 - a. ASCE/ T&DI/ ICPS 68-18 Permeable Interlocking Concrete Pavement (North American Standard) (2018)
 - b. NSC/CSA W200 Design of Bioretention Systems – Canadian Standards Association (2018)

- c. NSC/CSA W201 Construction of Bioretention Systems - Canadian Standards Association (CSA)

Where variations are identified between cited reference documents, site-specific justification shall be provided within the design.

03.00 Vegetation Adaptation

When selecting species for a site, designers should consider how climate conditions are expected to change over the lifespan of each planted asset. Expected changes to each of Pelham's climate variables can be found in [Appendix B of the Town's Corporate Climate Change Adaptation Plan](#). These climate variables, such as average annual temperature, average annual precipitation quantity, days with temperatures above 30°C, days with >10mm of precipitation, and number of frost-free days, can be contrasted against the bioclimatic profiles of any given plant to determine if that plant will still remain suitable for Pelham's future climate.

For example, planting a tree species with a 60-80 year lifespan near the current southern edge of its climatic range may present increased risk under projected warming conditions, particularly where future temperatures and moisture regimes are expected to exceed the species' climatic tolerances. This can increase physiological stress and reduce the likelihood that the tree will reach maturity or achieve its expected lifespan. Conversely, species occurring immediately south of Pelham and near the northern portion of their current range may warrant consideration where climate projections indicate increasing future suitability. As temperatures warm, climatically suitable ranges for many species are expected to shift northward over time.

03.01 Plant Hardiness Zones and the Ecological Land Classification System

Two geographic tools that are frequently utilized in determining suitability of any given plant for any given location, are Plant Hardiness Zones and the Ecological Land Classification system. All of Niagara Region is within plant hardiness zone 7a, and Pelham is considered within Ecodistrict 7E-5 (with a portion of Short Hills Provincial Park in Ecodistrict 7E-3).

To incorporate assisted migration principles and projected climate change into planting design, development should consider species native to the current 7E-5 Ecodistrict, as well as species occurring within adjacent Ecodistricts whose current climatic conditions may become more representative of Pelham's future climate. Similarly, consideration may be given to species suitable for the current 7a plant hardiness zone as well as those adapted to conditions characteristic of the adjacent 7b plant hardiness zone, where supported by climate projections and site conditions.

In general, plant hardiness zones are expected to shift toward warmer winter conditions as minimum temperatures increase. Changes in precipitation patterns, drought frequency, and extreme weather events should also be considered, as these factors are not reflected in plant hardiness zone classifications. Incorporating drought-tolerant native species found within the Town's current hardiness zone and Ecodistrict, as well as species from adjacent warmer Ecodistricts and hardiness zones that are projected to become climatically suitable in the future is recommended.

03.02 Species Diversity

To support biodiversity and improve resilience to pests, diseases, invasive species, and climate-related stressors, species diversity should be considered when planning plant communities and landscape designs. Wherever feasible, reliance on any single species should be minimized, and invasive species shall not be used.

Planting plans should seek to establish diverse assemblages of non-invasive trees, shrubs, grasses, sedges, wildflowers, and other vegetation appropriate to the site conditions. As a general guideline, no single species should dominate the planting assemblage or comprise more than 10% of the proposed plantings, unless justified by site-specific ecological, restoration, or design objectives.

03.03 Salt and Winter Maintenance Considerations

Where planting areas are adjacent to roadways, parking areas, sidewalks, snow storage areas, or other locations subject to de-icing activities, species selection should consider tolerance to salt spray, salt-laden runoff, and elevated soil salinity. Site design should seek to minimize unnecessary salt exposure to sensitive vegetation through appropriate setbacks, grading, drainage design, or vegetative buffering where feasible.

The use of salt-tolerant species in areas subject to routine winter maintenance is encouraged to improve long-term vegetation survival and reduce replacement requirements.

03.04 Resources/Tools

- The NPCA has developed a [Native Plant Guide](#) outlining which native trees, shrubs, wildflowers, grasses, and sedges are appropriate for varied conditions
- The Federal Government maintains [Plant Hardiness Zone mapping](#) and [plant species bioclimatic profiles](#)
 - There is a [tool](#) for modelling which species have bioclimatic profiles compatible with the future The Town of Pelham climate in 2041-2070 and 2071-2100
- The Provincial Government maintains the [Ecological Land Classification system](#) and a Tree Atlas for [Ecodistrict 7E-5](#)
- Current ranges for plants can be found at easyscape.com

- Anticipated changes to Pelham’s climatic variables can be found in [Appendix B of the Corporate Climate Change Adaptation Plan](#)
- Currently recommended street, specimen, and foundation trees can be found in Section G2.00

04.00 Climate Adjusted Intensity Duration and Frequency (IDF) Curves

Intensity-Duration-Frequency curves based solely on historical data are no longer entirely appropriate for planning infrastructure capacity due to the continually shifting climate and its impact on precipitation patterns. To this end, whenever possible, construction and development consider using a climate-adjusted IDF curve that accounts for the lifespan of the assets being constructed and the most likely extent of climate change.

The website idf-cc-uwo.ca/home can be used to generate this data for any given site. After identifying the property, proponents can select a time period of 10 years prior to the current year through to 50 years into the future (2016-2076 for year 2026), select Equidistance Quantile Matching (EQM) as the methodology, Generalized Extreme Value (GEV) for the Distribution, and utilize the CanDCS-M6 multivariate model (including all models).

The screenshot displays the 'IDF under climate change' tab on the website. It features a 'Climate Model Selection' section with a time period slider set to 'From 2016 to 2076'. Below this, the 'Methodology' section has 'Equidistance Quantile Matching (precipitation)' selected, and the 'Distribution' section has 'GEV' selected. The 'Multi-model ensemble selection' section has 'All models' selected. A list of climate models is shown, including ACCESS-CM2, CSIRO, ARCCSS, ACCESS-ESM1-5, BCC-CSM2-MR, and CanESM5_r1. Buttons for 'Continue' and 'Export Results' are at the bottom.

Figure X: Example of Appropriate Parameter Selection for the Year 2026

Using this data, the proponent has the information necessary to plan for the intensifying pluvial conditions expected under future climate conditions.

05.00 Microclimate Factors/Site Design Factors

05.01 Urban Heat Island Amelioration

Wherever possible, construction and development should use technologies such as reflective surfaces, cool paving, green facades, and green roofs to minimize the effects of heat stress on the assets and to improve thermal comfort levels for pedestrians and users of these spaces. A more exhaustive list of potential intervention technologies can be found in [C40's Urban Cooling Toolbox](#).

More information on best management practices surrounding urban heat island amelioration can be found on the Federal Government's [Urban Heat Island Tools and Resources](http://www.canada.ca/en/health-canada/services/climate-change-health/urban-heat-islands-tools-resources.html) website: www.canada.ca/en/health-canada/services/climate-change-health/urban-heat-islands-tools-resources.html

05.02 Building Orientation and Passive Climate Design

Where site constraints permit, building orientation should consider opportunities to improve passive heating, passive cooling, natural daylighting, and protection from prevailing winter winds. Building and site layouts should seek to maximize beneficial southern solar exposure during winter months while reducing excessive western solar heat gain during summer afternoons. Consideration should also be given to the placement of outdoor amenity areas, pedestrian spaces, and building entrances to enhance seasonal comfort and usability.

05.03 Tree Siting for Optimized Microclimates

Each tree species and individual affects its immediate microclimate differently based on characteristics such as height, shape, age, and canopy density. Considering tree siting over space and time is therefore important to optimize site microclimate. Well-sited trees improve pedestrian thermal comfort and building energy efficiency by buffering temperature and wind extremes. Wherever possible, trees should be sited to maximize these local microclimate benefits.

Tree Types and Impacts on Microclimate

Deciduous trees cool surrounding microclimates in warm months through shade and evapotranspiration. Shade reduces solar irradiance on surfaces, while evapotranspiration cools the air through latent heat absorption. In cooler months, this cooling effect declines as leaves fall, resulting in less evapotranspiration and more sunlight reaching previously shaded surfaces. This seasonal pattern helps moderate microclimate conditions year-round.

Evergreen trees, mainly non-deciduous conifers, retain their foliage year-round and therefore do not have the same seasonal microclimatic effects as deciduous trees. However, their denser, more persistent foliage and generally greater height make them more effective

windbreaks than deciduous trees. As a result, evergreens play a distinct role in microclimate regulation, reducing wind speed.

Cardinality and Tree Siting Best Practices

The positive microclimatic impact from these different types of trees can be optimized by siting them adjacent the assets that would benefit from a moderated microclimate with respect to cardinality.

Wherever possible, deciduous trees should be planted southwest of active transportation routes, pedestrian spaces, buildings, and infrastructure. This placement maximizes interception of intense afternoon summer sun, which generally comes from the southwest.

Wherever possible, evergreen trees should be planted northwest of, or upwind from, active transportation routes, pedestrian spaces, buildings, and infrastructure. They are most effective when placed between the assets being sheltered and the prevailing local winds. Although prevailing winds are generally northwesterly at a macro scale, site-specific conditions may shift wind direction, so site-specific wind consideration is recommended.

Section P – Planning Notes of Relevance

P1.00 Planning Application Submissions & Requirements

Submission and circulation of Engineering drawings related to Planning Applications are coordinated through the Town of Pelham's Community Planning & Development Department. The proponent is to make initial contact with the Community Planning & Development Department prior to submitting Planning Applications and Engineering drawings.

Acceptance of engineering drawings must be obtained from the Town of Pelham's Community Planning & Development Department, and any required permits must be obtained from all applicable parties prior to commencement of any and all development work.

P1.01 Type of Planning Applications

Although not required or mandatory, pre-consultation meetings should be arranged with the Community Planning & Development Department to confirm all requirements and site-specific concerns, prior to commencement of a Planning Application and applicable/appropriate Engineering drawings.

The Town's responsibility includes the review and acceptance of Engineering drawings for development proposals, including but not limited to:

- Severance (Consent)
- Minor Variance
- Site Plan
- Subdivision
- Condominium

Under special circumstances, Engineering drawings may be required at the time of Official Plan / Zoning By-law Amendments, where details are required prior to complete design for a decision related to land use approvals.

Varying levels of Engineering design and drawings are required for such planning applications, depending on the size and scale of a project. For example, a minor variance to allow an addition to an existing residential building lot typically requires the proponent's Engineer to consider the post-development grade of the property, while a plan of subdivision typically requires the consideration of such things as roadway standards, storm drainage, water and waste water mains and connections, signage, parklands, street lighting, etc.

The following table is presented as a guide illustrating the typical Engineering design and drawing information to be provided by a proponent's Engineer to assist the Town with its Engineering review.

Planning Application	Traffic Impact Study (TIS)	Functional Servicing Report (FSR)	Storm Design & Storm Water	Lot Grading	Sanitary Sewer (Urban areas only)	Watermains	Roadways	Street Tree Planting & Protection	Streetlights	Parklands	Signs & Fencing
Severance (Consent)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Minor Variance	✓		✓	✓							✓
Site Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subdivision	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Condominium	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zoning By-law/ Official Plan Amendment	✓	✓	✓				✓		✓		✓

Note:

The above table is intended to serve as a general guide and cannot address every type of development application scenario. Therefore, a pre-consultation meeting with Town staff is recommended to determine the specific requirements for a planning application proposal.

This Engineering Design Criteria and Standards manual provides the details of various Engineering works and drawings. Sections B – H describe specific submission requirements related to Traffic, Storm Water Management, Roadways, Lighting, Lots Grading, etc. The requirements for general and all Engineering works and drawings are in Section A.

For clarification purposes, please note that the words Site Plan Application and Site Plan Drawing are different terms within this manual. A Site Plan Application is a type of Planning application defined under the Planning Act. A Site Plan drawing is a defined Engineering term that represents the overall site drawing of a proposed development.

P1.02 Planning Application Process

Outlined below is the typical Planning Application process from submission through approval, construction, and release of securities. Not all steps apply to every application.

Planning Application Process



P1.03 Planning Application Agreement & Securities

Planning agreements and securities are used by the Town to ensure that development proceeds in accordance with approved plans, applicable legislation, and municipal standards, and that required works are completed to the Town's satisfaction

.

Where required as a condition of Planning approval, a Planning Agreement (including Site Plan, Subdivision, Development, or related agreements) establishes the owner's obligations respecting design, construction, inspection, timing, and responsibility for works associated with a development. These agreements provide a formal mechanism to secure compliance with approvals granted under the Planning Act and related municipal bylaws.

Securities are required to financially guarantee the completion, remediation, and warranty of the works identified in the Planning Agreement, including, but not limited to, site works, municipal infrastructure, landscaping, servicing, and any required engineering works. Securities protect the Town's interests by ensuring that funds are available to complete or correct work should the owner fail to meet their obligations.

The requirement for a Planning Agreement and/or securities is application-specific and depends on the nature, scale, and complexity of the proposed development, as well as the scope of works affecting municipal interests. Not all Planning applications will require an agreement or securities.

Securities must be provided prior to final Planning approval of development with agreements as outlined above and remain in effect until all obligations under the applicable agreement are satisfactorily completed, inspected, and accepted by the Town. Securities are released only after confirmation that all requirements have been fulfilled in accordance with Town standards and the terms of the agreement.

Detailed procedures for agreements, security amounts, acceptable forms of security, inspection, and release are outlined in the applicable sections of this manual and in the Planning approval conditions/ agreements.

The applicant's engineering consultant shall provide a detailed cost estimate and supporting information for the engineering portion of the financial security. Items to be included in the detailed cost estimate include, but are not limited to, the following;

- storm sewer system;
- sanitary sewer system;
- watermain;
- concrete curbing;
- concrete transfer pad for a garbage/recycling bin enclosure;
- concrete sidewalks;

- granular base and sub-base materials;
- granular driving surface or pavement for parking areas and internal road system;
- retaining walls;
- regulatory fencing;
- erosion control measures;
- stormwater management works;
- road cleaning; and,
- road damage.
- road signage
- street trees

The supporting information shall include material quantities, unit prices, site plan, and a grading and site servicing plan.

The applicant shall be responsible for removing mud and other debris that accumulates on the public streets during construction. If the applicant does not comply with the Town of Pelham's notification to clean the affected streets within twenty-four (24) hours, then the Town shall have the right to clean the affected streets at the sole expense of the applicant by use of a corresponding portion of the aforementioned financial security.

Internal Works

Twenty percent (20%) of an acceptable cost estimate will be included as the engineering portion of the financial security for on-site works in accordance with the Development Agreement Security Policy.

In addition to the engineering financial security, the Planning Department requires financial securities for all landscaping and other site works. Security will be returned by the Town after final inspection, and satisfactory completion of the secured works.

Off-Site Works

Similar information is required for off-site services under the Town of Pelham's jurisdiction that may be required to service the proposed development. One hundred percent (100%) of an acceptable cost estimate will be included in this financial security in accordance with the Development Agreement Security Policy.

All works (on-site and off-site) are subject to inspection by the Town of Pelham. Upon satisfactory completion, the Town will consider release of financial securities being held for the works.

Overall, Planning Applications are an integral tool for the completion of appropriate engineering design criteria and should be considered a priority of responsible engineering development.

Appendix A - Engineering Drawings: Items for Inclusion

Drawings forming part of engineering drawing sets as described in Section A shall include, as a minimum, the items listed following:

Plan and Profile Drawings

Miscellaneous:

- Key Plan
- Scale(s)
- Title, revision and signature block
- Street names, lot and block numbering
- Profile bands/charts for storm, sanitary, clean water collector sewers shall be provided on all profile plans (if applicable)
- Lot lines, street lines
- Right-of-Way dimensions
- Lot dimensions
- North arrow
- Match lines and chainage
- Geodetic bench mark information
- Sidewalks, driveways, fencing, street lights and hydrants
- Community mailbox locations including required curb depressions
- Watermain and sanitary information for Regional requirements
- Sewer crossing information
- Minimum basement elevation (MBE) (where applicable)
- Maximum underside of footing details (USF) (where applicable)
- Engineered Fill information (where applicable)
- All easements for servicing

Storm Sewer Information:

- Maintenance holes with side, standard and identification number
- Pipe diameter, lengths, grades, material, class and bedding
- Inverts at maintenance holes (to three (3) decimal places)
- Service connections

- Pipe crossing information
- Catchbasins including street, rear yard and ditch inlet
- 100 year H.G.L.
- Drop structures
- Benching details
- Inlet Control Device Table with ID, Type/Size, Invert Elevation (m), Grate Elevation (m), Design Head (m), Design Controlled Flow (L/s), 1:5 Year Peak Flow (L/s)

Roadway Information:

- Existing ground and proposed grade profiles
- Centre line road grade with distances between change in grade
- 3 decimal places for road segment lengths, chainage station and road elevations
- 2 decimal places for road gradients (%) and K values
- Plan View Centre line elevations every 25 m and at all low points, high point, intersections, changes in grade, at P.I., beginning and end of vertical curves
- Profile View Chainage indication on centre line, every 50 m
- Intersection chainage for all intersecting streets
- Beginning and end of horizontal curves
- Curb and gutter,
- Curb radii and depressions noted where required (ex. Overland flow outlets, sidewalk terminations, CMB pads)
- Gutter grade details on bends, cul-de-sacs and intersections
- Pavement structure design with curb type
- Pavement right of way and boulevard widths
- Traffic control

Grading Plans

(Not applicable to Municipal Projects)

- Key Plan
- Scale
- North arrow
- Lot numbers, street names
- Lot drainage type (ex. W/O, SD, BS, RF)
- Proposed building envelopes
- Curbs, sidewalks, fencing, transformers, hydrants, streetlights and driveways

- Community mailbox locations, including required curb depressions
- Maintenance holes and catchbasins, including street, rear yard and ditch inlet
- Easements
- Maximum underside of footing requirements adjacent to servicing easements or blocks
- Original ground contours, with reference to the topographic source
- Original ground and proposed elevations at all lot corners
- Indicate lots with Engineered Fill
- Road center line profile data with distances and slope between grade changes, elevations every 25 m and at all low points, high points, and intersections
- Centre line chainage indicator every 50 m
- 100-year flooding limits
- Lot elevations at all breaks in grade
- Swale direction and location indicators with an arrow
- Front and rear lot specified grade elevation
- Retaining wall locations with top and bottom elevations
- Any sloping
- Existing trees to be removed and/or preserved
- Mark all Fire Break lots by drawing an X through the lot, corners to corners

Utility Coordination Plan

(Not applicable to Municipal Projects)

- Key Plan
- Scale
- North arrow
- Legend showing symbols and typical structure size
- Dimensions for any atypical utility structures
- Lot numbers, street names and right of ways/property lines
- Curbs, sidewalks, fencing, transformers, hydrants, streetlights, pedestals and driveways
- Maintenance holes, and catchbasins, including street, rear yard and ditch inlets
- Easements
- Utility duct crossing locations
- Community mailbox locations to show temporary and permanent boxes, plus the number of modules at each location and the required curb

depressions

- Signature/approval block for each utility, Town of Pelham and Region of Niagara
- Standard # 400 to 404.30 – Utility Locations
- Potential tree locations

Streetlight Layout and Photometric Design Plans

(Not applicable to Municipal Projects)

- Key Plan
- Scale
- North arrow
- Legend
- Lot numbers, street names and right of ways/property lines
- Curbs, sidewalks, transformers, hydrants, streetlights, driveways, easements and potential tree locations
- Community mailbox locations
- Signature/approval block for Town of Pelham.
- Photometric Design – roadway lighting design criteria, photometric street light summary and certification meets RP-8 (latest edition) guidelines.
- Streetlight Layout- Duct schedule, street light service chart and clearance notes.

Appendix B - Capital Projects - Design Check List and Forms

Index

Roadway Design Criteria.....	3 Pages
Intersection Design Criteria.....	1 Page
Form A: 50% Detailed Design Submission / Review Check List.....	5 Pages
Form B: 90% Detailed Design Submission / Review Check List.....	4 Pages
Form C: Pre-Tender Package Submission / Review Check List.....	3 Pages
Form D: Tender Package Check List.....	2 Pages

Town of Pelham Roadway Design Criteria

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Project Name and Location: _____

Town of Pelham **Consultant**
Project Manager:_____ **Project Manager:**_____

Criteria	Reference/Notes	Design Standards	Proposed Standards
Classification	Town of Pelham Official Plan		
	TAC Page 1.3.2.2		
	TAC Table 1.3.2.1		
Design Speed			
Posted Speed	Town of Pelham Geometric Design		
	Table C3.1		
Minimum Radius	Town of Pelham Geometric Design Table C3.1		
Minimum Stopping Sight Distance	TAC Page 1.2.5.4 Table 1.2.5.3		
Minimum Decision Sight Distance	TAC Page 1.2.5.8 Table 1.2.5.6		
Minimum ‘K’ Value	CREST TAC Page 2.1.3.6 Table 2.1.3.2		
	SAG TAC Page 2.1.3.9 Table 2.1.3.4 Headlight Control Comfort Control		

Town of Pelham Roadway Design Criteria

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Criteria	Reference/ Notes	Design Standards	Proposed Standards
Grades - Maximum			
- Minimum			
Road Width (Face of Curb to Face of Curb)	Table C3.01		
Lane Width	Table C3.01		
Through Lanes			
Left Turn Lanes (If Applicable)			
Right Turn Lanes (If Applicable)			
Shoulder Width (Rural Roads)			
Paved Shoulder Width (Rural)			
Boulevard Width (Face of Curb to ROW)			
Sidewalk Width North or West Side			
South or East Side			
Bicycle Lane or Path Width (Both Sides)			
Right of Way Width			

Town of Pelham Roadway Design Criteria

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Other information to be submitted:

	N/A	Attached	Future Submissions
Geotechnical Report	☐	☐	☐
Traffic Report	☐	☐	☐
Drainage Report	☐	☐	☐
Other (Specify	☐	☐	☐

Other Reports required: _____

Prepared by: _____
(Consultant)

Date: _____

Checked by: _____
(Consultant)

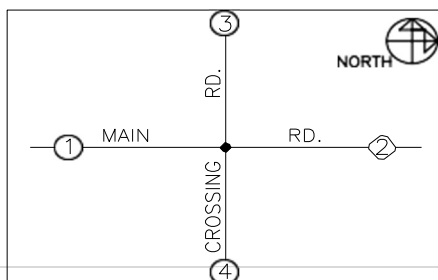
Date: _____

Approved by: _____
(Town of Pelham)

Date: _____

Notes:

Criteria	Reference/Notes	Detail			
		Main Road (Arterial)		Side Roads (Collectors)	
		Leg 1	Leg 2	Leg 3	Leg 4
Classification					
Design Speed					
Stopping Sight Distance	TAC Pg 1.2.5.4 Table 1.2.5.3.				
Road Turning Radius					
Design Vehicle					
Lane Width – Thru Lanes					
Left Turn					
Right Turn					
Shoulder Width					
Boulevard Width					
Left Turn Lane	TAC Pg 1.2.5.4 Table 1.2.5.3				
Set Back					
Storage					
Parallel					
Taper	TAC Pg 2.3.8.2 Table 2.3.8.1				
Right Turn Lanes	TAC Pg 2.3.5.5 Figure 2.3.5.3				
	TAC Pg 2.3.5.2				
Parallel					
Taper					
Islands (Median)	STD DWG 403				



Prepared by: _____

Checked by: _____

Approved by: _____

Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'A'

Page 1 of 5

Project Name & Location: _____

Town of Pelham **Consultant**
Project Manager: _____ **Project Manager**_____

Design	Yes	No	N/A	Comments
Base Plan:				
- Field Survey				
- Utilities				
- Right-of-Way (Existing)				
- Existing Storm Sewer				
- Existing Sanitary Sewer				
- Existing Watermain				
- Site Photos with Dates				
Confirm Project Scope				
Design Criteria				
Typical Section & Options				
Need of Other Users:				
- Bicycle				
- Sidewalks				
- Illumination				
- Landscaping				
- Other (Specify)				
Geotechnical Report				
Traffic Report				
Structure / Culvert Assessment				
Ex Vegetation Assessment				
Fish / Wildlife Habitat Assessment				

Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'A'

Page 2 of 5

	Yes	No	N/A	Comments
Horizontal & Vertical Alignment Design				
- Preliminary Design Sections				
Plan Design				
	Yes	No	N/A	Comments
Entrance Designs				
Property Impacts/ Alternative Designs				
Storm Water Management Concept				
- Preliminary SWM Design				
Submit Preliminary Plan & Profile				
- Preliminary Design Section				
- Entrance Profiles				
Operation Centre Review & Comment				
Field Review - Design				
Preliminary Cost Estimate				
- Construction				
- Utilities				
- Regional Work				
Other Items (Specify)				

Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'A'

Page 3 of 5

Utility / Services	Yes	No	N/A	Comments
Base Plan / Survey				
Field Check				
Submit to Utilities for Confirmation of Existing Locations and Future Locations				
Bell				
Cogeco				
Niagara Broadband				
NPEI				
Hydro One				
Gas				
Other (Specify)				
Submit to Region of Niagara for Confirmation of Existing Locations and Future Locations				
Water				
Sanitary				
Traffic Signals				
Update Base Plan				
Review Conflicts /Relocations				
Submit Relocation Requirements				
Bell				
Cogeco				
Niagara Broadband				
NPEI				
Hydro One				
Gas				
Other (Specify)				

Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'A'

Page 4 of 5

Utility Preliminary Cost Estimate and Schedule	Yes	No	N/A	Comments
Bell				
Cogeco				
Niagara Broadband				
NPEI				
Hydro One				
Gas				
Region of Niagara				
Other (Specify)				
Test Pits to Confirm Conflicts				
Utility Relocation Meeting(s)				
Preliminary Design Modifications to Reduce Relocation Costs				
Other Items				

**Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'A'**

Page 5 of 5

50% Review Approval:

Project Manager: _____ **Date:** _____
(Consultant)

Project Engineer: _____ **Date:** _____
(Consultant)

Comments:

Town Of Pelham

Engineering Department: _____ **Date:** _____
(Project Manager)

Comments:

- ☐ Proceed to 90% Design Stage. Address
- ☐ Comments and Resubmit

Page 1 of 4

Town of Pelham **Consultant**
Project Manager: _____ **Project Manager:** _____

Design	Yes	No	N/A	Comments
Field Review Base of Plan				
Base Plan C.A.D. Update				
Approved Design Criteria				
Approved Prelim. Design				
- Plan and Profile				
- Typical Section(s)				
Submit Preliminary Design to Region (If required)				
- Sanitary Design				
- Watermain Design				
- Traffic Signal Design				
Prepare Contract Dwgs				
(See list in Town Design Criteria and Standards-Section A)				
Storm Sewer Design				
Storm Water Management Design				
Finalize Design Cross-Sections				
Finalize Entrance Designs				
Finalize Property Impacts/Requirements				
Tender Form / Quantities				

Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'B'

Page 2 of 4

	Yes	No	N/A	Comments
Special Provisions				
Preliminary Cost Estimates				
- Construction				
- Utilities				
Identify / Initialize Permits and Approvals (Specify)				
MECP				
NPCA				
MNR				
DFO				
Others: (Specify)				
Submit Package to Town (Drawings and Documents)				
- Contract Drawings				
- Tender Items / Quantities				
- Specials				
- Standard List				
- Other Standard Contract Documents				
- Utility Information				
- Permit Status				
- Storm Sewer Design Calculation Sheets & Drainage Areas				
- Sanitary Sewer Design Calculation Sheets & Drainage Areas				
- Watermain Design				
- Prelim Cost Estimate				
Geotechnical Review of Design				
Schedule P.I.C				

Town of Pelham - Capital Projects
50% Detailed Design Submission / Review Check List
Form 'B'

Page 3 of 4

Utility	Yes	No	N/A	Comments
Bell				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
Cogeco				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
Niagara Broadband				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
NPEI				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
Hydro One				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
Gas				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
Region of Niagara				
- Relocation Requirements				
- Cost Estimate				
- Schedule				
Utility Relocation Meeting(s)				

Town of Pelham - Capital Projects
90% Detailed Design Submission / Review Check List
Form 'B'

Page 4 of 4

90% Review Approval:

Project Manager: _____ **Date:** _____
(Consultant)

Project Engineer: _____ **Date:** _____
(Consultant)

Comments:

Town Of Pelham

Engineering Department: _____ **Date:** _____
(Project Manager)

Comments:

- ☐ Proceed to Pre - Tender Stage. Address
- ☐ Comments and Resubmit

Page 1 of 3

Town of Pelham **Consultant**
Project Manager: _____ **Project Manager:** _____

Design	Yes	No	N/A	Comments
Provide Contract Number				
Finalize Contract Drawing Package				
Incorporate Region of Niagara Drawings & Documents (If required)				
Finalize Contract Documents				
Permits & Approvals				
MECP				
NPCA				
MNR				
DFO				
Others (Specify)				
Submit Contract Drawing Package				
Submit Contract Documents				
Submit Final Cost Estimates				
Construction Review				
- By Town				
- By Consultant				

Town of Pelham - Capital Projects
Pre – Tender Package Submission / Review Check List
Form ‘C’

Page 2 of 3

Utility	Yes	No	N/A	Comments
Bell				
- PO (By Town)				
- Approved Relocation & Schedule				
Cogeco				
- PO (By Town)				
- Approved Relocation & Schedule				
Niagara Broadband				
- PO (By Town)				
- Approved Relocation & Schedule				
NPEI				
- PO (By Town)				
- Approved Relocation & Schedule				
Hydro One				
- PO (By Town)				
- Approved Relocation & Schedule				
Gas				
- PO (By Town)				
- Approved Relocation & Schedule				
Region of Niagara				
- PO (By Town)				
- Approved Relocation & Schedule				

Town of Pelham - Capital Projects
Pre – Tender Package Submission / Review Check List
Form ‘C’

Page 3 of 3

Pre – Tender Approval:

Project Manager: _____ **Date:** _____
(Consultant)

Project Engineer: _____ **Date:** _____
(Consultant)

Comments:

Town Of Pelham

Engineering Department: _____ **Date:** _____
(Project Manager)

Comments:

- ☐ Prepare Tender Package.
- ☐ Address Comments and Resubmit

**Town of Pelham - Capital Projects
Tender Package Check List
Form 'D'**

Page 1 of 2

Contract No. _____ **Project Name & Location:** _____

Town of Pelham **Consultant**
Project Manager: _____ **Project Manager:** _____

Consultant Activities	Date	N/A	Comments
Town of Pelham Final Comments Received			
- Contract Drawings - Engineering			
- Contract Documents - Engineering			
- Purchasing			
Print Contract Drawings			
Print Documents			
Prepare Tender			
Final Review of Utility Relocation Schedules			
Bell			
Cogeco			
Niagara Broadband			
NPEI			
Hydro One			
Gas			
Region of Niagara			
Other (Specify)			
Contract Approvals by Others Received			
Prepare Public Information Centre Information			
Contract Administration Proposal Submitted			
Review Tender Bids			
Approve / Recommend Contractor			

**Town of Pelham - Capital Projects
Tender Package Check List
Form 'D'**

Page 2 of 2

Town of Pelham Activities	Date	N/A	Comments
Town of Pelham Final Comments Received			
- Contract Drawings - Engineering			
- Contract Documents - Engineering			
- Purchasing			
Prepare/Mail Project Letters/Notices			
Sign Contract Drawings			
Receive Dwgs & Docs for Tender			
Approve Contract Administration by Consultant			
Set Public Information Centre Date			
Review PIC Information			
Review Tender Report			
Prepare Sundry Items / Costs			
Approve Construction Material Testing			
Review / Resolve Property Issues			
Post Tender			
Prepare Contractor Documentation			
Contract Documents Executed			
Construction Start Date			
Pre-Construction Meeting			

Appendix C - Niagara Peninsula CAD Standard

NIAGARA PENINSULA CAD STANDARD (NPCS)

<https://www.niagararegion.ca/business/tenders/ngcs.aspx>

Appendix D - Construction Management Report Guidelines

A Construction Management Report (CMR) shall include all relevant items, as required by the Director of Public Works. The following are typical items to include for a Site Plan or similarly approved development project at the Town of Pelham:

1. Detailed best management practices (BMPs) for dust control, noise control, road/site cleaning, and catch basin protection details.
2. Resident/neighbourhood communication and advanced notification strategy, communication throughout the duration of the construction, referencing all construction activities that may impact the surrounding residents and the neighborhood as a whole.
3. Noise control: No works (including warming up of equipment) may be conducted between 8pm to 7am for construction projects from Monday to Saturday, no work on Sundays and Holidays, as per the Town of Pelham noise regulations By-Law No. 4454(2022).
4. Staging, Loading and Parking management plan. All construction vehicles and materials must be contained within the property unless special permissions are granted. Note that no construction vehicle queuing and idling will be allowed on any Town road.
5. A Traffic Control Plan shall accompany each phase within the Construction Management Report. Plans shall be based on the Ontario Traffic Manual (OTM), Book 7. Plans shall be appropriately dimensioned and include a visual representation of all proposed signage.
6. Construction route as approved by Operations, and/or the Engineering Department, as applicable.
7. Temporary construction signage such as truck speed limits, appropriate signage and commitment to adhere to all traffic control (e.g., fully stop at stop control and signals).
8. Radar Message Board (RMB's) to be provided, as requested by the Director of Public Works to support safe operating speeds within the construction zone.
9. Construction schedule for major stages such as, but not limited to, earthworks, servicing, building construction, top works, landscaping and street tree planting.
10. Regular construction update meetings scheduled.
11. Special permissions are required for the temporary use of any portion of the road right-of-way, i.e., boulevard, parking lanes, live traffic lanes.
12. 24-hour contact person information.
13. The Construction Management Plan must be updated to be consistent with, and explicitly reference, the Construction Management Report, Traffic Control Plan, and other related and approved materials.

Standard Drawings for Reference

100 Series

DWG 100	Benching for Precast Maintenance Holes
DWG 101	Drop Structure for Maintenance Holes
DWG 102	Backfilling Support for Existing Storm Sewers
DWG 103	Handrails for Sewers and Culvert Headwalls
DWG 104	Storm Sewer Residential Service Connection
DWG 105	Storm Sewer Residential Service Connection
DWG 106	Storm Sewer Residential Service Connection
DWG 106.10	Storm Service Connection under Basement Floor Slab
DWG 107	P.V.C. Catchbasin Connection
DWG 107.10	Rear Yard Catchbasin Connection
DWG 107.20	Typical Detail for Determining Max. USF next to RYCB Lead/Pipe
DWG 108	Subdrains
DWG 109	Subdrains for Installation Behind/Front of Existing Curb

200 Series

DWG 206	Two-Stage Curb and Gutter
DWG 208	Concrete Sidewalk
DWG 209	Overland Flow Walkway
DWG 210	Temporary Asphalt Sidewalk
DWG 214	Multi-Use Pathway
DWG 214.20	MUP Signage and Pavement Markings
DWG 214.30	MUP Signage and Pavement Markings Notes
DWG 215	Temporary Sidewalk Barricade
DWG 216	Speed Cushion

300 Series

DWG 300	Typical Front Lot Drainage
DWG 301	Rear Lot Drainage
DWG 302	Rear Lot Drainage for Walkout or Backsplit House

DWG 303	Standard Notes for Lot Grading Plans
DWG 303.10	Foundation Control Certificate
DWG 304	Driveway Profiles
DWG 305	Residential Driveways
DWG 306	Rural Entrance with Culvert Installation

400 Series

DWG 400	Local Urban Street 18m R.O.W. with Parking
DWG 400.10	Arterial / Collector (Downtown) 20m R.O.W. without Parking
DWG 400.20	Arterial / Collector (Urban) 20m R.O.W. without Parking
DWG 401	Collector Urban Main Street 20m R.O.W. with Parking on One Side
DWG 401.10	Collector Neighbourhood Main Street 20m R.O.W. without Parking
DWG 402	Collector Mixed Use Main Street 22m R.O.W. with Parking Both Sides
DWG 402.10	Collector Mixed Use Main Street 22m R.O.W. Shared Continuous Paving
DWG 403	Arterial / Collector 30m R.O.W. with Separated Median
DWG 404	Utility Duct Road Crossing Detail for Existing Roads
DWG 404.10	Utility Duct Road Crossing Detail for New Subdivisions
DWG 404.30	Direct Buried-joint Use Trench for Subdivisions – Only in 18m R.O.W.
DWG 404.50	Asphalt Restoration Area
DWG 405	Typical 90° Crescent 20.0m R.O.W.
DWG 405.10	Typical 90° Crescent with Eyebrow 20.0m R.O.W.
DWG 406	Typical 90° Crescent 18.0m R.O.W.
DWG 406.10	Typical 90° Crescent with Eyebrow 18.0m R.O.W.
DWG 410	Non-Residential and Multi-family Entrance Detail
DWG 411	Prop. Driveway Approaches Cul-De-Sac Area
DWG 413	Accessibility Parking – Proposed and Retrofit
DWG 415	Public Laneway – Criteria & Notes
DWG 415.10	Single-Loaded Public Laneway
DWG 415.20	Double-Loaded Public Laneway with Tandem Parking
DWG 415.30	Double-Loaded Public Laneway with Side-by-Side Parking
DWG 416	Trench Restoration Detail

500 Series

DWG 500	Street Sign Location
DWG 501	Street Name Signs
DWG 501.20	Storm Pond Sign Detail
DWG 505	Benchmark Tablet
DWG 506	Wood Acoustic Fence
DWG 506.10	Wood Acoustic Fence Notes
DWG 506.30	1500mm (5'-0") High Black Vinyl Coated Chain Link Fence
DWG 506.40	1800mm (6'-0") High Black Vinyl Coated Chain Link Fence
DWG 510	Service Connection Record – Subdivisions/Site Plans
DWG 511	Service Connection Record – Town of Pelham Projects
DWG 512	Rainfall Intensity Curve and Value
DWG 513	Storm Sewer Design Sheet
DWG 514	Tree Pit Rooting Zone