Planning Department Development Application Form

Complete Application

A complete development application consists of the following:

1. A completed, signed, and notarized application form
2. Supporting information adequate to illustrate your proposal as indicated in **Section H** of this application form
3. Written authorization from the registered owner of the subject lands where the applicant is not the owner as per Section N
4. Cash, debit, credit or cheque payable to Norfolk County in the amount set out in the user fees By-Law that will be accepted and deposited once the application has been deemed complete.

Pre-Submission Consultation:

Norfolk County requires a Pre-Consultation Meeting for all applications; however, minor applications may be exempted depending on the nature of the proposal. The purpose of a Pre-Consultation Meeting is to provide the applicant with an opportunity to present the proposed application, discuss potential issues, and for the Norfolk County and Agency staff to identify the application requirements. Application requirements, as detailed in the Pre-Consultation Meeting Comments, are valid for one year after the meeting date.

Development Application Process

Once an application has been deemed complete by a Planner, Norfolk County staff will circulate the application to adjacent landowners, public agencies, and internal departments for comment. The time involved in application processing varies depending on its complexity, acceptability to the other agencies, and statutory Planning Act decision time-frames.

Payment is required once your application is deemed complete. Pre-payments will not be accepted.

Norfolk County collects personal information submitted through this form under the Municipal Freedom of Information and Protection Act's authority. Norfolk County will use this information for the purposes indicated or implied by this form. You can direct questions about collecting personal information to Norfolk GIS Services at NorfolkGIS@norfolkcounty.ca.

Additional studies required for the complete application shall be at the applicant's sole expense. Sometimes, peer reviews may be necessary to review particular studies at the applicant's expense. In these caseds, Norfolk County staff will select the company to complete the peer review.

Norfolk County will refund the original fee if applicants withdraw their applications before circulation. If Norfolk County must recirculate your drawings, there will be an additional fee. If Norfolk County must do more than three reviews of engineering drawings due to revisions by the owner or failure to revise engineering drawings as requested, Norfolk County will charge an additional fee. Full refunds are only available before Norfolk County has circulated the application.

Notification Sign Requirements

For public notification, Norfolk County will provide you with a sign to indicate the intent and purpose of your development application. It is your responsibility to:

1. Post one sign per frontage in a conspicuous location on the subject lands.
2. Ensure one sign is posted at the front of the subject lands at least three feet above ground level and not on a tree.
3. Notify the Planner when the sign is in place.
4. Maintain the sign until the development application is finalized and, after that, remove it.

Contact Us

For additional information or assistance completing this application, please contact a Planner at 519-426-5870 or 519-875-4485 extension 1842 or planning@norfolkcounty.ca. Please submit the completed application and fees to the attention of the Planning Department at 185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6.

For Office Use Only:

File Number	_____	Public Notice Sign	_____
Related File Number	_____	Application Fee	_____
Pre-consultation Meeting	_____	Conservation Authority Fee	_____
Application Submitted	_____	Well & Septic Info Provided	_____
Complete Application	_____	Planner	_____

Check the type of planning application(s) you are submitting.

- ☐ Official Plan Amendment
- ☒ Zoning By-Law Amendment
- ☐ Temporary Use By-law
- ☐ Draft Plan of Subdivision/Vacant Land Condominium
- ☐ Condominium Exemption
- ☐ Site Plan Application
- ☐ Extension of a Temporary Use By-law
- ☐ Part Lot Control
- ☐ Cash-in-Lieu of Parking
- ☐ Renewable Energy Project or Radio Communication Tower

Please summarize the desired result of this application (for example, a special zoning provision on the subject lands to include additional use(s), changing the zone or official plan designation of the subject lands, creating a certain number of lots, or similar)

_____
_____
_____
_____
_____
_____
_____

Property Assessment Roll Number: _____

A. Applicant Information

Name of Owner _____

Address _____

Town and Postal Code _____

Phone Number _____

Cell Number _____

Email _____

Name of Applicant _____

Address _____

Town and Postal Code _____

Phone Number _____

Cell Number _____

Email _____

Name of Agent _____

Address _____

Town and Postal Code _____

Phone Number _____

Cell Number _____

Email _____

Unless otherwise directed, Norfolk County will forward all correspondence and notices regarding this application to both owner and agent noted above.

☐ Owner ☐ Agent ☐ Applicant

Names and addresses of any holder of any mortgagees, charges or other encumbrances on the subject lands:

_____

_____

B. Location, Legal Description and Property Information

1. Legal Description (include Geographic Township, Concession Number, Lot Number, Block Number and Urban Area or Hamlet):

   _____

   _____

   Municipal Civic Address: _____

   Present Official Plan Designation(s): _____

   Present Zoning: _____

2. Is there a special provision or site specific zone on the subject lands?

   ☐ Yes ☐ No If yes, please specify corresponding number:

   _____

3. Present use of the subject lands:

   _____

   _____

4. Please describe **all existing** buildings or structures on the subject lands and whether they will be retained, demolished or removed. If retaining the buildings or structures, please describe the type of buildings or structures, and illustrate the setback, in metric units, from the front, rear and side lot lines, ground floor area, gross floor area, lot coverage, number of storeys, width, length, and height on your attached sketch which must be included with your application:

   _____

   _____

   _____

5. If an addition to an existing building is being proposed, please explain what it will be used for (for example: bedroom, kitchen, or bathroom). If new fixtures are proposed, please describe.

   _____

   _____

   _____

6. Please describe **all proposed** buildings or structures/additions on the subject lands. Describe the type of buildings or structures/additions, and illustrate the setback, in metric units, from front, rear and side lot lines, ground floor area, gross floor area, lot coverage, number of storeys, width, length, and height on your attached sketch which must be included with your application:

   _____

   _____

   _____

7. Are any existing buildings on the subject lands designated under the *Ontario Heritage Act* as being architecturally and/or historically significant? Yes ☐ No ☐

   If yes, identify and provide details of the building:

   _____

   _____

8. If known, the length of time the existing uses have continued on the subject lands:

   _____

9. Existing use of abutting properties:

   _____

10. Are there any easements or restrictive covenants affecting the subject lands?

    ☐ Yes ☐ No If yes, describe the easement or restrictive covenant and its effect:

    _____

C. Purpose of Development Application

Note: Please complete all that apply.

1. Please explain what you propose to do on the subject lands/premises which makes this development application necessary:

   _____

   _____

   _____

   _____

2. Please explain why it is not possible to comply with the provision(s) of the Zoning By-law/and or Official Plan:

   _____

   _____

   _____

3. Does the requested amendment alter all or any part of the boundary of an area of settlement in the municipality or implement a new area of settlement in the municipality? ☐ Yes ☐ No If yes, describe its effect:

   _____

   _____

   _____

4. Does the requested amendment remove the subject land from an area of employment? ☐ Yes ☐ No If yes, describe its effect:

   _____

   _____

   _____

5. Does the requested amendment alter, replace, or delete a policy of the Official Plan? ☐ Yes ☐ No If yes, identify the policy, and also include a proposed text of the policy amendment (if additional space is required, please attach a separate sheet):

   _____

   _____

   _____

6. Description of land intended to be severed in metric units:
   Frontage: _____
   Depth: _____
   Width: _____
   Lot Area: _____
   Present Use: _____
   Proposed Use: _____
   Proposed final lot size (if boundary adjustment): _____
   If a boundary adjustment, identify the assessment roll number and property owner of the lands to which the parcel will be added: _____

   _____

   Description of land intended to be retained in metric units:
   Frontage: _____
   Depth: _____
   Width: _____
   Lot Area: _____
   Present Use: _____
   Proposed Use: _____
   Buildings on retained land: _____
7. Description of proposed right-of-way/easement:
   Frontage: _____
   Depth: _____
   Width: _____
   Area: _____
   Proposed use: _____
8. Name of person(s), if known, to whom lands or interest in lands to be transferred, leased or charged (if known):

   _____

9. **Site Information**	**Zoning**	**Proposed**
Please indicate unit of measurement, for example: m, m^2 or %		
Lot frontage	_____	_____
Lot depth	_____	_____
Lot width	_____	_____
Lot area	_____	_____
Lot coverage	_____	_____
Front yard	_____	_____
Rear yard	_____	_____
Left Interior side yard	_____	_____
Right Interior side yard	_____	_____
Exterior side yard (corner lot)	_____	_____
Landscaped open space	_____	_____
Entrance access width	_____	_____
Exit access width	_____	_____
Size of fencing or screening	_____	_____
Type of fencing	_____	_____

10. Building Size

Number of storeys	_____	_____
Building height	_____	_____
Total ground floor area	_____	_____
Total gross floor area	_____	_____
Total useable floor area	_____	_____

11. Off Street Parking and Loading Facilities

Number of off street parking spaces	_____	_____
Number of visitor parking spaces	_____	_____
Number of accessible parking spaces	_____	_____
Number of off street loading facilities	_____	_____

12. Residential (if applicable)

Number of buildings existing: _____

Number of buildings proposed: _____

Is this a conversion or addition to an existing building? ☐ Yes ☐ No

If yes, describe: _____

Type	**Number of Units**	**Floor Area per Unit in m2**
Single Detached	_____	_____
Semi-Detached	_____	_____
Duplex	_____	_____
Triplex	_____	_____
Four-plex	_____	_____
Street Townhouse	_____	_____
Stacked Townhouse	_____	_____
Apartment - Bachelor	_____	_____
Apartment - One bedroom	_____	_____
Apartment - Two bedroom	_____	_____
Apartment - Three bedroom	_____	_____

Other facilities provided (for example: play facilities, underground parking, games room, or swimming pool):

13. Commercial/Industrial Uses (if applicable)

Number of buildings existing: _____

Number of buildings proposed: _____

Is this a conversion or addition to an existing building? ☐ Yes ☐ No

If yes, describe:

_____

Indicate the gross floor area by the type of use (for example: office, retail, or storage):

_____

_____

_____

Seating Capacity (for assembly halls or similar): _____

Total number of fixed seats: _____

Describe the type of business(es) proposed: _____

Total number of staff proposed initially: _____

Total number of staff proposed in five years: _____

Maximum number of staff on the largest shift: _____

Is open storage required: ☐ Yes ☐ No

Is a residential use proposed as part of, or accessory to commercial/industrial use?

☐ Yes ☐ No If yes please describe:

_____

_____

14. Institutional (if applicable)

Describe the type of use proposed: _____

Seating capacity (if applicable): _____

Number of beds (if applicable): _____

Total number of staff proposed initially: _____

Total number of staff proposed in five years: _____

Maximum number of staff on the largest shift: _____

Indicate the gross floor area by the type of use (for example: office, retail, or storage):

_____

_____

_____

15. Describe Recreational or Other Use(s) (if applicable)

_____

_____

_____

_____

_____

D. Previous Use of the Property

1. Has there been an industrial or commercial use on the subject lands or adjacent lands? ☐ Yes ☐ No ☐ Unknown
   If yes, specify the uses (for example: gas station or petroleum storage):

   _____

   _____
2. Is there reason to believe the subject lands may have been contaminated by former uses on the site or adjacent sites?☐ Yes ☐ No ☐ Unknown
3. Provide the information you used to determine the answers to the above questions:

   _____

   _____

   _____
4. If you answered yes to any of the above questions in Section D, a previous use inventory showing all known former uses of the subject lands, or if appropriate, the adjacent lands, is needed. Is the previous use inventory attached? ☐ Yes ☐ No

E. Provincial Policy

1. Is the requested amendment consistent with the provincial policy statements issued under subsection 3(1) of the *Planning Act, R.S.O. 1990, c. P. 13*? ☐ Yes ☐ No

   If no, please explain:

   _____

   _____

   _____
2. It is owner's responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals, including the Endangered Species Act, 2007. Have the subject lands been screened to ensure that development or site alteration will not have any impact on the habitat for endangered or threatened species further to the provincial policy statement subsection 2.1.7? ☐ Yes ☐ No

   If no, please explain:

   _____

   _____

   _____

3. Have the subject lands been screened to ensure that development or site alteration will not have any impact on source water protection? ☐ Yes ☐ No

   If no, please explain:

   _____

   _____

   Note: If in an area of source water Wellhead Protection Area (WHPA) A, B or C please attach relevant information and approved mitigation measures from the Risk Manager Official.

4. Are any of the following uses or features on the subject lands or within 500 metres of the subject lands, unless otherwise specified? Please check boxes, if applicable.

   Livestock facility or stockyard (submit MDS Calculation with application)

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Wooded area

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Municipal Landfill

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Sewage treatment plant or waste stabilization plant

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Provincially significant wetland (class 1, 2 or 3) or other environmental feature

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Floodplain

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Rehabilitated mine site

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Non-operating mine site within one kilometre

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Active mine site within one kilometre

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Industrial or commercial use (specify the use(s))

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Active railway line

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Seasonal wetness of lands

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Erosion

   ☐ On the subject lands or ☐ within 500 meters – distance _____

   Abandoned gas wells

   ☐ On the subject lands or ☐ within 500 meters – distance _____

F. Servicing and Access

1. Indicate what services are available or proposed:
   Water Supply
   - ☐ Municipal piped water
   - ☐ Communal wells
   - ☐ Individual wells
   - ☐ Other (describe below)

   _____

   Sewage Treatment
   - ☐ Municipal sewers
   - ☐ Communal system
   - ☐ Septic tank and tile bed in good working order
   - ☐ Other (describe below)

   _____

   Storm Drainage
   - ☐ Storm sewers
   - ☐ Open ditches
   - ☐ Other (describe below)

   _____

2. Existing or proposed access to subject lands:
   - ☐ Municipal road
   - ☐ Provincial highway
   - ☐ Unopened road
   - ☐ Other (describe below)

   Name of road/street: _____

G. Other Information

1. Does the application involve a local business? ☐ Yes ☐ No
   If yes, how many people are employed on the subject lands?
   _____
2. Is there any other information that you think may be useful in the review of this application? If so, explain below or attach on a separate page.
   _____
   _____
   _____
   _____

H. Supporting Material to be submitted by Applicant

In order for your application to be considered complete, **folded** hard copies (number of paper copies as directed by the planner) and an **electronic version (PDF) of the properly named site plan drawings, additional plans, studies and reports** will be required, including but not limited to the following details:

1. Concept/Layout Plan
2. All measurements in metric
3. Key map
4. Scale, legend and north arrow
5. Legal description and municipal address
6. Development name
7. Drawing title, number, original date and revision dates
8. Owner's name, address and telephone number
9. Engineer's name, address and telephone number
10. Professional engineer's stamp
11. Existing and proposed easements and right of ways
12. Zoning compliance table – required versus proposed
13. Parking space totals – required and proposed
14. All entrances to parking areas marked with directional arrows
15. Loading spaces, facilities and routes (for commercial developments)
16. All dimensions of the subject lands
17. Dimensions and setbacks of all buildings and structures
18. Location and setbacks of septic system and well from all existing and proposed lot lines, and all existing and proposed structures
19. Gross, ground and useable floor area
20. Lot coverage
21. Floor area ratio
22. Building entrances, building type, height, grades and extent of overhangs
23. Names, dimensions and location of adjacent streets including daylighting triangles
24. Driveways, curbs, drop curbs, pavement markings, widths, radii and traffic directional signs
25. All exterior stairways and ramps with dimensions and setbacks
26. Retaining walls including materials proposed
27. Fire access and routes
28. Location, dimensions and number of parking spaces (including visitor and accessible) and drive aisles
29. Location of mechanical room, and other building services (e.g. A/C, HRV)
30. Refuse disposal and storage areas including any related screening (if indoors, need notation on site plan)
31. Winter snow storage location

32. Landscape areas with dimensions
33. Natural features, watercourses and trees
34. Fire hydrants and utilities location
35. Fencing, screening and buffering – size, type and location
36. All hard surface materials
37. Light standards and wall mounted lights (plus a note on the site plan that all outdoor lighting is to be dark sky compliant)
38. Business signs (make sure they are not in sight lines)
39. Sidewalks and walkways with dimensions
40. Pedestrian access routes into site and around site
41. Bicycle parking
42. Architectural elevations of all building sides
43. All other requirements as per the pre-consultation meeting

In addition, the following additional plans, studies and reports, including but not limited to, **may** also be required as part of the complete application submission:

☐ Zoning Deficiency Form

☐ On-Site Sewage Disposal System Evaluation Form (to verify location and condition)

☐ Architectural Plan

☒ Buildings Elevation Plan

☒ Cut and Fill Plan

☒ Erosion and Sediment Control Plan

☒ Grading and Drainage Control Plan (around perimeter and within site) (existing and proposed)

☐ Landscape Plan

☒ Photometric (Lighting) Plan

☐ Plan and Profile Drawings

☒ Site Servicing Plan

☒ Storm water Management Plan

☐ Street Sign and Traffic Plan

☐ Street Tree Planting Plan

☐ Tree Preservation Plan

☐ Archaeological Assessment

☐ Environmental Impact Study

☐ Functional Servicing Report

☐ Geotechnical Study / Hydrogeological Review

☐ Minimum Distance Separation Schedule

☒ Noise or Vibration Study

☐ Record of Site Condition

☐ Storm water Management Report

☐ Traffic Impact Study – please contact the Planner to verify the scope required

Site Plan applications will require the following supporting materials:

1. Two (2) complete sets of the site plan drawings folded to 8½ x 11 and an electronic version in PDF format
2. Letter requesting that the Holding be removed (if applicable)
3. A cost estimate prepared by the applicant's engineer
4. An estimate for Parkland dedication by a certified land appraiser
5. Property Identification Number (PIN) printout

Standard condominium exemptions will require the following supporting materials:

☐ Plan of standard condominium (2 paper copies and 1 electronic copy)

☐ Draft condominium declaration

☐ Property Identification Number (PIN) printout

Your development approval might also be dependent on other relevant federal or provincial legislation, municipal by-laws or other agency approvals.

All final plans must include the owner's signature as well as the engineer's signature and seal.

I. Development Agreements

A development agreement may be required prior to site plan approval, subdivision and condominium applications. Should this be necessary for your development, you will be contacted by the agreement administrator with further details of the requirements including but not limited to insurance coverage, professional liability for your engineer, additional fees and securities.

J. Transfers, Easements and Postponement of Interest

The owner acknowledges and agrees that if required, it is their solicitor's responsibility on behalf of the owner, to disclose the registration of all transfer(s) of land and/or easement in favour of the County and/or utilities. Also, the owner further acknowledges and agrees that it is their solicitor's responsibility on behalf of the owner for the registration of postponements of any charges in favour of the County.

K. Permission to Enter Subject Lands

Permission is hereby granted to Norfolk County officers, employees or agents, to enter the premises subject to this application for the purposes of making inspections associated with this application, during normal and reasonable working hours.

L. Freedom of Information

For the purposes of the *Municipal Freedom of Information and Protection of Privacy Act*, I authorize and consent to the use by or the disclosure to any person or public body any information that is collected under the authority of the *Planning Act, R.S.O. 1990, c. P. 13* for the purposes of processing this application.

Owner/Applicant Signature — Date: July 8th, 2025

M. Owner's Authorization

If the applicant/agent is not the registered owner of the lands that is the subject of this application, the owner(s) must complete the authorization set out below.

I/We B&B Landco Inc. c/o Jesse Buchan am/are the registered owner(s) of the lands that is the subject of this application.

I/We authorize G. Douglas Vallee Limited c/o Eldon Darbyson to make this application on my/our behalf and to provide any of my/our personal information necessary for the processing of this application. Moreover, this shall be your good and sufficient authorization for so doing.

Owner — Date: July 8th 2025

Owner — Date

N. Declaration

I, Jesse Buchan of Brantford

solemnly declare that:

all of the above statements and the statements contained in all of the exhibits transmitted herewith are true and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath and by virtue of *The Canada Evidence Act*.

Declared before me at:

Simcoe

In Norfolk County

This 8th day of July

A.D., 2025

A Commissioner, etc.

Owner/Applicant Signature

JAMES JOHN CIARALLO-CANZANO,
a Commissioner, etc., Province of Ontario,
for G. Douglas Vallee Limited.
Expires February 26, 2028.

Pre-Consultation Meeting Notes

Date: October 25, 2023

Description of Proposal: To construct two 5-storey buildings on subject lands and retail plazas

Property Location: 280, 289 and 292 Leamon Street, Waterford

Roll Number: 33502007500, 33502007400, 33502015700, 33502015800

Please read all the information in this document on the requirements for future development planning applications. As a result of the information shared at the pre-consultation meeting dated October 25, 2023, the following applications and qualified professional documents/reports are required as part of a complete application. Please include all listed items with the application to ensure a complete application. The County reserves the right to change, reduce or add requirements for a complete application, particularly if the submission does not match the proposal as reviewed during the pre-submission consultation meeting.

Please note that various fees are associated with each application, and there are also costs for qualified professionals retained to complete various documents/reports. All requirements identified are minimum and determined as of the date of the pre-consultation meeting, with the information available at that time. As the proposal proceeds, more information is made public, additional applications, studies, reports, etc., may be required. The information in this document is applicable for a maximum of one (1) year from the meeting date.

Before you submit your application, please contact the assigned Planner to confirm submission requirements and the applicable fee. Fees will not be accepted until the submission has been reviewed and confirmed by the Planning Department.

As part of a complete application, a signed version of these meeting notes is required.

Proponent / Agent Name	Signature	Date
Scott Puillandre		
Jesse Buchan		
Tom O'Hara		
Angie O'Hara		

Attendance List

Proponent	John Vallee Scott Puillandre Melissa Stickl Stewart Jesse Buchan Dean Braund Tom O'Hara Angie O'Hara Kyle Getty
Community Development – Planning and Agreement	Mohammad Alam, Supervisor, Development Planning (Chair) Annette Helmig, Agreement and Development Coordinator Fabian Serra, Planner
Building and Zoning	Jonathan Weir, Building Inspector Roxanne Lambrecht, Zoning Administrator
Environment & Infrastructure Services – Development Engineering	Tim Dickhout, Project Manager, Development
Corporate Support Services – Realty Services	Karen Lambrecht, Corporate Support Generalist

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Proposal Summary:

To construct two 5-storey residential buildings on the subject lands and retail plazas.

List of Application Requirements* and General Comments

Planning Department

Planning application(s) required to proceed	Required
Official Plan Amendment Application	x
Zoning By-law Amendment Application	x
Site Plan Application *Required per phase	x
Draft Plan of Subdivision Application *Required per lot	
Draft Plan of Condominium Application *May be Required	x
Part Lot Control Application	
Consent / Severance Application	x
Easement Application *May be Required	x

Minor Variance Application		
Removal of Holding Application		
Temporary Use By-Law Application		
Other - Click here to enter text.		
Planning requirements for a complete application The items below are to be submitted as part of the identified Planning Application(s). ** electronic/PDF copies of all plans, studies and reports are required**	**Required at OPA/ Zoning Stage**	**Required at Site Plan Stage**
Agricultural Impact Assessment		
Air Treatment Control Study		
Archeological Assessment		
Contaminated Site Study		
Dust, Noise and Vibration Study		
Elevation Plan		x
Environmental Impact Study		
Geotechnical Study		
Heritage Impact Assessment		
Hydrogeological Study		
Tree Plantation Plan		x
Retail Market Impact Study * Peer reviewed	x	
Minimum Distance Separation Schedule		
MOE D-Series Guidelines Analysis * Peer reviewed	x	
Neighbourhood Plan		
Odour Mitigation Plan		
Parking Assessment		
Planning Justification Report/Impact Analysis *may bee peer reviewed	x	
Photometrics (Lighting) Plan		x
Record of Site Condition *Phase ½	x	
Restricted Land Use Screening Form		
Site Plan/Drawing	x	x
Topographical Survey		x
Other:		
Other:		
Additional Planning Requirements		**Required**
Development Agreement		x
Parkland Dedication/Cash-in-lieu of Parkland		x

Other:		

* Any changes to a proposal may necessitate changes to Planning Department submission requirements. Reports and studies are subject to peer review.

Summary of Fees, Forms, and other information pertaining to the Planning process can found by visiting https://www.norfolkcounty.ca/government/planning/

See Appendix A for additional information

Planning Comments

The subject lands are designated Commercial in the Norfolk County Official Plan.

The subject lands are zoned Service Commercial (CS) in the Norfolk County Zoning By-Law 1-Z-2014.

To facilitate the proposal as presented at the pre-consultation meeting the applicant is required to submit an Official Plan Amendment to change the land use designation from Commercial to Urban Residential (for the residential portions of the subject lands). **Section 7.11.1 outlines the permitted uses within the Commercial Land Use Designation (7.11.1a,b,c &d).**

A Zoning By-Law Amendment Application is required to achieve the following:

- To permit Apartment Dwellings within the CS Zone or other 'R' zones as appropriate
- To permit "Retail" as a permitted use within the CS Zone
- To seek minor relief from parking requirements for Studio Apartments

The project is to take place in multiple phases. A regular Site Plan Application is required per each phase of the development, for a total of 3 applications).

In regards to severing the commercial plazas from the residential developments, staff understand that the proponent would be looking to apply for a severance application through the Committee of Adjustment. The applicant would be required to submit 2 separate consent to sever applications, one per lot.

It is understood that an easement application is not believed to be required at this time. Staff listed an easement application as a may be required item, in the event that an easement is required. The applicant would be required to submit multiple easement applications in order to establish multiple easements (1 easement per application).

At the Official Plan and Zoning By-law stage, the applicant is required to submit a Planning Justification report. Within that Planning Justification Report, the proponent is required to outline to provide justification that the proposal meets the MOE D6 guidelines. A Retail Market Impact Study to determine that the proposed commercial blocks will not have a

negative impact on the downtown of Waterford. In addition, due to the history of the subject lands and its previous land use, the proponent is required to submit a Record of Site Condition.

Lastly, a Photometric study and a Site Plan Drawing are required.

A Draft Plan of Condominium application (exemption/full depending on the condominium structure) may be required.

General Site Plan Comments:

- Bring the commercial blocks closer to the roads and have the parking areas located behind the commercial blocks and the residential buildings. This may assist in providing ammenity space and make the development look more aesthetically pleasing from a landscaping perspective.
    - By doing so, this would reduce the amount of entrances along Leamon Street.
- Are sidewalks proposed? Sidewalks around the entirety of the site and within would significantly improve pedestrian access.
- On the site plan drawing, a zoning table is to be provided.
- Ensure traffic arrows are shown in the proper flow of traffic (example: drop offs)
- Parking layout concerns (parking backing right onto the street)
- Is any green space proposed?
- Snow storage locations?

Endangered and threatened species and their habitat are protected under the provinces Endangered Species Act, 2007 (ESA), O. Reg. 242/08 & O. Reg. 830/21. The Act prohibits development or site alteration within areas of significant habitat for endangered or threatened species without demonstrating that no negative impacts will occur. The Ministry of Environment, Conservation and Parks provides the service of responding to species at risk information requests and project screenings. The proponent is responsible for discussing the proposed activity and having their project screened with MECP (Ministry of Environment, Conservation and Parks).

Please be advised that it is the owner's responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws, or other agency approvals.

Assigned Planner:
Fabian Serra
Planner
8046
Fabian.serra@norfolkcounty.ca

Development Engineering

Development Engineering – 280, 289, 292 Leamon St. Waterford

Development Engineering requirements to proceed The below requirements are to be submitted as part of the Formal Development Planning application.	**Required at OPA/ Zoning Stage**	**Required at Site Plan Stage**	**Potentially Required (See Notes Section)**
General Requirements			
Concept Plan	X	X	
Area Rough Grading Plan			
Lot Grading Plan		X	
Siltation and Erosion Control Plan		X	
General Plan of Services		X	
Plan and Profile Drawings		X	
Utility Plan		X	
Geotechnical Report			X
Functional Servicing Report	X	X	
Ministry of Environment, Conservation and Parks Permit			
Water Servicing Requirements– Section 10.0 Norfolk County Design Criteria and ISMP Section 4.0			
Extension of Watermain			
Water main Looping		X	
Easement and/or Block Registration			
Disconnection of Water Service(s) to Property Line		X	
Disconnection of Water Service(s) to Main		X	
Water Modelling (County Consultant)	X	X	
Backflow Preventer (RPZ)		X	
Water Allocation	X		

Sanitary Servicing Requirements – Section 9.0 Norfolk County Design Criteria and ISMP Section 4.0			
Sanitary Drainage Plan			
Sanitary Design Sheet			
Pumping Station Design	X?	X?	
Extension of Sanitary Mainline			
Disconnection of Sanitary Service(s) to Property Line		X	
Disconnection of Sanitary Service(s) to Main		X	
Sanitary Modelling (County Consultant)	X		
Property Line Inspection Maintenance Hole		X	
Storm Water Servicing Requirements – Section 7.0 and Section 8 Norfolk County Design Criteria and ISMP Section 4.0			
Storm Water Management Design Report (including calculations)	X	X	
Storm Water Drainage Plan			X
Storm Sewer Design Sheet			X
Establish/Confirm Legal and Adequate Outlet	X		
Anticipated Flow/Analysis to Receiving Collection System	X		
Extension of Storm Water Mainline			
Easement and/or Block Registration			
Municipal Drainage	X		
Transportation Requirements – Section 6.0 Norfolk County Design Criteria, ISMP Section 5.0, Section 6.0 and Appendix J			
Traffic Impact Study	X	X	
Street Signage/Traffic Control Plan			
Improvements to Existing Roads & Sidewalk (urbanization, pavement structure, widening sidewalk replacement, upgrades, extension and accessibility)		X	

Development Engineering Concerns and Consideration with Concept:

1. In review of the Concept, the parking as proposed along Leamon St will not be permitted as Norfolk County does not permit off street parking that must back out of a parking stall into a ROW. This is considered as an uncontrolled access to a ROW with an entrance wider than Design criteria allows

2. Development Engineering has concerns with the proximity of the commercial entrances on Leamon St in relation to the intersection of Thompson Road and Leamon St. Clearance distances between Intersections and Driveways must follow TAC criteria, additional consideration shall be given to the minimizing the the number of entrances to the county right of way, there is 14 proposed entrances.

3. Norfolk County does not have a large number of Mid Block Crossings, if they are required, they would need to be address in the TIS, and designed to meet MTO Book 12 requirements.

4. Norfolk County will require the Developer to upgrade Leamon St along the frontage of the properties to full urban standards including Curb and Gutter, sidewalks as per the latest Sidewalk policy and a full 8.0m asphalt road width. All new storm sewers required to drain the new urban cross section will be the responsibility of the Developer.

5. The county will require the site triangles at Leamon and James Street to be conveyed to the county.

6. It should be noted that sidewalks would be required for both sides of Leamon Street.

7. New Sidewalks will be required along the frontages of St James Street and Thompson Road.

8. Currently there are plans to start the design and reconstruction of Leamon Street. Construction is to be started in the 2026 construction year. The reconstruction will be a phased approached, and such, the design or construction of the road may not have started as this proposed development progresses to approvals.

9. Norfolk County would like to make the Developer aware that the County is currently investigating the existing sanitary conveyance and the impact future development may have on the downstream sewers.

10. Development Engineering have noticed that there is no indication on your site plan of storm water management.

    Please be advised that a Stormwater Management report and facility will be required. The SWM report must identify the Legal and Adequate outlet. At this time it is assumed that the Waterford South Municipal Drain may be the outlet. This outlet is to be considered as a Limited outlet.

General Notes:

11. Securities will be required in the form of a schedule. Any works completed within the Municipal Right-of-Way (R.O.W.) is to be shown as 100% security. Any works completed within private property is to be shown as 10% security. This can be submitted at time of Site Plan.

12. All reports and plans are to be signed and stamped by a Professional Engineer (P.Eng.).

13. All reports are to be completed in reference to Norfolk County's Design Criteria and Integrated Sustainable Master Plan (ISMP).

14. Recommendations from all reports (FSR, SWM, TIS, Modelling, etc.) must be incorporated into the design and is to adhere to Norfolk County's Design Criteria. A copy of this criteria is available upon request.

15. Recommendations from all reports (FSR, SWM, TIB, Modelling, etc.) must be incorporated into the design and be constructed at the developer's expense.

16. All applicable permits and inspections to be issued by Environmental and Infrastructure Services department.

17. Water / Wastewater allocation will not be issued as part of the Zoning By-law amendment.

    Water Allocation will not be issued until the end of the site plan application process. The applicant is to confirm capacities at the time of Site Plan application. At the time registration of agreement\approval allocation will be provided for the development, if available.

Required at Official Plan Amendment and/or Zoning By-Law Amendment Application Stage:

18. The following reports/studies will be required at time of Official Plan Amendment and/or Zoning By-law Amendment:

    a. Concept Plan;
    b. Functional Servicing Report (as per Norfolk County Design Criteria);
    c. Water / Sanitary Modelling.
    d. Storm Water Management Report.
    e. Traffic Impact Study (as per ISMP Appendix J – TIS Guidelines);

19. Sanitary and Water modelling will be required. This is to be completed by Norfolk County's third-party consultant. The cost to complete the modelling and any recommendations from reports are to be implemented into the design at the applicant's expense. The following information will be required to receive a quote and complete the modelling.

    a. General Plan of Services

b. Functional Servicing Report;
    i. Total Wastewater Design Flows;
    ii. Total Domestic Water and Fire Flows as per Norfolk County Design Criteria Section 10.1.1

The Functional Servicing Report must include water /sanitary servicing and fire flow calculations. Fire Flow calculations are to be completed in accordance with "Water Supply for Public Fire Protection 2020" by Fire Underwriters Survey.
Once the quote has been received, approval from the applicant will be required before proceeding.

20. The Functional Servicing Report needs to include a comprehensive assessment of the potential environmental impacts of the proposed development. The requirements of the Class EA integrated process may not apply to Site Plans. The legislation allows for an integrated approach and provides proponents with the opportunity to reduce duplication by simultaneously complying with the Planning Act and Class EA processes, including public/stakeholder notification and consultation requirements, technical reports and analyses, and land use planning and environmental protection decisions.

21. Norfolk County would like to make the Developer aware that the County is currently investigating the existing sanitary conveyance and the impact future development may have on the downstream sewers. Available capacity is not known at this time.

22. Stormwater Management Report is to be completed as per Norfolk County Design Criteria Section 7.0 and Section 4.0 of the ISMP.
    a. Given the fact the Outlet for this property is the Waterford South Municipal Drain and that it shall be considered a "Limited" outlet, the SWM report must identify enough details to justify that the site can retain pre development flows.
    b. There are also concerns as to WHERE will the SWM be designed? The concept does not show much green space.
    c. Although the lands are within a municipal drain watershed, the existing storm sewers will replaced with storm sewers constructed under the MECP CLI, as such the storm shall be designed based on the current standards.

23. Most of the property identified in this proposal is currently part of the Waterford South Main Street Drain. Early consultation with Norfolk County's Drainage Department will be required. This will be necessary prior to completing the determination of the legal and adequate outlet.

24. As per Norfolk County's Integrated Sustainable Master Plan (ISMP) – Appendix J: Traffic Impact Study (TIS) Guidelines, a full Traffic Impact Study will be required. These guidelines are available upon request.
    a. Total number of entrances needs to be addressed in the TIS
    b. Location of entrances must be addressed in the TIS. Especially the one-way entrances, and those entrances in Proximity to intersections or other entrances.
    c. Demonstrate that that driveway entrance is appropriately spaced from Thompson Rd

25. Under the current Consolidated Zoning section 4.2.4 C

For group townhomes and apartment buildings, no parking lot or parking space shall be located between a dwelling and the street line, except for individual or tandem parking spaces, leading directly to each townhouse dwelling unit.

Required at Site Plan Stage:

All Site Plan submissions are to comply with Section 16 of the Norfolk County Design Criteria in addition to the comments below. All requirements mentioned above are to be resubmitted at the time of Site Plan review.

26. Any recommendations/upgrades from the modelling reports must be implemented at the time of Site Plan submission. Upgrades, if any, are to be completed at the Developer's expense.

27. Concept Plan

28. Lot Grading Plan, Siltation and Erosion Control Plan, and General Plan of Services drawing can be shown on one engineering plan as long as it's legible for review.

29. Plan and Profile drawings will be required as per Section 16.4.03.

30. A Utility Plan is required as per Section 4.4.07 of Norfolk County Design Criteria for all utilities to be installed in the Municipal ROW. An Electrical Services Plan as per Section 16.4.05 and 16.5.05 shall also be included with the Utility Plan

31. As per Norfolk County By-law 2013-65, only one domestic water service pipe shall be installed per property.

32. Watermain looping through a private site WILL NOT be permitted.

33. Disconnection of existing water services will be required prior to installation of the new water service. Permits are required prior to any work being completed. It should be assumed that disconnection will be required earlier at the Demolition stage.

34. A Testable DCVA Backflow device shall be placed in a watertight chamber at the property line for each property. Approval from the Manager of Environmental Services must be obtained as per Norfolk County Design criteria.

35. Depending on eventual design of proposed water service and the proposed usage within the development a Backflow Preventer (RPZ) may be required for the apartments and commercial properties. Approval from the Manager of Environmental Services must be obtained as per Norfolk County Design criteria.

36. Confirmation of the location, size and condition of existing Sanitary lateral will be required. If location, size and / or condition is not adequate, then disconnection of existing Sanitary service will be required prior to installation of a new sanitary service. The minimum size of lateral for a proposal such as this is 150mm as per NCDC Section 9.7.1.

37. A Sanitary Inspection manhole will be required on Property line.

38. Please be aware that only One sanitary lateral is permitted to each property.

39. Stormwater Management Report is to be completed as per Norfolk County Design Criteria Section 7.0 and ISMP Section 4.

40. A Storm Drainage area plan will be required as per Norfolk County Design Criteria and must identify any external overland flows tributary to this site. The drainage plan must also identify that all Stormwater is self-contained on site and does not travel to neighboring properties.

41. Confirmation of Legal and Adequate outlet will be required. According to current Norfolk County records there is no storm sewer along the frontage of this property. Extension of Storm sewer may be required.

42. The developer will be responsible to confirm anticipated flow to the existing storm system and ensure adequate capacity exists to accept the proposed development. It shall be the developer's responsibility to satisfy themselves that there is an adequate storm collection to the proposed development. All associated costs of construction for upgrades to existing and new infrastructure shall be the responsibility of the owner / applicants of the development.

43. The ultimate handling of all Storm water discharge shall be identified in the Stormwater Management Report, including all overland discharges from site.

44. In consultation with Norfolk County's Drainage Department, they have responded that they will require at a minimum a Drainage Act Section 65 report to review the alteration within the watershed. The report shall consider any increase or decrease in flows.

45. New Sidewalks will be required along the frontages of St James Street and Thompson Road. Sidewalks will be required on Both sides of Leamon St .

46. All entrances are to be shown on the plans. Entrances must conform to Norfolk County Design Criteria and By-law 2016-32 for commercial/heavy industrial minimum driveway design.

a. Driveway Grades (Section 6.7.02);
b. Driveway Widths (Section 6.7.03);
c. Number of Commercial entrances (By-Law 2016-32)

Entrance design must also encompass any recommendations from the Traffic Impact Study.

47. Design of those drop off areas might be a concern – Norfolk County does not have specific design criteria for these and must review each concept individually. Future consultation will be required prior to submission.

Potentially Required Notes:

48. A Geotechnical report must be submitted if Storm water management practices involving infiltration are proposed.

Tim Dickhout
Project Manager, Development
Tim.Dickhout@norfolkcounty.ca

Agreements

A recommended condition of your planning application approval will be to enter into a development agreement with the County that will be registered on title to the subject lands, at the Owner's expense. The additional requirements for a development agreement could include, but are not limited to the following:

- Engineering drawing review
- Engineer's schedule of costs for the works
- Clearance letter and supporting documentation to support condition clearance
- User fees and performance securities
- Current property identification number (PIN printout) (can be obtained by visiting https://help.onland.ca/en/home/)
- Owner's commercial general liability insurance to be obtained and kept in force during the terms of the agreement
- Postponement of interest. If there are mortgages / charges on your property identifier, your legal representative will be required to obtain a postponement from your bank or financial institution to the terms outlined in your development agreement
- Transfers and / or transfer easements along with registered reference plan

Annette Helmig
Agreement and Development Coordinator
Annette.Helmig@norfolkcounty.ca

Building

Zoning Administrator:

Zoned CR
Comments are not detailed at this point;

- Isle widths on angle parking to be provided
- Already asking for relief on residential parking, maybe relocate visitor parking and ask for further relief on visitor parking so it's in a more ideal location. If the lots will be severed it may create a deficiency in parking.
- Small section used for parking zoned R1-A, will this section be re-zoned?

- Covered areas in front of residential apartments may require relief of exterior side yard
- 1st storey (ground level proposed parking) would be beneficial to locate wheelchair accessible spots on ground floor parking close to elevators.
- Comments made on limitations of general retail for both proposed commercial spaces.This will need to be clear for each commercial building as retail is currently not a permitted use of the CS zone.

Roxanne Lambrecht
Zoning Administrator
Extension 1839
Roxanne.Lambrecht@norfolkcounty.ca

Building Inspector:

The proposed construction is considered a Residential group C for the dwelling units and an F2 Industrial occupancy for the parking garage.

The commercial component will be considered a group D and/or E depending on the type use. You will need to retain the services of an Architect and a Professional Engineer to complete the design documentation for this application.

The Designer will need to provide a Part 3 Building Code matrix. This matrix represents selected elements from your detailed code analysis and presents a quick overview to the municipal building official of the key OBC factors concerning your design. The matrix will identify OBC review items such as occupant loads, fire separations, project description, building size, building classification, fire alarms, type of construction, barrier free requirements, plumbing fixture requirements and spatial separations.

The Designer will need to focus on OBC Sections 3.2. Building Fire Safety, 3.3. Safety Within Floor Areas, 3.4. Exits and 3.8. Barrier Free requirements. A standpipe system will be required as per OBC 3.2.9. The Designers chosen building classification and construction type as per OBC Subsection 3.2.2. will address further the provisions for firefighting.

The Designer will also need to review OBC Subsection 3.1.19. Above Ground Electrical Conductors, depending on the voltage, the clearances to the building will vary.

A demolition permit will be required for removal of the existing buildings.

Signs proposed due to development will require a permit as part of Norfolk's Sign Bylaw and may need a Building Permit according to the OBC.

MULTI LEVEL ROOFS AND SNOW LOADS

A letter signed by a Professional Engineer licensed in the Province of Ontario regarding multi-

level roof drifting snow load may be required. Provide calculations as required by Ontario Building Code Part 4 Subsections 4.1.6.5. – 4.1.6.15. If additional snow load is calculated to fall on neighboring structures, an engineered analysis of the neighboring is required. Completion of compensating construction to the neighboring structure may also be required. Separate building permit required for compensating construction.

MORE THAN 2 DWELLINGS-PLUMBING

The Ontario Building Code (OBC) 7.6.3.4 requires a review of water service connection size at the time of application for projects connected to a water system with more than one dwelling unit. To help with this the Building Department has created an excel spread sheet. This is to be included with at time building permit application.

Items for Site Plan

Site plan drawings need to have enough detail, to determine compliance with the code references listed.

1. Indicate location of access route and access route design [OBC 3.2.5.4 to 3.2.5.6]
2. Water supply design and calculations. [OBC 3.2.5.7]
3. Indicate location of existing and new fire department connections. Dimensions between hydrants and building entrances is required.

[OBC 3.2.5.16]

3. Location and specifications of exterior lighting. Lighting to be included in SB-10 report – energy efficiency
4. Indicate barrier free path of travel from parking area to building entrance. Construction of curb cuts and location of tactile attention indicators is required. [OBC 3.8.1.3, & 3.8.3.2]
5. Location of revised septic system (if required)
6. Provide building elevations and cross section, showing building massing, location of proposed entrances and exits, barrier free controls, exterior lighting locations, and exterior signage. [Planning Act 41(4).2]

Items for Building Permit

If you have any questions on the building permit process or plans required, please contact permits@norfolkcounty.ca or 226-NORFOLK (226-667-3655) ext. 6016

Jonathan Weir
Building Inspector

Extension 1832
jonathan.weir@norfolkcounty.ca

Corporate Support Services – Realty Services

1. If a Development Agreement is required, then the County will require postponements of any charges/mortgages (if any) on title to the County's Development Agreement. We recommend that you contact your Lender(s) (if any) and/or your solicitors as early as possible to avoid any delays in your project.

2. Depending on whether any severances are occurring in your proposed development, the Property Owner may be required to confirm, through their solicitors, that the two parcels on the east side of Leamon Street have merged together in title, and also confirm, through their solicitors, that the two parcels on the west side of Leamon Street have merged together in title.

Specialist, Realty Services
realty.services@norfolkcounty.ca

Corporate Support Services - Accessibility for Ontarians with Disabilities Act

No comments at this stage while understanding site layout and parking configurations may change.

Sam McFarlane
Manager, Accessibility and Special Projects
Corporate Support Services
519-426-5870 x. 8099 Sam.McFarlane@norfolkcounty.ca

Appendix A: Planning Reference Materials

Following is a summary of some land use planning reference materials. It is the requirement of the applicant to ensure compliance with applicable legislation, policies and regulations.

Provincial Policy Statement, 2020

https://www.ontario.ca/page/provincial-policy-statement-2020

Norfolk County Official Plan
https://www.norfolkcounty.ca/government/planning/official-plan/

Section 7.7 outlines policies in regards to the Urban Residential Land Use Designation.

Section 7.11.1 outlines the permitted uses within the Commercial Land Use Designation

(7.11.1a,b,c &d).

Section 9.6.1 outlines requirements in relation to requests to amend the Official Plan.

Section 9.6.2 outlines requirements in relation to requests to amend the Zoning By-law.

Section 9.7.2 outlines policies as it pertains to Retail Market Impact Study.

It is the responsibility of the proponent to review and ensure relevant Official Plan policies are addressed in any future development application.

Norfolk County Zoning By-Law 1-Z-2014
https://www.norfolkcounty.ca/government/planning/new-zoning-by-law/

The provisions of the Norfolk County Zoning By-Law shall apply to all lands within the boundaries of Norfolk County. No land, building or structure shall be used, erected, or altered in whole or in part except in conformity with the provisions of this By-Law. No land, building or structure shall be used or occupied except for uses that are specifically identified in the By-Law as permitted uses by the relevant zoning category.

It is the responsibility of the proponent to review and ensure relevant Zoning By-law provisions are addressed in any future development application

REQUIRED INFORMATION

Name of Owner_____

Property Legal Description_____

Roll Number_____

PIN Number_____

Type and Number of Units

Single Detached_____

Semi-Detached_____

Duplex _____

Triplex _____

Four-plex_____

Street Townhouse_____

Stacked Townhouse_____

Apartment_____

Transfer Easements Block Number and Purpose_____

Transfer Block Number and Purpose_____

Geotechnical Report prepared for Lands	YES	NO	UNKNOWN
Lands are Within the Source Water Protection Area	YES	NO	UNKNOWN
Lands Contain any Contaminated or Impacted Soil	YES	NO	UNKNOWN
Lands Contain any Natural Watercourse	YES	NO	UNKNOWN
Lands Contain any Wetlands	YES	NO	UNKNOWN
Lands Contain any Archaeological Sites	YES	NO	UNKNOWN
Lands Contain an Existing Well and or Septic Field	YES	NO	UNKNOWN
Species at Risk Branch MECP Screening	YES	NO	UNKNOWN
Lands Contain any Endangered Species	YES	NO	UNKNOWN

OWNER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

AGENT INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

ENGINEER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

LAWYER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL_____

INSURANCE PROVIDER INFORMATION

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL_____

FINANCIAL INSTITUTION INFORMATION (IF APPLICABLE)

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL_____

MORTGAGEE INFORMATION (IF APPLICABLE)

NAME AND CONTACT_____

ADDRESS WITH POSTAL CODE_____

PHONE NUMBER_____

EMAIL _____

SPECIES AT RISK SCREENING

The Ontario Endangered Species Act inquiries and Species at Risk screening are now handled by the Ministry of the Environment, Conservation and Parks, specifically the "Species at Risk Branch" and the new e-mail address for handling these inquiries is now SAROntario@ontario.ca.

TRANSFERS, EASEMENTS AND POSTPONEMENT OF INTEREST

The owner acknowledges and agrees that, it is their solicitor's responsibility on behalf of the owner for the registration of all transfer(s) of land to the County, free and clear of any charges or encumbrances, and/or transfer(s) of easement in favour of the County and/or utilities at no cost to the County. In addition, the owner further acknowledges and agrees that it is their solicitor's responsibility on behalf of the owner for the registration of postponements of any charges to the County's agreements.

INSURANCE CERTIFICATES

Prior to the execution of the development agreement, the owner shall at their expense obtain and keep in force, during the term of this development agreement, commercial general liability insurance coverage satisfactory to the County. The owner further acknowledges and agrees that he/she has authorized the County to discuss with their insurance provider the specific insurance requirements of the County for agreement purposes. In addition, the County will require any professionals hired to carry professional liability insurance to provide coverage for acts, errors and omissions arising from their professional services performed.

OWNER'S AUTHORIZATION

I/We _____ am/are the registered owner(s) of the lands that is the subject of this site plan agreement.

I/We authorize our Agent _____ to provide information on my/our behalf and to provide any of my/our personal information necessary for the processing of this site plan agreement. Moreover, this shall be your good and sufficient authorization for so doing.

I/We authorize the Agreement Administrator to provide and receive information on my/our behalf in connection to the insurance coverage, letter of credit and agreement registration of my/our development.

I/We acknowledge that if there are any new charges or mortgage holders on the property they will be added to the development agreement and will be required to postpone their interest on the property to the County's development conformity interest.

Owner Signature Date

To start your agreement, please return the required supporting information and fees along with the first three pages of this document completed and signed. Provide your payments by the mail or courier to the address below or drop off at ServiceNorfolk customer service desk on the first floor 185 Robinson Street, Simcoe ON N3Y 5L6 Monday to Friday from 9 am to 4 pm. Please make your cheque payable to the Corporation of Norfolk County. If paying by credit card please contact ServiceNorfolk at 519 426-5870 Ext. 4636.

CONTACT FOR FURTHER INFORMATION AND QUESTIONS

Annette Helmig, Agreement and Development Coordinator
Norfolk County, Community Development Division, Planning Department, Agreement Services
185 Robinson Street Suite 200, Simcoe ON N3Y 5L6
226.777.1445
annette.helmig@norfolkcounty.ca

The information submitted on this form is collected under the authority of the *Freedom of Information and Protection of Privacy Act* (FIPPA) and *Municipal Freedom of Information and Protection of Privacy Act* (MFIPPA) for Norfolk County employees to use for the purpose of preparing and registering a development agreement. Questions about the collection of personal information through this form may be directed to the Agreement and Development Coordinator or Information and Privacy Coordinator, Corporation of Norfolk County, 50 Colborne Street South, Simcoe ON N3Y 4H3.

DOCUMENTATION AND FEES REQUIRED

Owner's agreement authorization

Postponement of interest from mortgagee / chargee (if applicable)

Current parcel register (property identifier or PIN printout)

Owner's commercial general liability certificate of insurance

Construction estimates (100% for external works and 10% of internal works)

Professional liability insurance for surveyor and / or engineer

Final reference plan for any easements and lands to be conveyed

Letter from owner requesting holding (H) symbol be removed from the subject lands

Letter of credit or certified cheque for performance securities

Current property taxes paid

User fees (according to the By-Law in effect at the time that payment is made). If time is of the essence, a certified cheque is requested otherwise it will take three weeks for the cheque to clear our financial institution.

$2,780 for preparation of the site plan agreement
$924 to remove the holding from the zoning on the property (if applicable)
$447 for financial administration of this agreement
$542 per tree cash-in-lieu of trees (if applicable)
2% or 5% land appraisal cash-in-lieu of parkland as per consolidated by-law 2016-126 (if applicable)

vallee
Consulting Engineers, Architects & Planners

September 22, 2025

Norfolk County
Community Development Division
12 Gilbertson Drive,
Simcoe ON, N3Y 3N3

Attention: **Alisha Cull | Manager Of Planning Services**

Reference: **B&B Landco Inc.**
Application for Zoning By-Law Amendment
289 Leaman Street, Waterford
Our File 25-120

Please accept this package as our formal submission for a **Zoning By-law Amendment** for **289 Leaman Street** on behalf of B&B Landco Inc. Included as part of our complete application package are the following documents:

1. Zoning By-law Application Form
2. Planning Justification Report prepared by G. Douglas Vallee Limited, July 14, 2025
3. Functional Servicing and Stormwater Management Report prepared by G. Douglas Vallee Limited, dated September 11, 2025
4. Traffic and Parking Analysis prepared by RC Spencer Associates Inc., dated June 20, 2025.
5. Preliminary Survey prepared by MacAulay, White & Muir Ltd, dated June 26, 2025
6. Land Use Compatibility Study prepared by Sonair, dated May 21, 2025.
7. Geotechnical Study prepared by Gemtec, dated September 4, 2025
8. Full Drawing Set, including Site Plan, Building Elevations, Building Sections, 3D Renderings, and Shadow Study Prepared by BIM Studio, dated 2025 (submitted separately due to size)

Some time has passed since the original development concept was considered by Norfolk County staff. This revised development concept includes 1 apartment building consisting of 5-storeys, and is attached to a commercial unit. This property is proposed to be mixed use, noting that some of the parking is located on the ground floor, under the residential component of the overall building.

Furthermore, the pre-consultation meeting completed in 2023, required various submission items to which not all are applicable based on the new proposed development.

1) Retail Market Impact Study (peer reviewed)

This study was requested as it was contemplated to change the zoning to permit retail. This is no longer the case. As such, a retail market impact study is not required.

2) Planning Justification Report (may be peer reviewed)

A planning justification report is submitted with this application. However, it is not appropriate to

peer review a planning justification report when the County has registered professional planners on staff.

3) Record of Site Condition

This study is underway. However, it is to be submitted at the time of Site Plan application. Through the site plan, appropriate conditions can be considered to implement any recommendations of the study, including achieving the record of site condition. Furthermore, the ground floor of the development is not proposed to include residential units.

4) Official Plan Amendment

Based on the policies of 7.11.1 e), it does not appear that an Official Plan Amendment to change the land use designation from Commercial to Urban Residential is required. This is discussed in the Planning Justification Report. However, it is briefly summarized that:

a) The commercial element permitted by the Official Plan and Zoning is proposed with this development.
b) Section 7.11 d) permits mixed residential and commercial uses that have historically located along the major transportation routes.
c) See 7.11.1 e) Residential uses shall be permitted, provided that the uses do not negatively impact the planned function of the Commercial areas subject to the following provisions:
"in a building of residential character, either single detached or multiple dwelling, residential and/or commercial uses shall be permitted, provided the residential character of the building is maintained."

The proposed development satisfies this provision by:

- Replacing low intensity warehouse type commercial, with new a more intense ground-floor commercial component that is visible, accessible, and functionally viable;
- Further intensifying the lands with residential uses above the ground floor, in a form that reflects a residential building character;
- Avoiding land use conflicts with adjacent residential, industrial or institutional lands through site planning, setbacks and buffering.

As such, the interpretation of the Official Plan policies, does not need to be overly explicit. Rather, the overall form and function of the intent of the policies is implemented through the proposed use, intensification, and design of the property.

5) Other changes.

Initially, multiple phases were proposed, along with a severance of lands, and multiple easement applications. These are no longer being pursed.

6) Class 4 Area

A unique section of the Planning Justification Report includes a description of what a Class 4 Area is from a Ministry Noise perspective. You are encouraged to review Appendix F to better understand how this tool is used by municipalities to protect Industrial uses and Residential land

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uses. This approach is supported by the Sonair Compatibility Study and the Ministry.

The submission has been made electronically through the Norfolk County CityView portal. Payment of fees will be made once the application has been deemed complete. Should you have any questions or comments, please feel free to get in touch so that we can address your items in a timely manner.

Thank you in advance for your support of this project.

Best regards,

James Canzano, BA Spec Hons
Planning Technician
G. DOUGLAS VALLEE LIMITED
2 Talbot Street North, Simcoe Ontario, N3Y 3W4
Phone: 519.426.6270x1009 I www.gdvallee.ca

vallee

Consulting Engineers,
Architects & Planners

July 15, 2025

B&B Landco Inc.
245 King George Road, Suite 222
Brantford, Ontario
N3R 7N7

Attention: **Mr. Jesse Buchan**

Reference: **Functional Servicing Report**
Leamon Street Midrise
Waterford – Norfolk County
Our Project #25-120

Introduction

This functional servicing report has been prepared in support of the zoning amendment application and site plan application for a five-storey midrise building located in Waterford, Norfolk County. The proposed building will contain commercial use on the ground floor and residential units on floors two to five. This report presents the functional servicing for the proposed development, including sanitary, storm and domestic and fire water servicing. It is the intention to submit this report to Norfolk County for review and approval.

The 0.48 ha development site consists of two separate parcels located at 285 and 289 Leamon Street in Waterford, Norfolk County and is bound by Thompson Road to the south, Leamon Street to the west, existing residential dwelling to the north and Norfolk County Fire Station 3 and Kooi Trucking to the east. The site is currently occupied by several large commercial buildings. Refer to Figure 1.

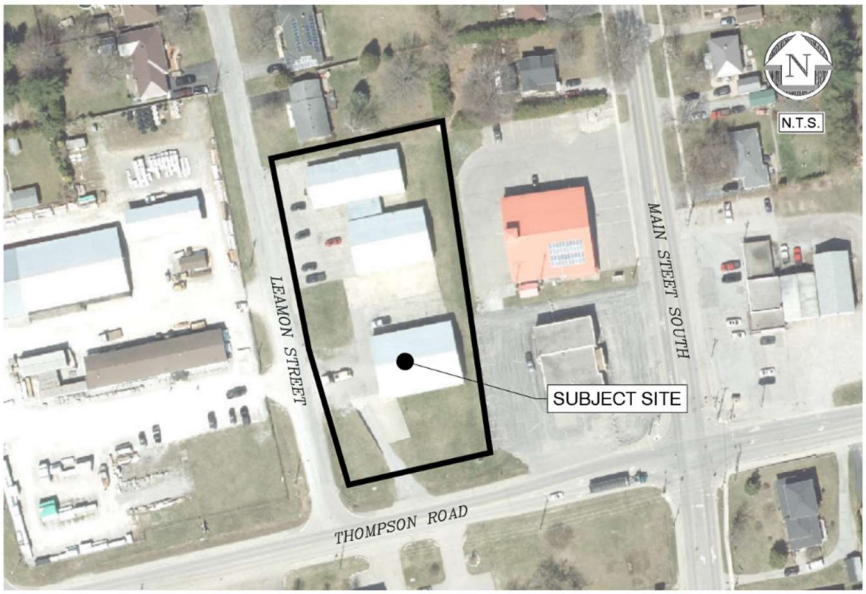


Figure 1 – Site Location

Land Use and Design Assumptions

The proposed development will consist of the following construction:

- 5-story midrise building with 44 residential units and ground floor commercial space
- Parking lot for residential units and commercial spaces
- Water, storm and sanitary infrastructure to support the proposed construction
- Stormwater management facility
- Curbs, sidewalks and other miscellaneous items to support the proposed construction

The following table outlines the mix of land use and calculates the anticipated population based on an apartment residential dwelling density of 2.0 ppu and a commercial density of 90 people per hectare as per the Norfolk County Design Criteria. Note that 25% of the total site area has been used to calculate the commercial population.

Table 1
Estimate of Population

Land Use	Number of Units	Population
Residential	44 units @ 2.0 ppu	88 people
Commercial	0.12 ha @ 90 pph	11 people
	Total	99 people

Sanitary Servicing

Norfolk County GIS mapping and record drawings indicate an existing 200mm asbestos cement sanitary sewer along Leamon Street. An existing sanitary service (of unknown diameter) at the northwest corner of the site currently services the existing buildings. It is proposed that the existing service be removed, and that a new 150mm sanitary service be installed from the proposed building to the existing 200mm sewer along Leamon Street. Norfolk County has advised that they will be undertaking the reconstruction of Leamon Street in 2026. If the road reconstruction work is complete by the time that this proposed development goes to construction, the proposed sanitary lateral will connect to the new 200mm sanitary sewer within Leamon Street.

Sanitary design flows for the proposed development were calculated using the Norfolk County Design Criteria. Table 2 presents the flow information associated with each of the proposed development zones. In summary, the development is anticipated to generate a total sanitary flow of approximately 1.50 L/s to the existing sanitary sewer on Leamon Street. Detailed calculations are outlined in Appendix A.

Table 2
Sanitary Design Flows

	Residential	Commercial
Population	88 persons	11 persons
Per Capita Flow	285 L/person/day	40 m^3/hectare/day
Peak Extraneous Flow	0.28 L/sec/ha	
Peak Design Flow	1.37 L/s	0.13 L/s
Total	1.50 L/s	

Sanitary Network Review

To confirm the calculations presented, Vallee requests that sanitary hydraulic modelling be completed by Norfolk County's consultant to determine if the existing County infrastructure provides adequate capacity to accommodate the estimated sanitary design flows from the proposed development further downstream.

Water Servicing

Norfolk County GIS mapping and record drawings indicate an existing 150mm diameter asbestos cement watermain on Leamon Street, and an existing 250mm diameter watermain (unknown material) along Thompson Road. An existing water service (of unknown diameter) at the northwest corner of the site currently services the existing buildings. It is proposed that the existing service be removed, and a new 150mm water service be installed from the proposed building and connected to the existing 250mm watermain along Thompson Road to service the proposed development.

Norfolk County's design criteria stipulates the following requirements for system pressures, and the system shall be designed to meet the greater of either of the following requirements;

- Fire flow conditions– not less than 140 kPa
- Normal operating conditions – not less than 280 kPa

Domestic Water Demand

The domestic water demand for the proposed development has been calculated using Norfolk County's design criteria. Table 3 presents the domestic water flow information for the proposed development.

Table 3
Domestic Water Demands

	Residential	Commercial
Population	88 persons	11 persons
Average Daily Demand	285 L/person/day	
Maximum Day Demand Factor	2.25	
Maximum Day Demand	0.65 L/s	0.08 L/s
Peak Hourly Demand Factor	4	2
Peak Hourly Demand	1.16 L/s	0.07 L/s

In summary, the proposed development is anticipated to have a total maximum daily demand of 0.73 L/s and a maximum hourly demand of 1.23 L/s. Refer to Appendix B for detailed calculations.

Fire Water

According to the County GIS online mapping, there is an existing fire hydrant at the northwest corner of Thompson Road and Leamon Street, directly across from the proposed development. The hydrant is within the minimum distance required by the Ontario Building Code (OBC) to adequately protect the proposed building; however, an additional hydrant will be installed on the subject property.

The proposed building will be sprinklered, and the fire flow will be provided by the new hydrant located within the development parking lot.

Typically, available fire flow during the maximum day demand is the critical criteria when evaluating a watermain distribution system's performance. Using the requirements of the Ontario Building Code, the estimated fire flow required for the proposed development was determined to be 150 L/s. Refer to the complete calculations in Appendix B.

Norfolk County has revised its required fire flow criteria and has determined that the required fire flow for development shall be the greater of the fire flow required by the OBC and the required fire flow based on the land use and the community in which the development is located. For a residential development with greater than 3 units, and a commercial development in Waterford, the required fire flow is 90 L/s and 150 L/s, respectively. Therefore, the required fire flow for the proposed development has been determined to be 150 L/s. Refer to Form FFD1 in Appendix B.

Water Network Review

Information obtained from Norfolk County ISMP indicates that the existing 250mm diameter watermain along Thompson Road has available fire flow rate greater than 159 L/s, and the existing 150mm diameter watermain along Leamon Street has an available fire flow rate between 57 L/s and 83 L/s, as shown in Appendix B. The proposed hydrant located within the development parking lot shall be fed off the existing 250mm watermain along Thompson Road. Therefore, it is anticipated that adequate fire flow is available.

Vallee requests that watermain hydraulic modelling be completed by Norfolk County's consultant to determine if the existing water system has adequate system flows and pressure provide the aforementioned fire flow demands.

Stormwater Management

The following summarizes the proposed SWM Facility for the proposed development:

- Discharge from the SWM facility is controlled by 125mm orifice and shall be released to the existing 825mm storm sewer along Leamon Street, which connects to the existing Waterford South Municipal Drain storm sewer along Thompson Road.
- The underground storage chamber facility uses 30 StormTech MC-7200 chambers and has a total storage volume of 274 m^3.
- The total peak post-development flows from the site have been controlled to less than the 2-year pre-development allowable release rate for all storm events up to and including the 100-year storm event.
- During events greater than the 100-year storm, runoff from the site will surcharge the SWM facility, and flow overland towards Leamon Street and Thompson Road as it does under pre-development conditions.
- The proposed StormTech Isolator PLUS Row shall be utilized to achieve an enhanced level of water quality protection, corresponding to 80% TSS removal.

Complete details of the stormwater management design are provided in the Buchan Midrise Stormwater Management Report dated September 11, 2025.

Conclusions and Recommendations

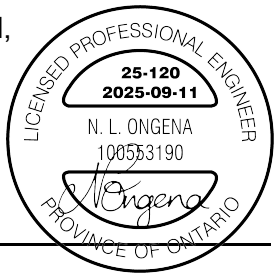
The functional servicing design for the proposed development can be summarized as follows:

- A peak sanitary design flow of approximately 1.50 L/s is anticipated from the proposed development.
- Modelling from Norfolk County's consultant has been requested to confirm that the existing sanitary collection system can accommodate the additional flows from the proposed development.
- The domestic maximum day demand and peak hourly demand for the proposed development were found to be 0.73 L/s and 1.23 L/s, respectively.
- The required fire flow demand for the proposed development was found to be 150 L/s based on Norfolk County's fire flow requirements.
- Modelling from Norfolk County's consultant has been requested to confirm that the available fire flow at the existing fire hydrant across from the proposed development is greater than the required fire flow of 150 L/s.
- Discharge from the SWM facility is controlled by 125mm orifice and shall be released to the existing 825mm storm sewer along Leamon Street, which connects to the existing Waterford South Municipal Drain storm sewer along Thompson Road.
- The underground storage chamber facility uses 30 StormTech MC-7200 chambers and has a total storage volume of 274 m^3.
- The total peak post-development flows from the site have been controlled to less than the 2-year pre-development allowable release rate for all storm events up to and including the 100-year storm event.
- The proposed StormTech Isolator PLUS Row shall be utilized to achieve an enhanced level of water quality protection, corresponding to 80% TSS removal.

It is recommended that this report be provided to Norfolk County in support of the zoning amendment and site plan application for the proposed development.

We trust that this information is complete and sufficient for submission. Should you have any questions or require further information please do not hesitate to contact us.

Respectfully submitted,



Natalie Ongena, P.Eng
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects and Planners

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List of Appendices

Appendix A
– Sanitary Flow Calculations

Appendix B
– Norfolk County Domestic Water Demand Calculations
– Required Water Service Diameter Calculations
– OBC Fire Flow Calculations
– Form FFD1 – Norfolk County Fire Flow Determination
– DWG FIRE – Fire Separation Distances
– Norfolk County ISMP Waterford Pressure and Available Fire Flow

APPENDIX A

Sanitary Flow Calculations

Proposed Per Capita Flow/Demand	
Water	285 L/c/d
Wastewater	285 L/c/d
Persons per unit Component (by zone basis)	
Low Density Res	25 units/ha at 3.0 ppu
Medium Density Res	75 units/ha at 2.4 ppu
High Density Res	150 units/ha at 1.6 ppu
Single and semi detach	3.0 ppu
Town/rowhomes	2.4 ppu
Apt and ADU's (2+ bdrm)	2.0 ppu
Apt and ADU's (1 bdrm)	1.6 ppu

SANITARY FLOW - RESIDENTIAL

Tributary Population

Townhouse Residential Development:

Units:	2	persons/unit	**assumed 2+ bedroom units*
Number of Persons:	44	Units	
Site Area	88	persons	
	0.48	ha	

Sewage Flow

Per Capita Flow:

Average Sewage Flow:	0.285	m^3/person/day
	0.290	L/s

Peak Sanitary Flow Factor

Residential Peaking Factor Formula:

M = 1 + (14/(4+ [14 / { 4 + P^(0.5)}])

P =

M =	0.088	
	4.258	2 < M < 5

Infiltration Allowance

Infiltration Allowance:	0.28	L/s/ha
Infiltration Allowance:	0.134	L/s

Design Flow

Design Flow:

Design Flow = (Average Sewage Flow * Peak Sanitary Flow Factor) + Infil. Allowance

Design Flow =	1.37	L/s

Proposed Per Capita Flow/Demand	
Water	285 L/c/d
Wastewater	285 L/c/d
Persons per unit Component (by zone basis)	
Low Density Res	25 units/ha at 3.0 ppu
Medium Density Res	75 units/ha at 2.4 ppu
High Density Res	150 units/ha at 1.6 ppu
Single and semi detach	3.0 ppu
Town/rowhomes	2.4 ppu
Apt and ADU's (2+ bdrm)	2.0 ppu
Apt and ADU's (1 bdrm)	1.6 ppu

SANITARY FLOW - COMMERCIAL AREA

Tributary Population

Commercial Development:	90	persons/ha	
Site Area:	0.12	ha	*use approx. 25% of total site area
Number of Persons:	11	persons	*as conservative estimate*

Sewage Flow

Per Capita Flow:	0.285	m^3/person/day
Average Sewage Flow:	0.036	L/s

Peak Sanitary Flow Factor

Commercial Peaking Factor Formula:
M = 0.8* (1 + (14/(4+ [14 / { 4 + P^(0.5)}])))

Pe=	0.0108	
M =	3.529	2 < M < 5

Infiltration Allowance

Infiltration Allowance:	0.00	L/s/ha	*accounted for in residential
Infiltration Allowance:	0.000	L/s	*calculation*

Design Flow

Design Flow:
Design Flow = (Average Sewage Flow * Peak Sanitary Flow Factor) + Infil. Allowance

Design Flow =	0.13	L/s

SUMMARY OF SANITARY DESIGN FLOWS

Residential:	1.37	L/s
Commercial:	0.13	L/s
Total Design Flow:	**1.50**	**L/s**

APPENDIX B

Norfolk County Domestic Water Demand Calculations
Required Water Service Diameter Calculations
OBC Fire Flow Calculations
Form FFD1 – Norfolk County Fire Flow Determination
DWG FIRE – Fire Separation Distances
Norfolk County ISMP Waterford Pressure and Available Fire Flow

Proposed Per Capita Flow/Demand	
Water	285 L/c/d
Wastewater	285 L/c/d
Persons per unit Component (by zone basis)	
Low Density Res	25 units/ha at 3.0 ppu
Medium Density Res	75 units/ha at 2.4 ppu
High Density Res	150 units/ha at 1.6 ppu
Single and semi detach	3.0 ppu
Town/rowhomes	2.4 ppu
Apt and ADU's (2+ bdrm)	2.0 ppu
Apt and ADU's (1 bdrm)	1.6 ppu

WATER DEMAND - RESIDENTIAL

Maximum Daily Demand

Total Number of Units	44	units	
Zoning of Land	Residential		
Equiv. Population Density	2	ppl/unit	**assumed 2+ bedroom units*
Equiv. Population	88		
Av. Daily Demand Per Capita	0.285	m^3/capita/day	
Maximum Daily Demand Peaking Factor	2.25		
Maximum Daily Demand	56.43	m^3/day	
	0.65	l/s	

Maximum Hourly Demand

Total Number of Units	44	units	
Zoning of Land	Residential		
Equiv. Population Density	2	ppl/ha	
Equiv. Population	88		
Av. Daily Demand Per Capita	0.285	m^3/capita/day	
Maximum Hourly Demand Peaking Factor	4		
Maximum Hourly Demand	4.18	m^3/hour	
	1.16	l/s	

WATER DEMAND - COMMERCIAL

Maximum Daily Demand

Area	0.12	ha	**use approx. 25% of total site area as conservative estimate*
Zoning of Land	Commercial		
Equiv. Population Density	90	ppl/ha	
Equiv. Population	11		
Av. Daily Demand Per Capita	0.285	m^3/capita/day	
Maximum Daily Demand Peaking Factor	2.25		
Maximum Daily Demand	7.05	m^3/day	
	0.08	l/s	

Maximum Hourly Demand

Area	0.12	ha	
Zoning of Land	Commercial		
Equiv. Population Density	90	ppl/ha	
Equiv. Population	11		
Av. Daily Demand Per Capita	0.285	m^3/capita/day	
Maximum Hourly Demand Peaking Factor	2		
Maximum Hourly Demand	0.26	m^3/hour	
	0.07	l/s	

SUMMARY OF MAXIMUM DAILY DEMAND

Phase 2 Residential:	0.65 L/s
Phase 2 Commercial:	0.08 L/s
Total Maximum Daily Demand:	**0.73 L/s**

SUMMARY OF MAXIMUM HOURLY DEMAND

Phase 2 Residential:	1.16 L/s
Phase 2 Commercial:	0.07 L/s
Total Maximum Hourly Demand:	**1.23 L/s**

Required Service Diameter

Assume pressure is adequate (ie 60+ psi)

max flow velocity [V]	10	ft/s
max flow velocity [V]	3	m/s
Max flow as per Peak Estimate [Q]	19.55	gpm
Max flow as per Peak Estimate [Q]	1.23	l/s
	0.00123	m3/s

Q=VA

A = pi*r^2

Area = Q/V [A]	0.00041	m2
Radius [r]	0.01144	m
Diameter [d]	11.44	mm

Table 3-6: Maximum Velocity Limited by Hydraulic Considerations

Process	Maximum velocity (m/s)
Raw Water (pumped)	3.0 (10 ft/s)
Filter Effluent	2.0 (6.6 ft/s)
Wash Supply	3.0 (10 ft/s)
Wash Drains	2.5 (8.2 ft/s)
Treated Water (pumped)	3.0 (10 ft/s)

Therefore the 150mm service to the building is acceptable.

vallee
Consulting Engineers, Architects & Planners

Subject:	Buchan Mid-Rise, Waterford		
Date:	Jun-25	By:	NLO
Project #:	25-120	Page:	1

ON-SITE FIRE PROTECTION SUPPLY CALCULATION

Per Fire Protection Water Supply Guideline, Ontario Building Code Division 3, Part B, 3.2.5.7

Project:	Buchan Mid-Rise Leamon Street	Building/Block #:	**Mid-Rise**
Project Location:	Waterford, ON	Firewalls/Sprinkler:	No

Conditions not requiring On-Site Fire Protection:

Building area is Less than 200 m^2 or Less	☐
Building height is 2 Storeys or Less	☐
Building does not have a Group B Occupancy (Care or Detention)	☑
Building does not require a sprinkler system or standpipe and hose system	☑
Limiting distance from the property line is at least 13 m if the building has an F-1 (high hazard industrial) occupancy	☑
Building constitutes no significant environmental contamination potential under fire conditions	☑
On-Site Supply Required?	**YES**

Calculation Information:

$$Q = K^* V * S_{Tot}$$

where: Q = Minimum supply of water in litres (L)
V = Total Building Volume in cubic metres
K = Water supply coefficient from Table 1
S_{Tot} = total of spatial coefficient values from property line exposures on all sides, as obtained from the formula:

$$S_{Tot} = 1.0 + [(S_{Side1}) + (S_{Side2}) + (S_{Side3}) + \ldots \text{etc.}]$$

where: S_{Side} = values are obtained from Figure 1, as modified by Sections 6.3 (e) and 6.3 (f) of the OBC Guideline
S_{Tot} = need not exceed 2.0 (see Section 7.0 of the OBC Guideline)

Determining K Value:

Major Occupancy Classification	Residential Occupancies
Group	C
Division	-

Building is of combustible construction. Floor assemblies, roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire resistance rating.

K Factor **23**

Determining Building Volume:

Storey Height	3.5	m2
Residential Storeys	5	
Residential Building Area	1155.0	m2
Commerical Storeys	1.0	
Commercial Building Area	230.0	m2

Building Volume (m^3) **21018**

Total Spatial Coefficient:

	Exposure Distance (m)	Factor
North Side	>10	0
East Side	>10	0
South Side	>10	0
West Side	>10	0

S_{Tot} Factor **1**

Minimum Water Supply Flow:

Q (L) **483,403**

Minimum Water Supply Flow Rate OBC:

9000	**L/min**
150.0	**L/sec**

Table 2:
Minimum Water Supply Flow Rates

Building Code, Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/min.)
One-storey building with building area not exceeding 600m² (excluding F-1 occupancies)	1800
All other buildings	2700 (If **Q** ≤ 108,000L)(1) 3600 (If **Q** > 108,000L **and** ≤ 135,000L)(1) 4500 (If **Q** > 135,000L **and** ≤ 162,000L)(1) 5400 (If **Q** > 162,000L **and** ≤ 190,000L)(1) 6300 (If **Q** > 190,000L **and** ≤ 270,000L)(1) 9000 (If **Q** > 270,000L)(1)

Note: (1) **$Q=KVS_{Tot}$** as referenced in Section 3(a)

Ontario Building Code Tables and Figures

Table 3.1.2.1.
Major Occupancy Classification

Forming Part of Sentences 3.1.2.1.(1), 3.1.2.2.(1) and 3.11.2.1.(3)

Item	Column 1 Group	Column 2 Division	Column 3 Description of *Major Occupancies*
1.	A	1	*Assembly occupancies* intended for the production and viewing of the performing arts
2.	A	2	*Assembly occupancies* not elsewhere classified in Group A
3.	A	3	*Assembly occupancies* of the arena type
4.	A	4	*Assembly occupancies* in which occupants are gathered in the open air
5.	B	1	Detention occupancies
6.	B	2	Care and treatment occupancies
7.	B	3	Care occupancies
8.	C	---	Residential occupancies
9.	D	---	Business and personal services occupancies
10.	E	---	Mercantile occupancies
11.	F	1	High hazard industrial occupancies
12.	F	2	Medium hazard industrial occupancies
13.	F	3	Low hazard industrial occupancies

Table 2:
Minimum Water Supply Flow Rates

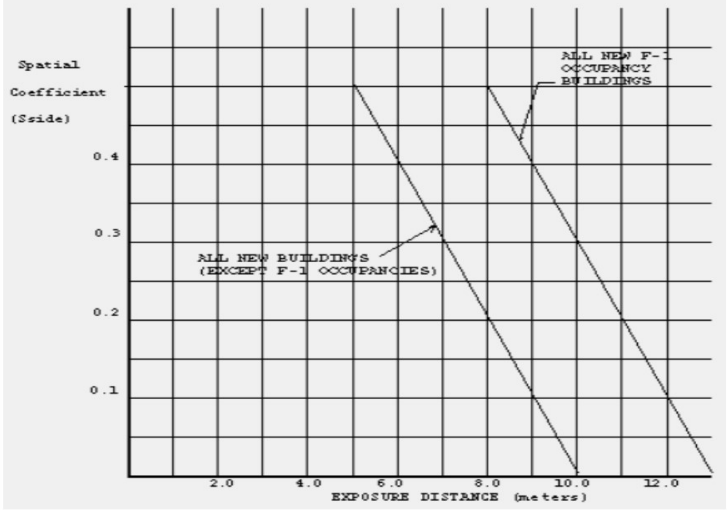
Building Code, Part 3 Buildings	**Required Minimum Water Supply Flow Rate (L/min.)**
One-storey building with building area not exceeding 600m² (excluding F-1 occupancies)	1800
All other buildings	2700 (If **Q** ≤ 108,000L)[1] 3600 (If **Q** > 108,000L **and** ≤ 135,000L)[1] 4500 (If **Q** > 135,000L **and** ≤ 162,000L)[1] 5400 (If **Q** > 162,000L **and** ≤ 190,000L)[1] 6300 (If **Q** > 190,000L **and** ≤ 270,000L)[1] 9000 (If **Q** > 270,000L)[1]

Note: [1] **$Q=KVS_{Tot}$** as referenced in Section 3(a)

Table 1:
Water Supply Coefficient - K

TYPE OF CONSTRUCTION	**Classification by Group or Division in Accordance with Table 3.1.2.1 of the Ontario Building Code**				
	A-2 B-1 B-2 B-3 C D	**A-4 F-3**	**A-1 A-3<**	**E F-2**	**F-1**
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC, including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. of the OBC. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC, including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2. of the OBC.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

FIGURE 1
SPATIAL COEFFICIENT VS EXPOSURE DISTANCE



FORM FFD1 - Fire Flow Determination - Required Fire Flow (RFF) and Available Fire Flow (AFF)

Application Number:	TO BE DETERMINED
Municipal Address:	289 LEAMON STREET, WATERFORD

Through staff report - Norfolk County Development Application Guidelines - a new Fire Flow Determination approach was adopted. This form is intended to guide applicants throught the documenation requirements of this change. FUS calcuations are no longer required for new submissions. This form is supplemental to related and supporting documentation/calcuations.

1. REQUIRED FIRE FLOW - RFF

1 a) Required Fire Flow - RFF a) Ontario Building Code

Q=KVS$_{Tot}$

Please provide required fire flow -RFF using the water supply flow rate method (OBC section A-3.2.5.7; OFM-TG-03-1999 FIRE PROTECTION WATER SUPPLY GUIDELINE FOR PART 3 IN THE ONTARIO BUILDLING CODE - Q=KVS$_{Tot}$. **This methodology** shall be applied to all buildings falling under Part 3 **and Part 9** of the Building Code (OBC sections 1.1.2.2 and 1.1.2.4). Detailed calculations shall be submitted as an appended memo.

Enter calcuated value here (highest if mutliple buildings)

Required fire volume as calculated using Q=KVSTot	483,403	Litres
A .Required min. Water Supply Flow rate (Table 2 OBC A.3.2.5.7)	150	Litres/second
B. Spinkler Requirements (per NFPA 13)	TBD	Litres/second
C. Standpipe Requirements (per NFPA 14)	TBD	Litres/second
Total OBC Requirements (A+B+C)	150	Litres/second

1 b) Required Fire Flow - RFF b) Land Use Based and based on Community Area

Land Use Target Table

Please select from Table 1: Target Required Fire Flow (based on land use)

	Community Area	
	Simcoe, Delhi, Port Dover	**Waterford, Port Rowan, Courtland**
Land Use	**Target RFF (L/s)**	**Target RFF (L/s)**
Commercial	150	150
Industrial	150	150
Intituational	150	150
Small ICI (<1800m3)	100	100
Residential- Multi greater than 3 units)	150	90
Residential- Medium (3 units or less)	125	75
Residential- Single	85	50
Residential - Single (dead-end)	30	30

Enter calcuated value here (highest if mutliple buildings)

150 Litres/second

1 c) Required Fire Flow - RFF c)

Enter the higher of a) or b) from above

150 Litres/second

Comments:

FORM FFD1 - Fire Flow Determination - Required Fire Flow (RFF) and Available Fire Flow (AFF)

Application Number: TO BE DETERMINED

Municipal Address: 289 LEAMON STREET, WATERFORD

2 a) Available Fire Flow-AFF a)

Fire Hydrant Test calculated at 20 psi	
Please provide available fire flow-AFF as determined through developer hydrant fire flow test or County Hydrant test database.	
Enter value here:	
	Litres/second
Please check:	☐ Developer hydrant fire flow test, OR
	☐ County Hydrant test database

Comments:

2 b) Available Fire Flow-AFF b)

Computer Modelling	
Please provide available fire flow-AFF as determined through computer modelling.	
☐ Modelling criteria and boundary conditions were approved by Norfolk County	
Enter value here:	
Litres/second	TO BE DETERMINED BY NORFOLK COUNTY MODELLING

Comments:

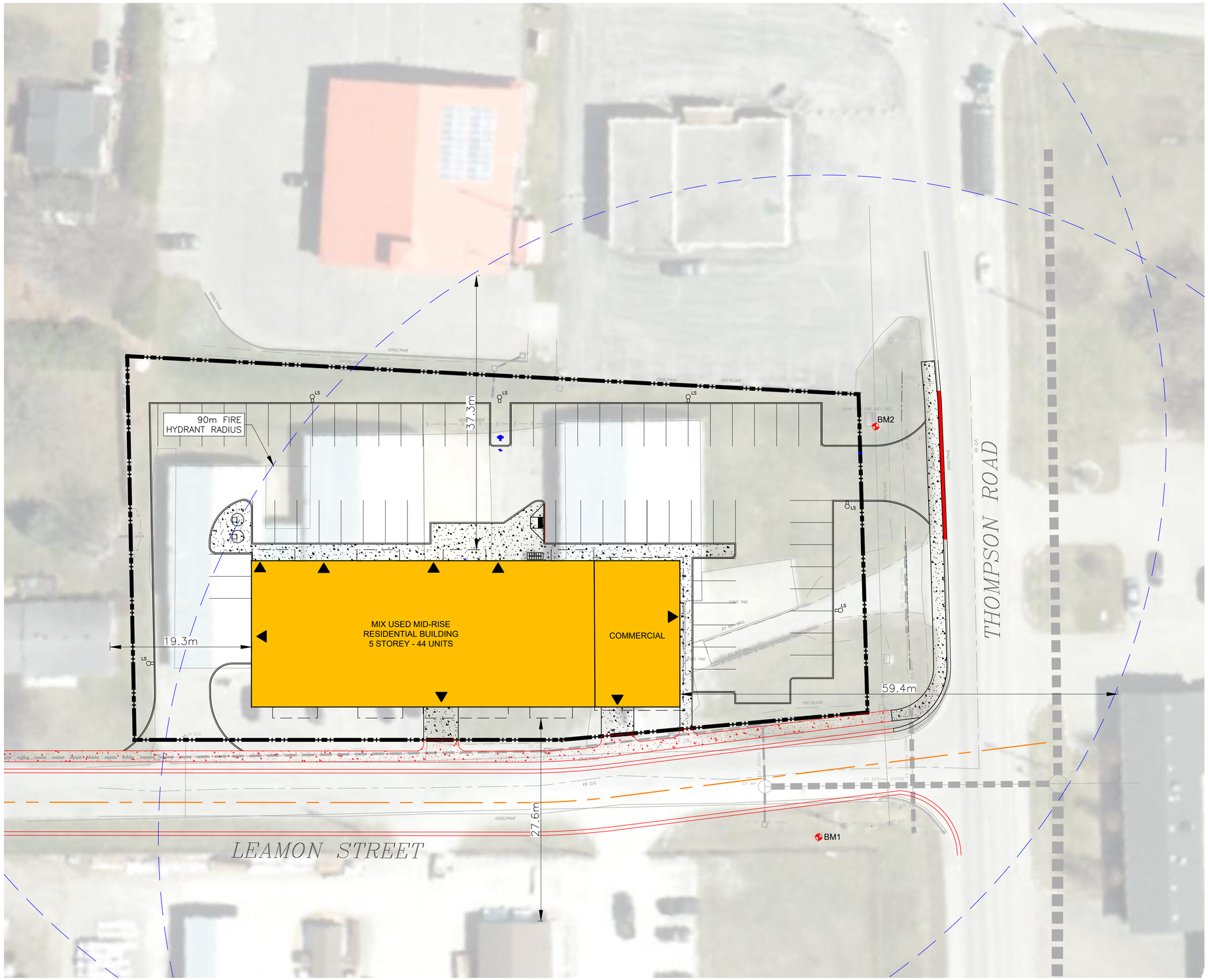
DECLARATION OF ADEQUATE SERVCIES

☐ RFF c) is less than or equal to AFF, or TO BE DETERMINED

☐ RFF c) is greater than AFF.

Prepared by: N. Ongena

Date: 2025-06-19



REV. No.	DATE	REVISION
0	07/15/2025	ISSUED FOR ZONING AMENDMENT

NOTE:
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SURVEY INFORMATION:
LEGAL SURVEY COMPLETED BY MACAULAY, WHITE & MUIR LTD. DATED 06/26/25, PART1 – PLAN OF SURVEY OF LOT 23 REGISTERED PLAN 298 PART OF BLOCK 38 REGISTERED PLAN 198

TOPOGRAPHIC SURVEY COMPLETED BY G. DOUGLAS. VALLEE DATED 05/30/2025 BASED ON THE FOLLOWING:

VERTICAL DATUM: 1928:1978 ADJUSTMENT (CGVD28: 78)

COORDINATE SYSTEM: WORLDWIDE UTM ZONE 17N, NAD83, GLOBAL REFERENCE EPOCH 2010, GEOID MODEL HTV2.0(2010)

SITE BENCHMARKS:

BM1: ELEV: 243.73m
SOUTHWEST CORNER OF CONCRETE PAD LOCATED ON THOMPSON ROAD BETWEEN 289 LEAMON ST AND 308 MAIN ST S

BM2-ELEV: 243.45
TOP OF LARGE PUMPER NOZZLE OF FIRE HYDRANT LOCATED ON LEAMON ST APPROXIMATELY 22M NORTH OF THOMPSON ROAD

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

SCALE:
5 15 25
HORIZONTAL : 1 : 500

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
FIRE DISTANCES

Designed by : NLO	Drawn By : NLO/NBN
Checked by : NLO/JTI	Date Started : June 19, 2025
Drawing Scale : AS NOTED	Drawing No. FIRE
Project No. 25-120	

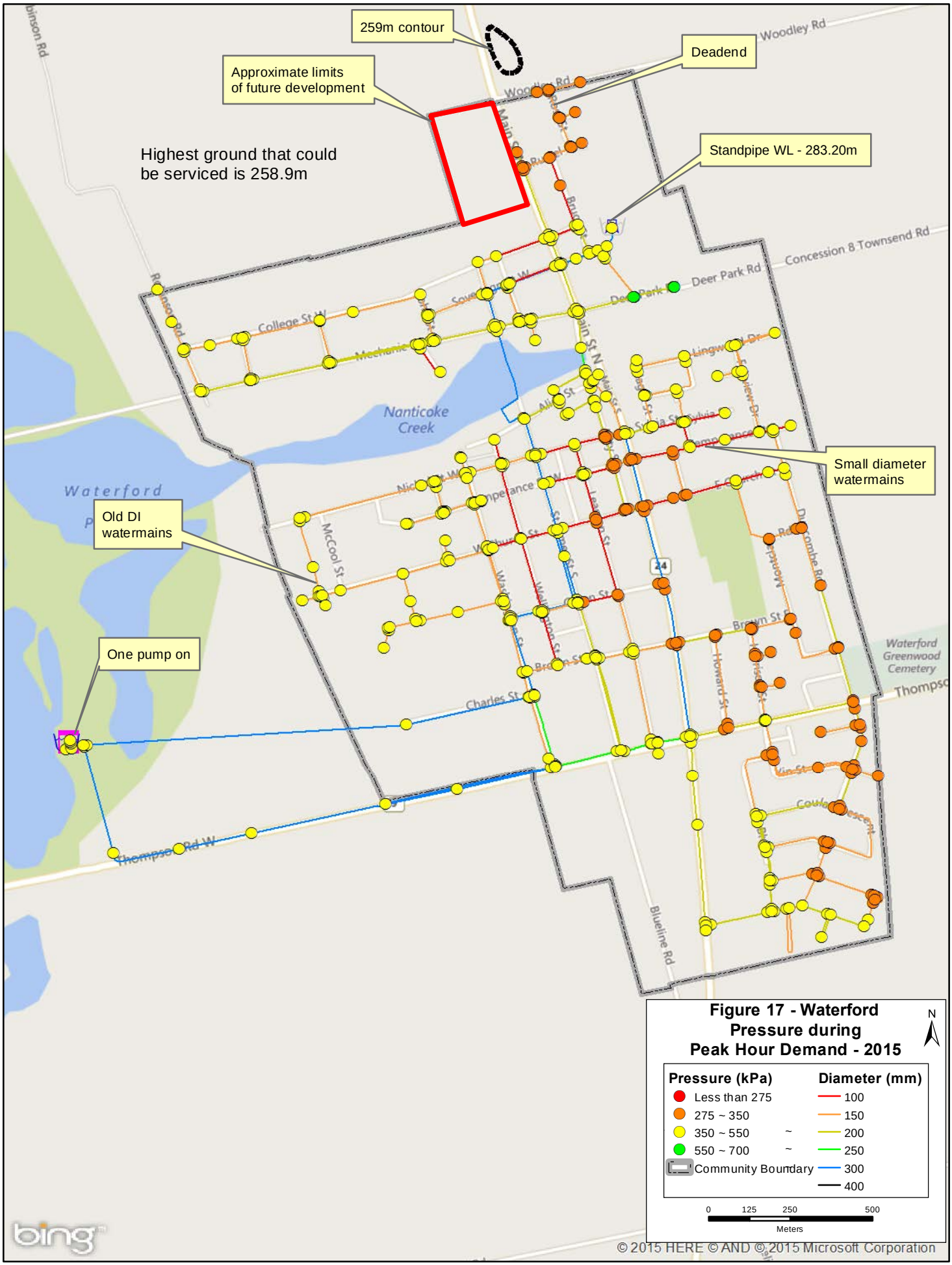


Figure 17 - Waterford Pressure during Peak Hour Demand - 2015

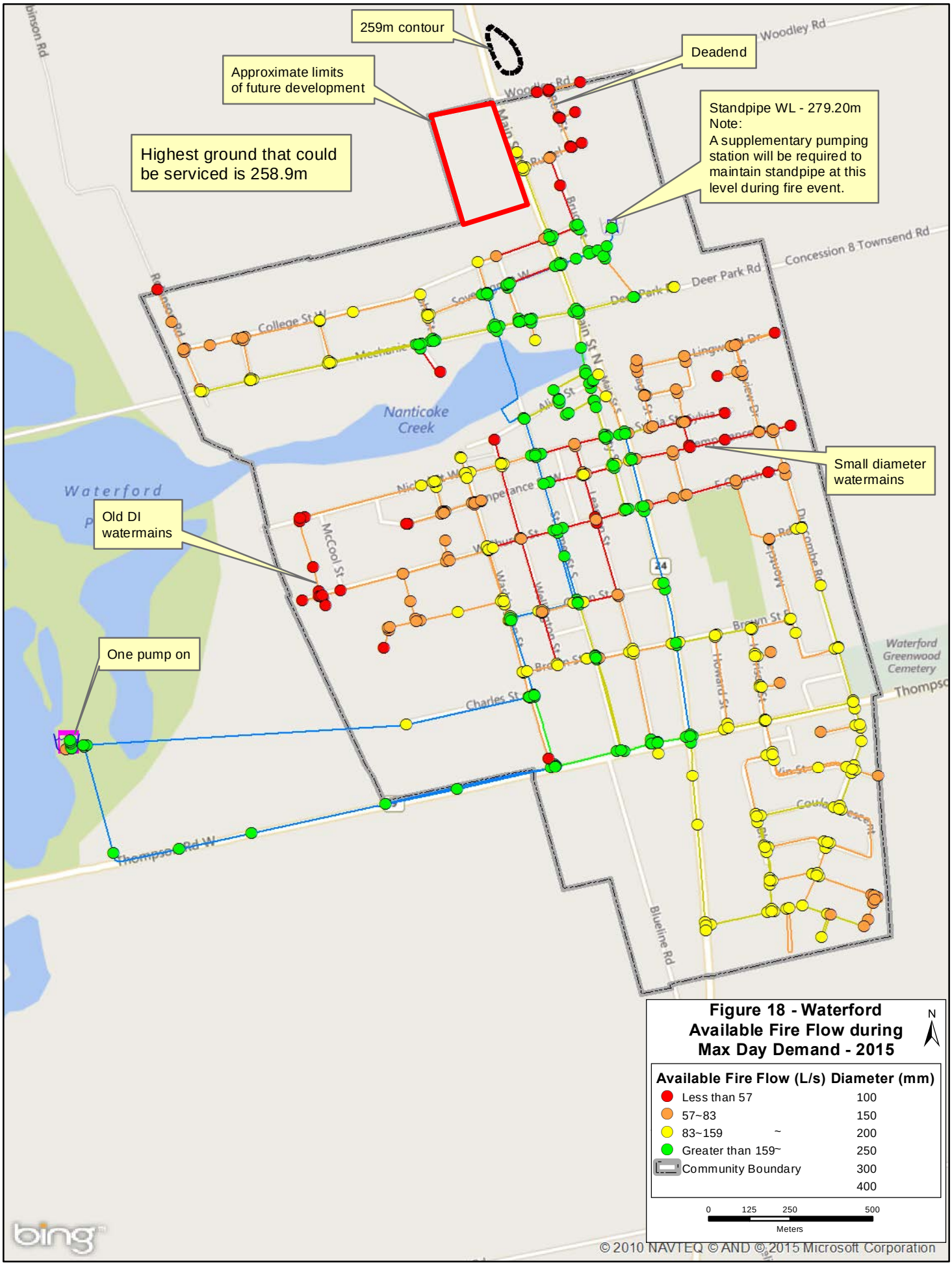


Figure 18 - Waterford Available Fire Flow during Max Day Demand - 2015

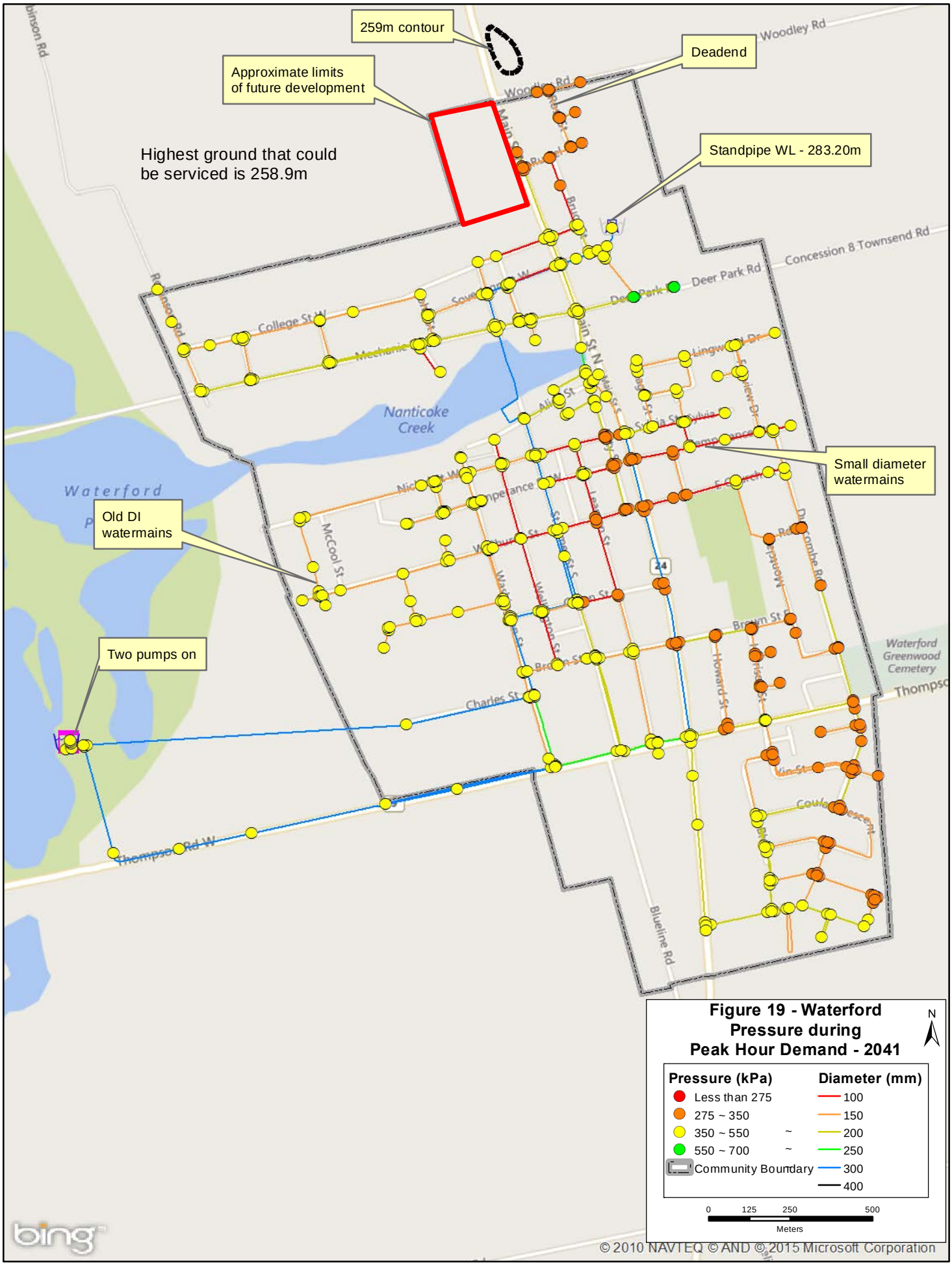
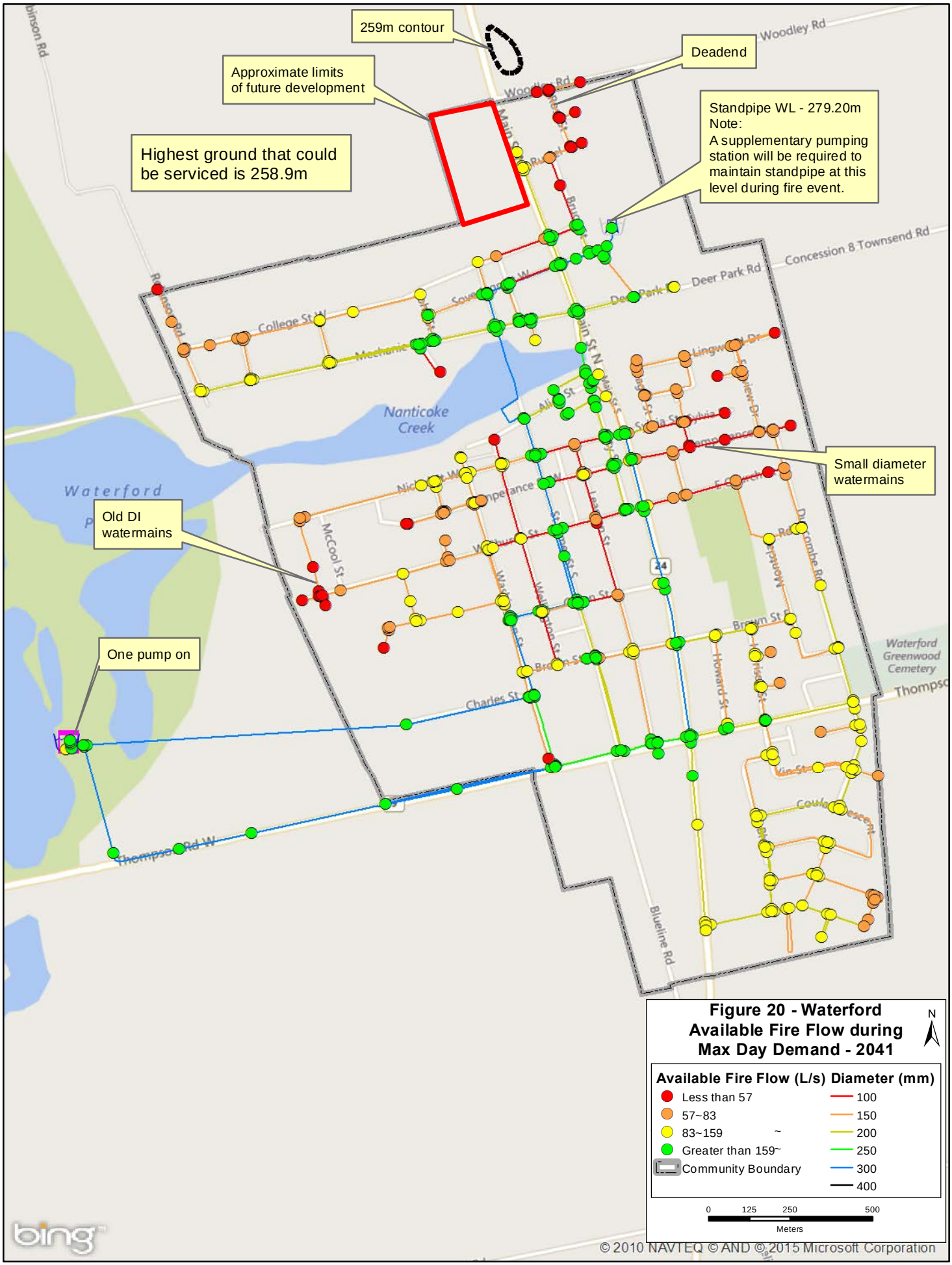


Figure 19 - Waterford Pressure during Peak Hour Demand - 2041


259m contour
Deadend
Approximate limits of future development
Highest ground that could be serviced is 258.9m
Standpipe WL - 279.20m
Note:
A supplementary pumping station will be required to maintain standpipe at this level during fire event.
Small diameter watermains
Old DI watermains
One pump on
Nanticoke Creek
Waterford
Woodley Rd
Concession 8 Townsend Rd
Deer Park Rd
College St W
Main St N
McCool St
Charles St
Thompson Rd W
Blueline Rd
Waterford Greenwood Cemetery
Figure 20 - Waterford
Available Fire Flow during
Max Day Demand - 2041
N
Available Fire Flow (L/s)
Less than 57
57~83
83~159
Greater than 159
Community Boundary
Diameter (mm)
100
150
200
250
300
400
0 125 250 500
Meters
bing
© 2010 NAVTEQ © AND © 2015 Microsoft Corporation

May 21, 2025

SE #: 1451.001

Mr. Jesse Buchan
B&B Landco Inc.
245 King George Road, Suite 222
Brantford, ON N3R 7N7

Re: Land Use Compatibility Study
289/295 Leamon Street, Waterford

1.0 OVERVIEW

It is our understanding that G. Douglas Vallee Limited is representing B&B Landco Inc. (*Client*) who is proposing a 5-storey mix-use residential/commercial building to be located at 289/295 Leamon Street in Waterford. The proposal would introduce a mix-use development as a new sensitive land use. As requested by the Norfolk County, a land use compatibility study is required.

Land Use Compatibility (LUC) Assessments are governed by criteria set out in the Ministry of the Environment, Conservation and Parks (MECP) D-Series Guidelines. Effectively, the study looks at existing land uses within 1,000 metres of the subject property, evaluate if the proposed development is adequately separated from nearby land uses of concern and if any potential impact exists. The MECP D-Series Guidelines sets out the required setback distances for sensitive land uses. In the event that the minimum setback distances cannot be met, detailed studies may be warranted to determine the potential impact surrounding facilities may have on the proposed development.

As part of the process, SONAIR will use publicly available information as well as search the MECP registry for Environmental Compliance Approvals (ECA) and/or Environmental Activity and Sector Registries (EASR) for existing industries within the impact assessment area to assess the potential adverse effects from significant sources towards the proposed development.

SONAIR will conduct a site visit of the study area to identify facilities with any potential environmental concerns. Wind roses may also be generated using available meteorological data to determine the direction and frequency of prevailing winds and how emissions may impact the proposed development, if necessary.

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2.0 SCOPE AND DELIVERABLES

The scope of the project, and SONAIR's deliverables are as follows:

2.1 Work will commence upon receipt of signed Project Authorization Form and retainer.

2.2 A site visit will be conducted to investigate the surrounding area of the proposed development to better understand nearby operations and any potential adverse dust, odour, noise and vibration impact that may exist in support of the study. One (1) site visit has been included as part of this proposal.

2.3 The MECP registry will be searched for industries within the impact assessment area to determine if facilities have obtained the necessary approvals that may affect the proposed development. Available approvals will be analyzed to determine the scale and nature of its operations.

2.4 A list of existing industries within a 1000m radius from the subject property will be created and evaluated for potential dust, odour, noise/vibration impact based on separation distances and classifications in accordance with the D-1 and D-6 guidelines.

2.5 Wind roses will be prepared using available meteorological data, and plotted using AERMET, if necessary. Wind direction and frequency of wind will be analyzed and discussed to determine the potential impact nearby operations may have on the proposed development, if warranted.

2.6 A draft report will be prepared for the Client to review. A final report will be prepared after the Client's review.

3.0 PRICE

The fees for SONAIR's services are as follows:

- 289/295 Leamon Street, Waterford
  - Land Use Compatibility Study $ 3,000

4.0 RETAINER AND BALANCE PAYMENT

A 50% retainer payment, including applicable taxes in the amount of $1,695 is required by SONAIR in order to initiate the project. The invoice for the balance payment will be issued along with the draft report. The balance payment will be required prior to issuance of the final report.

Please note that the retainer payment, including applicable taxes, must be received before SONAIR can initiate the project. Late payments will result in the project being delayed.

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Payments can be completed using one of the following options:

- E-Transfer (*Preferable)*
  - Recipient: payment@SONAIRenviro.com
  - E-transfer message box: Include your SE# (top of proposal) or Invoice Number
  - Email us back to ensure the transfer went through
- Cheque
  - Payable to: **SONAIR Environmental Inc.**
  - Remit to:

    PO Box 56702 PINE VALLEY PO
    VAUGHAN, ON L4L 8V3
- Credit Card.
  - A 6% surcharge will be applied.
  - Contact the undersigned to process the credit card payment.

5.0 CLARIFICATIONS

5.1 Additional site visits, meetings, or other services not identified in the proposal, will require signed Change Orders from the Client before commencement.

5.2 Feasibility or detailed studies (e.g noise impact studies, air quality/odour studies etc), if warranted, are not covered within this proposal.

SONAIR Environmental Inc.

Prepared by:

Thomas Li, MEPP, P.Eng
Principal Consultant
tli@SONAIRenviro.com

Encl: Project Authorization Form

© 2025 SONAIR Environmental Inc.

Project Authorization Form

Client: Mr. Jesse Buchan	**SONAIR Contact:** Thomas Li
Address: 222-245 King George Road, Brantford, ON N3R 7N7	

Project: LUC
Services:

- ☐ 289/295 Leamon Street, Waterford
  - Land Use Compatibility Study $ 3,000

Terms of Agreement

1. The CLIENT agrees to pay SONAIR Environmental Inc. (SONAIR) for its services as described in the proposal and listed above. Applicable taxes and regulatory fees are extra.
2. SONAIR's proposal was prepared only for the CLIENT's consideration. It may not be used or disclosed in any part to another party without prior written consent from SONAIR.
3. This Proposal is open for acceptance for 30 (thirty) days from date of issue. It may be extended by mutual agreement of both parties in writing.
4. The CLIENT will promptly provide any materials, information, instruction, or equipment required to be supplied under the proposal or reasonably requested by SONAIR. If anything is not so provided, SONAIR, may adjust the price to reflect changes in labour and material costs.
5. At any time or from time-to-time SONAIR has the right not to commence and/or continue to provide its services until payment arrangements satisfactory to SONAIR are made.
6. Method of payment include direct banking deposits, E-mail transfers, business cheques and credit cards (Visa, Master Card). A 6% surcharge will be applied to any credit card transactions.
7. Work provided by SONAIR will be conducted in accordance with generally acceptable engineering and scientific principles at the time the work is performed.
8. Reports prepared by SONAIR refer only to the particular matters referred to in it, and is limited by the work, investigations, tests or analyses performed. No warranty is either expressed or implied, or intended by this agreement.
9. The liability of SONAIR or its staff, directors, or shareholders will be limited to the lesser of the fees paid or the actual damages incurred by the CLIENT provided the damages resulted from the negligence of SONAIR.
10. SONAIR will not be responsible for any consequential or indirect damages.
11. No report issued by SONAIR shall be published in part or in whole without SONAIR's prior written consent.
12. SONAIR will make reasonable efforts to keep confidential any confidential material and/or information provided by the Client.
13. Invoices shall be payable within 30 days from the invoice date. Any amounts (including applicable taxes) not received by SONAIR within 30 days of the invoice date will bear interest thereafter until received at a rate of 1.5% per month, or 18% per annum until paid.

SE Project # 1451.001	**Billing Contact Name:**
Purchase Order #	**Billing Contact Phone:**
Company:	**Billing Contact Email:**
CLIENT Authorization Signature:	**Billing Address:**
Name:	**Date:**

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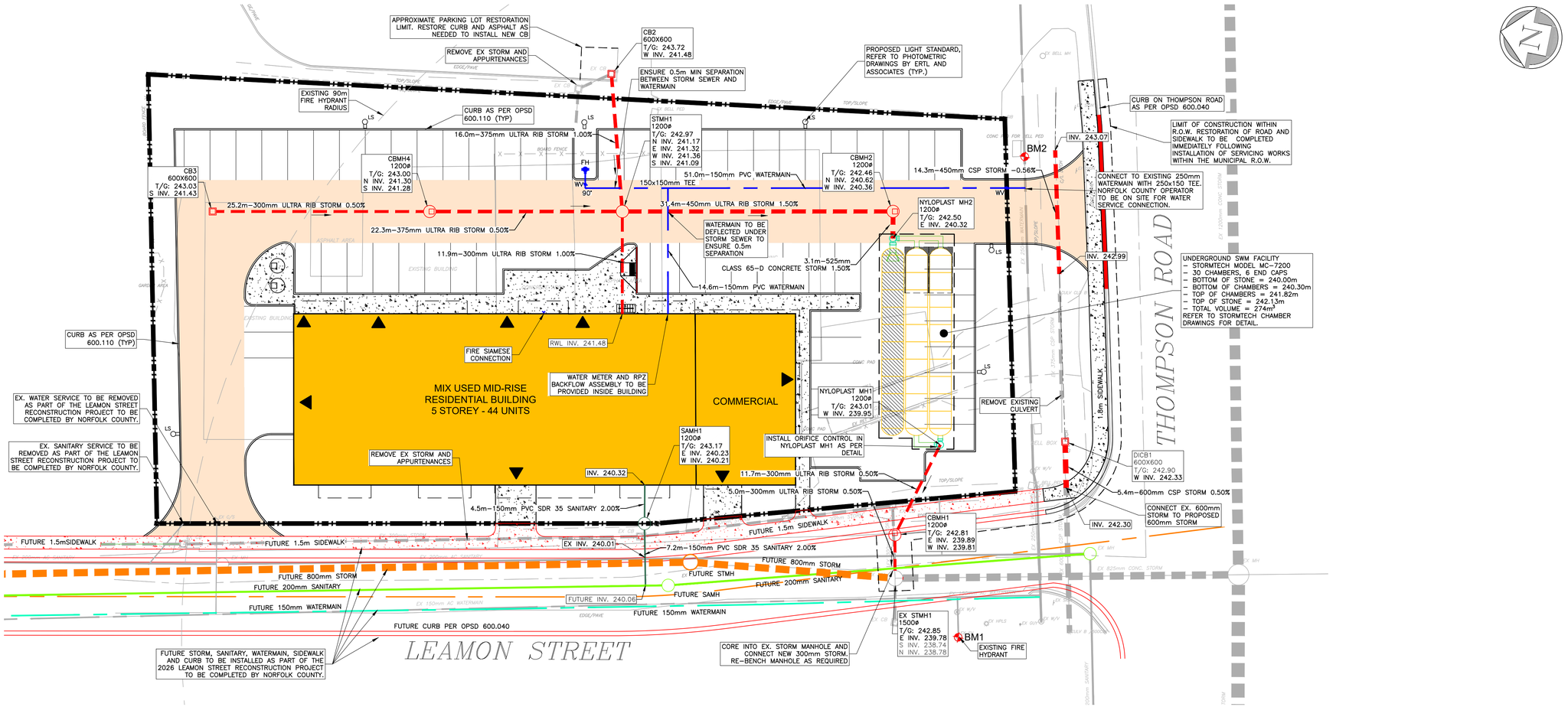

REV. No.	DATE	REVISION
0	07/24/2025	ZBA & SPA SUBMISSION 1

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BM2: ELEV: 243.45
TOP OF LARGE PUMPER NOZZLE OF FIRE HYDRANT LOCATED ON LEAMON ST APPROXIMATELY 22M NORTH OF THOMPSON ROAD

DRAWING LIST:
G. DOUGLAS VALLEE LIMITED DRAWINGS

25–120–C101	SERVICING PLAN
25–120–C102	GRADING PLAN
25–120–C103	EROSION AND SEDIMENT CONTROL PLAN
25–120–C104	EXCESS CUT FILL PLAN
25–120–GN	GENERAL NOTES AND DETAILS
25–120–STM	STORM DRAINAGE AREAS

APPLICANT INFORMATION

APPLICANT: MR. JESSE BUCHAN, B&B LANDCO INC.
TELEPHONE: 1-519-717-6865
ADDRESS: 245 KING GEORGE ROAD, SUITE 222, BRANTFORD, ON N3Y 7N7

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

SCALE:
5 15 25
HORIZONTAL : 1 : 500

NOTES:

1. PROPOSED SEWERS TO ADHERE TO THE FOLLOWING OPSD:

1200mm MAINTENANCE HOLE STRUCTURE	OPSD 701.010
SINGLE CATCH BASIN STRUCTURE 600mm X 600mm	OPSD 705.010
DOUBLE CATCH BASIN STRUCTURE 1450mm X 600mm	OPSD 705.020
1200mm MAINTENANCE HOLE GRATE	OPSD 401.010
1200mm CATCH BASIN MAINTENANCE HOLE GRATE	OPSD 400.020
SINGLE CATCH BASIN GRATE 600mm X 600mm	OPSD 400.020
DOUBLE CATCH BASIN GRATE 1450mm X 600mm	OPSD 400.020

ALL COMPONENTS OF THE PROPOSED SEWERS ARE TO ADHERE TO DIVISION 700 OF THE OPSD.

2. PROPOSED SEWERS TO BE INSULATED PER OPSD 1109.030 AS INDICATED ON THIS PLAN. REFER TO DRAWING GN FOR DETAIL.
3. ALL STORM SEWERS 450mm AND SMALLER IN DIAMETER TO BE HDPE WITH CLASS B BEDDING. ALL STORM SEWERS 525mm AND ABOVE TO BE CONCRETE CLASS 65-D WITH CLASS B BEDDING.
4. SANITARY SEWERS TO BE PVC SDR28 PIPE WITH CLASS 'B' BEDDING. FOR THE LOCATION OF CONNECTION TO BUILDING, SEE MECHANICAL DRAWINGS.
5. ALL WATER SERVICES BETWEEN 19mm AND 50mm TO BE BLUE904 SDR9 PEX. ALL WATER MAINS AND WATER SERVICES ABOVE 50mm TO BE PVC DR18 BLUE BRUTE.
6. PROVIDE 2.5m MINIMUM HORIZONTAL CLEARANCE BETWEEN ANY EXISTING / PROPOSED WATER SERVICE AND ANY PROPOSED STORM / PROPOSED SANITARY SEWER OR MAINTENANCE HOLES AS PER NORFOLK COUNTY DESIGN CRITERIA.
7. WHERE A WATER SERVICE CROSSES ABOVE OR BELOW A STORM OR SANITARY SEWER, A MINIMUM VERTICAL CLEARANCE OF 0.5m SHALL BE PROVIDED.
8. WHERE A STORM OR SANITARY SEWER CROSSES ANOTHER STORM OR SANITARY SEWER, A MINIMUM VERTICAL CLEARANCE OF 0.15m SHALL BE PROVIDED.
9. WATER SERVICES SHALL MAINTAIN A MINIMUM COVER OF 1.7m.
10. VALVES ARE TO BE INSTALLED 1.0m FROM THE PROPOSED BUILDING FOUNDATION FOR EACH PROPOSED WATER SERVICE. VALVES AND VALVE BOXES ARE TO BE SIZED TO MATCH THE WATER SERVICE SIZE.
11. ANODES ARE TO BE SUPPLIED AND INSTALLED AS PER THE REQUIREMENTS OF NORFOLK COUNTY'S DESIGN CRITERIA.
12. PROPOSED CATCH BASINS AND CATCH BASIN MAINTENANCE HOLES TO BE INSTALLED WITH SUB-DRAINS AS PER DETAIL ON DRAWING GN
13. FIRE HYDRANTS TO BE AWWA C502 COMPLIANT, NON-DRAINING, OPEN LEFT AS PER NORFOLK COUNTY'S DESIGN CRITERIA.
14. ALL WATER MAIN BENDS TO BE MANUFACTURED FITTINGS AS REQUIRED.
15. WATER MAIN FITTINGS SHALL BE MECHANICAL JOINT OR PUSH-ON JOINTS INSTALLED WITH APPROVED MECHANICAL THRUST RESTRAINTS. WATER MAINS TO BE INSTALLED WITH ANODES AS PER SECTION 10.13.0 OF NORFOLK COUNTY'S DESIGN CRITERIA.
16. ALL DISTURBED AREAS WITHIN THE RIGHT OF WAY TO BE RESTORED PER THE FOLLOWING DETAILS:

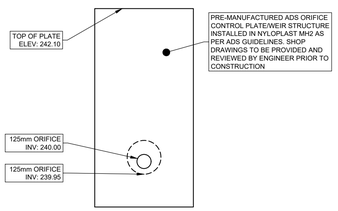
LANDSCAPED AREA:
100mm TOPSOIL & SOD

LIGHT ASPHALT AREA:
40mm HL3
50mm HL8
150mm GRANULAR 'A'
300mm GRANULAR 'B'

HEAVY DUTY ASPHALT AREA:
50mm HL3
70mm HL8
150mm GRANULAR 'A'
450mm GRANULAR 'B'

SIDEWALK AREA:
125mm CLASS C-2 CONCRETE (200mm AT COMMERCIAL ENTRANCES)
150mm GRANULAR 'A'

17. NORFOLK COUNTY STAFF TO BE PRESENT FOR ALL CONNECTIONS TO EXISTING SEWERS AND WATERMAIN. A MINIMUM OF 48HRS NOTICE IS REQUIRED TO SCHEDULE STAFF TO ATTEND THE SITE. ALL COSTS FOR CONNECTION FEES ARE THE RESPONSIBILITY OF THE OWNER/CONTRACTOR.



OUTLET CONTROL PLATE DETAIL

N.T.S.

NOTES:

ORIFICE CONTROL PLATE/WEIR STRUCTURE TO BE PRE-MANUFACTURED BY ADS.

CONTROL FEATURE MUST BE INSTALLED AND INSPECTED BY THE ENGINEER PRIOR TO PAVING TO ENSURE STORMWATER RUNOFF FLOW CONTROLS ARE IN PLACE TO PROTECT DOWNSTREAM SYSTEM.

SERVICING PLAN LEGEND

- PROPOSED ENTRANCE / EXIT
- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED CONCRETE
- PROPOSED BUILDING
- PROPOSED LIGHT STANDARD
- PROPOSED LIGHTING PEDESTAL
- PROPOSED HYDRO TRANSFORMER
- PROPOSED TREE PLANTING
- PROPOSED BELL 'GRADE LEVEL BOX'
- PROPOSED BELL PEDESTAL
- PROPOSED CATV PEDESTAL
- PROPERTY LINE
- PROPOSED DROP CURB
- PROPOSED SWALE
- PROPOSED STORM
- PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED SANITARY
- PROPOSED SANITARY MANHOLE
- PROPOSED WATERMAIN
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- EX. FIRE HYDRANT
- FUTURE STORM
- FUTURE STORM MANHOLE
- FUTURE SANITARY
- FUTURE SANITARY MANHOLE
- FUTURE WATERMAIN

vallee
Consulting Engineers, Architects & Planners

G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

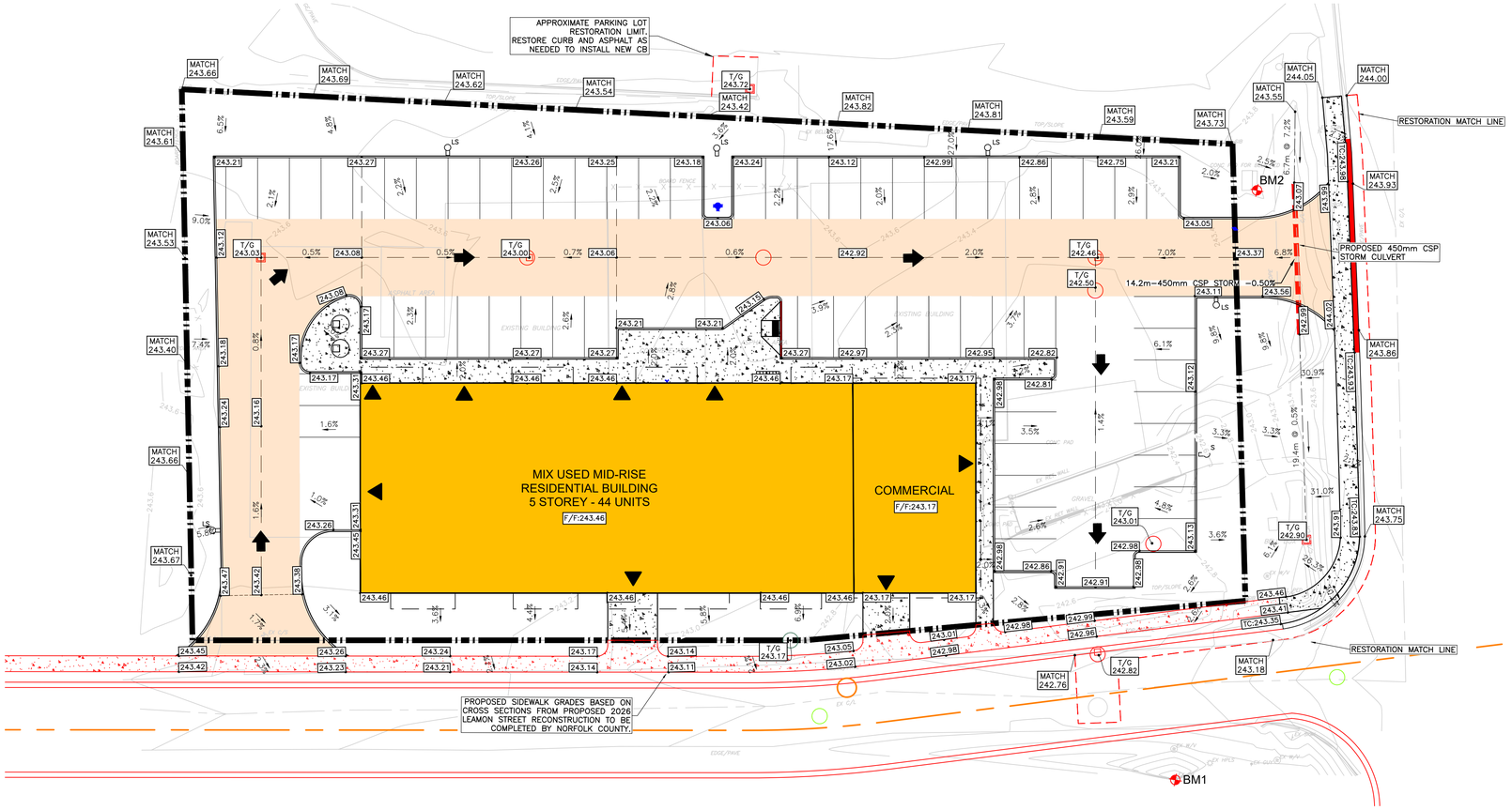
Stamp

LICENSED PROFESSIONAL ENGINEER
25-120
2025-09-11
N. L. ONGENA
100153190
PROVINCE OF ONTARIO

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
SERVICING PLAN

Designed by : NLO/NBN	Drawn By : NBN
Checked by : NLO/JTI	Date Started : August 13, 2025
Drawing Scale : AS NOTED	Drawing No. C101
Project No. 25-120	



EROSION & SEDIMENT CONTROL NOTE:
ALL ROAD CATCH BASINS TO HAVE FILTER CLOTH COVER IN PLACE UNTIL BASE ASPHALT IS IN PLACE. STORMWATER INLET STRUCTURES (DITCH INLET CATCH BASINS, CATCH BASINS, CATCH BASIN MANHOLES ETC.) TO HAVE SILT PROTECTION. ALL EROSION CONTROL TO BE TO THE SATISFACTION OF ENGINEER AND L.P.R.C.A.

MATCH ELEVATIONS:
MATCH ELEVATIONS AT THE PROPERTY LINE ARE BASED ON INTERPOLATED TOPOGRAPHIC DATA. CONTRACTOR TO CONFIRM MATCH ELEVATIONS AND REPORT AND DISCREPANCY TO THE ENGINEER PRIOR TO CONSTRUCTION.

NOTES:

1. PARKING AND AISLE PAVEMENT TO ADHERE TO PAVEMENT DESIGNS CONTAINED WITHIN THE GEOTECHNICAL REPORT AND NORFOLK COUNTY DESIGN CRITERIA:

   LIGHT DUTY FOR PARKING STALLS:

   40mm HL3
   50mm HL8
   150mm GRANULAR A
   300mm GRANULAR B

   HEAVY DUTY FOR DRIVE AISLES AND LANES:

   50mm HL3
   70mm HL8
   150mm GRANULAR A
   450mm GRANULAR B

2. GENERAL CONTRACTOR TO COORDINATE ALL WORK WITHIN THE SITE WITH THE COUNTY AND OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM LOCAL AUTHORITIES. EXECUTE ALL WORK AS PER NORFOLK COUNTY REQUIREMENTS.

3. GENERAL CONTRACTOR TO EXECUTE WORK TO CONSTRUCTION SITE ACCESS UNDER SUPERVISION OF THE ENGINEER. REFER TO ENTRANCE PERMIT REQUIREMENTS WHERE APPLICABLE. DRIVEWAY ENTRANCE TO BE MODIFIED OR INSTALLATION OF NEW ENTRANCE AS PER NORFOLK COUNTY REQUIREMENTS. PROVIDE NEW CONC. ENTRANCE CURBS TO MATCH EXISTING AS REQUIRED.

4. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL BENCHMARKS, ELEVATIONS, DIMENSIONS AND GRADES MUST BE CHECKED BY THE CONTRACTOR AND ANY DISCREPANCIES REPORTED TO THE ENGINEER.

5. AT LEAST TWO DIFFERENT BENCHMARKS MUST BE REFERRED TO AT ALL TIMES.

6. COORDINATE WITH SITE GRADING PLAN FOR PROPOSED FINAL FINISH GRADE ELEVATIONS AND DRAINAGE SLOPES.

7. TRAFFIC CONTROL SHALL BE IMPLEMENTED BY THE CONTRACTOR IN ACCORDANCE WITH OTM TEMPORARY CONDITIONS BOOK 7. APPROVAL FOR THE TRAFFIC CONTROL WILL BE SOUGHT FROM THE MUNICIPALITY BY THE CONTRACTOR.

GRADING PLAN LEGEND

- PROPOSED ENTRANCE / EXIT
- PROPOSED CONCRETE
- PROPOSED BUILDING
- HEAVY DUTY ASPHALT
- PROPOSED GRADE BREAK
- PROPOSED DROP CURB
- PROPERTY LINE
- PROPOSED SWALE
- MATCH TO EXISTING ELEVATION (MATCH 97.85)
- PROPOSED SPOT ELEVATION (97.85)
- PROPOSED CENTRELINE ELEVATIONS (235.15)
- EXISTING CONTOUR ELEVATIONS (246.2)
- PROPOSED FLOW DIRECTION (MINOR) (2.0%)
- PROPOSED OVERLAND FLOW DIRECTION (MAJOR)
- EX. FIRE HYDRANT
- PROPOSED WATERVALVE
- PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED SANITARY MANHOLE
- PROPOSED LIGHT STANDARD (LS)
- FUTURE STORM MANHOLE
- FUTURE SANITARY MANHOLE

REV. No.	DATE	REVISION
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SURVEY INFORMATION:
LEGAL SURVEY COMPLETED BY MACAULAY, WHITE & MUIR LTD. DATED 06/26/25, PART1 – PLAN OF SURVEY OF LOT 23 REGISTERED PLAN 298 PART OF BLOCK 38 REGISTERED PLAN 198

TOPOGRAPHIC SURVEY COMPLETED BY G. DOUGLAS. VALLEE DATED 05/30/2025 BASED ON THE FOLLOWING:

VERTICAL DATUM: 1928:1978 ADJUSTMENT (CGVD28: 78)

COORDINATE SYSTEM: WORLDWIDE UTM ZONE 17N, NAD83, GLOBAL REFERENCE EPOCH 2010, GEOID MODEL HTV2.0(2010)

SITE BENCHMARKS:

BM1: ELEV: 243.73m
SOUTHWEST CORNER OF CONCRETE PAD LOCATED ON THOMPSON ROAD BETWEEN 289 LEAMON ST AND 308 MAIN ST S

BM2: ELEV: 243.45
TOP OF LARGE PUMPER NOZZLE OF FIRE HYDRANT LOCATED ON LEAMON ST APPROXIMATELY 22M NORTH OF THOMPSON ROAD

DRAWING LIST:
G. DOUGLAS VALLEE LIMITED DRAWINGS

25-120-C101	SERVICING PLAN
25-120-C102	GRADING PLAN
25-120-C103	EROSION AND SEDIMENT CONTROL PLAN
25-120-C104	EXCESS CUT FILL PLAN
25-120-GN	GENERAL NOTES AND DETAILS
25-120-STM	STORM DRAINAGE AREAS

APPLICANT INFORMATION

APPLICANT: MR. JESSE BUCHAN, B&B LANDCO INC.
TELEPHONE: 1-519-717-6865
ADDRESS: 245 KING GEORGE ROAD, SUITE 222, BRANTFORD, ON N3Y 7N7

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

SCALE:
5 15 25
HORIZONTAL : 1 : 500

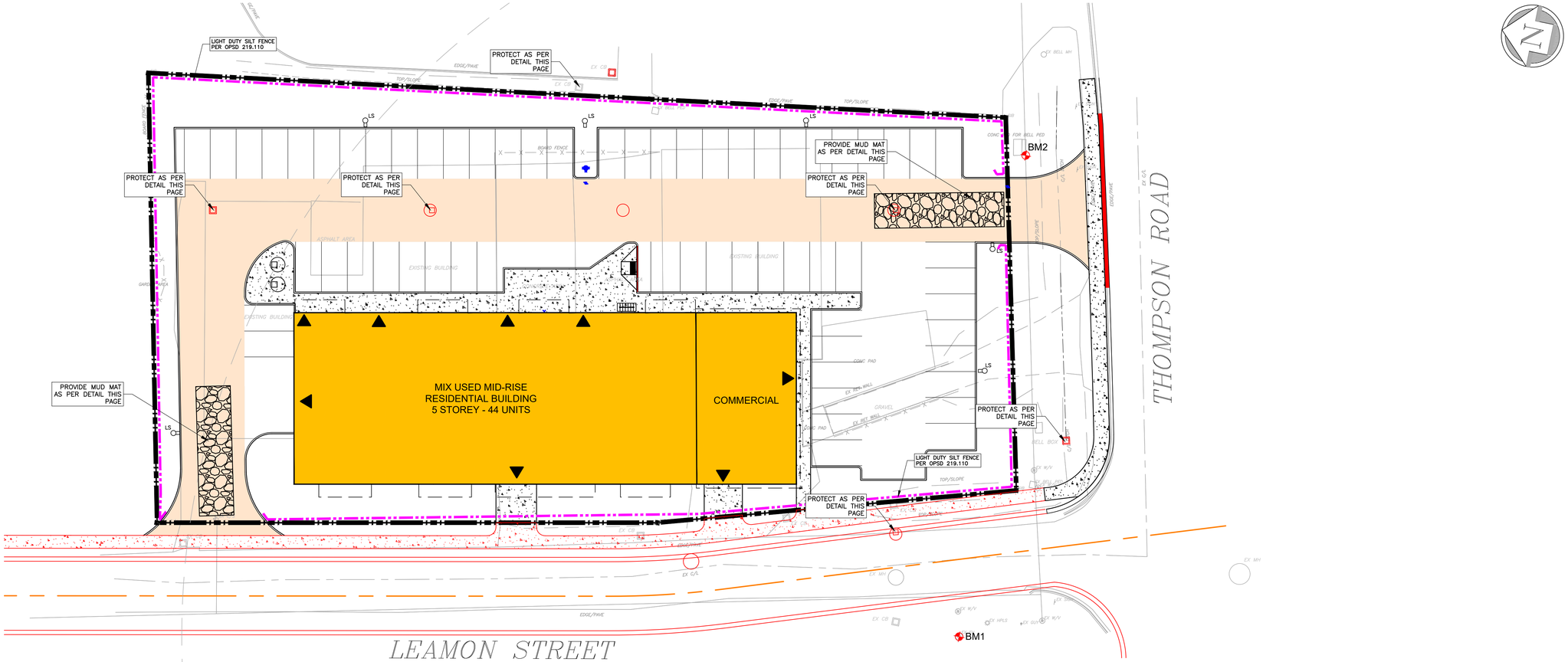
vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp
LICENSED PROFESSIONAL ENGINEER
25-120
2025-09-11
N. L. ONGENA
100533190
PROVINCE OF ONTARIO

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

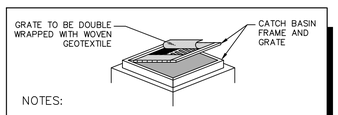
Drawing Title
GRADING PLAN

Designed by : NLO/NBN	Drawn By : NBN
Checked by : NLO/JTI	Date Started : July 14, 2025
Drawing Scale : AS NOTED	Drawing No. C102
Project No. 25-120	



LEGEND

- EXISTING GROUND CONTOUR
- PROPOSED SWALE
- PROPOSED LIGHT DUTY SILT FENCE AS PER OPSD 219.110



NOTES:

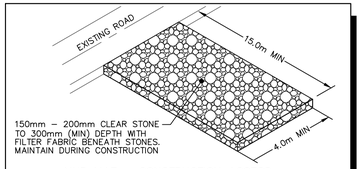
- FILTER CLOTH WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
- WOVEN GEOTEXTILE TO HAVE A MINIMUM EQUIVALENT OPENING SIZE OF 0.15mm AND A MAXIMUM EQUIVALENT OPENING SIZE OF 0.25mm.
- WOVEN GEOTEXTILE TO BE REPLACED PERIODICALLY WHEN ACCUMULATED SEDIMENTS INTERFERES WITH DRAINAGE.
- CLEAR STONE TO BE PLACED ON TOP OF WRAPPED CATCHBASIN TO PROTECT GEOTEXTILE FROM LARGE OBJECTS.

CATCHBASIN SEDIMENT PROTECTION DETAIL
N.T.S.

EROSION CONTROL NOTES

1. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR DESIGN AND PROVISION OF ALL SEDIMENT CONTROL MEASURES AS MAY BE REQUIRED TO PROTECT THE WORK SITE OR THE ADJACENT LANDS, REGARDLESS OF THE SOURCE OR ORIGIN OF EROSION OR SEDIMENTS. IF THE ENGINEER IS NOT SATISFIED WITH THE EXTENT OF THE MEASURES TAKEN, THE ENGINEER MAY DIRECT THAT ADDITIONAL CONTROLS BE PUT IN PLACE.

   THE ENGINEER'S REQUIREMENTS FOR SEDIMENT AND EROSION CONTROL SHALL BE CONSIDERED ABSOLUTE MINIMUMS. THE ULTIMATE RESPONSIBILITY TO ENSURE THAT THE MEASURES ARE ADEQUATE SHALL LIE SOLELY ON THE CONTRACTOR. ANY DAMAGE RESULTING FROM FAILURE OF THESE MEASURES SHALL BE REPAIRED AT THE CONTRACTORS EXPENSE.
2. PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
3. ALL EROSION CONTROL MEASURES TO BE IN PLACE UNTIL RESTORATION IS COMPLETE.
4. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION.
5. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION.
6. MINIMIZE AREA DISTURBED DURING CONSTRUCTION.
7. ALL DEWATERING TO BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN.
8. PROTECT ALL CATCH BASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION WITH GEOTEXTILE AND MAINTAIN IN FREE FLOWING STATE (TERRAFIX 270R OR APPROVED EQUIVALENT). REFER TO DETAIL THIS PAGE.
9. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION INCLUDING OIL GRIT SEPARATOR.
10. PREVENT WIND-BLOWN DUST.
11. CONTRACTOR TO PROVIDE MUD MAT AT ALL CONSTRUCTION ENTRANCES.



MUD MAT – CONSTRUCTION ACCESS
N.T.S.

REV. No.	DATE	REVISION
0	07/24/2025	ZBA & SPA SUBMISSION 1

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COORDINATE SYSTEM: WORLDWIDE UTM ZONE 17N, NAD83, GLOBAL REFERENCE EPOCH 2010, GEOID MODEL HTV2.0(2010)

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TOP OF LARGE PUMPER NOZZLE OF FIRE HYDRANT LOCATED ON LEAMON ST APPROXIMATELY 22M NORTH OF THOMPSON ROAD

DRAWING LIST:
G. DOUGLAS VALLEE LIMITED DRAWINGS

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APPLICANT INFORMATION

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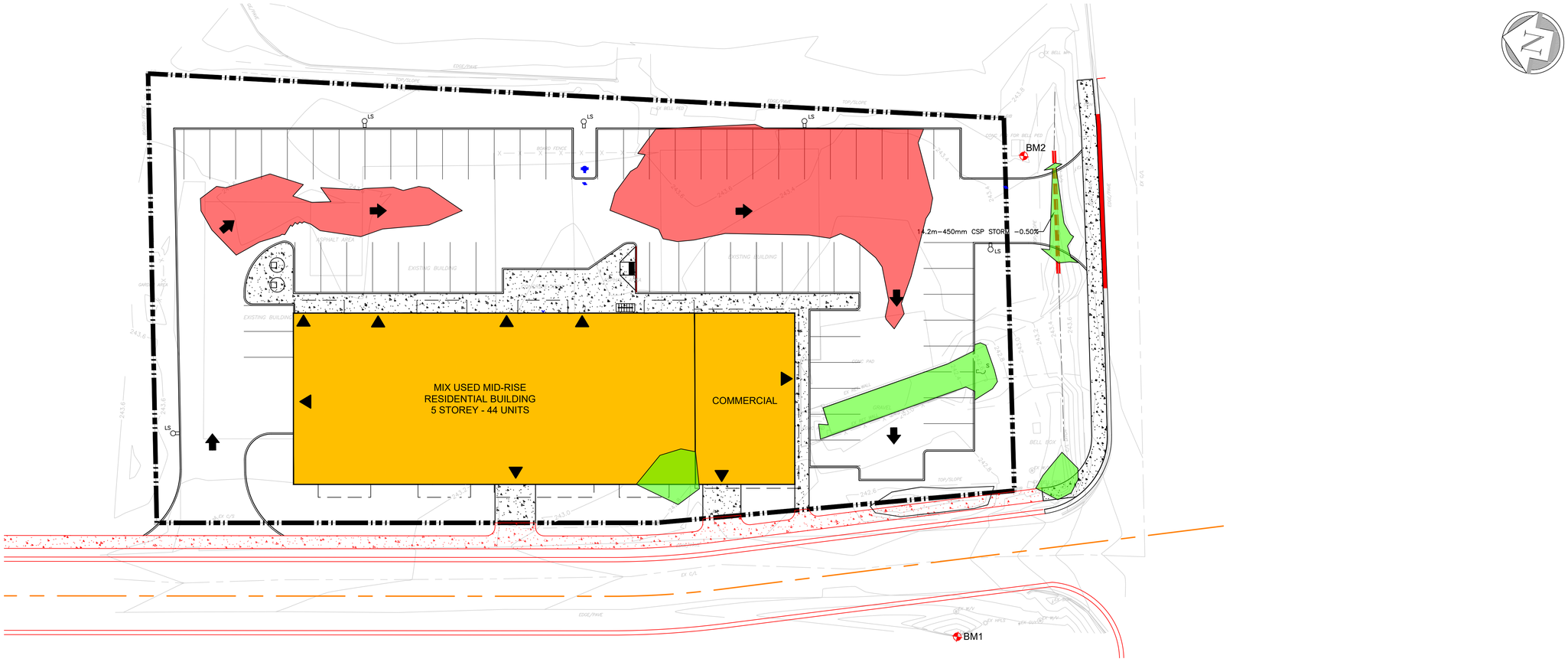
(519) 426-6270

Stamp
LICENSED PROFESSIONAL ENGINEER
25-120
2025-09-11
N. L. ONGENA
100553190
PROVINCE OF ONTARIO

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
EROSION AND SEDIMENT CONTROL PLAN

Designed by : NLO/NBN	Drawn By : NBN
Checked by : NLO/JTI	Date Started : September 10, 2025
Drawing Scale : AS NOTED	Drawing No. C103
Project No. 25-120	



LEGEND

- 247.20 — PROPOSED SPOT ELEVATION
- 247.20 — PROPOSED CENTRELINE OF ROAD ELEVATION
- OVERLAND FLOW DIRECTION
- 246.2 — EXISTING GROUND CONTOUR
- FILL IN EXCESS OF 0.5m
- CUT IN EXCESS OF 0.5m

REV. No.	DATE	REVISION
0	07/24/2025	ZBA & SPA SUBMISSION 1

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Stamp
LICENSED PROFESSIONAL ENGINEER
25-120
2025-09-11
N. L. ONGENA
100533190
PROVINCE OF ONTARIO

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
EXCESS CUT FILL PLAN

Designed by : NLO/NBN	Drawn By : NBN
Checked by : NLO/JTI	Date Started : September 11, 2025
Drawing Scale : AS NOTED	Drawing No. C104
Project No. 25-120	

GENERAL NOTES

1. PRIOR TO CLOSING ANY STREET, THE CONTRACTOR SHALL OBTAIN CLEARANCE BY FILLING 1. OUT THE COUNTY'S NOTICE OF ROAD CLOSURE FORM AND NOTIFY SCHOOL BUS OPERATORS OF STREETS USED FOR DETOUR AND THE DURATION OF THE DETOUR. THE CONTRACTOR MUST SUPPLY AND MAINTAIN ADEQUATE LOCAL DETOUR SIGNS AND LIGHTS.
2. THE CONTRACTOR MUST MAINTAIN MAXIMUM ACCESS TO ALL PROPERTIES AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHALL CONSTRUCT TEMPORARY MEASURES TO CONTROL SILT ENTERING THE STORM DRAINAGE SYSTEM TO THE SPECIFICATIONS OUTLINED IN THE GUIDELINES ON EROSION AND SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES PREPARED BY THE MINISTRY OF NATURAL RESOURCES. THESE MEASURES ARE TO BE INSTALLED PRIOR TO COMMENCING ANY CONSTRUCTION AND ARE TO REMAIN IN PLACE UNTIL CONSTRUCTION HAS BEEN COMPLETED TO THE SPECIFICATIONS OF THE ENGINEER.
3. THE CONTRACTOR IS TO MEET ALL THE REQUIREMENTS OF THE OWNERS OF THE UTILITIES ON THE PLANS, AND MUST MAKE SATISFACTORY ARRANGEMENTS WITH THE UTILITY COMPANIES FOR CROSSING THEIR INSTALLATIONS AND FOR PROVIDING ADEQUATE PROTECTION DURING CONSTRUCTION.
4. PRIOR TO COMMENCING ANY CONSTRUCTION, ALL EXISTING UNDERGROUND UTILITIES SHALL BE LOCATED AND MARKED. ANY UTILITIES DAMAGED OR DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER AT THE CONTRACTORS EXPENSE.
5. ALL ORGANIC, SUITABLE OR UNSUITABLE MATERIALS BENEATH THE ROAD ALLOWANCES MUST BE REMOVED AND THESE AREAS BACKFILLED WITH AN APPROVED FILL MATERIAL, ALL TO THE SATISFACTION OF THE ENGINEER.
6. PRIOR TO COMMENCING ANY CONSTRUCTION, ALL EXISTING SEWER OUTLET INFORMATION, BENCHMARKS, DIMENSIONS, ELEVATIONS AND GRADES MUST BE CHECKED AND VERIFIED AND ANY DISCREPANCIES REPORTED TO THE ENGINEER IMMEDIATELY.
7. ALL CATCH BASIN LEADS FOR SINGLE CATCH BASINS SHALL BE 250mm ø PVC SDR35 WITH CLASS 'B' BEDDING. ALL CATCH BASIN LEADS FOR TWIN INLET CATCH BASINS SHALL BE 300mm ø PVC SDR35 WITH CLASS 'B' BEDDING.
8. ALL PVC WATERMAIN SHALL HAVE TWU 10 COPPER TRACING WIRE LAID ALONG ENTIRE LENGTH. WATERMAIN SHALL HAVE 1.7m TO 1.9m COVER WITH CLASS 'B' BEDDING.
9. ALL 50mm WATER SERVICE TO BE BLUE904 SDR9 PEX AND ALL 150mm WATERMAIN TO BE PVC DR18 BLUE BRUTE WITH MANUFACTURED FITTINGS.
10. WATERMAIN FITTINGS SHALL BE MECHANICAL JOINT OR PUSH-ON JOINT INSTALLED WITH APPROVED MECHANICAL THRUST RESTRAINTS.
11. ALL MECHANICAL THRUST RESTRAINTS SHALL CONFORM TO CONTRACT DOCUMENT SPECIFICATIONS.
12. WHERE A WATERMAIN OR WATER SERVICE CROSSES ABOVE A STORM OR SANITARY SEWER, A MINIMUM VERTICAL CLEARANCE OF 0.50m SHALL BE PROVIDED. WHERE THE WATERMAIN OR WATER SERVICE IS UNABLE TO CROSS ABOVE THE SEWER, IT SHALL CROSS UNDERNEATH WHILE PROVIDING A MINIMUM SEPARATION OF 0.5m BETWEEN THE SEWER INVERT AND THE CROWN OF THE WATERMAIN OR WATER SERVICE. WHERE A STORM OR SANITARY SEWER CROSSES ANOTHER STORM OR SANITARY SEWER, A MINIMUM VERTICAL CLEARANCE BETWEEN PIPE BARRELS OF 0.50m SHALL BE PROVIDED.
13. PROPOSED SEWERS TO ADHERE TO THE FOLLOWING OPSD:

MAINTENANCE HOLE STRUCTURES	OPSD 701.01X
BENCHING	OPSD 701.021
SINGLE CATCH BASIN STRUCTURE 600mm X 600mm	OPSD 705.010
1200mm MAINTENANCE HOLE GRATE	OPSD 401.010
1200mm CATCH BASIN MAINTENANCE HOLE GRATE	OPSD 400.020
SINGLE CATCH BASIN GRATE 600mm X 600mm	OPSD 400.020

ALL COMPONENTS OF THE PROPOSED SEWERS ARE TO ADHERE TO DIVISION 700 OF THE OPSD.

14. ALL STORM SEWERS TO BE PVC DR35 OR CLASS 65-D CONCRETE WITH CLASS B BEDDING.
15. PROPOSED SANITARY TO BE PVC DR35 WITH CLASS 'B' BEDDING.
16. FIRE HYDRANTS TO BE AWWA C502 COMPLIANT, NON-DRAINING, OPEN LEFT.
17. MUNICIPALITY WATERMAIN PROCEDURES TO BE ADHERED TO FOR INSTALLATION OF WATERMAINS OR SERVICES
18. WATERMAINS AND WATER SERVICES SHALL MAINTAIN A MINIMUM COVER OF 1.7m.
19. PROVIDE 2.5m MINIMUM HORIZONTAL CLEARANCE BETWEEN THE PROPOSED WATERMAIN AND ANY STORM OR SANITARY SEWERS OR MAINTENANCE HOLES.

GENERAL SEDIMENT CONTROL MEASURES

1. PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION
2. ALL EROSION CONTROL MEASURES TO BE IN PLACE BEFORE STARTING CONSTRUCTION AND REMAIN IN PLACE UNTIL RESTORATION IS COMPLETE
3. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION
4. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION
5. MINIMIZE AREA DISTURBED DURING CONSTRUCTION
6. ALL DEWATERING TO BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN
7. PROTECT ALL CATCHBASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION WITH GEOTEXTILE (TERRAFIX 270R OR APPROVED EQUIVALENT)
8. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION
9. PREVENT WIND-BLOWN DUST
10. STRAW BALES TO BE USED IN LOCALIZED AREAS AS SHOWN AND AND AS DIRECTED BY THE ENGINEER DURING CONSTRUCTION

ROAD & BOULEVARD RESTORATION

ALL DISTURBED AREAS SHALL BE RESTORED AS FOLLOWS:

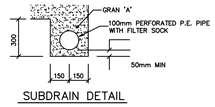
i. ALL ROAD CUTS SHALL BE RESTORED WITH
- -40mm HL3 SURFACE ASPHALT (97% MARSHALL)
- -50mm HL8 BASE ASPHALT (97% MARSHALL)
- -150mm GRANULAR "A" BASE (100% SPMDD)
- -300mm GRANULAR "B" TYPE 2 SUBBASE (100% SPMDD) GRANULAR "B" TO BE EXTENDED 0.3m BEHIND EDGE OF THE PAVEMENT
- -UNSHRINKABLE FILL (OPSS 1359) TO BE USED UP TO SUBGRADE LEVEL

ii. BOULEVARDS SHALL BE RESTORED WITH SOD OVER 100mm TOPSOIL (min) UNLESS OTHERWISE NOTED

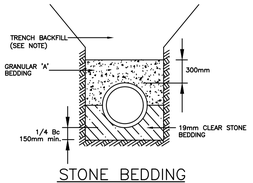
iii. ASPHALT DRIVEWAYS SHALL BE RESTORED WITH 150mm OF GRANULAR "A" (100% SPMDD) WITH 50mm OF HL3A ASPHALT (97% MARSHALL)

iv. GRAVEL DRIVEWAYS SHALL BE RESTORED WITH 150mm OF GRANULAR "A" (100% SPMDD)

v. CONCRETE DRIVEWAYS SHALL BE RESTORED WITH 150mm OF GRANULAR "A" (100% SPMDD) WITH 150mm OF CONCRETE (OPSS MIX, 30MPa MINIMUM)

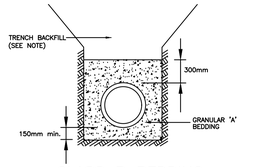


SUBDRAIN DETAIL



STONE BEDDING

NOTES:
1. 19mm CLEAR STONE STONE BEDDING SHALL BE USED IN PLACE OF THE STANDARD BEDDING WHERE HIGH HYDRAULIC GRADIENT CONDITIONS ARE ENCOUNTERED DURING CONSTRUCTION.

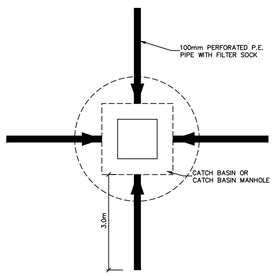


CLASS B BEDDING

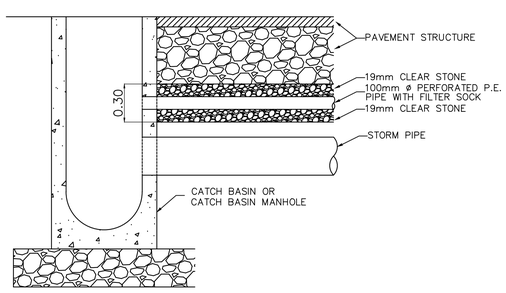
NOTES:
1. PIPE BEDDING AS SPECIFIED ON PLAN AND PROFILE DRAWINGS COMPACTED TO 95% SPMDD IN LAYERS NOT EXCEEDING 150mm, TO 300mm ABOVE TOP OF PIPE.
2. TRENCH BACKFILL FROM TOP OF PIPE BEDDING TO UNDERSIDE OF GRANULAR 'B' SUBBASE SHALL CONSIST OF APPROVED NATIVE MATERIALS COMPACTED TO 95% SPMDD IN LAYERS NOT EXCEEDING 300mm.
3. PRIOR TO PLACING THE GRANULAR SUBBASE MATERIAL, ALL TOPSOIL, SOFT OR OTHERWISE COMPRESSIBLE MATERIAL MUST BE REMOVED FROM THE SUBGRADE AREA, AND THE SUBGRADE SHALL BE PROOF-ROLLED TO COMPACT ANY LOOSE SURFACE ZONES. ALL EXCAVATED AREAS MUST BE BACKFILLED WITH APPROVED ON-SITE NATIVE MATERIALS OR IMPORTED

LEGEND

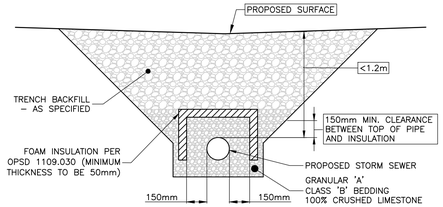
- EX. STORM SEWER
- PROPOSED STORM SEWER
- EX. SANITARY SEWER
- PROPOSED SANITARY SEWER
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- EX. MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED TWIN INLET CATCHBASIN
- PROPOSED CATCHBASIN MANHOLE
- EX. CATCHBASIN
- PROPOSED WATERMAIN
- EX. WATERMAIN
- PROPOSED 3-WAY FIRE HYDRANT C/W STORZ CONNECTION
- EX. FIRE HYDRANT
- PROPOSED WATERVALVE
- EX. WATERVALVE
- EX. BURIED GAS LINE
- EX. BURIED BELL LINE
- EX. BURIED CABLE LINE
- EX. UNDERGROUND HYDRO LINE



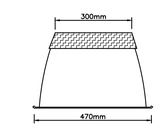
SUBDRAIN PLAN DETAIL
N.T.S.



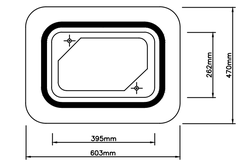
SUBDRAIN SECTION DETAIL
N.T.S.



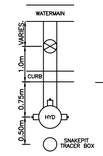
TYPICAL STORM INSULATION FOR STORM WITH <1.2m COVER PER OPSD 1109.030
N.T.S.



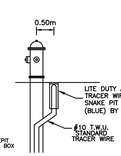
END VIEW



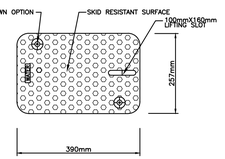
PLAN VIEW



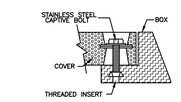
PLAN – BOX LOCATION



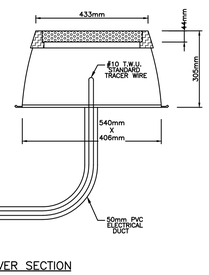
SECTION



BOX COVER



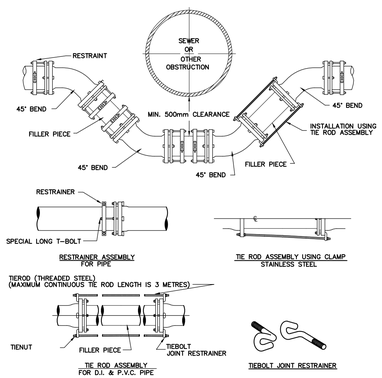
COVER BOLTDOWN OPTION



BOX COVER SECTION

TRACER WIRE HAND HOLE DETAIL

N.T.S.



WATERMAIN DEFLECTION DETAIL

WATERMAIN RESTRAINTS TABLE						
DIAMETER (mm)	MINIMUM LENGTH TO BE RESTRAINED ON EACH SIDE OF FITTINGS (m)					
	11-1/4°	22-1/2°	45°	90° BENDS AND TEES	REDUCER (IN DIRECTION OF LARGER PIPE)	DEAD END AND VALVES
150	2			9	N/A	12

NOTES:
1. ALL JOINTS WITHIN DISTANCES SHOWN SHALL BE RESTRAINED WITH A MEG-A-LUG JOINT RESTRAINT.
2. ALL TEES SHALL HAVE A MINIMUM OF 1.0m SOLID PIPE OUT EACH SIDE OF THE MAIN RUN OF THE TEE.
3. ALL DISTANCES TO BE CONFIRMED TO THE MANUFACTURERS STANDARDS FOR ALTERNATE RESTRAINTS TO MEGALUG.

REV. No.	DATE	REVISION
0	07/24/2025	ZBA & SPA SUBMISSION 1

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LEGAL SURVEY COMPLETED BY MACAULAY, WHITE & MUIR LTD. DATED 06/26/25, PART1 – PLAN OF SURVEY OF LOT 23 REGISTERED PLAN 298 PART OF BLOCK 38 REGISTERED PLAN 198

TOPOGRAPHIC SURVEY COMPLETED BY G. DOUGLAS. VALLEE DATED 05/30/2025 BASED ON THE FOLLOWING:

VERTICAL DATUM: 1928:1978 ADJUSTMENT (CGVD28:78)

COORDINATE SYSTEM: WORLDWIDE UTM ZONE 17N, NAD83, GLOBAL REFERENCE EPOCH 2010, GEOID MODEL HTV2.0(2010)

SITE BENCHMARKS:

BM1: ELEV: 243.73m
SOUTHWEST CORNER OF CONCRETE PAD LOCATED ON THOMPSON ROAD BETWEEN 289 LEAMON ST AND 308 MAIN ST S

BM2: ELEV: 243.45
TOP OF LARGE PUMPER NOZZLE OF FIRE HYDRANT LOCATED ON LEAMON ST APPROXIMATELY 22M NORTH OF THOMPSON ROAD

DRAWING LIST:
G. DOUGLAS VALLEE LIMITED DRAWINGS

25-120-C101	SERVICING PLAN
25-120-C102	GRADING PLAN
25-120-C103	EROSION AND SEDIMENT CONTROL PLAN
25-120-C104	EXCESS CUT FILL PLAN
25-120-GN	GENERAL NOTES AND DETAILS
25-120-STM	STORM DRAINAGE AREAS

APPLICANT INFORMATION

APPLICANT:	MR. JESSE BUCHAN, B&B LANDCO INC.
TELEPHONE:	1-519-717-6865
ADDRESS:	245 KING GEORGE ROAD, SUITE 222, BRANTFORD, ON N3Y 7N7

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

SCALE:
5 15 25
HORIZONTAL : 1 : 500

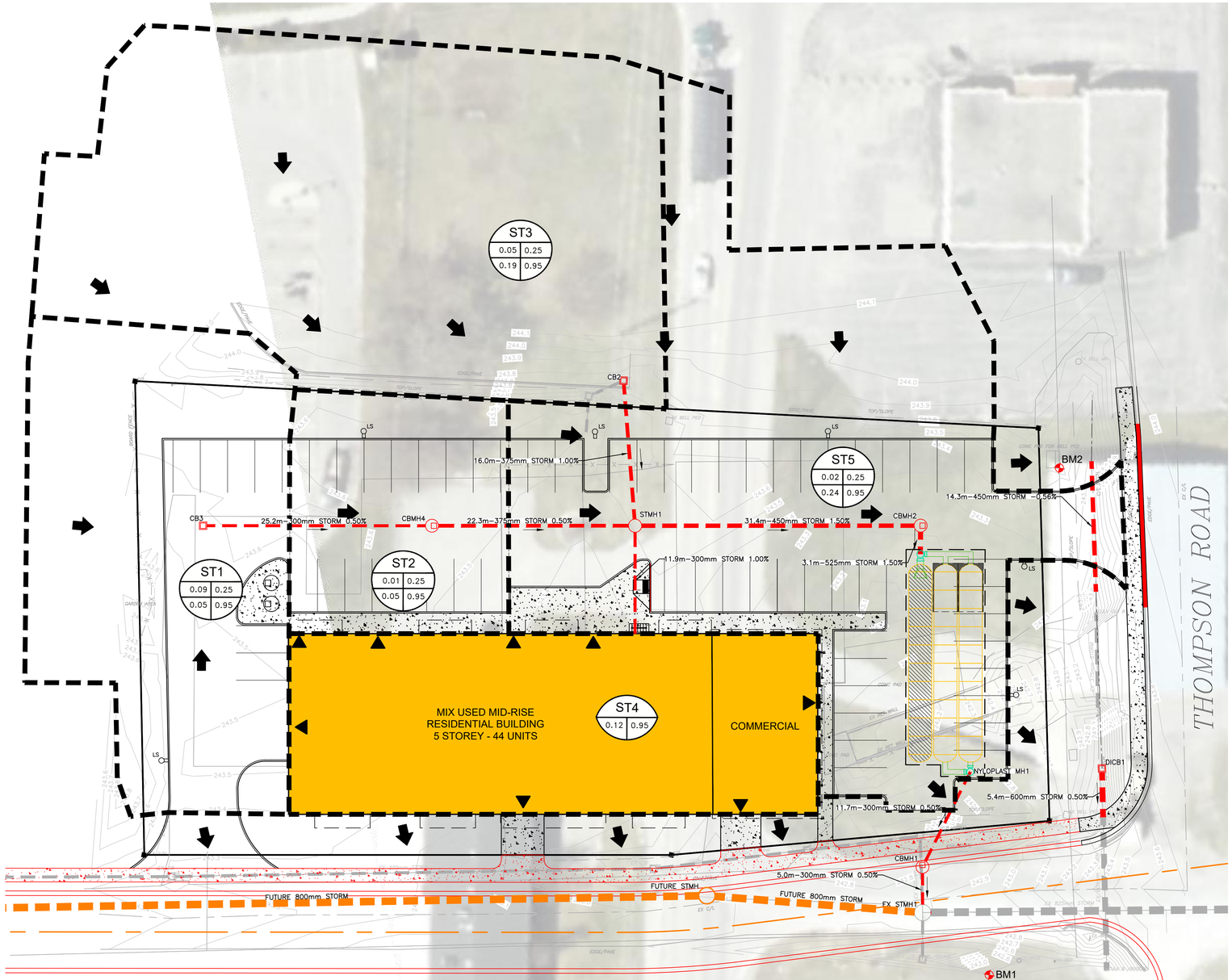
vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp
LICENSED PROFESSIONAL ENGINEER
25-120
2025-09-11
N. L. ONGENA
100153190
PROVINCE OF ONTARIO

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
GENERAL NOTES AND DETAILS

Designed by : NLO/NBN	Drawn By : NBN
Checked by : NLO/JTI	Date Started : July 2, 2025
Drawing Scale : AS NOTED	Drawing No. GN
Project No. 25-120	



LEGEND

- ST1 (0.99 / 0.45): STORM DRAINAGE AREA NUMBER; RUN–OFF COEFFICIENT; AREA (ha)
- OVERLAND FLOW (MAJOR)
- STORM SEWER FLOW (MINOR)
- STMH5 — PROPOSED STORM MANHOLE
- PROPOSED SINGLE CATCH BASIN MH
- PROPOSED DOUBLE CATCH BASIN MH
- STORM DRAINAGE BOUNDARY
- FUTURE STORM MANHOLE

STORM SEWER DESIGN SHEET

Date: 6/25/2025
Project: 25-120 Buchan Midrise
Town/County: Waterford, Norfolk County

Return: 100-year
A 801.041
B 1.501
C 0.657
Multiplier 1.25

Pipe Material: PVC<=450, Concrete >450
n 0.013

Designed by: NBN/NLO
Checked by: JTI

Sheet: 1 of 1

Location			Area			Total	Individual	Cumulative	Time of	Rainfall	Flow	Sewer Design					
Area	From	To	Ha	Ha	Ha	Area	C*A	C*A	Concentration	mm/hr	2.78*I*A*C	Size	Slope	Capacity (Full)	Vel (Full)	Length	Time	Cap
			0.25	0.45	0.95	Ha			min		L/s	mm	%	L/s	m/s	m	min	%
ST1	CB3	CBMH4	0.09		0.05	0.14	0.07	0.07	5.00	234.17	58.6	300	0.50%	68.4	0.97	25.2	0.43	86%
ST2	CBMH4	STMH1	0.01		0.05	0.06	0.05	0.12	5.43	224.43	96.7	375	0.50%	124.0	1.12	22.3	0.33	78%
ST3	CB2	STMH1	0.05		0.19	0.24	0.19	0.19	5.00	234.17	156.3	375	1.00%	175.3	1.59	16.0	0.17	89%
ST4	BUILDING	STMH1			0.12	0.12	0.11	0.11	5.00	234.17	89.2	300	1.50%	118.4	1.68	11.9	0.12	75%
-	STMH1	CBMH2				0.00	0.00	0.43	5.77	217.66	322.0	450	1.50%	349.2	2.20	31.4	0.24	92%
ST5	CBMH2	NYLOPLAST MH2	0.02		0.24	0.26	0.23	0.66	6.00	213.09	488.2	525	1.50%	526.7	2.43	3.1	0.02	93%
-	NYLOPLAST MH1	CBMH1									45.0	300	0.50%	68.4	0.97	10.5	0.18	66%
-	CBMH1	EX STMH1									45.0	300	0.50%	68.4	0.97	5.0	0.09	66%

LEGEND:
45 L/s = Allowable 100-year flow from from SWM Chamber Facility

REV. No.	DATE	REVISION
0	07/24/2025	ZBA & SPA SUBMISSION 1

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Stamp
LICENSED PROFESSIONAL ENGINEER
25-120
2025-09-11
N. L. ONGENA
100533190
PROVINCE OF ONTARIO

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
STORM DRAINAGE AREAS

Designed by : NLO/NBN
Drawn By : NBN
Checked by : NLO/JTI
Date Started : July 11, 2025
Drawing Scale : AS NOTED
Drawing No. STM
Project No. 25-120

LEAMON STREET, WATERFORD

[2] 2025 Issued for SPA Submission

PATRICK DAVID TROTTIER
ARCHITECT
266 DUFFERIN AVE, BRANTFORD, ON N3T 4S2
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TORONTO, ON, M5V 1M7

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PROJECT
LEAMON STREET, WATERFORD

ADDRESS
289, LEAMON ST, WATERFORD, ON

CLIENT
FAST TRACK MODULAR PRECAST

2	Issued for SPA Submission	2025

SHEET NAME
COVER PAGE

SCALE

SHEET SIZE	24"x36"
ISSUE DATE	
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	JJ

N
28.01°

A.000

ZONING DATA

SITE INFORMATION - NORFOLK COUNTY

CURRENT ZONE : SERVICE COMMERCIAL (CS)
PROPOSED ZONE : SERVICE COMMERCIAL (CS) ZONE WITH SPECIAL PROVISIONS

	Required	Proposed	
Zoning Bylaw - 1-Z-2014-Section 6 Density	~~0~~ N/A	44	✓
Zoning Bylaw - 1-Z-2014-Section 6 Property Area	495 m² *min*	4841.06 m²	✓
Zoning Bylaw - 1-Z-2014-Section 6 Lot Frontage	16.5 m *min*	43.2 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Front Yard Setback - Thompson Road W.	3 m *min*	24.87 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Exterior Side Yard Setback - Leamon St.	3 m *min*	3.02 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Interior Side Yard Setback	3 m *min*	23.85 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Rear Yard Setback-Abutting Res. Zone	9 m *min*	15.96 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Usable Floor Area	N/A	N/A	✓
Zoning Bylaw - 1-Z-2014-Section 6 Building Height - Number of Storeys	11 m *max*	17.36 m	✕
Zoning Bylaw - 1-Z-2014-Section 6 Lot Coverage	35% 3,872.85m²/*max*	24% 1,155.35 m²	✓
Zoning Bylaw - 1-Z-2014-Section 6 Outdoor Storage	0% N/A	0% N/A	✓
Zoning Bylaw - 1-Z-2014-Section 6 Landscape Open Space	0% N/A	27.98% 1354.3 m²	✓
Landscape Open Space Breakdown Hardscape (Sidewalk Area) = **345.78 m² (7.14%) Provided** Softscape (Green Area) = **1008.52 m² (20.81%) Provided** Total Landscape Open Space = **1354.3 m² (27.95%) Provided**			
Amenity Area Breakdown **Balconies = 331.36 m²** **Indoor Amenity = 177.25 m²** (4.01 m² per Unit) **Provided** **Total Amenity Area = 508.61 m² Provided**			
Front Yard Landscaping - ZBL 1-Z-2014 - Section 4 4.2.5 (a) *A minimum of 50 percent of the front yard shall be maintained as landscape area* **Front Yard Area: 1117.15 m2** **Required Front Yard Landscape Area: 558.58 m2 (50%)** **Provided Front Yard Landscape Area: 280.7 m2 (25.13%)**			
Parking Statistics			
Zoning Bylaw - 1-Z-2014-Section 4.9 b) Apartment Dwelling Requirement	1.5 *min*	1.13	✕
Parking Count Breakdown (Apartment Dwelling) = **44** (Total Units) x 1.50 = **66** Parking spots **Required** = **44** (Total Units) x 1.13 = **50** Parking spots **Provided**			
Zoning Bylaw - 1-Z-2014-Section 4.9 f) Visitor Parking Requirement: 1/3 Units	15 *min*	15	✓
Parking Count Breakdown (Visitor) = **44** (Total Units) / 3 = **15** Parking spots **Required** = **44** (Total Units) / 3 = **15** Parking spots **Provided**			
Zoning Bylaw - 1-Z-2014-Section 4.9 uu) Other non-residential use: 1/35m2	7 *min*	7	✓
Parking Count Breakdown (Commercial Area) = **230m2** (Commercial Area) / 35 = **7** Parking spots **Required** = **230m2** (Commercial Area) / 35 = **7** Parking spots **Provided**			

BUILDING STATS

MIXED-USE BUILDING

RESIDENTIAL UNITS: 44

OF STOREYS: 5 STOREYS ; 17.36m BUILDING HEIGHT

BUILDING AREA: 1,155.35m²

RESIDENTIAL GFA: 4,626.40m²

COMMERCIAL GFA: 230.06m²

RESIDENTIAL STATS

RESIDENTIAL UNIT COUNTS

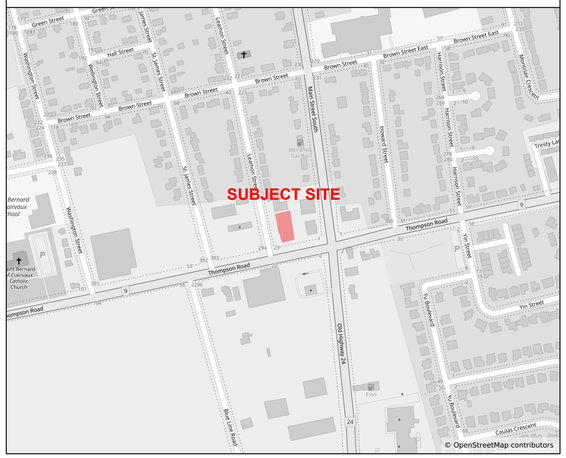
NAME	*COUNT*	*GFA RANGE*	*%*
ONE BED	20	56 m² ... 57 m²	45%
TWO BED	24	79 m² ... 97 m²	55%
GRAND TOTAL	44		

BARRIER-FREE UNITS

NAME	*COUNT*	*GFA RANGE*	*%*

0 / 0 = 0%

CONTEXT PLAN



OBC MATRIX

PATRICK DAVID TROTTIER ARCHITECT
266 DUFFERIN AVE, BRANTFORD, ON N3T 4S2
226.208-1543c patrick@pdtarch.ca www.pdtarch.ca

CLIENT

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PROJECT
LEAMON STREET, WATERFORD

ADDRESS
289, LEAMON ST, WATERFORD, ON

CLIENT
FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

2	Issued for SPA Submission	2025

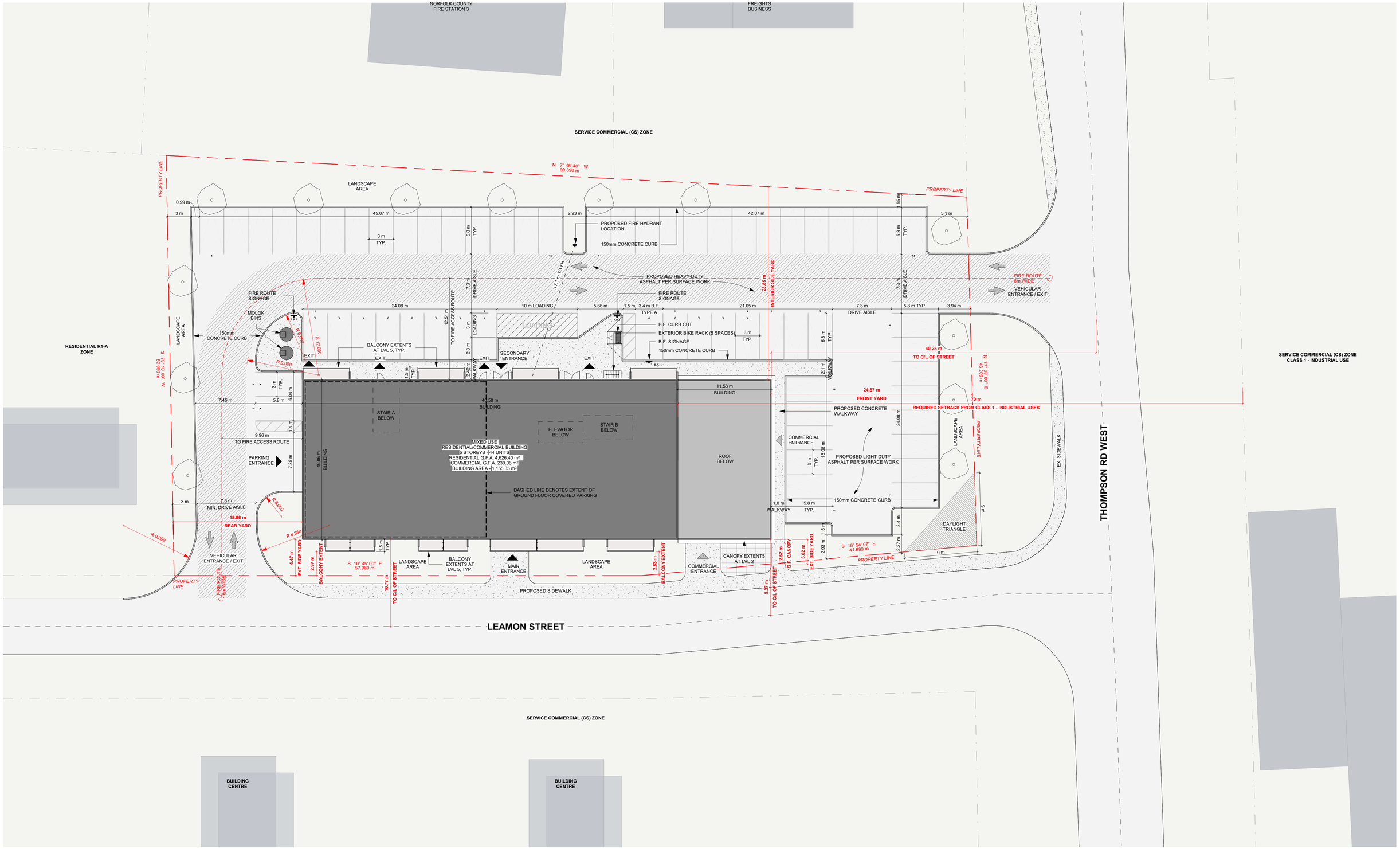
SHEET NAME
BUILDING INFORMATION

SCALE
As indicated

SHEET SIZE	**24"x36"**
ISSUE DATE	**2025-05-21**
PROJECT #	**0067**
DRAWN BY	**Author**
CHECKED BY	**Checker**

N
28.01°

A.001



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289, LEAMON ST, WATERFORD, ON

CLIENT
FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

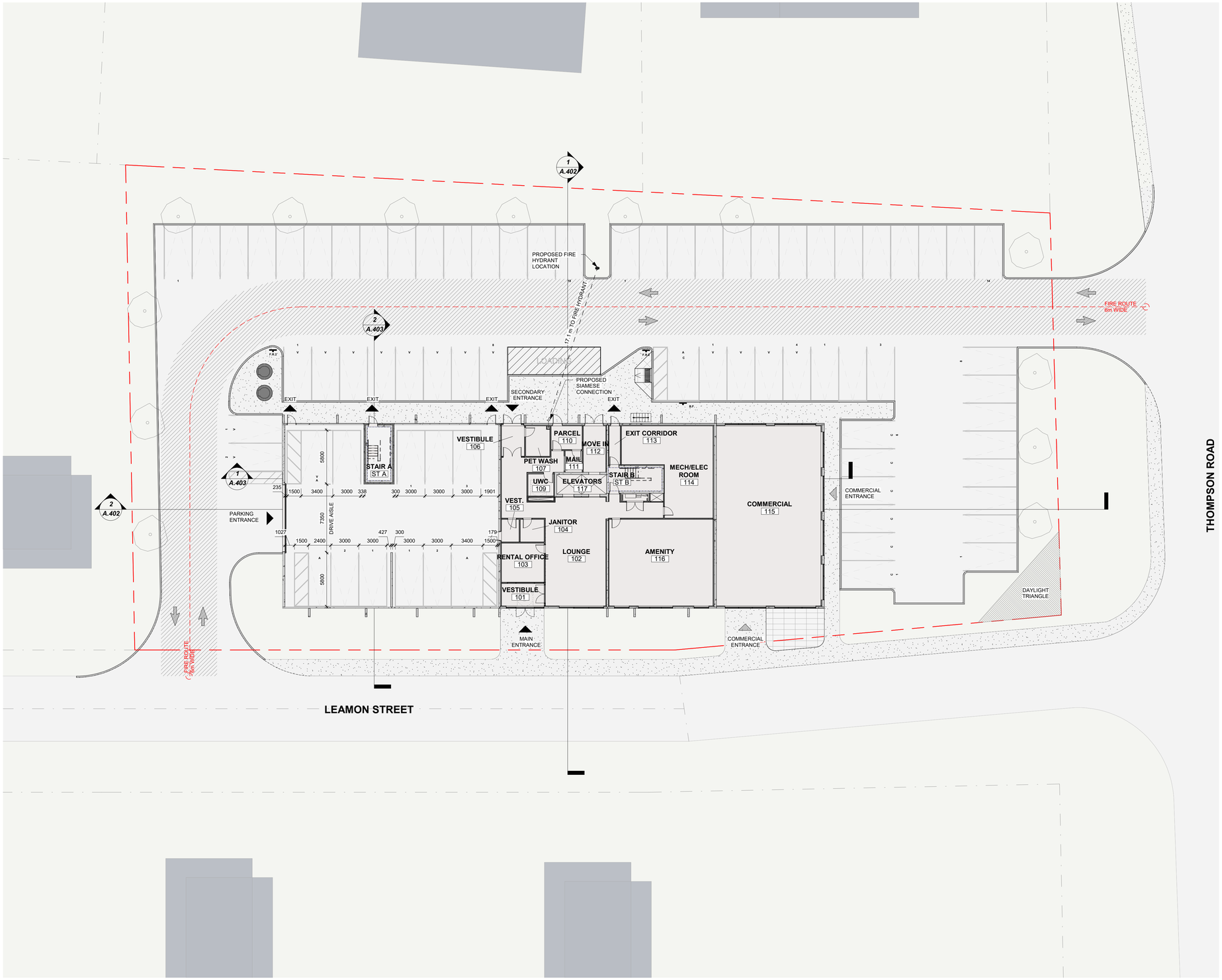
2	Issued for SPA Submission	2025

SHEET NAME
SITE PLAN

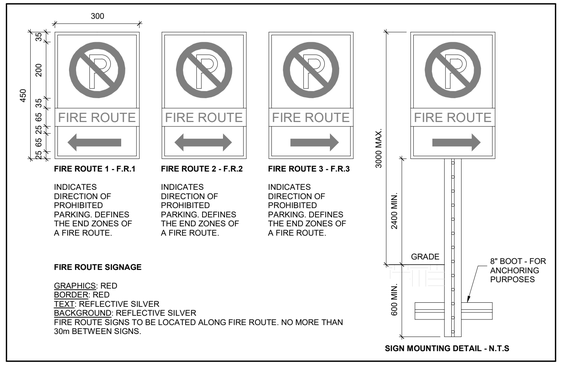
SCALE
1 : 200

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

A.002



FIRE ROUTE SIGNS



FIRE ROUTE 1 - F.R.1

INDICATES DIRECTION OF PROHIBITED PARKING. DEFINES THE END ZONES OF A FIRE ROUTE.

FIRE ROUTE 2 - F.R.2

INDICATES DIRECTION OF PROHIBITED PARKING. DEFINES THE END ZONES OF A FIRE ROUTE.

FIRE ROUTE 3 - F.R.3

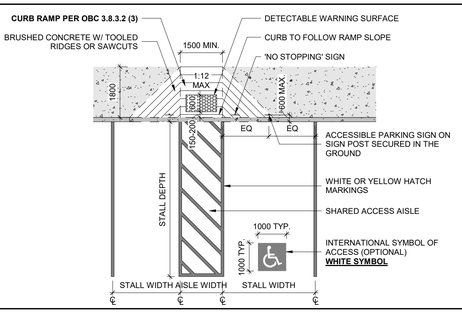
INDICATES DIRECTION OF PROHIBITED PARKING. DEFINES THE END ZONES OF A FIRE ROUTE.

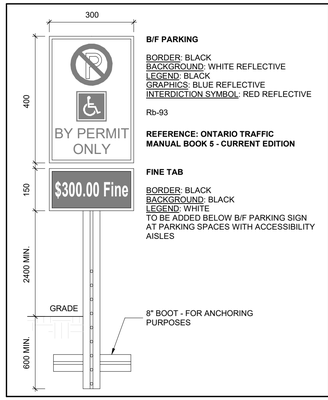
FIRE ROUTE SIGNAGE

GRAPHICS: RED
BORDER: RED
TEXT: REFLECTIVE SILVER
BACKGROUND: REFLECTIVE SILVER
FIRE ROUTE SIGNS TO BE LOCATED ALONG FIRE ROUTE. NO MORE THAN 30m BETWEEN SIGNS.

SIGN MOUNTING DETAIL - N.T.S

CURB RAMP PER OBC 3.8.3.2 (3)





B/F PARKING

BORDER: BLACK
BACKGROUND: WHITE REFLECTIVE
LEGEND: BLACK
GRAPHICS: BLUE REFLECTIVE
INTERDICTION SYMBOL: RED REFLECTIVE

Rb-93

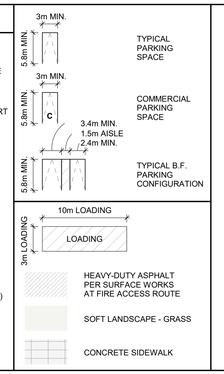
REFERENCE: ONTARIO TRAFFIC MANUAL BOOK 5 - CURRENT EDITION

FINE TAB

BORDER: BLACK
BACKGROUND: BLACK
LEGEND: WHITE
TO BE ADDED BELOW B/F PARKING SIGN AT PARKING SPACES WITH ACCESSIBILITY AISLES

LEGEND

- PROPOSED FIRE HYDRANT
- DISTANCE FROM FIRE HYDRANT TO SIAMESE CONNECTION
- PROPOSED FIRE DEPARTMENT CONNECTION/FIRE DEPARTMENT DRAFT PORT CONNECTION
- PROPOSED PEDESTRIAN BUILDING ENTRANCE/EXIT
- PROPOSED COMMERCIAL ENTRANCE
- FIRE ACCESS ROUTE
- B.F. PROPOSED ACCESSIBLE SIGN
- FR.S FIRE ROUTE SIGN
- SNOW REMOVAL/STORAGE
- SITE LIGHTING (REFER TO ELECTRICAL DWGS FOR DETAILS)
- CONCRETE RETAINING WALL, REFER TO LANDSCAPE DESIGN FOR DETAILS



- HEAVY-DUTY ASPHALT PER SURFACE WORKS AT FIRE ACCESS ROUTE
- SOFT LANDSCAPE - GRASS
- CONCRETE SIDEWALK

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PROJECT
LEAMON STREET, WATERFORD

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CLIENT
FAST TRACK MODULAR PRECAST

2	Issued for SPA Submission	2025

SHEET NAME
SITE PLAN - GROUND FLOOR

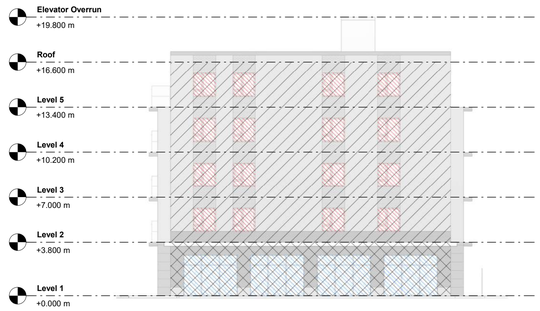
SCALE
1 : 200

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
28.01°

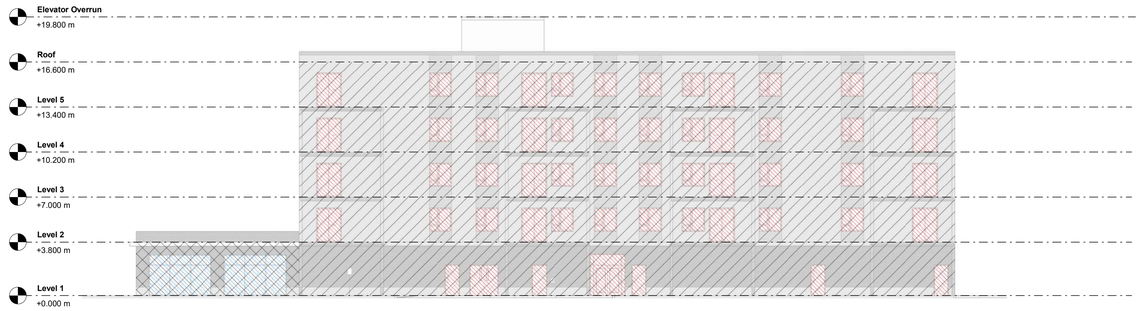
A.003

RESIDENTIAL U.P.O 42.92 m²
COMMERCIAL U.P.O 44.31 m²



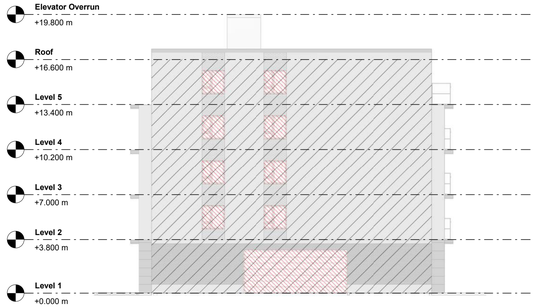
1 EAST FACADE
A.004 1 : 200

RESIDENTIAL U.P.O 178.5 m²
COMMERCIAL U.P.O 25.62 m²



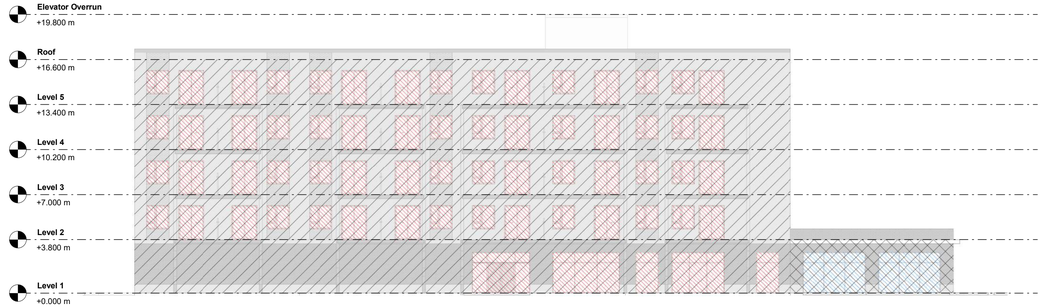
3 NORTH FACADE
A.004 1 : 200

RESIDENTIAL U.P.O 43.93 m²



2 WEST FACADE
A.004 1 : 200

RESIDENTIAL U.P.O 253.55 m²
COMMERCIAL U.P.O 25.62 m²



4 SOUTH FACADE
A.004 1 : 200

MIXED USE BUILDING	COMMERCIAL (GROUP D) OBC T.3.2.3.1.D							
	GROUP	E.B.F.	L.D.	U.P.O. PERM.	U.P.O. PROP.	F.R.R.	CONSTR. REQ.	CLADD. REQ.
NORTH FACE	D	44.0 m²	23.8 m	100%	58%			
EAST FACE	D	75.5 m²	40.3 m	100%	59%			
SOUTH FACE	D	44.0 m²	9.4 m	100%	58%			
WEST FACE	D	0.0 m²	0.0 m	0%	0%			

MIXED USE BUILDING	RESIDENTIAL (GROUP C) OBC T.3.2.3.1.D							
	GROUP	E.B.F.	L.D.	U.P.O. PERM.	U.P.O. PROP.	F.R.R.	CONSTR. REQ.	CLADD. REQ.
NORTH FACE	C	773.3 m²	23.8 m	100%	23%			
EAST FACE	C	254.3 m²	40.3 m	100%	17%			
SOUTH FACE	C	773.3 m²	10.8 m	100%	33%			
WEST FACE	C	329.8 m²	15.9 m	100%	13%			

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FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

2	Issued for SPA Submission	2025

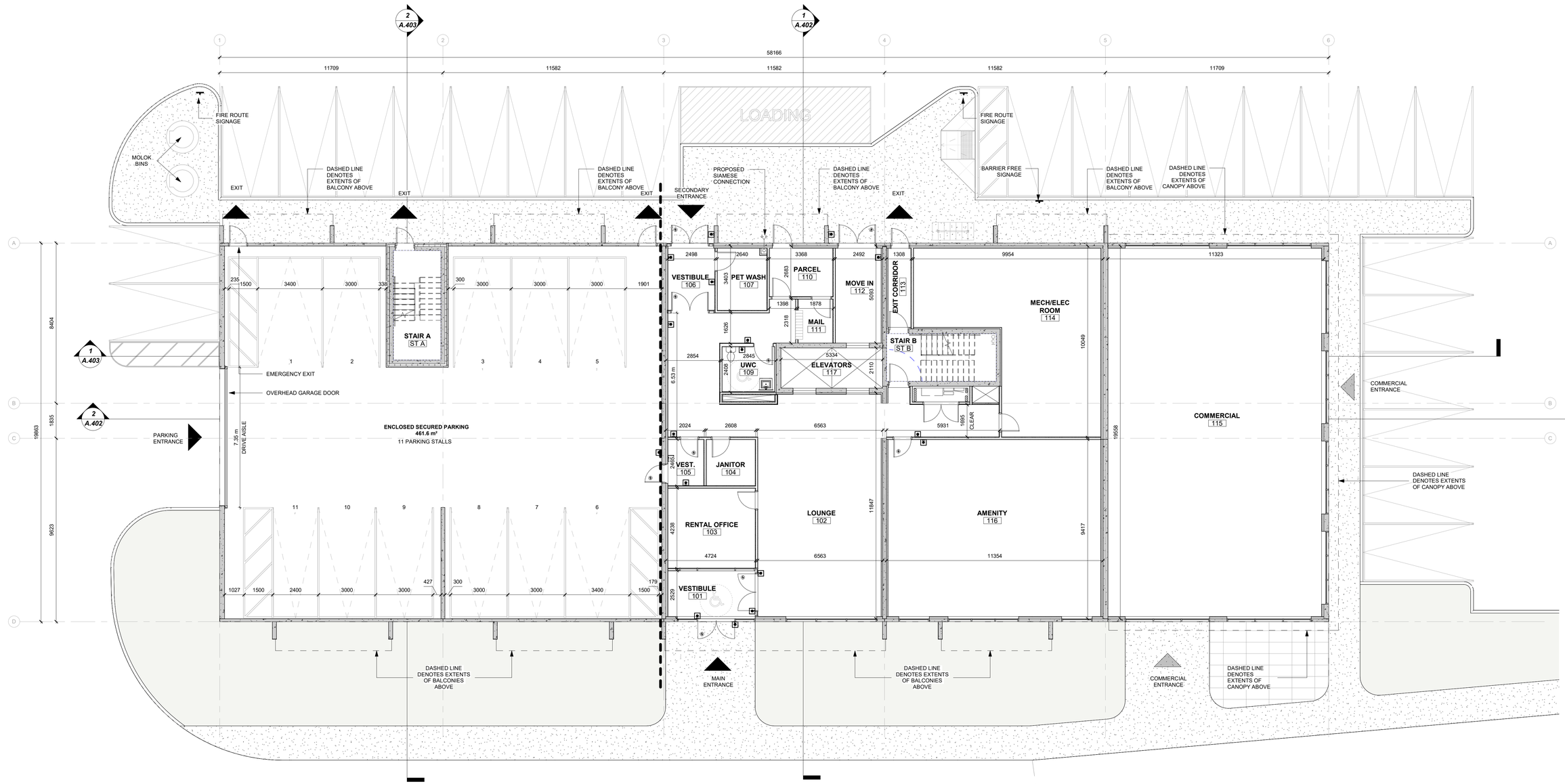
SHEET NAME
OBC SPATIAL SEPARATION

SCALE
As indicated

SHEET SIZE	**24"x36"**
ISSUE DATE	**2025-05-21**
PROJECT #	**0067**
DRAWN BY	**Author**
CHECKED BY	**Checker**

N

A.004



AREA SCHEDULE - LEVEL 1

Unit	Count	Area (sqft)	Count Ratio
AMENITY			
1,213 SF	1	1,213	5%
	1	1,213	5%
COMMERCIAL			
2,476 SF	1	2,476	5%
	1	2,476	5%
CORRIDOR			
648 SF	1	648	5%
	1	648	5%
ELEC			
35 SF	1	35	5%
	1	35	5%
ELEV			
142 SF	1	142	5%
	1	142	5%

AREA SCHEDULE - LEVEL 1

Unit	Count	Area (sqft)	Count Ratio
ENCLOSED SECURED PARKING			
4,968 SF	1	4,968	5%
	1	4,968	5%
JANITOR'S			
75 SF	1	75	5%
	1	75	5%
LOBBY/LOUNGE			
695 SF	1	695	5%
	1	695	5%
MAIL			
53 SF	1	53	5%
	1	53	5%
MAIN PIPE SHAFT			
16 SF	1	16	5%
	1	16	5%

AREA SCHEDULE - LEVEL 1

Unit	Count	Area (sqft)	Count Ratio
MECH / ELEC ROOM			
855 SF	1	855	5%
	1	855	5%
MECH SHAFT			
17 SF	1	17	5%
	1	17	5%
MOVE IN			
153 SF	1	153	5%
	1	153	5%
PARCEL			
107 SF	1	107	5%
	1	107	5%
PETWASH			
106 SF	1	106	5%
	1	106	5%

AREA SCHEDULE - LEVEL 1

Unit	Count	Area (sqft)	Count Ratio
RENTAL OFFICE			
227 SF	1	227	5%
	1	227	5%
STAIR			
72 SF	1	72	5%
177 SF	1	177	5%
	2	249	9%
UWC			
83 SF	1	83	5%
	1	83	5%
VESTIBULE			
60 SF	1	60	5%
106 SF	1	106	5%
144 SF	1	144	5%
	3	309	14%
Grand Total:	22	12,425	100%

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FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

2	Issued for SPA Submission	2025

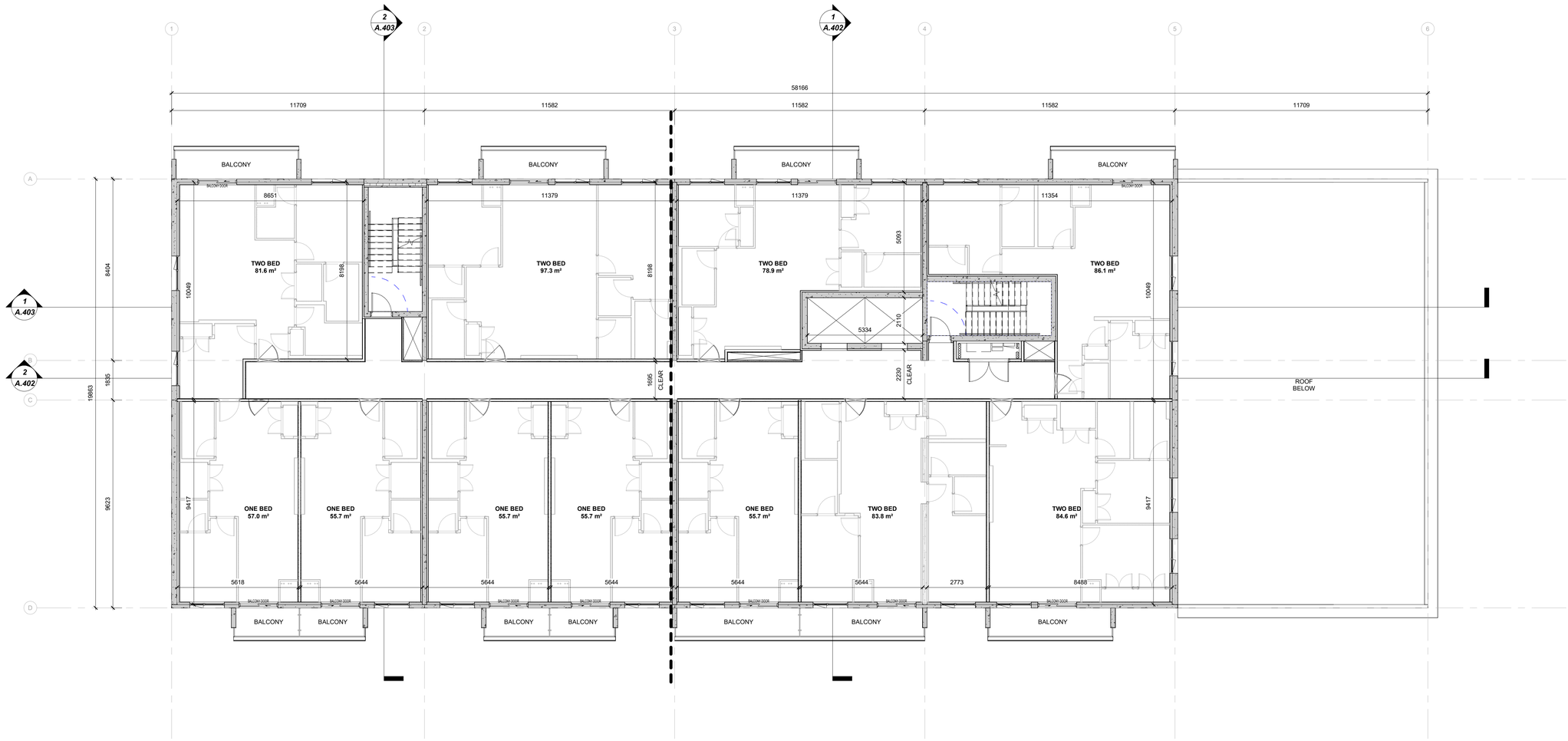
SHEET NAME
GROUND FLOOR PLAN

SCALE
1 : 100

SHEET SIZE	**24"x36"**
ISSUE DATE	**2025-05-21**
PROJECT #	**0067**
DRAWN BY	**Author**
CHECKED BY	**Checker**

N
28.01°

A.101



AREA SCHEDULE - TYP LEVEL

Unit	*Count*	*Area (sqft)*	*Count Ratio*
ONE BED			
600	16	9,598 SF	36%
613	4	2,452 SF	9%
	20	12,050 SF	45%
TWO BED			
849	4	3,396 SF	9%
879	4	3,515 SF	9%
902	4	3,610 SF	9%
910	4	3,641 SF	9%
927	4	3,707 SF	9%
1,048	4	4,191 SF	9%
	24	22,061 SF	55%
Grand Total:	44	34,111 SF	100%

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2	Issued for SPA Submission	2025

SHEET NAME

TYPICAL FLOOR PLAN

SCALE

1 : 100

SHEET SIZE	**24"x36"**
ISSUE DATE	**2025-05-21**
PROJECT #	**0067**
DRAWN BY	**Author**
CHECKED BY	**Checker**

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28.01°

A.102

1 A.400 **BUILDING ELEVATION EAST**
1 : 150

3 A.400 **BUILDING ELEVATION NORTH**
1 : 150

2 A.400 **BUILDING ELEVATION - WEST**
1 : 150

4 A.400 **BUILDING ELEVATION - SOUTH**
1 : 150

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2	Issued for SPA Submission	2025

SHEET NAME
BUILDING ELEVATIONS

SCALE
1 : 150

SHEET SIZE	**24"x36"**
ISSUE DATE	**2025-05-21**
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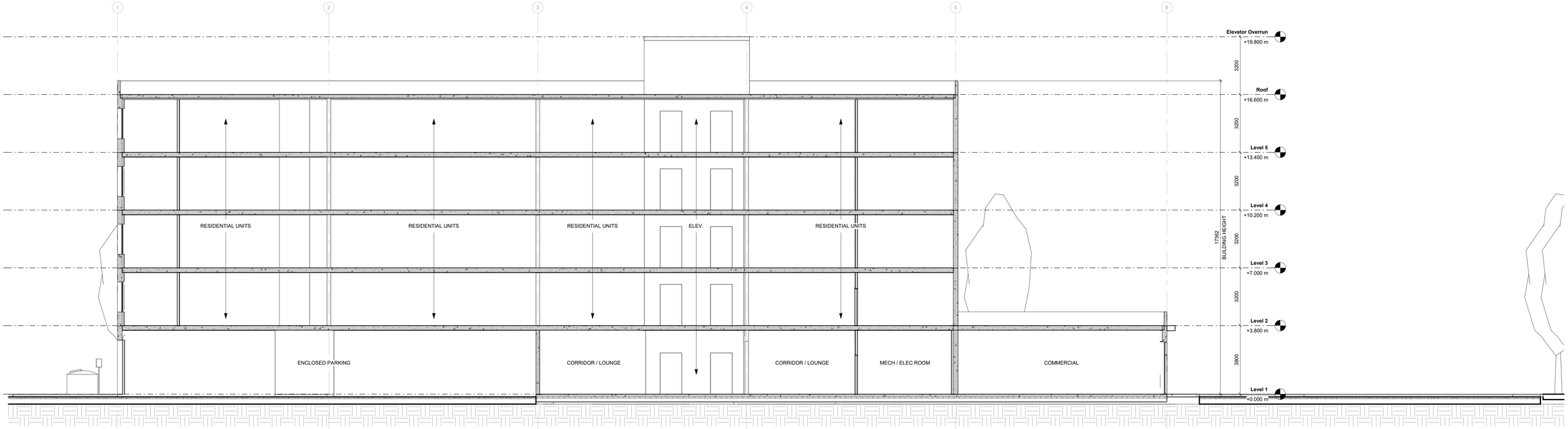
DRAWN BY	**Author**
CHECKED BY	**Checker**

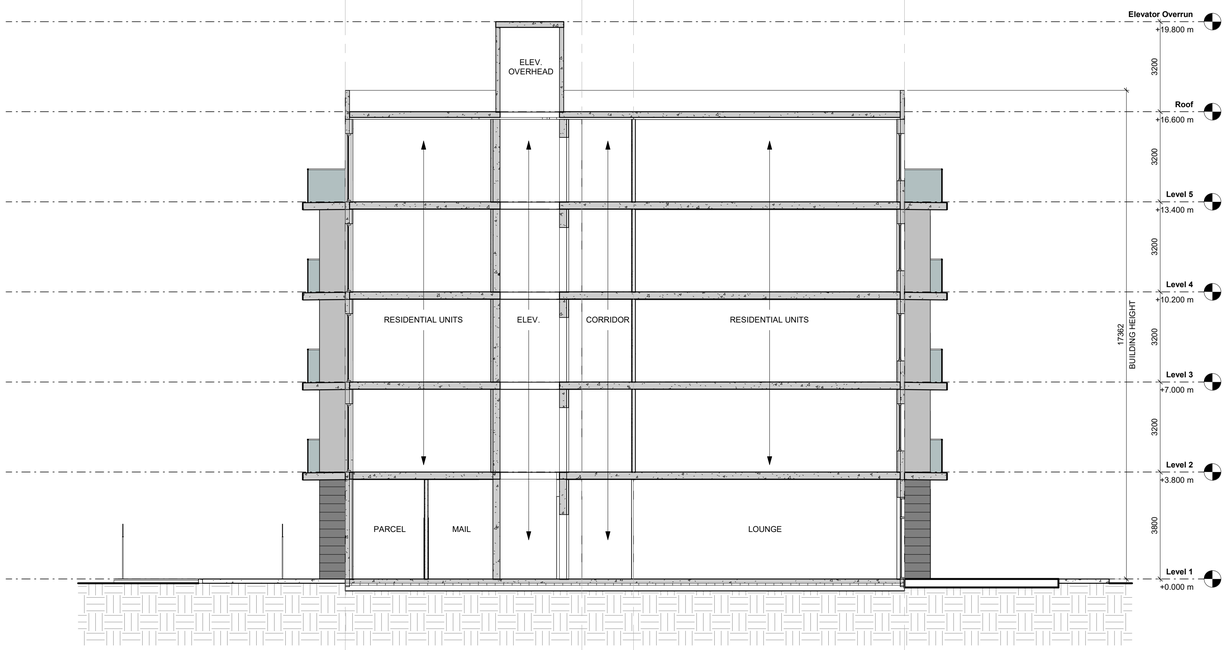
28.01°

A.400



2 A.402 **SITE SECTION - LONGITUDINAL**

1 : 100



1 A.402 **SITE SECTION - TRANSVERSAL**

1 : 100

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SHEET NAME
SITE SECTIONS

SCALE
1 : 100

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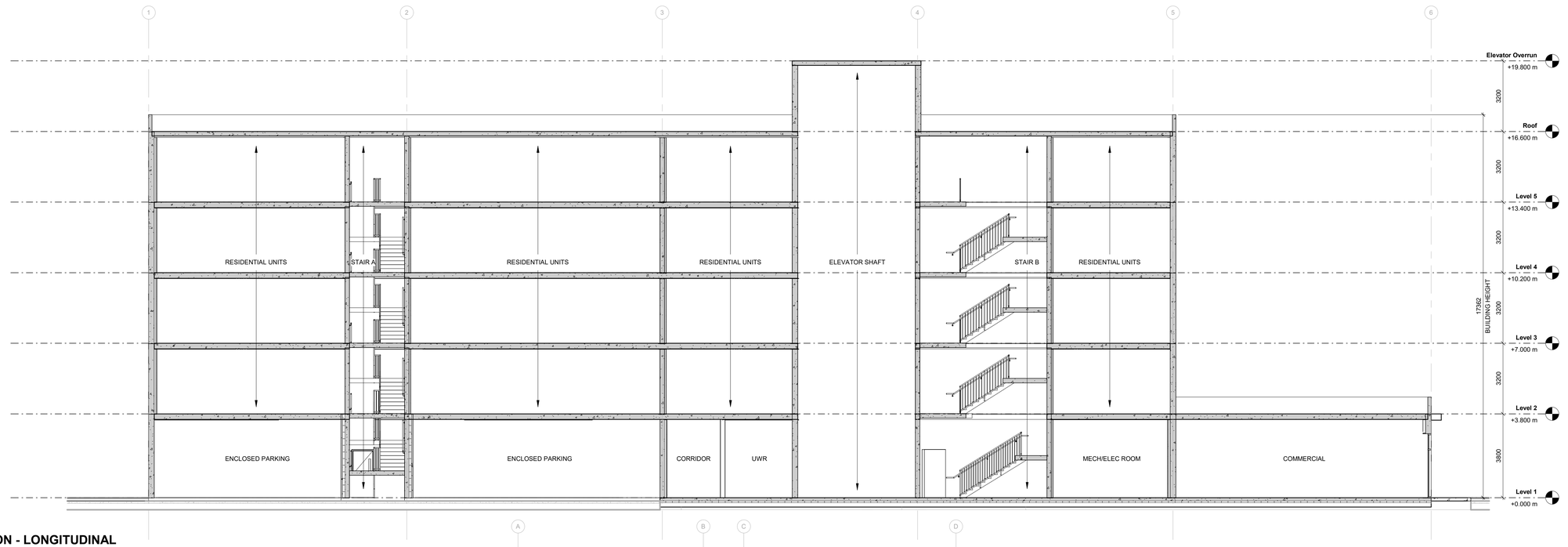
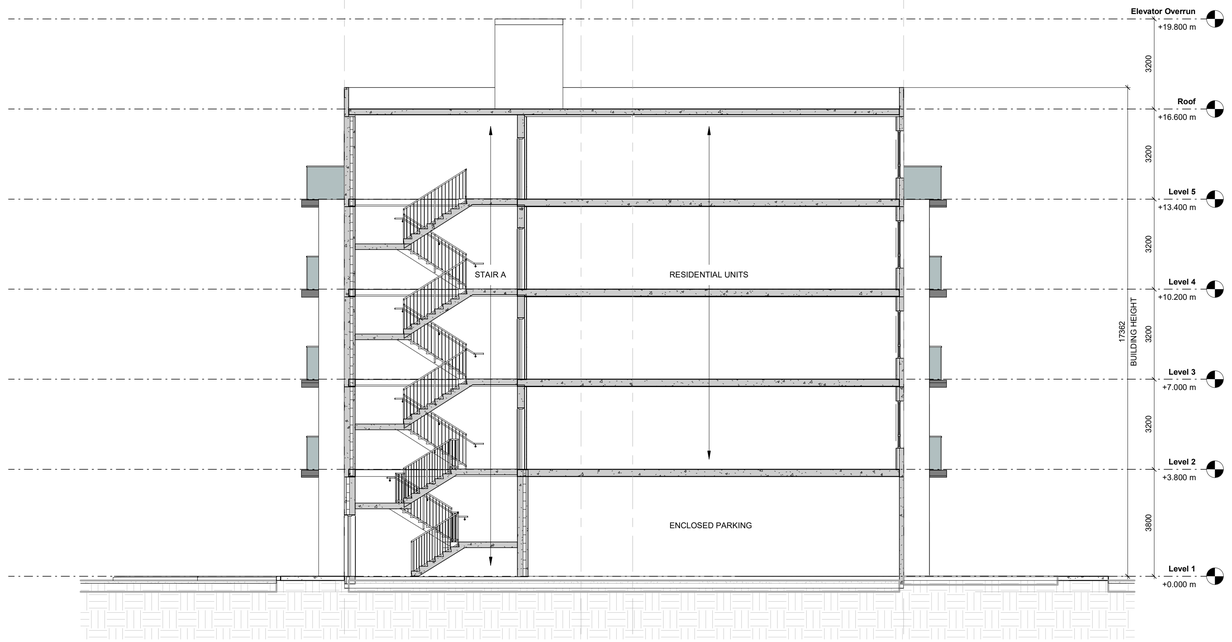
A.402



1 / A.403 **BUILDING SECTION - LONGITUDINAL**

1 : 100



2 / A.403 **BUILDING SECTION - TRANSVERSAL**

1 : 100

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SHEET NAME
BUILDING SECTIONS

SCALE
1 : 100

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ISSUE DATE	**2025-05-21**
PROJECT #	**0067**
DRAWN BY	**Author**
CHECKED BY	**Checker**

N
28.01°

A.403

1 / A.404 **MAIN ENTRANCE MATERIAL BOARD**

1 : 50

LEGEND

- PRECAST RUNNING BOND BRICK VENEER - DARK GREY
- PRECAST RUNNING BOND BRICK VENEER - LIGHT GREY
- PRECAST HORIZONTAL BOARD VENEER - DARK GREY
- PRECAST WOOD TEXTURED FORMLINER

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2	Issued for SPA Submission	2025

SHEET NAME
EXTERIOR MATERIALS - BUILDING ENTRANCE

SCALE
As indicated

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
28.01°

A.404

1
A.801
SOUTH - EAST

2
A.801
SOUTH - WEST

3
A.801
NORTH - EAST

4
A.801
NORTH - WEST

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PROJECT
LEAMON STREET, WATERFORD

ADDRESS
289, LEAMON ST, WATERFORD, ON

CLIENT
FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

2	Issued for SPA Submission	2025

SHEET NAME
ISO VIEWS

SCALE

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
28.01°

A.801

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SHEET NAME
RENDERS

SCALE

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
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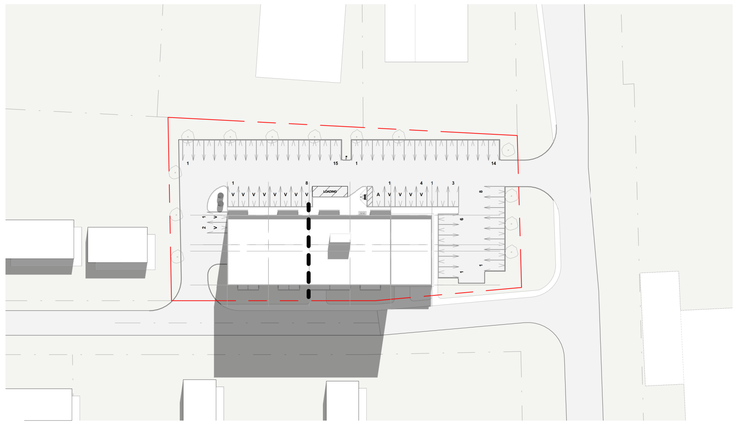
SUMMER SOLSTICE - JUNE 21 SHADOWS



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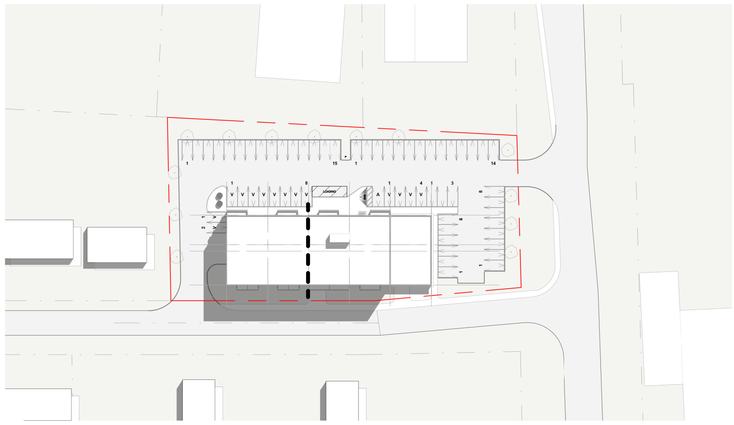

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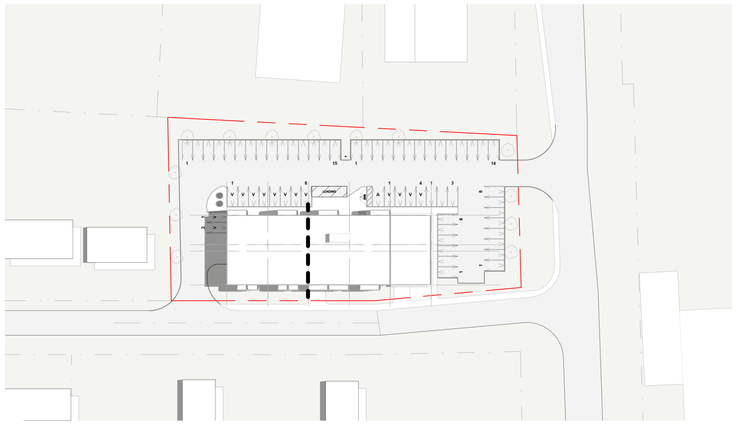

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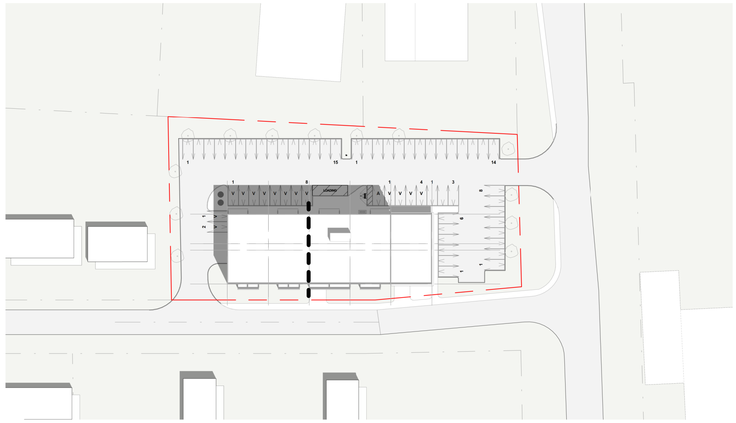

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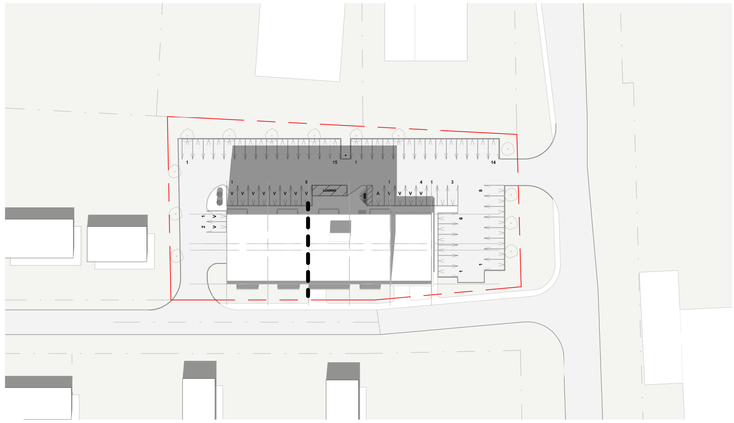

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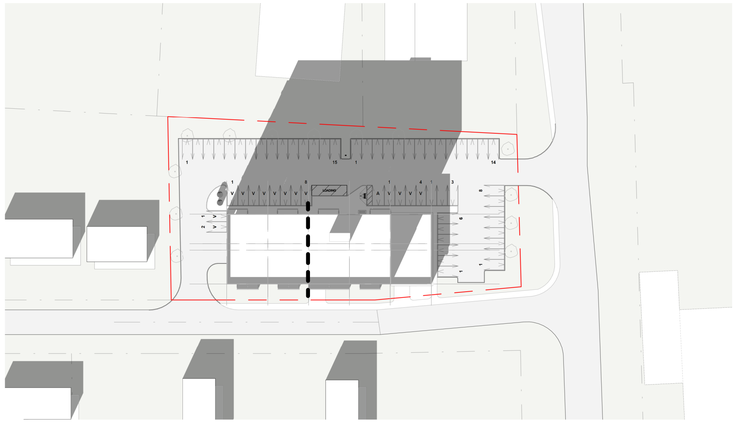

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2	Issued for SPA Submission	2025

SHEET NAME
SHADOW STUDIES - SUMMER SOLSTICE

SCALE
1 : 800

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
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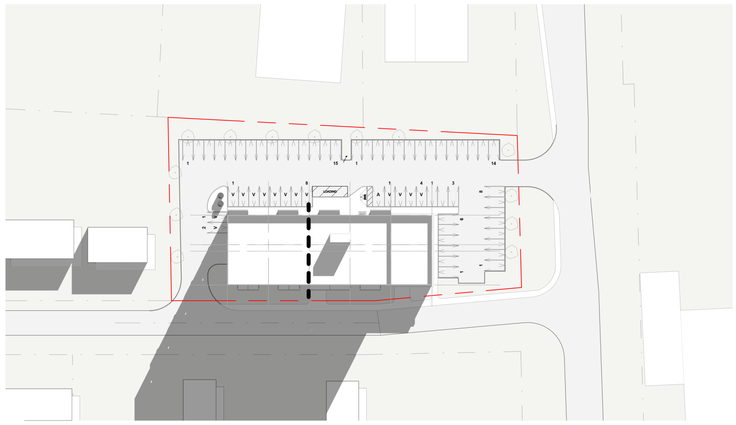
A.900

SPRING EQUINOX - MARCH 20 SHADOWS



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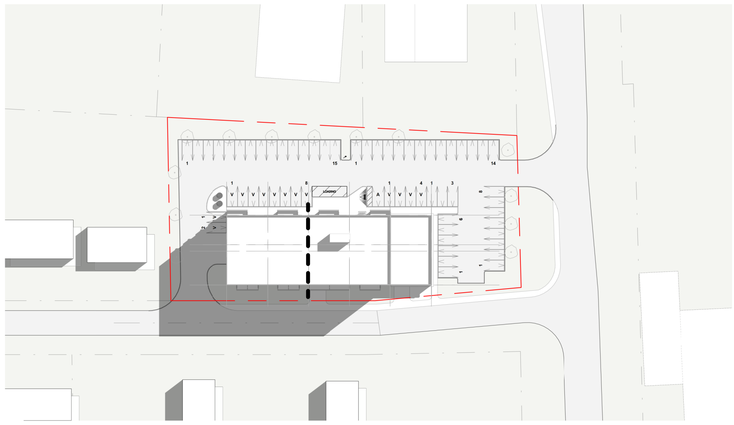

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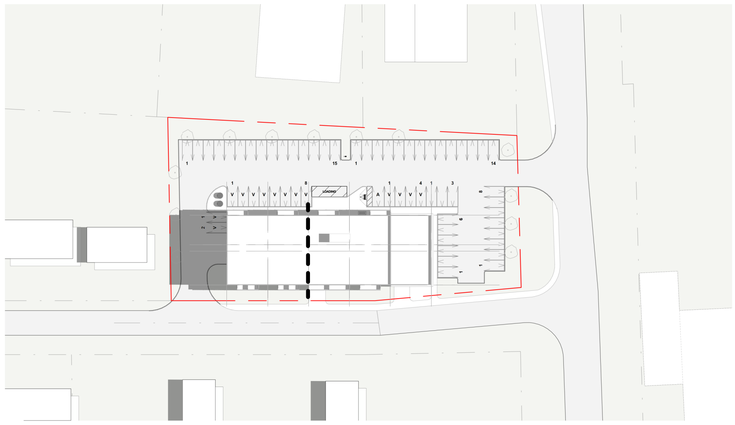

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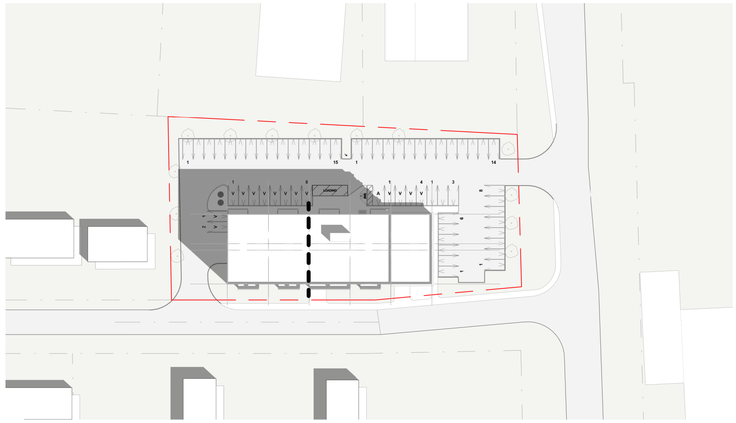

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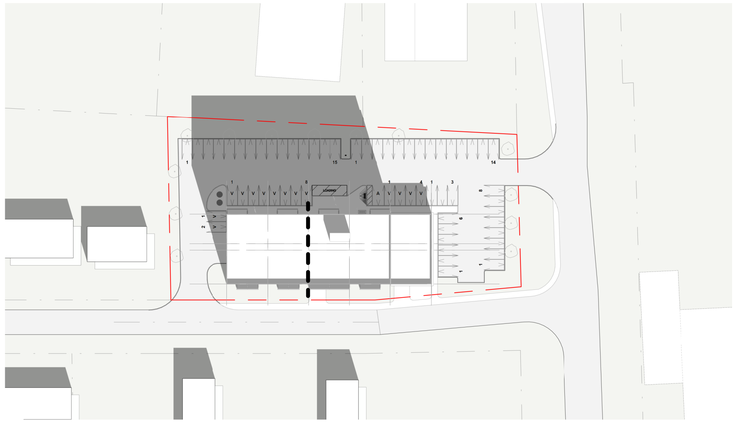

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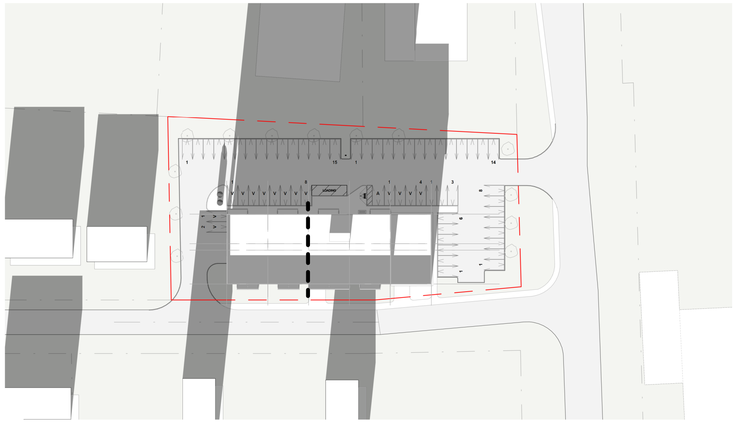

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2	Issued for SPA Submission	2025

SHEET NAME
SHADOW STUDIES - SPRING EQUINOX

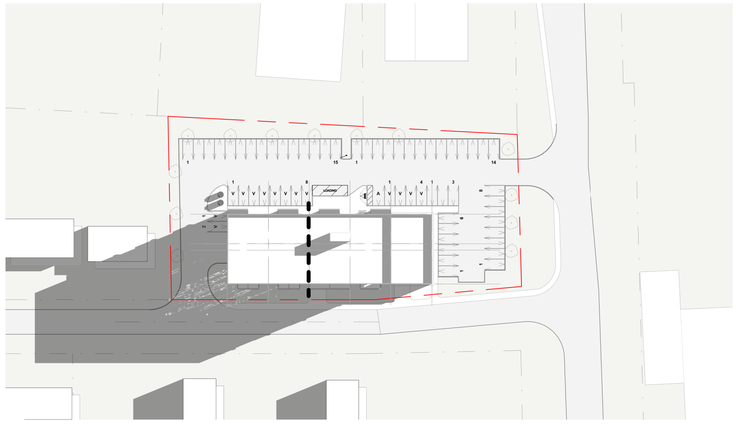
SCALE
1 : 800

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
28.01°

A.901

WINTER SOLSTICE - DECEMBER 21 SHADOWS



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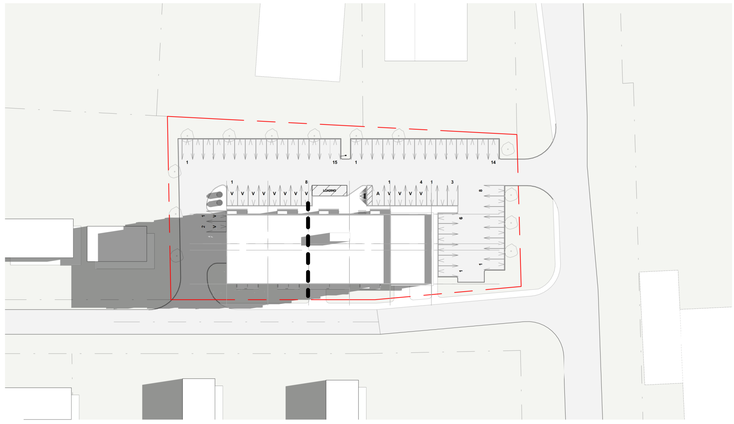

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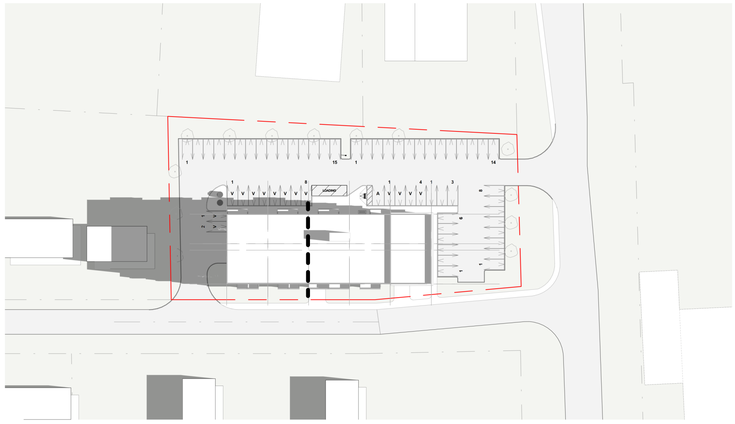

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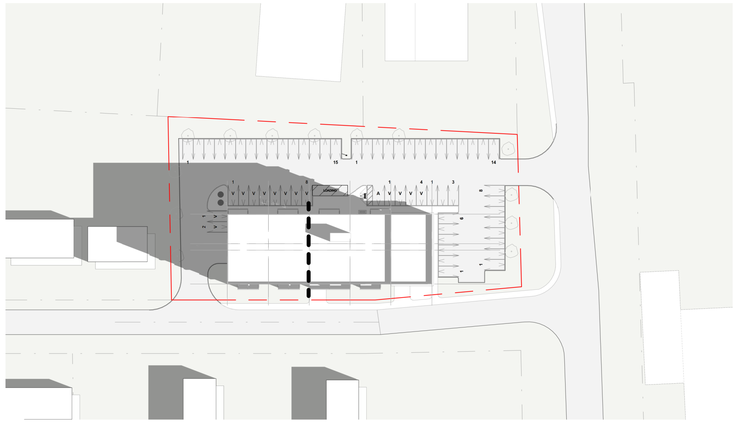

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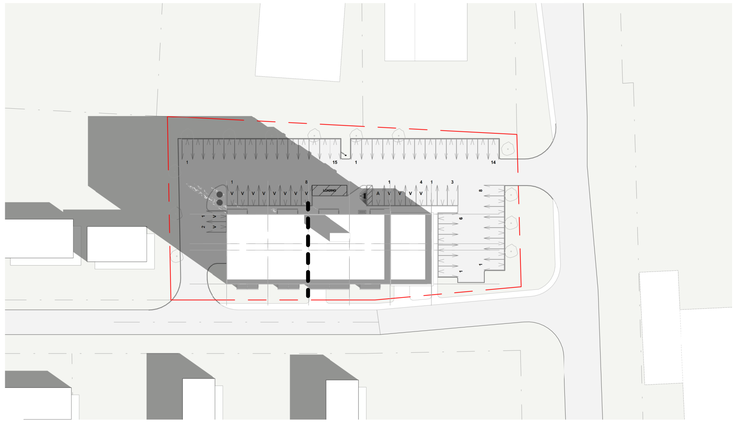

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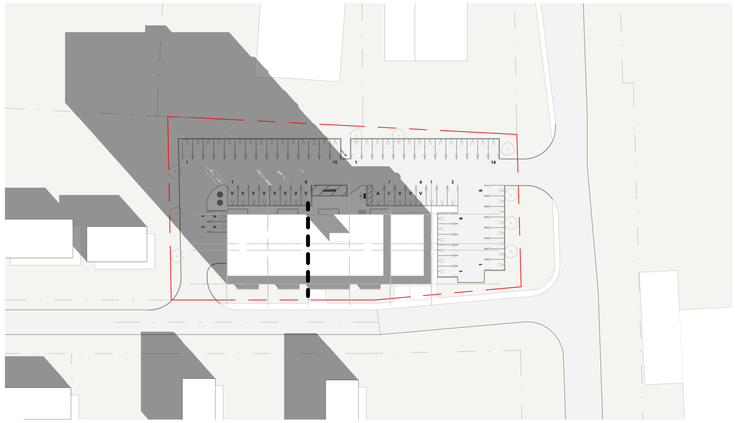

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SHEET NAME
SHADOW STUDIES - WINTER SOLSTICE

SCALE
1 : 800

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

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RC SPENCER ASSOCIATES INC.
Consulting Engineers

RC SPENCER ASSOCIATES INC.
Consulting Engineers
EST. 1989
35 YEARS STRONG!

16 June 2025
File No.: 25-Pro-127

B&B Landco Inc.
245 King George Road, Suite 222
Brantford ON N3R 7N7

Via email: **natalieongena@gdvallee.ca**

Attention: **Jesse Buchan**

Re: **289 Leamon Street, Waterford, Ontario**
Parking Impact Analysis

Dear Mr. Buchan:

The following provides our outline of engineering services deemed to be required for the proposed mixed-use development, located at 289 Leamon Street, in Waterford, Ontario.

General

We are basing our scope of work on the 12 – 16 June 2025 email correspondence between Ms. Natalie Ongena and our Mr. Aaron Blata as well as the site plan package provided to our office. We understand that the development will include a 5-storey, 44-unit apartment building with approximately 2,476 sq. ft. of first-floor commercial space. We also understand that the proposed development is to be supplemented by 72 parking spaces.

Scope of Services

- Correspondence with Officials;
- Review of land-use specific ITE peak parking demand data for a standard weekday;
- Preparation of a final report (including engineers' comments and supporting figures) to be integrated into our previously approved traffic impact brief.

Fees

Our lump sum fee to prepare this parking impact analysis as described will be **$2,500.00** plus HST. Please note that this quotation is for the defined scope of work (to the completion of the final report). Any work that may be required beyond the completion of the report and attendance at any meetings will be considered an extra to be billed on a per diem basis. Likewise, should the proposed site plan be amended, it is requested that RC Spencer Associates Inc. be notified immediately so that the scope of services can be revisited.

Payment

RC Spencer Associates Inc. has a corporate policy requiring payment in full, **$2,825.00** ($2,500.00 + $325.00 HST), prior to undertaking the aforementioned scope of services. All payment should be addressed to RC Spencer Associates Inc., located at 800 University Avenue West, Windsor, ON, N9A 5R9.

Closure

Thank you for providing us with an opportunity to submit this outline of engineering services. If you are in agreement, please sign the affidavit below and return one copy to this office. If you have any questions, please call Mr. Aaron Blata at our Leamington Office at 519-324-0606.

Yours Truly,
RC Spencer Associates Inc.

Richard C. Spencer, M.A.Sc., P.Eng.
Consulting Engineer
President

cc: **Aaron Blata**
Cheryl Morden

AFFIDAVIT

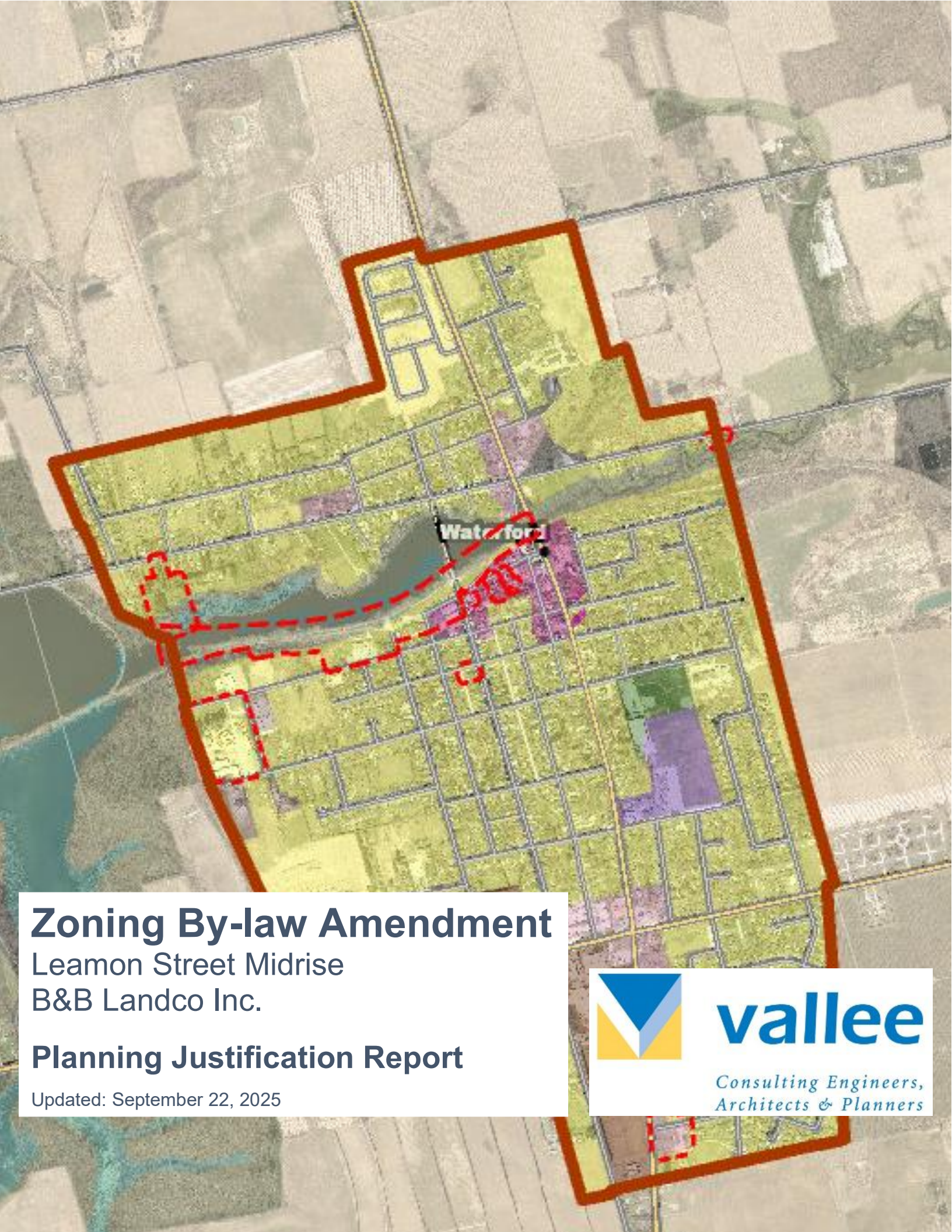
I am in agreement with the outline of engineering services re: Parking Impact Analysis for the proposed Leamon Street Mixed-Use development, located in Waterford, Ontario, and authorize RC Spencer Associates Inc. to proceed immediately as noted. I, the undersigned, have read and agree to the payment conditions outlined under "Fees" and "Payment".

_____

WITNESS

_____ _____

DATE **B&B Landco Inc.**



Zoning By-law Amendment

Leamon Street Midrise
B&B Landco Inc.

Planning Justification Report

Updated: September 22, 2025

vallee
Consulting Engineers, Architects & Planners

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Planning Observations and Area Description **2**
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Provincial Planning Statement (2024) 5
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Supporting Studies **25**
Functional Servicing and Stormwater Management Report 25
Traffic and Parking Analysis 26
Land Use Compatibility Assessment 27
Geotechnical and Soil Investigation 27
Shadow Analysis 28
Conclusion **28**
Appendices **30**
Appendix A – Site Plan
Appendix B – Planning Act – Matters of Provincial Interest
Appendix C – Provincial Planning Statement 2024 Review
Appendix D – Norfolk Official Plan Review
Appendix E – Community Integration
Appendix F – Ministry Class 4 Area

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Ontario Association of Architects

Introduction

G. Douglas Vallee Limited, on behalf of B&B Landco Inc. (B&B) c/o Jesse Buchan, is submitting a Zoning By-law Amendment application to facilitate a five-storey, 44-unit mixed-use midrise apartment with ground-floor commercial space at 289 Leamon Street, Waterford. The site is approximately 0.48 hectares and proposes a total of 72 parking spaces (50 residential, 15 visitor, and 7 commercial), including spaces located beneath the building footprint. The project will proceed through the Site Plan Control process, with the intent to achieve construction readiness by March 2026.

Background

Planning Observations and Area Description

The subject property is located at the northeast corner of Leamon Street and Thompson Road West in Waterford and is currently occupied by a contractor supply and service establishment (Home Hardware). The property is situated within an area containing a mix of commercial, institutional, and industrial land uses.

Immediately west of the site is a similar commercial use. To the east are the Waterford Fire Hall and additional commercial buildings fronting onto Main Street South. To the north, the area transitions to low-density residential dwellings, providing a clear residential interface. South of the property, the land use pattern shifts to industrial and service commercial, including operations related to light manufacturing, warehousing, and logistics.

The broader neighbourhood includes institutional facilities such as Waterford District High School, Waterford Public School, and St. Bernard Catholic Elementary School, as well as various places of worship. The site is located within a fully serviced urban area, supported by sidewalks and public transit, contributing to its suitability for compact, mixed-use redevelopment.

Figure 1 – Subject Lands

Studies

The following studies have been completed in support of the proposed applications:

- Functional Servicing Report prepared by G. Douglas Vallee Limited, dated xxx.
- Stormwater Management Report prepared by G. Douglas Vallee Limited, dated xxx
- Traffic and Parking Analysis prepared by RC Spencer Associates Inc., dated July 2025.
- Geotechnical Investigation prepared by Gemtec, dated September 4, 2025.
- Land Use Compatibility Study prepared by Sonair dated August 22, 2025.

Development Review Summary

The proposed development:

- Supports matters of provincial interest under Section 2 of the Planning Act, including housing provision, efficient infrastructure use, and settlement area intensification.
- Is consistent with the Provincial Planning Statement (2024), promoting compact, mixed-use development within a designated Urban Area.
- Implements the intent of the Norfolk County Official Plan by contributing to housing diversity and maintaining the commercial function of the site.
- Can be accommodated by the existing road network without adverse traffic impacts, as confirmed by the supporting Traffic Study.
- Provides adequate parking supply based on site-specific analysis using ITE Parking Generation data.
- Demonstrates compatibility with surrounding residential, institutional, and employment land uses through appropriate building scale and buffering.
- Does not conflict with adjacent industrial permissions and is supported by a Land Use Compatibility Study.
- Is fully serviceable by municipal water, wastewater, and stormwater systems.
- Represents good planning and is appropriate for approval.

Planning Applications

1. **Zoning By-law Amendment**
   A Zoning By-law Amendment is required to modify the current Service Commercial (CS) zoning to add a special provision that permits a midrise apartment dwelling in addition to existing commercial uses. Site-specific provisions are proposed to address building height, parking, setbacks, and other development standards.

2. **Site Plan Control**
   The development is subject to Site Plan Control, which will address servicing, stormwater management, landscaping, vehicle access, and hard surface layout. The detailed design will be finalized through the Site Plan Approval process.

3. **Official Plan Amendment (Not Required)**

   While the applicant maintains that an Official Plan Amendment is not necessary, justification has been provided in the event Norfolk County determines one is required. The subject lands are designated Commercial, and Section 7.11.1(e) of the Norfolk County Official Plan permits residential uses within commercial areas, provided the planned commercial function is maintained. The proposed development includes ground-floor commercial space and is consistent with this intent.

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Consulting Engineers, Architects & Planners
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Proposed Zoning By-law Amendment

To rezone the portion of lands currently zoned Service Commercial to add multiple residential units in the form of an apartment:

Service Commercial (CS) with a special provision: (on zoning Schedule "A16")

6.3.2 Provisions

- Minimum setback from Class 1 Industry: 70 metres (Add special provision)
- Height: 18 metres (5 storeys)
- Section 4.2.5 a) Minimum of 50 percent of the front yard shall be maintained as landscape area: Proposed 25%.
- Number of parking spaces reduction from 1.5 spaces per unit to 1.13 spaces per unit
- Parking area setback to dwelling/apartment: 2.4 meters
- Parking area setback to interior property line: 3 metres except for driveway ingress/egress area which may be reduced to nil.
- Parking area location: permitted in all yards
- Commercial Canopy encroachment: 1.5 metres

The proposed zoning by-law provisions are designed to implement the site plan included in Appendix A. The site plan demonstrates that the proposed apartment will comply with these provisions and those other provisions of the CS Zone. Details of the proposed provisions are discussed further in this report.

List of Appendices

Several appendices for part of this report which include:

Appendix A – Site Plan
Appendix B – Planning Act – Matters of Provincial Interest
Appendix C – Provincial Planning Statement 2024 Review
Appendix D – Norfolk Official Plan Review
Appendix E – Community Context
Appendix F – Ministry Class 4 Area

Planning Review

The proposed Zoning By-law amendment was prepared considering several planning documents including the *Planning Act*, Provincial Policy Statement, Norfolk County Official Plan, and the Norfolk County Zoning By-law 1-ZA-2014.

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Planning Act

Section 2	Lists matters of provincial interest to have regard to.
Section 3	Requires that, in exercising any authority that affects a planning matter, planning authorities "shall be consistent with the policy statements" issued under the Act and "shall conform with the provincial plans that are in effect on that date, or shall not conflict with them, as the case may be".
Section 22	Allows amendments to the Official Plan.
Section 34	Allows amendments to the Zoning By-law.
Section 41	Allows the application for site plan control.

Provincial Interest

Section 2 of the *Planning Act* establishes matters of provincial interest. The Minister, the council of a municipality, a local board, a planning board, and the Tribunal, in carrying out their responsibilities under this Act, shall have regard to, among other matters, matters of provincial interest. These matters are reviewed in Appendix B.

It is noted that these provincial interests are from the highest level of policy being the *Planning Act*; however, the intent of the owner's application meets these interests and are demonstrated in this report.

Section 3 of the *Planning Act* requires that, in exercising any authority that affects a planning matter, planning authorities "shall be consistent with the policy statements" issued under the *Act* and "shall conform with the provincial plans that are in effect on that date, or shall not conflict with them, as the case may be". Section 22 and Section 34 of the *Planning Act* allows for the consideration of amendments to the Official Plan and Zoning By-law, respectively.

Provincial Planning Statement (2024)

The subject land is identified as being within an Urban Settlement Area, according to the Provincial Planning Statement, 2024 (PPS). Details describing the applicable Provincial policies and how the application is consistent with the PPS are included in Appendix C.

The Provincial Planning Statement (PPS) is Ontario's key policy framework for guiding land use planning to promote efficient, sustainable, and equitable growth. It aims to encourage compact development, optimize the use of land and infrastructure, and create complete, inclusive communities with diverse housing, transportation, and employment options. The PPS also seeks to protect natural resources, mitigate environmental impacts, and ensure public health and safety. Additionally, it supports economic growth by safeguarding employment lands and promoting land use compatibility to prevent conflicts. Ultimately, the PPS balances Ontario's growth needs with long-term environmental, social, and economic sustainability.

Building Homes, Sustainable Strong and Competitive Communities
Planning for People and Homes (Sections 2.1 and 2.2)

- **Housing Options:** The proposal adds 44 residential units in a midrise mixed-use building, contributing to housing variety and regional supply in line with PPS direction.
- **Infrastructure Capacity:** The development is supported by existing municipal infrastructure. Final servicing confirmation will be completed through County modeling.
- **Transit and Accessibility:** The site is located within a 6-minute walk to a public transit stop, and is adjacent to sidewalk connections that support active transportation.
- **Social Equity and Accessibility:** The building will comply with Ontario Building Code accessibility standards and is intended to accommodate a range of household incomes and needs.

Settlement Areas and Land Use Compatibility (Section 2.3)

- **Settlement Area Focus:** The subject lands are within a designated settlement area, reinforcing the PPS directive to direct growth where infrastructure already exists.
- **Land Use Efficiency:** The proposed density is appropriate for the parcel size, and the use of existing roads, parks, and institutional services promotes compact growth.
- **Active and Transit-Supportive:** Sidewalk and transit infrastructure in place make the area supportive of active transportation and reduce car dependence.
- **Traffic and Access:** A Traffic Impact Brief confirms that all adjacent intersections and proposed site accesses will operate at acceptable levels of service without upgrades.
- **Parking Strategy:** The proposed 72 parking spaces exceed ITE-based peak demand (51 spaces), supporting a balanced supply aligned with PPS direction to optimize infrastructure and promote compact urban form.
- **General Intensification:** The project redevelops an existing lot, repurposing it for a mixed use, contributing to Norfolk County's intensification goals (target of 25% of new development).
- **Freight Supportive Context:** The mixed-use format is compatible with nearby employment lands, which supports goods movement and commercial viability.

Employment (Section 2.8)

- **Compatibility with Employment Areas:** A Land Use Compatibility Study prepared by Sonair August 22, 2025 confirms the development does not interfere with nearby industrial uses provided the County recognizes the subject lands as a Class 4 area in accordance with Ministry Guidelines.

  (Note: A Class 4 Area under Ontario's NPC-300 Environmental Noise Guideline is a land use compatibility designation that permits new noise-sensitive developments, such as residential or institutional uses, near existing stationary noise sources (e.g., industry or rail yards), by allowing higher exterior noise thresholds, provided that appropriate building-level noise mitigation and disclosure measures are implemented. See Appendix F)

- **Integration of Commercial Uses:** The commercial component of the proposal enhances land use mix without compromising the employment land base.
- **No Conversion of Employment Lands:** The subject lands are not designated employment lands and do not require conversion or redesignation.

Energy Conservation, Air Quality, and Climate Change (Section 2.9)

- **Compact Urban Form:** The proposed re-development achieves a density of approximately 91 units per hectare on an existing serviced parcel. Its proximity to public transit stops and walkable access to local amenities, commercial and employment opportunities reduces dependence on private vehicles and supports energy efficiency through reduced infrastructure sprawl and land consumption.
- **Local Integration:** The building form and servicing strategy support compact development and will connect to existing infrastructure.
- **Stormwater Resilience:** Engineered infrastructure (e.g., underground detention system) supports the long-term stormwater resilience through controlled discharge and quality protection.
- **Active Transportation:** Existing sidewalks promote walkability and reduce auto dependence.

Land Use Compatibility (Section 3.5) (See Appendix F)

- **Class 4 Area Justified**: The Sonair study confirms LaFarge is a stationary noise source. With Class 4 designation and building mitigation, no adverse noise effects are expected.
- **No Other Compatibility Issues**: The study also confirms no concerns related to air quality, odour, vibration, or other industrial or commercial uses within 1,000 m.
- **No Impact on Industry**: No separation or operating changes are required for LaFarge or other nearby businesses.
- **Policy Implementation**: This approach aligns with PPS 2024 Section 3.5 by protecting existing employment uses while enabling compatible residential development.
- **Requested Action**: Norfolk County is asked to apply the Class 4 designation as part of this application.

Infrastructure and Facilities (Section 3.6 – Sewage, Water and Stormwater)

- **Efficient Use of Services:** The project proposes to connect to existing municipal water and sewer services, optimizing available capacity.
- **Functional Servicing Review:** Water modeling will confirm capacity, and the stormwater design uses underground detention to manage both quality and quantity.
- **Stormwater Management Strategy:** The development includes an underground detention system to manage stormwater quantity and quality. Landscaping and pervious surfaces will be integrated where feasible to reduce runoff and allow for infiltration, consistent with PPS guidance for efficient, environmentally responsible infrastructure.
- **Ontario Building Code Compliance:** Water and energy conservation features will meet all applicable provincial standards.

Public Spaces, Recreation, Parks, Trails and Open Space (Section 3.9)

- **Community Integration:** Nearby sidewalk networks support pedestrian movement. Public parks and commercial amenities are within walking distance.
- **Access to Recreation:** Lions Park, local trails, and open spaces like the Waterford Heritage Trail are easily accessible from the development site.

PPS Conclusion

The proposed Leamon Street Midrise development is consistent with the Provincial Planning Statement (2024), advancing compact, mixed-use intensification within a fully serviced Urban Settlement Area. The project contributes to a more diverse housing supply and supports walkable access to nearby commercial, institutional, and recreational amenities. Transit is accessible within a 6-minute walk, further reinforcing a transit-supportive form of development.

A comprehensive Land Use Compatibility Study prepared by Sonair Environmental Inc. confirms that the proposal is compatible with adjacent industrial operations, including LaFarge, when a Class 4 Area designation is applied under the NPC-300 Environmental Noise Guideline. The Class 4 approach is a structured, policy-supported mechanism that permits sensitive land uses near stationary noise sources by implementing building-level noise mitigation (e.g., upgraded windows, mechanical ventilation, warning clauses) without requiring changes to the operation of industrial facilities. This enables Norfolk County to balance residential intensification with the protection of existing employment areas.

The compatibility study identified no concerns related to air quality, odour, or vibration, and determined that no additional separation or mitigation is required from surrounding industrial or commercial uses. Importantly, the Class 4 designation fully implements the land use compatibility objectives of PPS 2024 Section 3.5 and Norfolk County's Official Plan Section 7.12, preserving the long-term viability of employment lands while enabling residential development in strategic locations.

Servicing capacity will be confirmed through the County's modeling review, and stormwater will be managed through an underground detention system designed to meet both municipal and provincial requirements. These features support sustainable infrastructure use and the efficient redevelopment of underutilized urban lands.

In summary, the proposed Zoning By-law Amendment facilitates a form of development that is consistent with the Provincial Planning Statement (2024), enables compatible intensification through the use of a Class 4 Area designation, and supports Norfolk County's broader goals for housing, infrastructure optimization, and long-term employment land protection.

Norfolk County Official Plan

The subject property is designated Service Commercial in accordance with Schedule "B-18" of the Norfolk County Official Plan. The proposed development includes a zoning by-law amendment to permit a midrise residential apartment with ground-floor commercial use. Several sections of the Norfolk County Official Plan are applicable to the proposed amendment and were reviewed as part of this report:

a) Section 2.2 – Goals and Objectives
b) Section 5.3 – Housing
c) Section 5.3.1 – Residential Intensification
d) Section 5.4 – Community Design
e) Section 6.4 – Urban Areas
f) Section 6.5.4 – Waterford Urban Area
g) Section 7.11 – Commercial Designation
h) Section 8.0 – Networks and Infrastructure
i) Section 8.9 – Water and Wastewater Services

The Official Plan of Norfolk County encourages the majority of development to occur within established Urban Areas, including Waterford. The subject lands are within the Waterford Urban Area and are designated Service Commercial on Schedule "B-18" of the Official Plan. The proposed mixed-use development aligns with this policy direction by supporting infill and intensification on a fully serviced parcel.

Section 2.2 of the Official Plan outlines six high-level strategic directions, or "Goals and Objectives," that provide the foundation for all land use policy. The proposed development supports the following goals:

- **Strong and Diverse Economy**
  The proposed development includes a commercial component at grade, providing space for local business and services within walking distance of residents. While primarily residential, this mixed-use format contributes to a more diversified local economy and aligns with the Official Plan's objective of supporting compact, service-integrated development within Urban Areas. The commercial use promotes economic activity while enhancing walkability and convenience for area residents.

- **Maintaining and Enhancing the Rural and Small-Town Character**
  The project introduces new housing within an established neighbourhood context, replacing a low-density commercial yard with a well-designed midrise mixed-use building that reflects the evolving character of the Waterford Urban Area. Sensitive transitions are achieved through increased setbacks, landscape buffering, and building orientation, including the placement of balconies away from adjacent residential properties. While some visibility toward nearby rear yards remains, the design minimizes overlook and incorporates mitigation measures to reduce privacy impacts. These elements contribute to a compact, walkable built form that supports growth while respecting the character and livability of the surrounding neighbourhood.

- **Maintaining a High Quality of Life**
  The building design and mix of one- and two-bedroom units increase the diversity of available housing. The location benefits from proximity to public institutions (schools, EMS), commercial amenities, and sidewalk and transit access, enhancing livability and connectivity.

- **Upgrading and Expanding Infrastructure**
  The project utilizes existing municipal water, sanitary, and stormwater infrastructure. A Functional Servicing Report has been prepared confirming adequate service capacity, which will be further verified through municipal review. This supports efficient use of infrastructure without the need for expansion.

- **A Well Governed, Well Planned and Sustainable County**
  The development contributes to a compact, mixed-use form within the Waterford Urban Area. The lands are subject to a public planning process and will undergo site plan control, ensuring that design, function, and compatibility with the surrounding area are reviewed and addressed. The proposal supports the County's financial and environmental sustainability objectives by maximizing existing service investment.

The proposed amendment is consistent with the County's long-term vision and supports the Goals and Objectives of the Official Plan by promoting appropriate infill, optimizing infrastructure, enhancing neighbourhood character, and increasing housing variety without contributing to urban sprawl.

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Housing and Residential Intensification

The proposed development supports Norfolk County's housing and growth management objectives by contributing to the supply of multi-residential housing within a designated Urban Area. The Official Plan identifies intensification and infill as critical tools to reduce the need for expansion into agricultural and greenfield lands. The project proposes a compact, five-storey mixed-use apartment on the subject lands, thereby maximizing land efficiency and supporting urban sustainability.

The development aligns with Section 5.3.1 of the Official Plan, which sets a target that 25% of all new housing be provided through infill, intensification, and redevelopment. The proposal also helps advance the County's goal of achieving 15% multi-residential development, as stated in Section 5.3(b). The subject lands are within the built-up area of Waterford and are fully serviced. Supporting studies confirm that existing water, wastewater, and road networks can accommodate the new residential density. With a proposed density of approximately 91 units per hectare, the development meets the Official Plan's definition of high-density residential and satisfies intensification policy objectives in designated Urban Areas.

The Official Plan emphasizes the importance of ensuring compatibility with surrounding neighbourhoods during intensification projects. This proposal achieves that through a building massing and design approach that transitions appropriately to adjacent land uses, includes landscaped buffering, and retains mixed-use integration. Final site design considerations will be addressed through the required site plan control process, ensuring alignment with community character and urban design expectations.

Community Design and Land Use Compatibility

Section 5.4 of the Norfolk County Official Plan outlines the County's commitment to high-quality, safe, and attractive design in all new development. The policies encourage thoughtful community planning that enhances the public realm, supports walkability, and ensures development contributes positively to existing neighbourhood character.

The proposed midrise development introduces a compact residential form that is integrated with commercial use, supporting a mixed-use environment within the Waterford Urban Area. The design provides a sensitive transition to surrounding land uses, including existing low-density residential dwellings to the north and institutional and commercial uses to the east and south. The proposed building orientation and massing are intended to maintain appropriate height, scale, and setbacks.

Design elements such as landscaping, parking layout, and façade articulation will be refined through the site plan control process to reinforce compatibility and enhance visual appeal. Special attention will be given to:

- Enhancing streetscape conditions along Leamon Street and Thompson Road West;
- Creating a pedestrian-friendly entrance and sidewalk connectivity;
- Integrating landscape buffers and fencing between residential and non-residential land uses;
- Addressing lighting, access, and circulation to ensure safety and ease of use.

The development's infill context also supports compact urban form and contributes to Norfolk's objective to revitalize urban areas with high-quality, compatible redevelopment. It reflects key community design principles by reinforcing local character while accommodating new growth in a sustainable, well-integrated way.

Urban Areas
Section 6.4 of the Norfolk County Official Plan outlines the planned structure and role of Urban Areas as the primary focus for growth and development. These areas are intended to accommodate a full range of land uses in a compact, well-serviced, and financially sustainable manner. Waterford is one of Norfolk County's six Urban Areas and is identified as a key location for intensification and mixed-use development.

The subject property is located within the Waterford Urban Area and is serviced by existing municipal infrastructure. The proposal supports the intensification objectives of the Plan by providing residential and commercial uses on an underutilized parcel in proximity to community amenities, institutional services, and transit access. This aligns with Section 6.4.2, which encourages the efficient use of land and infrastructure and supports mixed-use development forms that promote walkability and reduce vehicle dependency.

The proposed development is consistent with the intent of the Urban Area policies, which aim to:

- Direct the majority of growth to designated settlement areas;
- Encourage compact, transit-supportive development;
- Provide a range of housing types and densities to meet evolving community needs;
- Optimize the use of existing infrastructure and public services.

By replacing a low-intensity commercial yard with a midrise residential-commercial building, the proposal supports the planned function of the Waterford Urban Area and contributes to achieving the County's long-range growth and intensification targets.

Waterford Urban Area
The Waterford Urban Area is one of Norfolk County's six primary settlement areas and is identified in the Official Plan as a community with capacity for residential intensification and mixed-use development. Section 6.5.4 provides area-specific policies that support infill, compact form, and the integration of land uses within the existing urban fabric.

The proposed midrise development is a strategic form of intensification that complements the surrounding built environment and fulfills the Official Plan's direction for growth within Waterford.

The policies of Section 6.5.4 encourage:

- A mix of residential and commercial uses along key roadways;
- Development forms that support walkability and local services;
- The redevelopment of underutilized parcels within serviced boundaries;
- Protection of adjacent land use compatibility through thoughtful design and interface treatment.

The development satisfies these objectives by proposing:

- A five-storey mixed-use building offering residential units above ground-floor commercial space;
- Direct access to adjacent sidewalks and proximity to existing schools, employment, and community facilities;
- Buffering and massing controls to ensure compatibility with nearby single-detached homes and institutional lands;
- Use of full municipal services, with servicing capacity confirmed through detailed technical reports.

The proposed Zoning By-law Amendment supports the long-term vision for the Waterford Urban Area by promoting a compact, mixed-use, and well-integrated development pattern.

Commercial Designation

The subject property is designated **Service Commercial** on Schedule "B-18" of the Norfolk County Official Plan. Section 7.11 outlines the land use policies for Commercial designations, emphasizing flexibility, compatibility, and the integration of land uses that support community function, neighbourhood-serving commercial activity, and local employment opportunities.

The proposed Zoning By-law Amendment maintains and reinforces the commercial role of the site through the inclusion of ground-floor commercial space oriented toward Leamon Street and Thompson Road West. This ensures that the site continues to contribute to the local commercial fabric while supporting pedestrian activity and visibility at the street level.

The residential component of the proposal is introduced in the form of a midrise apartment building that is fully integrated with the commercial function of the site. This mixed-use model is consistent with the policies of Section 7.11, which encourage the addition of residential uses in a manner that enhances, rather than displaces, the planned commercial purpose of designated lands. The proposal reflects the broader intent of the Official Plan to support compact, mixed-use intensification within serviced Urban Settlement Areas.

Section 7.11.1(e) of the Norfolk County Official Plan permits residential uses within Commercial designations, provided that the residential component does not negatively impact the planned function of the commercial area. Subsection ii) further specifies that residential and/or commercial uses may be permitted in buildings of residential character, including multiple dwellings, provided that the residential character of the building is maintained.

In the proposed development, no residential units are located on the ground floor. The base of the apartment building includes parking, mechanical utilities, and tenant amenities such as a lobby and lounge. A separate but attached commercial unit is located towards the south side of the overall building, fronting Thompson Road West. This configuration preserves the visibility and accessibility of the commercial space while ensuring that residential uses are limited to the upper storeys.

The proposed development satisfies these criteria in the following ways:

- It replaces a low-intensity, warehouse-type commercial use with a more prominent and visible commercial unit located towards the south side of the overall building, fronting Thompson Road West. This attached commercial component is functionally separate from the residential portion of the building and preserves the commercial function of the site.
- It introduces residential units above the ground floor in a midrise building of residential character, with a distinct architectural expression, defined massing, and appropriate scale that responds to the surrounding context.
- It achieves compatibility with adjacent residential, institutional, and employment uses through site planning, perimeter setbacks, and buffering, while maintaining a clear functional separation from nearby industrial uses through a 70-metre commercial setback.

While the language in Section 7.11.1(e) references buildings "of residential character," this policy should not be interpreted narrowly as applying only to converted residential structures. The proposed midrise building reflects

the intended residential character through its built form while integrating commercial functions at grade. This approach implements the functional intent of the policy by supporting commercial viability, intensifying underutilized land, and contributing to a mixed-use, compact urban structure.

From a zoning and implementation perspective, dividing the site between Commercial and Urban Residential designations would introduce unnecessary complexity. The site functions as a single mixed-use parcel, with shared access, parking, sidewalks, and landscaped open space. Importantly, the proposed zoning includes a 70-metre setback from the industrial-designated lands on the south side of Thompson Road West, within which only commercial uses are permitted. This setback ensures that the commercial function of the site is preserved along the industrial interface and that residential uses are appropriately setback. The proposed development integrates residential and commercial functions in a coherent manner, enabling live-work opportunities, supporting neighbourhood-serving businesses, and contributing to the revitalization of the site in alignment with the Official Plan.

In addition, the proposal aligns with Section 7.11.2(a) of the Norfolk County Official Plan, which allows for site-specific proposals that may not strictly conform to the Commercial designation, provided they maintain the planned function and support the broader goals of the Plan. The proposed development supports this flexibility by redeveloping an underutilized commercial property into a more intensive, mixed-use form that strengthens the commercial node and contributes to a more complete and transit-supportive urban neighbourhood.

The proposed amendment does not compromise the planned function of the Commercial designation. Instead, it enhances it by preserving at-grade commercial activity, supporting residential intensification on fully serviced land, and contributing to a built form that integrates well with adjacent uses. The application is in full conformity with the Official Plan's intent to accommodate compatible residential uses in strategic commercial locations through thoughtful design and policy-aligned implementation.

Residential Designation Policies (Section 7.7 and 7.7.2)
Although the subject lands are designated Commercial, the introduction of residential uses warrants consideration of applicable policies under the Urban Residential Designation. While these policies do not directly apply, they offer relevant direction for evaluating the appropriateness, compatibility, and design of the proposed midrise residential use, particularly given the site's proximity to existing low-density residential development to the north.

The proposed density of approximately 91 units per hectare falls within the high-density range as identified in Section 7.7.2(c), and is appropriate in the context of a fully serviced, mixed-use site within an Urban Area. The building has been designed to provide a gradual transition in scale and function, with residential units located above parking and commercial space, and compatibility addressed through setbacks, fencing, and perimeter landscaping.

The development contributes to housing diversity in Waterford by introducing a midrise form that complements nearby low-density residential areas and supports broader intensification objectives. The site is located in close proximity to community amenities, transit, schools, and recreational facilities, and is fully serviced by municipal

water and wastewater infrastructure, aligning with the locational and servicing criteria embedded in Urban Residential policies.

No Official Plan Amendment is required to change the land use designation; however, this analysis confirms that the residential component is consistent with the objectives of the Urban Residential framework, including intensification, housing choice, and compact form. These policies reinforce the appropriateness of the proposed residential use and its integration into a mixed-use urban setting.

Protected Industrial Designation Policies (Section 7.12 - Compatibility Consideration)
The subject lands are not designated Protected Industrial; however, this section of the Official Plan is relevant due to the site's proximity to designated industrial lands immediately south of Thompson Road West. These adjacent lands are currently occupied by active employment uses, and the introduction of sensitive residential uses warrants an assessment of land use compatibility.

The proposed apartment building is sited more than 70 metres from the property line of the adjacent Protected Industrial designation. The existing industrial buildings are located further beyond that line, resulting in a total separation distance that meets or exceeds the recommended minimum thresholds established in the Ministry of the Environment, Conservation and Parks (MECP) D-6 Guidelines for Class I and Class II industrial facilities. A Land Use Compatibility Study prepared by Sonair confirms that the development will not result in adverse impacts on nearby industrial operations. Compatibility is further supported through design measures such as building orientation, landscape buffering, and spatial separation integrated into the site plan.

The intent of the Protected Industrial policies under Section 7.12 is to preserve the long-term viability of employment lands while minimizing potential conflicts with sensitive land uses. While the subject lands are designated Commercial, this application responds to the Official Plan's direction for thoughtful interface design and demonstrates that residential intensification can be accommodated without encroaching upon or constraining the function of adjacent industrial lands. Including this analysis reinforces the proposal's policy conformity and confirms that compatibility has been fully addressed from both a residential and employment land perspective.

Land Use Compatibility with Protected Industrial Lands: Class 4 Area Application
To address compatibility between the proposed midrise development and the adjacent Protected Industrial lands to the south (notably the LaFarge operation), the applicant seeks the application of a Class 4 Area designation under Ontario's Environmental Noise Guideline NPC-300. A detailed rationale for this designation is provided in Appendix F to this report.

Appendix F clearly outlines that a Class 4 Area is a planning tool used by municipalities to support the co-location of sensitive land uses, such as residential apartments, in proximity to long-standing stationary noise sources, such as industrial or employment lands. It does so by shifting mitigation responsibilities to the new development, through enhanced building construction and disclosure, without requiring operational changes from the industrial use.

> *"A Class 4 Area designation is a pragmatic land use compatibility tool that enables municipalities to facilitate housing intensification in a serviced Urban Area; preserve the viability of nearby employment*

lands; implement PPS 2024 and Official Plan objectives; and enable a mixed-use infill project without impacting existing industrial uses." Appendix F, p.1

The supporting Land Use Compatibility Study prepared by Sonair Environmental Inc. (dated August 22, 2025) confirms the appropriateness of a Class 4 Area designation and identifies no compatibility concerns with respect to noise, air quality, odour, or vibration. The need for a Class 4 designation does not indicate that the site is incompatible with adjacent uses. Rather, it reflects a considered and policy-supported approach to compatibility. An approach that allows sensitive uses to locate in mixed-use urban contexts while preserving the viability of nearby employment lands. This is precisely the intent of PPS 2024 and NPC-300.

The LaFarge operation is confirmed as a stationary noise source, and the study concludes that no adverse impacts are anticipated with the proposed mitigation strategy. Prevailing winds do not direct emissions from industrial uses toward the development, and no odour-generating operations were identified within the 1,000 m assessment area.
This designation ensures that no adverse noise impacts are expected from adjacent industry if Class 4 is approved and building-level mitigation is implemented, such as:

- Upgraded façade/window assemblies,
- Centralized mechanical ventilation,
- Warning clauses in purchase and sale agreements.

The LaFarge site will not require retrofitting, noise barriers, or operating restrictions as a result of this development. The proposal complies with the MECP D-Series Guidelines and supports continued industrial viability.

Importantly, the study also confirms that the Class 4 Area approach fully implements the land use compatibility objectives of both the Provincial Policy Statement 2024 and the Norfolk County Official Plan, offering a policy-aligned solution rather than a workaround.

Importantly, the application of Class 4:

- Implements the compatibility intent of Section 7.12 – Protected Industrial Designation, which seeks to preserve industry while managing sensitive land uses nearby.
- Aligns with Section 7.11 – Commercial Designation, which permits residential uses provided the commercial function is maintained.
- Responds to Section 5.3 and 6.4 of the Official Plan by enabling infill, intensification, and efficient infrastructure use.
- Conforms to PPS 2024 Section 3.5, which explicitly permits sensitive land uses near stationary noise sources where studies and mitigation confirm no adverse effects.

In summary, the Class 4 Area designation is not an exception or a compromise. It is a structured, policy-supported mechanism that allows Norfolk County to manage compatibility without sterilizing existing industrial lands or impeding urban infill. The Land Use Compatibility Study prepared by Sonair Environmental Inc. (SE1451.001) supports this approach and confirms no undue impact with the proposed mitigation strategy.

Networks and Infrastructure

Section 8.0 of the Norfolk County Official Plan outlines policies related to infrastructure networks and public services, emphasizing the importance of coordinated, efficient systems that support current and future development. These include transportation, water and wastewater, stormwater, and utility networks. The Official Plan encourages growth that maximizes the use of existing infrastructure and minimizes the need for costly expansions.

The proposed development is fully supported by existing municipal infrastructure. As confirmed through the accompanying Functional Servicing Report and Stormwater Management Report, the site will be connected to:

- Municipal water services;
- Municipal sanitary sewer infrastructure;
- Stormwater management systems, including underground detention features designed to manage runoff quality and quantity.

These servicing strategies are consistent with Section 8.9.1, which directs that new development in Urban Areas proceed only where full municipal services are available. No extension of services is required.

In addition, the proposal is located within close proximity to a public transit stop and is bounded by roadways capable of accommodating projected traffic volumes, as confirmed in the Traffic Impact Study. The site layout also incorporates provisions for safe access, circulation, and parking, in accordance with applicable by-law standards and County expectations.

The project supports key goals of Section 8.0 by:

- Utilizing existing infrastructure efficiently;
- Reducing the need for greenfield expansion;
- Enhancing active transportation opportunities via proximity to sidewalks and local trail connections;
- Supporting sustainable stormwater practices through engineered green infrastructure.

This ensures that the development represents cost-effective, responsible intensification, aligned with long-term infrastructure planning objectives in Norfolk County.

Water and Wastewater Services

Section 8.9 of the Norfolk County Official Plan provides direction on the provision, allocation, and phasing of municipal water and wastewater services. The Official Plan clearly states that new development in Urban Areas must occur on full municipal services, with a focus on optimizing infrastructure capacity and avoiding unnecessary extension of systems.

The proposed development is located within the fully serviced Waterford Urban Area and will connect to the existing municipal water and sanitary sewer networks. As demonstrated in the Functional Servicing Report prepared in support of the application, both systems have sufficient capacity to accommodate the proposed 44 residential units and commercial space. Final servicing approval will be confirmed through the County's modeling review process.

The project conforms to the objectives of Section 8.9.1 (Services in Urban Areas) by:

- Utilizing existing infrastructure within an established service boundary;

- Ensuring the development is phased appropriately in line with municipal growth projections;
- Minimizing environmental risk by avoiding the use of private servicing;
- Reducing per-unit servicing costs through compact, higher-density development.

In addition, stormwater will be managed entirely on-site through a combination of landscape treatments and a proposed underground detention system, as outlined in the Stormwater Management Report. This strategy aligns with Section 8.9.4, which promotes innovative design approaches that manage water quantity and quality while minimizing downstream impacts.

The development satisfies all applicable servicing policies and supports the County's goal of sustainable, cost-efficient, and environmentally responsible infrastructure use.

Official Plan Summary:
The proposed development has been evaluated against the relevant policies of the Norfolk County Official Plan. The subject lands are located within the Waterford Urban Area and designated Service Commercial on Schedule "B-18." The proposed Zoning By-law Amendment supports a high-density, midrise mixed-use development that introduces residential apartments with an attached commercial component fronting Thompson Road West. This form of development:

- Aligns with the County's goals for redevelopment, intensification, and infill within fully serviced Urban Areas;
- Provides compact and accessible housing that contributes to a more diverse residential supply in Waterford;
- Maintains and enhances the planned commercial function of the site through at-grade commercial space and street-oriented design;
- Leverages existing municipal servicing and transportation infrastructure, supporting efficient infrastructure use;
- Strengthens the visual and functional character of Thompson Road West through built form, streetscaping, and site integration.

The proposal reflects Norfolk County's long-term vision for compact, complete, and connected communities, and demonstrates full conformity with the Official Plan's direction for mixed-use intensification, land use compatibility, and thoughtful urban design. A Land Use Compatibility Study completed by Sonair Environmental Inc. confirms that, with the application of a Class 4 Area designation under NPC-300, there are no anticipated adverse effects from the adjacent LaFarge operation. The study also confirms no compatibility concerns with surrounding industrial, commercial, or institutional uses in terms of air quality, odour, or vibration.

The development respects the planned function of adjacent industrial lands, achieves compatibility with surrounding residential and institutional uses, and integrates both commercial and residential functions within a coordinated site layout.

The proposed development represents a desirable and appropriate use of urban land, is consistent with the County's planning framework, and contributes positively to the continued evolution of the Waterford Urban Area.

Justification for Official Plan Amendment

Under Section 7.11.1(e) of the Norfolk County Official Plan, residential uses are permitted within commercial buildings, provided the residential character of the building is maintained and the planned commercial function is not undermined. In the opinion of the applicant, the proposed mixed-use development conforms to this policy direction and can be implemented without requiring an Official Plan Amendment.

However, at the request of municipal staff, this report provides a justification in support of a site-specific Official Plan Amendment, should one be required to formally recognize the residential component. The amendment would redesignate the northerly portion of the site to Urban Residential, while retaining the southerly portion in the Commercial designation to reflect the continued commercial use at the frontage of Thompson Road West.

The subject lands are currently used for a low-intensity general warehousing operation. The proposed redevelopment replaces this use with a midrise residential building and an attached ground-floor commercial component, consistent with mixed-use intensification objectives. The residential use achieves a density of approximately 91 units per hectare, which falls within the high-density range contemplated under Section 7.7.2(c) of the Official Plan. The proposed form integrates both residential and commercial functions in a compact, efficient configuration that maintains compatibility with adjacent land uses and leverages existing municipal services and infrastructure.

A Land Use Compatibility Study (Sonair Environmental Inc., 2025) has confirmed that the adjacent LaFarge industrial operation is a stationary noise source, but that no adverse effects are anticipated with the application of a Class 4 Area designation under NPC-300. The study also confirms no compatibility concerns related to air quality, odour, or vibration, and no mitigation is required from surrounding uses. This approach directly supports the compatibility objectives of Section 7.12 – Protected Industrial Designation and Section 8.8, which encourage the use of technical studies and mitigation tools to enable residential development near employment lands without undermining industrial function.

The analysis of relevant residential policies is provided in Appendix D, including Sections 7.7 and 7.7.2, and supports the appropriateness of the proposed use in the context of the Waterford Urban Area. Additionally, the commercial function of the site is preserved and strengthened, in alignment with the objectives of Section 7.11, through the introduction of new, street-facing commercial space and a 70-metre setback to protect adjacent industrial lands.

The proposed amendment, if deemed necessary, is consistent with the Provincial Planning Statement (2024) and conforms to the broader goals of the Norfolk County Official Plan, including those related to growth management, housing diversity, land use compatibility, and complete communities. The development represents a balanced, policy-supported form of intensification and, if required, a site-specific amendment to recognize residential use would be appropriate, defensible, and represent good planning.

Nonetheless, it remains the opinion of the applicant that the existing Commercial designation, as interpreted through Section 7.11.1(e), is sufficient to permit the proposed mixed-use development without requiring an amendment.

Norfolk County Zoning By-law

It is proposed to rezone the subject property to permit an apartment, in addition to the permitted uses to the Service Commercial (CS) Zone with special zone provisions. An amendment to Schedule "A16" of the Norfolk County Zoning By-law is also proposed to add the proposed special provisions.

The purpose of the zoning amendment is to facilitate the development of a 5 storey, 44-unit apartment building, in accordance with the proposed site plan drawing submitted with this application. In order to achieve the number of units and parking, four special provisions are required.

These special provisions are discussed as follows:

Provisions

a) Minimum setback from Class 1 Industry: 70 metres
b) Height: 18 metres (5 storeys)
c) Section 4.2.5 a) Minimum of 50 percent of the front yard shall be maintained as landscape area: Proposed 25%.
d) Number of parking spaces reduced from 1.5 spaces per unit to 1.13 spaces per unit
e) Parking area setback to dwelling/apartment: 2.4 meters
f) Parking area setback to interior property line: 3 metres except for driveway ingress/egress area which may be reduced to nil.
g) Parking area location: permitted in all yards

Special Provision a)

- Minimum front yard setback to employment lands: 70 metres

  Comment: While this provision is not a standard provision of the zoning by-law, in order to ensure proper separation of the proposed residential component in accordance with Ministry D Series guidelines and Official Plan policies, the imposition of a minimum setback of 70 metres is proposed.

  A minimum separation distance for a Class 2 industry is 70 metres and 20 metres for a Class I industry. It is not likely that the existing Class 1 or 2 industry will increase to a Class 3 industry as it would fail to meet the minimum 300 metre setback required by the guidelines to both the existing residential neighbourhood and the proposed apartment building. Furthermore, classifying the lands as a Class 4 area will ensure greater compatibility with nearby industrial land uses, allowing greater flexibility for minor industrial operations to increase, as discussed in this report.

  The imposition of this minimum separation from employment lands ensures that both residential and industrial uses can exist outside of the 70 metre separation.

Special Provision b)

- Maximum Building Height: From 11 metres to 18 metres (or 5 storeys)

  Comment: The proposed development requires a height of 18 metres (5 storeys) in order to facilitate sufficient parking and the increase in density. As such, buffering methods for potential impacts due to height have been designed to include fencing, landscaping, parking and a parking aisle between the proposed building and northerly property line.

In addition, shadow renderings reveal minimal impact on residential properties. Longer shadows occur in the winter months where outdoor enjoyment of amenity space is far less likely. Short shadows occur in the seasons where outdoor activities are most likely, noting that there are little to no impacts rendered by the proposed 5 storey apartment building.

As such, an increase to the height of the proposed building is reasonable as it does not create sufficient negative impacts on adjacent properties.

Special Provision c)

- Section 4.2.5 a) Minimum of 50 percent of the front yard shall be maintained as landscape area:
  Proposed: Minimum landscaped front yard: 25%.

  Comment: The proposed reduction in landscaped open space in the front yard is appropriate in consideration of the proposed site plan and context of the established area. The frontage is along Thompson Road West which has a mix of outdoor storage, parking areas and driveways. The landscaped area is generally consistent with the land uses along Thompson Road West. The existing property will retain a landscaped front yard spanning the entirety of the frontage, with the exception of a driveway entrance. The depth is sufficient to allow for required parking to serve the commercial unit, and other parking dedicated for both residential and visitor parking.

The proposed landscaping plan will enhance the current condition on site and represents an overall improvement compared to nearby properties, many of which do not maintain 50% front yard landscaping, particularly along Thompson Road West. In addition, the wide landscaped boulevards along Thompson Road contribute to the visual depth of green space, supporting the conclusion that the proposed reduction remains appropriate.

Special Provision d)

- Parking per dwelling unit: Reduction from 1.5 spaces to 1.13 spaces per unit
  Comment: The proposed reduction in required parking from 66 spaces to 50 spaces, is well-founded, aligning with provincial planning policy, and broader transportation planning principles. The justification for this reduction is supported by the Provincial Planning Statement (PPS) 2024, which promotes efficient land use, housing affordability, and sustainable transportation options.

Requirement	Provided
Commercial Use • 1 space per 35m^2 of usable floor area – other non-residential uses	Required: 230.6m^2 / 35m^2 = 6.6 or 7 spaces Provided: 7 spaces
Residential Use • 1.5 spaces for each dwelling unit	Required: 44 x 1.5 = 66 spaces Provided: 50 – 16 spaces deficient
Visitor • 1 space for every 3 dwelling units	Required: 44 / 3 = 14.7 or 15 Provided: 15 spaces
Total	Residential and Visitor – 81 spaces Commercial – 7 Spaces Total required – 88 spaces Total provided – 72 spaces

The RC Spencer Parking Brief confirms that the whole development will provide a total of 72 on-site parking spaces, compared to the ITE-based peak demand estimate of 51 spaces, resulting in a 21-space buffer. This demonstrates that the proposed supply is sufficient to meet anticipated needs while supporting the requested reduction from the Zoning By-law standard. The approach aligns with PPS policy direction for efficient, compact, and transit-supportive development, and no changes are proposed to the commercial or visitor parking requirements.

Compatibility of Parking Area

To mitigate potential impacts with adjacent properties, a closed-board fence will be incorporated into the site plan to prevent vehicle headlights from affecting the rear yards of adjacent residential properties. The building is setback greater than the required 9 metres and landscaping will form part of the periphery of the site adjacent to the closed board fence.

Special Provision e)

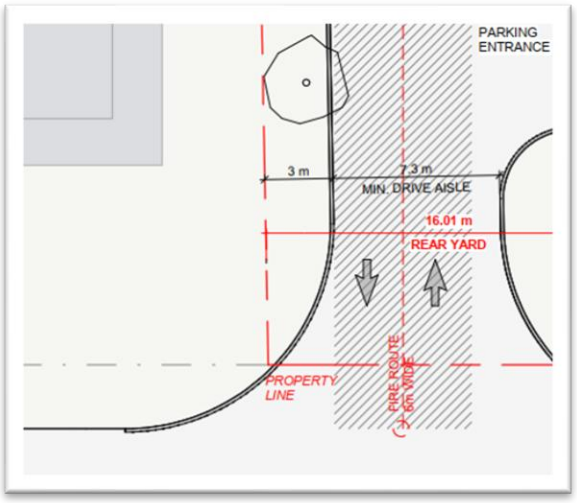
- Parking area setback to dwelling/apartment: Reduction from 3 metres to 2.4 metres

  Comment: The proposed reduction of the setback from the apartment to the internal sidewalk does not impair the ability for a pedestrian to access the building from the parking area. The design of the building and internal units are appropriate, however, the size of the property and zone provisions squeeze this separation distance by 0.6 metres. There are no perceived loss of functionality or safety issues caused by the minimal reduction. As such, it seems appropriate to permit the reduction.

Special Provision f)

- Parking area setback to interior property line: 3 metres except for driveway ingress/egress area which may be reduced to nil.

  Comment: The figure to the right shows how the required setback from the interior property line (residential neighbour) is met, with the exception of where the driveway access radius results in a curved curb. The location of this reduction is adjacent to the residential property to the north, but impacts associated with the reduction for vehicle maneuvering do not appear to be significant as the area is located to the southwest corner of the front yard of the residential property, an unlikely location for enjoying amenity space. It seems appropriate to permit this reduction as minimal impacts are perceived to occur.



Professional Engineers Ontario
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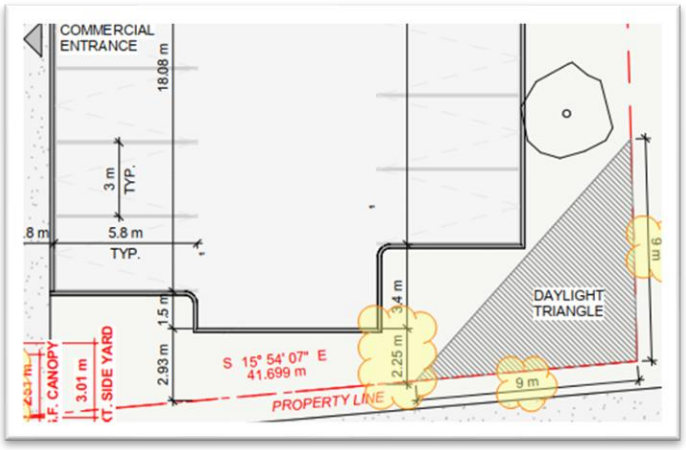
Ontario Association of Architects

Special Provision g)

- Parking area location: permitted in all yards



Comment: The zoning by-law restricts parking areas in various locations. In this case, the commercial use includes parking in the 'front yard'. The zoning by-law restricts residential parking in the front yard. Since this is a mixed use, it is recommended to permit parking in all yards to avoid any misinterpretation of how the zoning is applied. The space between the edge of the parking area to the exterior side yard does not appear to be in non-compliance. If there is any non-compliance with a zoning provision, there does not appear to be any safety concerns caused by a setback of 2.25 metres from the exterior side yard and the entire parking area remains outside the site triangle.

Special Provision h)

- Commercial Canopy encroachment: 1.5 metres

The exterior side yard setback of 3 metres is maintained for the commercial unit. However, its canopy extends beyond the walls. It is proposed to specifically permit the canopy to encroach into the setback up to 1.5 metres, similar to the encroachment of 1.5 metres permitted by the zoning by-law for balconies. While the drawing shows 0.48 metre encroachment, there may be future design element changes to increase the size of the canopy. There are no anticipated impacts created by the encroachment as the height of the canopy will not interfere with site lines and allows for an visual enhancement of the commercial building. It is also important to consider the extension of the canopy over the sidewalk. If this design element is incorporated through the site plan, then the encroachment is important to consider at this time to avoid another planning application.

Parking Policy Analysis:

a) Alignment with Provincial Planning Statement (PPS) 2024

The PPS supports flexible zoning standards to accommodate a range and mix of housing options. Additionally, it promotes higher densities and mixed land uses to optimize existing infrastructure, transportation, and public service facilities. A reduction in parking requirements aligns with these principles by maximizing land efficiency and supporting transit-oriented development. Furthermore, the PPS prioritizes safe, energy-efficient transportation systems and encourages active transportation and transit integration to reduce reliance on private automobiles. By lowering parking minimums, the proposed development supports sustainable growth, enhances affordability, and aligns with provincial objectives for compact, multimodal communities.

Reduced Vehicle Ownership

The Provincial Planning Statement (2024) encourages flexible zoning standards to accommodate a mix of housing types and promote compact, efficient development. Reducing parking minimums directly supports this direction by enabling more intensive use of land within serviced settlement areas, lowering housing costs, and enhancing overall site efficiency. The proposed development contributes to a compact, mixed-use form that supports walkability, active transportation, and transit-oriented growth, all of which are priorities under the PPS.

b) Efficient and Environmental Performance

A lower parking requirement allows the site to reduce impermeable surface area, support landscaping and pedestrian-oriented design, and accommodate additional features such as stormwater infrastructure and tenant amenities. These outcomes directly support Section 3.6.8 of the PPS, which encourages the integration of stormwater resilience and compact infrastructure in new development. Parking flexibility also advances provincial goals for sustainable land use and supports provincial objectives related to stormwater resilience, reduced surface runoff, and the efficient use of urban land.

c) Transit and Active Transportation Considerations

The site is located within walking distance of a public transit route, with a stop within approximately a 6 minutes, and is connected to sidewalks and community amenities. This satisfies the PPS direction to support transit-supportive locations with multimodal access, including pedestrians and cyclists. In this context, reduced parking is not only feasible, but appropriate, and ensures that development decisions align with broader provincial objectives for affordable, inclusive, and transit-supportive communities.

d) Technical Justification – RC Spencer Parking Analysis

The RC Spencer Parking Analysis confirms that the proposed development will provide a total of 72 on-site spaces, compared to an ITE-based peak demand estimate of 51 spaces, resulting in a buffer of 21 spaces. This demonstrates that the reduced Zoning By-law standard is appropriate and supported by technical evidence. When considered alongside PPS 2024 policy direction for compact, transit-supportive, and multimodal development, the analysis reinforces that the proposed reduction represents both efficient land use and good planning practice.

The proposed Zoning By-law Amendment seeks to modify several provisions of the Norfolk County Zoning By-law to enable the redevelopment and intensification of the subject lands for a midrise, mixed-use housing project. The amendment is appropriate and well supported by policy, aligning with the Provincial Planning Statement (PPS 2024) by promoting flexible zoning, efficient use of land, and transit-supportive design.

The reduction in landscaping requirements continues to support a meaningful improvement to the existing streetscape while accommodating on-site vehicle access and maneuvering. Site design features, including fencing, landscaped buffers, and strategic setbacks, ensure compatibility with adjacent uses and maintain privacy for neighbouring properties.

The proposed reduction in required parking from 66 to 50 spaces is consistent with PPS 2024 directions to support housing affordability, sustainable development, and multimodal transportation. Given the site's proximity to public transit and local amenities, the reduced parking standard reflects appropriate land use optimization and supports a shift toward more compact, connected communities. The PPS encourages municipalities to adopt flexible zoning standards to facilitate diverse housing forms, further reinforcing the appropriateness of the proposed modifications.

Zoning Conclusion

Overall, the proposed rezoning and site-specific provisions support the efficient and appropriate use of urban land, enabling a compact, mixed-use development that aligns with Norfolk County's planning objectives and the Provincial Planning Statement (2024). The amendment facilitates the introduction of new housing while maintaining compatibility with surrounding land uses and supporting a transit-oriented, sustainable community form.

In this instance, the proposed Zoning By-law Amendment, to permit a midrise apartment building with special provisions, in addition to the existing permitted uses, is well founded in policy and represents good planning.

Community Integration & Accessibility

A detailed analysis of the site's accessibility, proximity to essential services, and alignment with planning objectives is provided in Appendix E – Community Integration & Accessibility. This analysis reinforces the suitability of the site for housing with attached commercial development, further justifying the proposed zoning amendments, including the parking reduction.

The subject lands are strategically located within a well-established and service-rich area of Waterford's Urban Area, offering future residents and commercial tenants access to a wide range of community, institutional, and recreational amenities. This context supports the principles of complete community development as emphasized in both the Norfolk County Official Plan and the Provincial Planning Statement (2024).

For future residents, proximity to educational institutions, public parks, health services, and transit options will contribute to a high quality of life and allow for reduced reliance on private automobiles. The nearby presence of multiple schools, child care services, healthcare clinics, and local transit stops ensures that daily needs can be met efficiently and accessibly, especially for seniors, families with children, and individuals with limited mobility. Additionally, the availability of cultural and recreational spaces within walking distance supports social inclusion, mental and physical well-being, and opportunities for community engagement.

The development benefits from existing sidewalks along Thompson Road West and proximity to Ride Norfolk transit stops, which aligns with PPS 2024 objectives for multimodal accessibility. These features contribute to a reduced reliance on private vehicles, supporting the variance request for reduced on-site parking.

From a commercial standpoint, the subject property benefits from a built-in customer base drawn from the surrounding residential neighbourhoods and nearby public service institutions, including the adjacent Fire Station and community centre. The site's visibility at the intersection of Leamon Street and Thompson Road West, combined with proximity to a grocery store, retail locations, and public facilities, offers strong foot traffic potential and a supportive commercial environment for ground-floor tenants. The integrated mixed-use format is ideally

suited to accommodate neighbourhood-serving commercial uses such as personal services, healthcare offices, or small-format retail, all of which would benefit from the site's walkability and connectivity.

By integrating residential intensification with access to existing infrastructure and community supports, the proposal contributes meaningfully to Waterford's evolution as a vibrant, walkable, and economically active small urban centre. This reinforces the project's alignment with broader planning objectives for livability, economic vitality, and sustainable urban growth.

Summary
The analysis in Appendix E – Community Integration & Accessibility confirms that the subject lands are located within an established urban area that provides future residents and commercial tenants with convenient access to a broad range of community services and infrastructure including access to schools, parks, community spaces, and essential healthcare services. The location supports walkability, access to local transit, and proximity to schools, parks, and healthcare facilities. These characteristics contribute to a high standard of livability for residents and create appropriate conditions for neighbourhood-serving commercial uses. The integration of residential and ground-floor commercial development at this site supports Norfolk County's objectives for complete and compact community growth.

Supporting Studies

Several studies have been conducted to determine the feasibility of the proposed development. This section of the report summarizes the studies, which conclude general support for the zoning by-law amendment application.

Functional Servicing and Stormwater Management Report

Sanitary Servicing Summary

The proposed development at 285–289 Leamon Street will be serviced via a new 150 mm sanitary lateral connecting to the existing 200 mm sanitary sewer on Leamon Street. The estimated peak sanitary flow generated by the development is 1.50 L/s, calculated using Norfolk County's Design Criteria. While the existing sewer infrastructure is anticipated to accommodate these flows, confirmation through downstream hydraulic modelling by Norfolk County is recommended to verify capacity and ensure long-term servicing feasibility.

Water Servicing and Fire Protection Summary

Water servicing will be provided through a new 150 mm water connection from the development to the existing 250 mm watermain along Thompson Road. The development's projected maximum daily demand is 0.73 L/s, with a peak hourly demand of 1.23 L/s. Fire protection requirements, based on the Ontario Building Code and Norfolk County standards, identify a required fire flow of 150 L/s. This will be achieved using a new on-site hydrant fed by the Thompson Road main, supported by an existing hydrant at the nearby intersection. County-led hydraulic modelling is advised to confirm system pressure and fire flow availability under peak demand conditions.

Stormwater Management Summary

Stormwater runoff from the site will be managed through an underground StormTech MC-7200 chamber facility providing a total storage volume of 274 m³. Flows will be discharged via a 125 mm orifice to the existing 825 mm storm sewer on Leamon Street, which outfalls to the Waterford South Municipal Drain. The post-development

release rates will be controlled to below the 2-year pre-development rates for all events up to the 100-year storm. For larger events, overland flow will safely follow existing drainage paths. Enhanced water quality treatment, achieving 80% total suspended solids (TSS) removal, will be provided using a StormTech Isolator Plus Row.

Conclusion

The Functional Servicing Report demonstrates that the proposed five-storey mixed-use development can be fully serviced with municipal sanitary, water, and storm infrastructure in accordance with Norfolk County standards. Servicing designs have been developed to accommodate site-specific demands while maintaining downstream system capacity and environmental protection through best practices in stormwater management. The recommendations align with the Provincial Policy Statement (PPS) 2024 objectives of promoting intensification, efficient infrastructure use, and public safety. Pending confirmation through municipal hydraulic modelling, the site is considered suitable for development from a functional servicing perspective.

Traffic and Parking Analysis

A Traffic Impact and Parking Brief was prepared by RC Spencer Associates Inc. in July 2025 to evaluate the effects of the proposed development on the surrounding road network and to assess parking supply against Norfolk County Zoning By-law standards and ITE-based demand forecasts.

The study concluded that:

- **Traffic volumes generated by the proposed development will not adversely impact the level of service (LOS) at the study area intersections.**
    - The intersections of Leamon Street at Thompson Road West and Thompson Road West at Main Street South are projected to operate at LOS A–B during all peak periods, with or without site-generated traffic.
    - Both proposed site accesses (at Leamon Street and Thompson Road West) will operate efficiently, and no signalization or geometric modifications are required.
- **A sight line analysis confirmed adequate visibility at both proposed accesses**, supporting safe ingress and egress movements in compliance with TAC design standards.
- **Left-turn lane warrants were evaluated and found to be unwarranted** for eastbound left turns into the site from Thompson Road West. Traffic volumes and turning percentages fall significantly below the MTO threshold for treatment.
- **With respect to parking**, the County Zoning By-law requires 88 spaces, while the proposal provides 72. However, based on ITE Parking Generation Manual (6th Edition) demand rates:
    - **Peak demand is estimated at only 51 spaces**, including 44 for the residential component (based on unit mix) and 7 for commercial.
    - The 72 proposed spaces exceed ITE peak demand by 21 spaces, offering an effective buffer.
- **Transit and active transportation options in the immediate area** (including Ride Norfolk stops and continuous sidewalks on Thompson Road West) further support the reduced parking demand rationale.

The Traffic and Parking Analysis Report concludes that both traffic operations and on-site parking supply are sufficient to accommodate the proposed mixed-use development.

Land Use Compatibility Assessment

A Land Use Compatibility Study was prepared by Sonair Environmental Inc. (SE1451.001 dated August 22, 2025) to assess the relationship between the proposed mixed-use development and surrounding land uses, including the adjacent Protected Industrial lands to the south (LaFarge). The study was completed in accordance with the Ministry of the Environment, Conservation and Parks (MECP) D-Series Guidelines and the NPC-300 Environmental Noise Guideline.

The study evaluated potential impacts related to:

- **Noise**: The LaFarge operation was identified as a stationary noise source. With the application of a Class 4 Area designation under NPC-300 and building-level mitigation (enhanced façade/window assemblies, centralized mechanical ventilation, and warning clauses), no adverse noise impacts are expected.
- **Air Quality and Odour**: No odour-generating facilities or air quality concerns were identified within 1,000 m of the site. Prevailing wind analysis confirmed that emissions from nearby industrial uses are not directed toward the development.
- **Vibration**: No vibration sources of concern were identified.
- **Other Land Uses**: The study confirmed no compatibility issues with surrounding residential, commercial, or institutional uses.

Importantly, the study recommends the application of a Class 4 Area designation to the subject lands. This designation ensures compatibility between the proposed residential use and nearby industrial operations while protecting LaFarge from any future constraints or complaints.

The findings confirm that the proposal:

- Meets the intent of Section 7.12 – Protected Industrial Designation of the Norfolk County Official Plan by protecting the long-term viability of industrial lands through compatibility measures;
- Implements PPS 2024 Section 3.5, which permits sensitive land uses near stationary noise sources where mitigation ensures no adverse effects;
- Provides a structured, policy-supported mechanism to achieve compatibility without restricting adjacent employment operations.

Overall, the Land Use Compatibility Study demonstrates that the proposed development can be accommodated without adverse impacts on nearby industrial or commercial operations and represents a balanced approach to intensification and compatibility.

Geotechnical and Soil Investigation

The geotechnical investigation was completed by GEMTEC Consulting Engineers and Scientists Limited (September 4, 2025) to characterize subsurface and groundwater conditions at the site. The study confirmed:

- **Soils**: The site is underlain by disturbed native silty sand over deposits of sand to silty sand, consistent with the Norfolk Sand Plain.

- **Groundwater**: Stabilized groundwater was encountered at approximately 4.8–5.5 m below ground surface. Seasonal variation is expected.
- **Foundations**: Shallow foundations are not generally suitable due to very loose near-surface soils. The report recommends ground improvement with engineered fill or deep foundations (e.g., driven H-piles, micropiles, or caissons) to achieve adequate bearing capacity.
- **Seismic Classification**: The site is classified as Site Class D (stiff soil) for structural design under the 2024 Ontario Building Code.
- **Servicing and Pavement**: Soils are suitable for supporting site services and pavements with appropriate bedding, compaction, and engineered fill. Design infiltration rates range from 12 to 30 mm/hr, providing preliminary guidance for stormwater management.

Overall, the investigation confirms that the site is technically suitable for redevelopment, provided standard geotechnical recommendations are implemented during detailed design and construction.

Shadow Analysis

BIM Tec has prepared a shadow analysis noting that the 5-storey building may create shadow implications on the adjacent residential neighbourhood. The study confirms that shadow renderings reveal minimal impact on residential properties. Longer shadows occur in the winter months at reduced durations, and cast where outdoor enjoyment of amenity space is far less likely. Short shadows occur in the seasons where outdoor activities are most likely, noting that there are little to no impacts rendered by the proposed 5 storey apartment building.

As such, an increase to the height of the proposed building from a shadowing perspective is reasonable as it does not create sufficient impacts on adjacent properties.

Conclusion

The proposed development supports the redevelopment of an underutilized site within the Urban Area of Waterford, enabling the construction of a five-storey, 44-unit midrise apartment building with ground-floor commercial space. The mixed-use format aligns with Norfolk County's growth management objectives and contributes to a more diverse and compact housing supply within a fully serviced settlement area.

The subject lands are designated Commercial in the Norfolk County Official Plan. Residential uses are permitted in commercial buildings under Section 7.11.1(e), provided the commercial function is maintained. The proposed development includes ground-floor commercial space that preserves the intended commercial role of the area while introducing compatible residential intensification. The development is well integrated with surrounding land uses and demonstrates an appropriate built form transition to nearby residential, industrial, and institutional properties.

It is the professional planning opinion that an Official Plan Amendment is not required, as the proposal conforms to the intent of the Official Plan and the applicable Commercial policies. However, should one be required, the analysis confirms that the development maintains the commercial designation, supports residential growth within a settlement area, and contributes to the creation of a complete community.

The proposal is also consistent with the Provincial Planning Statement (2024), which promotes intensification, compact built form, housing diversity, and the efficient use of infrastructure. The site is well located with respect to community amenities, schools, parks, healthcare services, and public transit. Appendix E confirms that the development will benefit from and contribute to the existing community context, supporting both livability for future residents and viability for neighbourhood-serving commercial uses.

Technical studies submitted in support of this application, including a Functional Servicing Report, Stormwater Management Report, Traffic Impact Study, Geotechnical Investigation, and Land Use Compatibility Assessment, confirm that the development can be accommodated on existing infrastructure and that there are no anticipated adverse impacts to the surrounding area. The Land Use Compatibility Study specifically recommends the application of a Class 4 Area designation, which ensures that the proposed residential use can coexist with the adjacent LaFarge operation and other employment lands without requiring operational changes or additional mitigation. This approach protects industrial viability while enabling housing intensification, fully implementing the compatibility objectives of both the Norfolk County Official Plan and PPS 2024.

In summary, the proposal conforms to applicable provincial and municipal policies, supports the intensification objectives of Norfolk County and the PPS 2024, and represents good planning.

Report prepared by:

Eldon Darbyson, BES, MCIP, RPP
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners
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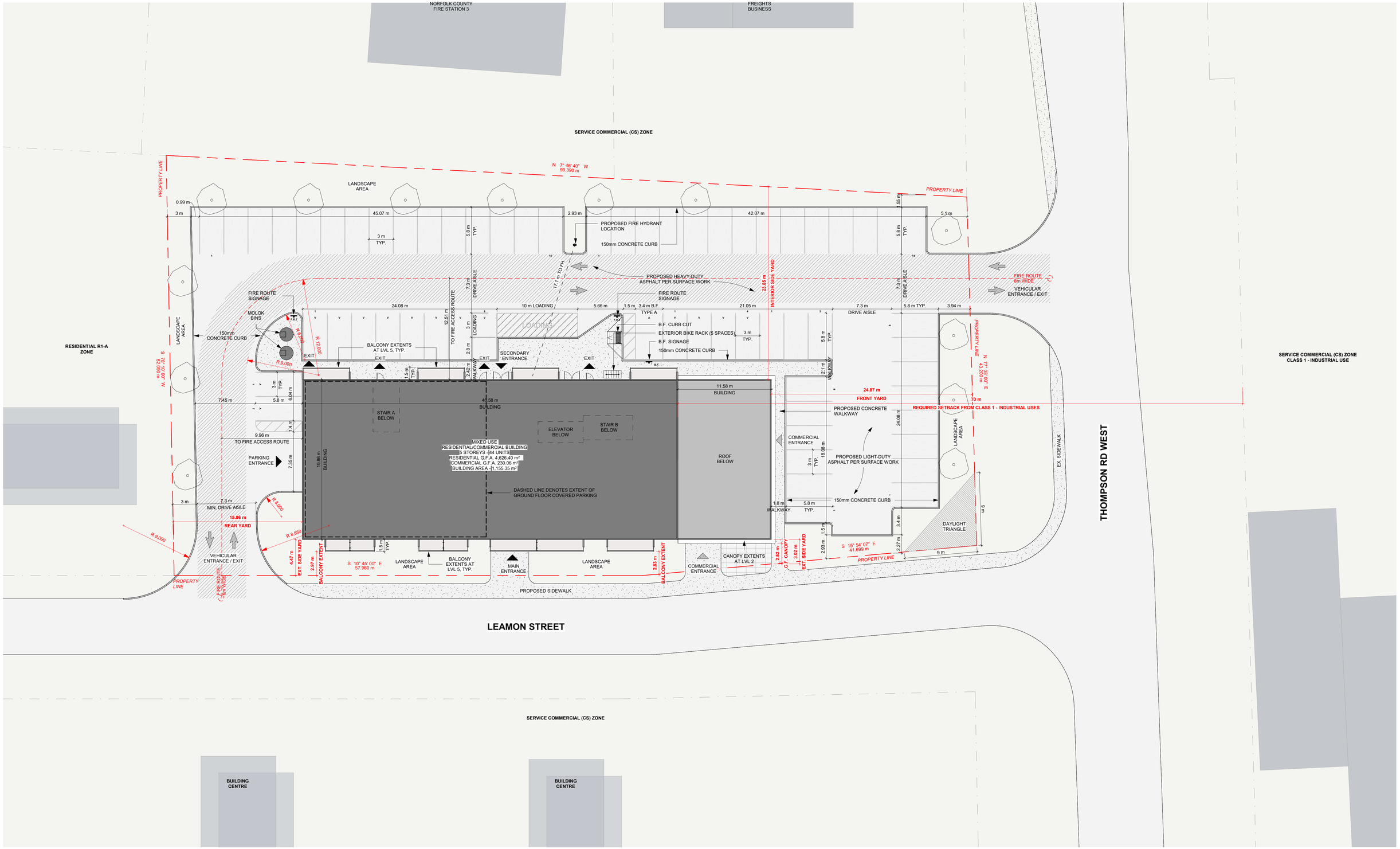
Appendices

Appendix A
Site Plan



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E: bim@bimstudio.ca
636 KING ST W, 3RD FLR,
TORONTO, ON, M5V 1M7

GENERAL DISCLAIMER

1. ALL CONSTRUCTION TO MEET THE CURRENT REQUIREMENTS OF THE ONTARIO BUILDING CODE AND ZONING BY-LAWS.

2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS, ASSEMBLIES, AND TAGS PRIOR TO CONSTRUCTION. DO NOT SCALE THE DRAWINGS. REPORT ANY DISCREPANCIES TO THE ARCHITECT.

3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ARCHITECTURAL, STRUCTURAL, CIVIL, MECHANICAL, ELECTRICAL DRAWINGS, GEOTECHNICAL REPORT(S) & ENVIRONMENTAL REPORT(S).

4. ARCHITECTURAL DRAWINGS SHALL NOT BE REPRODUCED WITHOUT CONSENT FROM THIS ARCHITECT.

PROJECT
LEAMON STREET, WATERFORD

ADDRESS
289, LEAMON ST, WATERFORD, ON

CLIENT
FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

2	Issued for SPA Submission	2025

SHEET NAME
SITE PLAN

SCALE
1 : 200

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N 28.01°

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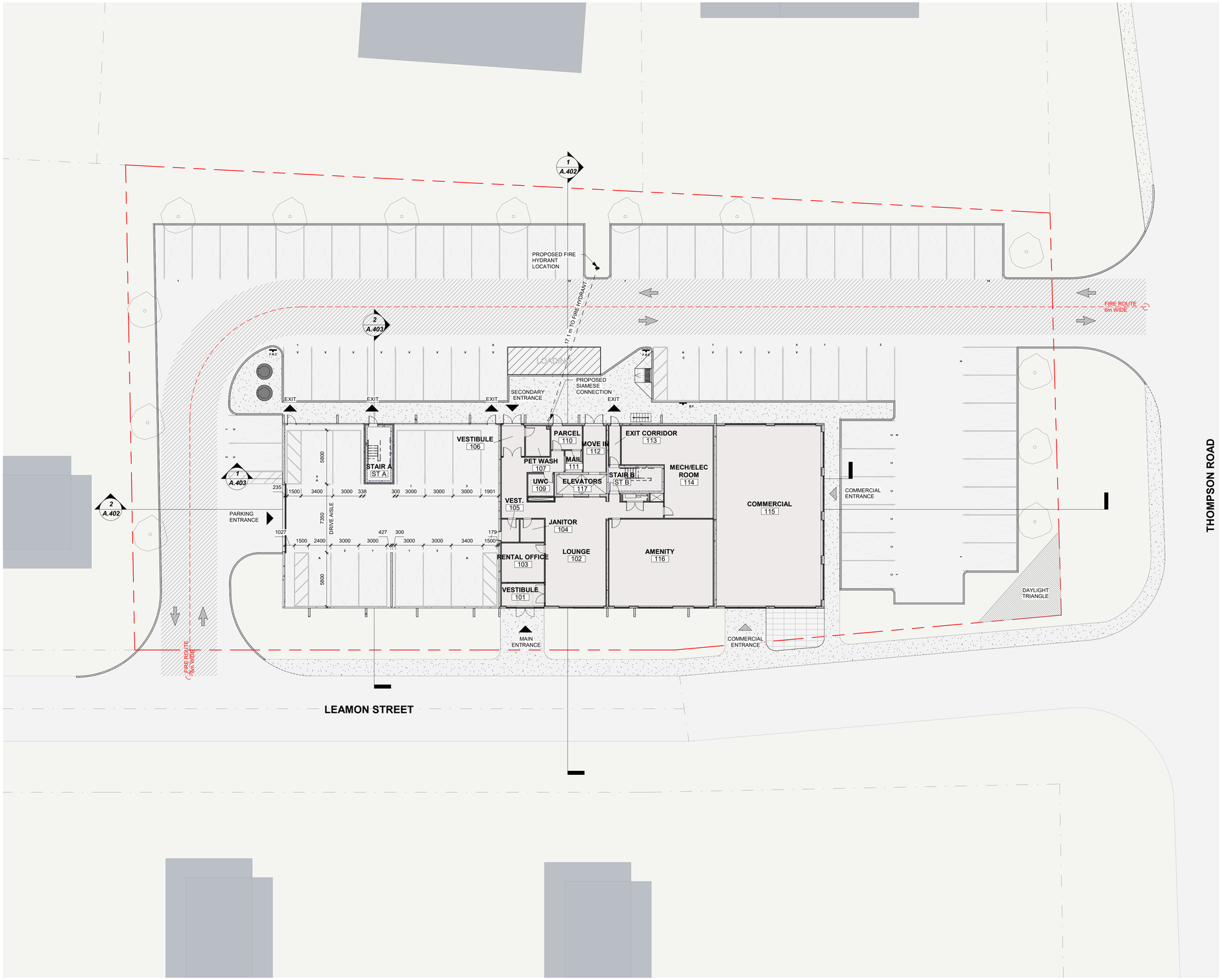
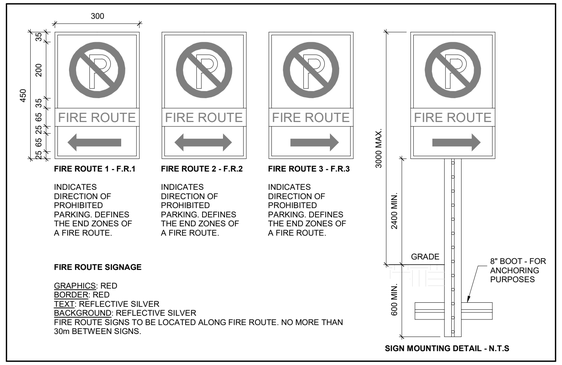


FIRE ROUTE SIGNS



FIRE ROUTE 1 - F.R.1

INDICATES DIRECTION OF PROHIBITED PARKING. DEFINES THE END ZONES OF A FIRE ROUTE.

FIRE ROUTE 2 - F.R.2

INDICATES DIRECTION OF PROHIBITED PARKING. DEFINES THE END ZONES OF A FIRE ROUTE.

FIRE ROUTE 3 - F.R.3

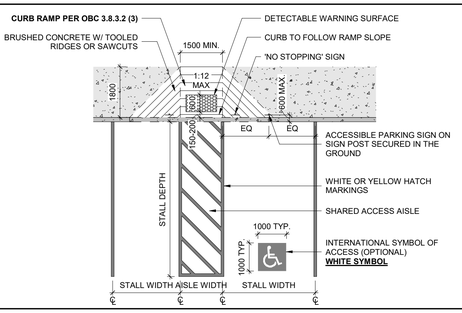
INDICATES DIRECTION OF PROHIBITED PARKING. DEFINES THE END ZONES OF A FIRE ROUTE.

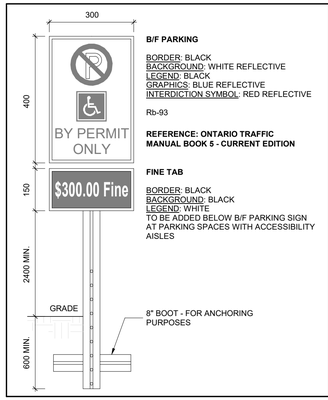
FIRE ROUTE SIGNAGE

GRAPHICS: RED
BORDER: RED
TEXT: REFLECTIVE SILVER
BACKGROUND: REFLECTIVE SILVER
FIRE ROUTE SIGNS TO BE LOCATED ALONG FIRE ROUTE. NO MORE THAN 30m BETWEEN SIGNS.

SIGN MOUNTING DETAIL - N.T.S

CURB RAMP PER OBC 3.8.3.2 (3)





B/F PARKING

BORDER: BLACK
BACKGROUND: WHITE REFLECTIVE
LEGEND: BLACK
GRAPHICS: BLUE REFLECTIVE
INTERDICTION SYMBOL: RED REFLECTIVE

Rb-93

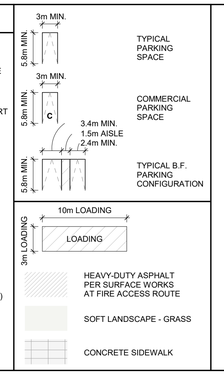
REFERENCE: ONTARIO TRAFFIC MANUAL BOOK 5 - CURRENT EDITION

FINE TAB

BORDER: BLACK
BACKGROUND: BLACK
LEGEND: WHITE
TO BE ADDED BELOW B/F PARKING SIGN AT PARKING SPACES WITH ACCESSIBILITY AISLES

LEGEND

- PROPOSED FIRE HYDRANT
- DISTANCE FROM FIRE HYDRANT TO SIAMESE CONNECTION
- PROPOSED FIRE DEPARTMENT CONNECTION/FIRE DEPARTMENT DRAFT PORT CONNECTION
- PROPOSED PEDESTRIAN BUILDING ENTRANCE/EXIT
- PROPOSED COMMERCIAL ENTRANCE
- FIRE ACCESS ROUTE
- B.F. PROPOSED ACCESSIBLE SIGN
- FR.S FIRE ROUTE SIGN
- SNOW REMOVAL/STORAGE
- SITE LIGHTING (REFER TO ELECTRICAL DWGS FOR DETAILS)
- CONCRETE RETAINING WALL, REFER TO LANDSCAPE DESIGN FOR DETAILS



- HEAVY-DUTY ASPHALT PER SURFACE WORKS AT FIRE ACCESS ROUTE
- SOFT LANDSCAPE - GRASS
- CONCRETE SIDEWALK

PATRICK DAVID TROTTER ARCHITECT
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TORONTO, ON, M5V 1M7

GENERAL DISCLAIMER

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2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS, ASSEMBLIES, AND TAGS PRIOR TO CONSTRUCTION. DO NOT SCALE THE DRAWINGS. REPORT ANY DISCREPANCIES TO THE ARCHITECT.

3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ARCHITECTURAL, STRUCTURAL, CIVIL, MECHANICAL, ELECTRICAL DRAWINGS, GEOTECHNICAL REPORT(S) & ENVIRONMENTAL REPORT(S).

4. ARCHITECTURAL DRAWINGS SHALL NOT BE REPRODUCED WITHOUT CONSENT FROM THIS ARCHITECT.

PROJECT
LEAMON STREET, WATERFORD

ADDRESS
289, LEAMON ST, WATERFORD, ON

CLIENT
FAST TRACK MODULAR PRECAST

2	Issued for SPA Submission	2025

SHEET NAME
SITE PLAN - GROUND FLOOR

SCALE
1 : 200

SHEET SIZE	24"x36"
ISSUE DATE	2025-05-21
PROJECT #	0067
DRAWN BY	Author
CHECKED BY	Checker

N
28.01°

A.003

ZONING DATA

SITE INFORMATION - NORFOLK COUNTY

CURRENT ZONE : SERVICE COMMERCIAL (CS)
PROPOSED ZONE : SERVICE COMMERCIAL (CS) ZONE WITH SPECIAL PROVISIONS

	Required	Proposed	
Zoning Bylaw - 1-Z-2014-Section 6 Density	~~0~~ N/A	44	✓
Zoning Bylaw - 1-Z-2014-Section 6 Property Area	495 m² *min*	4841.06 m²	✓
Zoning Bylaw - 1-Z-2014-Section 6 Lot Frontage	16.5 m *min*	43.2 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Front Yard Setback - Thompson Road W.	3 m *min*	24.87 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Exterior Side Yard Setback - Leamon St.	3 m *min*	3.02 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Interior Side Yard Setback	3 m *min*	23.85 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Rear Yard Setback-Abutting Res. Zone	9 m *min*	15.96 m	✓
Zoning Bylaw - 1-Z-2014-Section 6 Usable Floor Area	N/A	N/A	✓
Zoning Bylaw - 1-Z-2014-Section 6 Building Height - Number of Storeys	11 m *max*	17.36 m	✕
Zoning Bylaw - 1-Z-2014-Section 6 Lot Coverage	35% 3,872.85m²/*max*	24% 1,155.35 m²	✓
Zoning Bylaw - 1-Z-2014-Section 6 Outdoor Storage	0% N/A	0% N/A	✓
Zoning Bylaw - 1-Z-2014-Section 6 Landscape Open Space	0% N/A	27.98% 1354.3 m²	✓
Landscape Open Space Breakdown Hardscape (Sidewalk Area) = **345.78 m² (7.14%) Provided** Softscape (Green Area) = **1008.52 m² (20.81%) Provided** Total Landscape Open Space = **1354.3 m² (27.95%) Provided**			
Amenity Area Breakdown **Balconies = 331.36 m²** **Indoor Amenity = 177.25 m²** (4.01 m² per Unit) **Provided** **Total Amenity Area = 508.61 m² Provided**			
Front Yard Landscaping - ZBL 1-Z-2014 - Section 4 4.2.5 (a) *A minimum of 50 percent of the front yard shall be maintained as landscape area* **Front Yard Area: 1117.15 m2** **Required Front Yard Landscape Area: 558.58 m2 (50%)** **Provided Front Yard Landscape Area: 280.7 m2 (25.13%)**			
Parking Statistics			
Zoning Bylaw - 1-Z-2014-Section 4.9 b) Apartment Dwelling Requirement	1.5 *min*	1.13	✕
Parking Count Breakdown (Apartment Dwelling) = **44** (Total Units) x 1.50 = **66** Parking spots **Required** = **44** (Total Units) x 1.13 = **50** Parking spots **Provided**			
Zoning Bylaw - 1-Z-2014-Section 4.9 f) Visitor Parking Requirement: 1/3 Units	15 *min*	15	✓
Parking Count Breakdown (Visitor) = **44** (Total Units) / 3 = **15** Parking spots **Required** = **44** (Total Units) / 3 = **15** Parking spots **Provided**			
Zoning Bylaw - 1-Z-2014-Section 4.9 uu) Other non-residential use: 1/35m2	7 *min*	7	✓
Parking Count Breakdown (Commercial Area) = **230m2** (Commercial Area) / 35 = **7** Parking spots **Required** = **230m2** (Commercial Area) / 35 = **7** Parking spots **Provided**			

BUILDING STATS

MIXED-USE BUILDING

RESIDENTIAL UNITS: 44

OF STOREYS: 5 STOREYS ; 17.36m BUILDING HEIGHT

BUILDING AREA: 1,155.35m²

RESIDENTIAL GFA: 4,626.40m²

COMMERCIAL GFA: 230.06m²

RESIDENTIAL STATS

RESIDENTIAL UNIT COUNTS

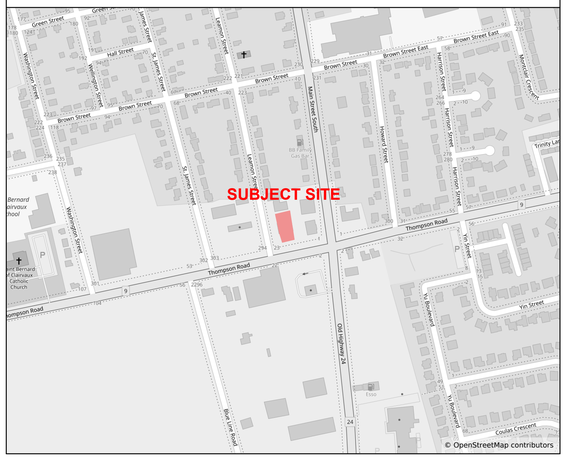
NAME	*COUNT*	*GFA RANGE*	*%*
ONE BED	20	56 m² ... 57 m²	45%
TWO BED	24	79 m² ... 97 m²	55%
GRAND TOTAL	44		

BARRIER-FREE UNITS

NAME	*COUNT*	*GFA RANGE*	*%*

0 / 0 = 0%

CONTEXT PLAN



OBC MATRIX

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CLIENT
FAST TRACK MODULAR PRECAST

SUBMITTED FOR/REVISION

2	Issued for SPA Submission	2025

SHEET NAME
BUILDING INFORMATION

SCALE
As indicated

SHEET SIZE	**24"x36"**
ISSUE DATE	**2025-05-21**
PROJECT #	**0067**
DRAWN BY	**Author**
CHECKED BY	**Checker**

N
28.01°

A.001

Appendix B
Provincial Interest

Section 2 Planning Act – Provincial Interest - Compliance Table

This appendix demonstrates how the proposed application is consistent with Section 2 of the Planning Act.

Matter	Comments	
a) the protection of ecological systems, including natural areas, features and functions;	There are no ecological systems impacted.	✓
b) the protection of the agricultural resources of the Province;	The lands are not designated for agricultural purposes.	✓
c) the conservation and management of natural resources and the mineral resource base;	Not applicable to this development application.	✓
d) the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest;	Not applicable.	✓
e) the supply, efficient use and conservation of energy and water;	This will be considered during the detailed design of the project.	✓
f) the adequate provision and efficient use of communication, transportation, sewage and water services and waste management systems;	Yes. Existing services and systems will be utilized were available.	✓
g) the minimization of waste;	Noted.	✓
h) the orderly development of safe and healthy communities; (h.1) the accessibility for persons with disabilities to all facilities, services and matters to which this Act applies;	Yes. The development is an intensification development in an established area. The form and function of the residential component of the development is apartment style housing that will be designed in accordance with current standards for accessibility.	✓ ✓
i) the adequate provision and distribution of educational, health, social, cultural and recreational facilities;	These community benefits are located in Waterford.	✓
j) the adequate provision of a full range of housing, including affordable housing;	Yes. This development adds to the range of housing types available in the area.	✓
k) the adequate provision of employment opportunities;	The commercial component will provide the opportunity for employment.	✓

l) the protection of the financial and economic well-being of the Province and its municipalities;	The development will add to the County's financial assets.	✓
m) the co-ordination of planning activities of public bodies;	The applications are subject to the public process.	✓
n) the resolution of planning conflicts involving public and private interests;	The applications are subject to the public process.	✓
o) the protection of public health and safety;	No negative impacts are anticipated as a result of the proposed development. Site triangles are maintained.	✓
p) the appropriate location of growth and development;	The project represents urban intensification which is encouraged. There are public spaces such as the Tricenturena Waterford Arena, Yins Park and the Waterford Audrey S. Hellyer Fenced Dog Park are within walking distance to the subject property. The area is comprised of residential, commercial and employment lands. The proposed residential component is adjacent to the existing residential neighbourhood.	✓
q) the promotion of development that is designed to be sustainable, to support public transit and to be oriented to pedestrians;	Public transit stops exist within a 6 minute walk.	✓
r) the promotion of built form that, (i) is well-designed, (ii) encourages a sense of place, and (iii) provides for public spaces that are of high quality, safe, accessible, attractive and vibrant;	The development is well designed and maximizes space for living accommodations. The site includes private balconies to ensure that outdoor amenity space is provided. There are some landscaped areas large enough for a few picnic tables.	✓
s) the mitigation of greenhouse gas emissions and adaptation to a changing climate.	This will be considered during the detailed design of the project.	✓

Appendix C
Provincial Planning Statement

Provincial Planning Statement 2024 – Policy Compliance Table

This appendix demonstrates the application is consistent with the applicable policies of the Provincial Planning Statement.

Section	Policy	Comments	
Chapter 2: Building Homes, Sustainable Strong and Competitive Communities			
2.1	**Planning for People and Homes** **Summary:** Section 2.1 outlines the planning framework for population and employment growth in Ontario, emphasizing that municipalities must base forecasts on provincial projections while ensuring adequate land availability for diverse housing and land use needs over a 20- to 30-year horizon. It promotes the creation of complete communities by supporting varied land uses, improving accessibility, and enhancing social equity to meet the needs of all residents.		
2.1.4	To provide for an appropriate range and mix of housing options and densities required to meet projected requirements of current and future residents of the regional market area, planning authorities shall:		
a)	maintain at all times the ability to accommodate residential growth for a minimum of 15 years	The application proposes the re-development and intensification of lands for residential units in the form of a mixed use residential and commercial building.	✓
b)	Maintain at all times where new development is to occur, land with servicing capacity sufficient to provide at least a three-year supply	The proposed development is supported by existing infrastructure. To be verified by County consultants modelling. No issues are anticipated.	✓
2.1.6	Planning authorities should support the achievement of complete communities by:		
a)	accommodating an appropriate range and mix of land uses, housing options, transportation options with multimodal access, employment, public service facilities and other institutional uses	The application proposes the re-development and intensification of lands for new housing units having access to local commercial, institutional and employment opportunities. The lands are located within a 6 minute walk to public transit.	✓
b)	improving accessibility for people of all ages and abilities by addressing land use barriers which restrict their full participation in society; and	The development will be designed to meet building code requirements and improve accessibility.	✓
c)	improving social equity and overall quality of life for people of all ages, abilities, and incomes, including equity-deserving groups.	The proposed development contributes to quality of life and inclusivity by providing additional housing opportunities within a walkable, serviced Urban Settlement Area. The site is located close to parks, schools, transit, and community amenities, which support residents of different ages and lifestyles. In accordance	✓

		with the Ontario Building Code, the building will incorporate required barrier-free features such as accessible entrances, parking, and circulation, ensuring inclusivity for persons with disabilities. While the development is not specifically intended to address income-based affordability, it expands the overall housing supply in Waterford, which indirectly supports equity and housing choice for a wider range of households.	

Section	Policy	Comments	
Chapter 2: Building Homes, Sustainable Strong and Competitive Communities			
2.2	**Housing** **Summary:** Section 2.2 outlines guidelines for planning authorities to ensure a diverse range of housing options and densities that meet the projected needs of current and future residents. This includes setting minimum targets for affordable housing, facilitating various housing types to support community well-being, promoting land-efficient densities, and prioritizing transit-oriented development near transit corridors and stations.		
2.2.1	Planning authorities shall provide for an appropriate range and mix of housing options and densities to meet projected needs of current and future residents of the regional market area by:		
a)	establishing and implementing minimum targets for the provision of housing that is affordable to low and moderate income households	The application proposes to intensify and redevelop the lands to add to the variety of housing accommodations to the area.	✓
b)	permitting and facilitating: 1. all housing options required to meet the social, health, economic and wellbeing requirements of current and future residents 2. all types of residential intensification, including the development and redevelopment of underutilized commercial and institutional sites (e.g., shopping malls and plazas) for residential use, development and introduction of new housing options within previously	A much needed and attainable form of housing accommodations to be provided with a range of 1 and 2 bedroom units. Represents redevelopment of lands for intensified residential and commercial use within an established area.	✓

	developed areas, and redevelopment, which results in a net increase in residential units in accordance with policy 2.3.1.3;		
c)	promoting densities for new housing which efficiently use land, resources, infrastructure and public service facilities, and support the use of active transportation; and	The application will facilitate redevelopment and intensification that will efficiently use land, infrastructure and encourage active transportation which opportunities exist in close proximity to the subject lands via local sidewalks.	✓
d)	requiring transit-supportive development and prioritizing intensification	The lands are within a 6 minute walk from a public transit stop.	✓

Section	Policy	Comments	
Chapter 2: Building Homes, Sustainable Strong and Competitive Communities			
2.3 **2.3.1**	**Settlement Areas and Settlement Area Boundary Expansions** **General Policies for Settlement Areas** **Summary**: Section 2.3 outlines that settlement areas should be the primary focus for growth and development, particularly in strategic areas like major transit stations. It emphasizes land use patterns that optimize resources and infrastructure while supporting active and transit-oriented transportation. Planning authorities must encourage intensification and redevelopment, establish minimum and density targets for growth areas, and implement phasing policies to ensure orderly development aligned with infrastructure needs.		
2.3.1.1	Settlement areas shall be the focus of growth and development. Within settlement areas, growth should be focused in, where applicable, strategic growth areas, including major transit station areas.	The lands are within a settlement area.	✓
2.3.1.2	Land use patterns within settlement areas should be based on densities and a mix of land uses which:		
a)	Efficiently use land and resources	This application proposes a density of housing units that is reasonable for the size and configuration of the lands.	✓

b)	Optimize existing and planned infrastructure and public service facilities;	The development will utilize existing services and is located within walking distance to public parks, institutional, and emergency services facilities. A Traffic and Parking Brief (RC Spencer, July 2025) confirms that adjacent road infrastructure can accommodate site-generated traffic with no upgrades required. Both proposed site accesses meet design and sightline standards. The proposed parking supply (72 spaces) exceeds ITE-based peak demand (51 spaces), avoiding oversupply and supporting the PPS objective of compact, infrastructure-efficient development.	✓
c)	Support active transportation	The lands are adjacent to sidewalks, and located within walking distance to parks, community amenities and employment opportunities.	✓
d)	Are transit-supportive	The area is supported by public transit. A bus stop is located in the local area.	✓
e)	Are freight supportive	The has a commercial component and is within proximity to employment lands, all of which are freight supportive.	✓
2.3.1.3	Planning authorities shall support general intensification and redevelopment to support the achievement of complete communities	The proposed application represents intensification of an existing property in an established neighbourhood.	✓
2.3.1.4	Planning authorities shall establish and implement minimum targets for intensification and redevelopment within built-up areas, based on local conditions.	The County encourages that 25 percent of all development be through intensification, infill and redevelopment. This application works towards achieving this goal.	✓
2.3.1.5	Planning authorities are encouraged to establish density targets for designated growth areas, based on local conditions. Large and fast-growing municipalities are encouraged to plan for a target of 50 residents and jobs per gross hectare in designated growth areas.	Not applicable.	
2.3.1.6	Planning authorities should establish and implement phasing policies, where appropriate	Not applicable.	

Section	Policy	Comments	
Chapter 2: Building Homes, Sustainable Strong and Competitive Communities			
2.8 **2.8.2**	**Employment** **Employment Areas** **Summary**: Section 2.8.2 requires planning authorities to protect and preserve employment areas for current and future needs. They must safeguard locations near major goods movement facilities for appropriate uses, designate long-term employment areas in settlements, and prohibit unrelated residential and commercial uses. Compatibility with sensitive land uses is essential, and any removal of lands from these areas must show no negative impact on viability or access to goods movement, while ensuring adequate land for projected employment growth.		
2.8.2.1	Planning authorities shall plan for, protect and preserve employment areas for current and future uses	The area is primarily made up of mix of residential, commercial, industrial and parkland type uses. The Land Use Compatibility analysis prepared by Sonair recommends a Class 4 area be applied to the subject lands and confirms the development is compatible with surrounding industrial land uses, and does not impact the surrounding lands.	✓
2.8.2.2	Planning authorities shall protect employment areas that are located in proximity to major goods movement facilities and corridors	There is existing residential development in the area. The proposed re-development does not impact the ability to move goods along Thompson Road West for which it is designed.	✓
2.8.2.3	Planning authorities shall designate, protect and plan for all employment areas in settlement areas by:		
a)	Planning for employment area uses over the long-term that require those locations including manufacturing, research and development in connection with manufacturing, warehousing and goods movement, and associated retail and office uses and ancillary facilities;	The Land Use Compatibility analysis prepared by Sonair recommends a Class 4 area be applied to the subject lands and confirms the development is compatible with surrounding industrial land uses and the proposed development will not further impact the employment area and its ability to develop.	✓

b)	prohibiting residential uses, commercial uses, public service facilities and other institutional uses;	The Land Use Compatibility analysis prepared by Sonair confirms the development is compatible with nearby industrial land uses.	✓
c)	prohibiting retail and office uses that are not associated with the primary employment use;	Not applicable.	✓
d)	prohibiting other sensitive land uses that are not ancillary to uses permitted in the employment area; and	The Land Use Compatibility analysis prepared by Sonair confirms the development is compatible with nearby industrial land uses.	✓
e)	including an appropriate transition to adjacent non-employment areas to ensure land use compatibility and economic viability.	There is physical separation between the employment uses and the subject lands. The buffer area is confirmed to be compatible in accordance with the Land Use Compatibility analysis prepared by Sonair.	✓
2.8.2.4	Planning authorities shall assess and update employment areas identified in official plans to ensure that this designation is appropriate to the planned function of employment areas. In planning for employment areas, planning authorities shall maintain land use compatibility between sensitive land uses and employment areas in accordance with policy 3.5 to maintain the long-term operational and economic viability of the planned uses and function of these areas.	This policy directs municipalities when planning for employment functions and to maintain compatibility with sensitive land uses in accordance with Policy 3.5. The area in which the proposed application pertains is already established with commercial and residential uses. The Official Plan encourages mixed use developments. The Norfolk County Official Plan encourages mixed-use redevelopment in such locations. A Land Use Compatibility Study prepared by Sonair recommends the application of a Class 4 Area designation under NPC-300, which provides for the proposed residential component to coexist compatibly with nearby industrial uses while safeguarding their long-term operational viability.	✓

Section	Policy	Comments	
Chapter 2: Building Homes, Sustainable Strong and Competitive Communities			
2.9	**Energy Conservation, Air Quality and Climate Change** **Summary**: Section 2.9 emphasizes the role of planning authorities in reducing greenhouse gas emissions and adapting to climate change. It advocates for the development of compact, transit-supportive communities, incorporates climate considerations into infrastructure planning, and promotes energy conservation, green infrastructure, and active transportation. The section also encourages additional measures to enhance community resilience and improve air quality.		
2.9.1	Planning authorities shall plan to reduce greenhouse gas emissions and prepare for the impacts of a changing climate through approaches that:		
a)	support the achievement of compact, transit-supportive, and complete communities;	The proposed development is a compact infill development achieving 91 residential units per hectare. The lands are located within a 6 minute walk to a public transit stop.	✓
b)	incorporate climate change considerations in planning for and the development of infrastructure, including stormwater management systems, and public service facilities;	The proposed development is supported by local infrastructure, local public services in Waterford, and stormwater can be managed appropriately.	✓
c)	support energy conservation and efficiency;	At a minimum, those requirements of the Ontario Building Code will be achieved.	✓
d)	promote green infrastructure, low impact development, and active transportation, protect the environment and improve air quality; and	Active transportation is encouraged by virtue of the nearby local sidewalk and road network linking the lands to commercial, institutional, employment, and open space opportunities.	✓
e)	take into consideration any additional approaches that help reduce greenhouse gas emissions and build community resilience to the impacts of a changing climate.	Noted.	✓

Section	Policy	Comments	
Chapter 3: Infrastructure and Facilities			
3.5	**Land Use Compatibility** **Summary**: Section 3.5 emphasizes the need for careful planning to ensure compatibility between major facilities and sensitive land uses. Authorities must aim to avoid or mitigate adverse effects from odour, noise, and contaminants while protecting public health and safety and the viability of major facilities. When avoidance is not possible, the planning and development of adjacent sensitive land uses can only proceed if potential negative impacts on both the sensitive uses and the major facilities are minimized and mitigated according to provincial guidelines.		
3.5.1	Major facilities and sensitive land uses shall be planned and developed to avoid, or minimize and mitigate any potential adverse effects from odour, noise, risk to public health and safety, and to ensure the long-term operational and economic viability	A Land Use Compatibility Study prepared by Sonair recommends the application of a Class 4 Area designation under NPC-300, which provides for the proposed residential component to coexist compatibly with nearby industrial uses while safeguarding their long-term operational viability. The assessment identifies there are no odour or air quality concerns.	✓
3.5.2	Where avoidance is not possible in accordance with policy 3.5.1, planning authorities shall protect the long-term viability of existing or planned industrial, manufacturing or other major facilities that are vulnerable to encroachment	The application of a Class 4 Area designation under NPC-300 provides for the proposed residential component to coexist compatibly with nearby industrial uses while safeguarding their long-term operational viability.	✓

Section	Policy	Comments	
Chapter 3: Infrastructure and Facilities			
3.6	**Sewage, Water, and Stormwater** **Summary**: Section 3.6 outlines planning requirements for sewage, water, and stormwater services. It prioritizes timely growth accommodation and optimization of existing municipal services, with municipal systems favored for settlement areas. Private communal services are alternatives when municipal options are unavailable, while		

	individual on-site services are permitted under suitable conditions. Partial services may be allowed to address specific failures. For stormwater management, planning must minimize volumes and contaminants, promote green infrastructure, and align with comprehensive municipal plans.		
3.6.1	Planning for sewage and water services shall:		
a)	accommodate forecasted growth in a timely manner that promotes the efficient use and optimization of existing municipal services	The proposed application intends to connect to existing municipal services thereby improving the efficiency and optimization of these services.	✓
b)	ensure that these services are provided in a manner that: 1. can be sustained by the water resources upon which such services rely; 2. is feasible and financially viable over their life cycle; 3. protects human health and safety, and the natural environment, including the quality and quantity of water; and 4. aligns with comprehensive municipal planning for these services, where applicable.	1. Water capacity is not anticipated to be problematic. Water modelling will need to confirm. 2. Municipal services already exist in the area. The proposed development makes more efficient use of the existing services. 3. Municipal water supplied. Quality and quantity is ensured by municipal systems. 4. This is an infill development that takes advantage of previous municipal service planning.	✓
c)	Promote water and energy conservation and efficiency;	The structure will be constructed in accordance with the Ontario Building Code.	✓
d)	Integrate servicing and land use considerations	The proposed application facilitates re-development and intensification.	✓
e)	consider opportunities to allocate the unused system capacity of municipal water services and municipal sewage services	Modeling will be conducted to ensure that the development can be sustained by municipal services.	✓

f)	be in accordance with the servicing options outlined through policies 3.6.2, 3.6.3, 3.6.4 and 3.6.5.	Complies with the hierarchy of servicing.	✓
3.6.2	Municipal sewage services and municipal water services are the preferred form of servicing for settlement areas	This level of the servicing hierarchy is achieved.	✓
3.6.8	Planning for stormwater management shall:		
a)	be integrated with planning for sewage and water services and ensure that systems are optimized, retrofitted as appropriate, feasible and financially viable over their full life cycle;	The functional servicing report supports the proposed development. Modelling will be conducted. No issues are anticipated.	✓
b)	minimize, or, where possible, prevent or reduce increases in stormwater volumes and contaminant loads;	The property will be designed to manage stormwater volumes both quantify and quality.	✓
c)	minimize erosion and changes in water balance through the use of green infrastructure;	All open spaces will be planted with grass and landscaping where not required for hard surfaces.	✓
d)	Mitigate risks to human health, safety, property and the environment	The development is designed to be safe and stormwater managed in accordance with County requirements. Environmental challenges are not anticipated.	✓
e)	Maximize the extent and function of vegetative and pervious surfaces	Landscaping will be maximized and pervious surfaces proposed where necessary.	✓
f)	promote best practices, including stormwater attenuation and re-use, water conservation and efficiency, and low impact development; and	An underground detention system will control quality and quantity of stormwater.	✓
g)	align with any comprehensive municipal plans for stormwater management	The County will review and then confirm the acceptability of the stormwater management plan. No issues are anticipated.	✓

Section	Policy	Comments	
Chapter 3: Infrastructure and Facilities			
3.9	**Public Spaces, Recreation, Parks, Trails and Open Space** **Summary**: Section 3.9 promotes the development of healthy, active, and inclusive communities by ensuring public streets and spaces are safe and accessible for all ages and abilities. It emphasizes the need for a diverse range of publicly accessible recreational settings, including parks, trails, and water-based resources, while encouraging public access to shorelines. The section also highlights the importance of recognizing and protecting provincial parks and conservation reserves from negative impacts.		
3.9.1	Healthy, active, and inclusive communities should be promoted by:		
a)	planning public streets, spaces and facilities to be safe, meet the needs of persons of all ages and abilities, including pedestrians, foster social interaction and facilitate active transportation and community connectivity;	This is a re-development and intensification project in an established area. The nearby sidewalk and road network facilitate the opportunity for active transportation and the design of the development facilitates social interaction. There are a variety of public parks, institutional, and commercial businesses located within walking distance to the property.	✓
b)	planning and providing for the needs of persons of all ages and abilities in the distribution of a full range of publicly-accessible built and natural settings for recreation, including facilities, parklands, public spaces, open space areas, trails and linkages, and, where practical, water-based resources;	There are parks located within walking distance. Waterford contains other amenity spaces including the Waterford ponds, the Lion's Park, the Waterford Heritage Trail, Ponds, and Shadow Lake Trail Head, and the Waterford Heritage Trail to Simcoe.	✓
c)	Providing opportunities for public access to shorelines; and	Not applicable to this development.	
d)	Recognizing provincial parks, conservation reserves, and other protected areas, and minimizing negative impacts on these areas	Not applicable to this development.	

Appendix D
Official Plan Policy Analysis

Norfolk County Official Plan – Policy Analysis Table

This appendix demonstrates how the proposed application is consistent with applicable policies of the Norfolk County Official Plan.

Section	Policy	Comments	
Section 2.2 Goals & Objectives			
2.2	Goals and Objectives This section of the Official Plan sets out six "Goals and Objectives" to which the following four are applicable to the proposed residential development:		
2.2.1	Strong and Diversified Economy	The inclusion of ground-floor commercial space supports local service provision and contributes to the diversity of Waterford's economy. While primarily residential, the mixed-use form promotes business activity in a compact format consistent with the Plan's economic development goals.	**n/a**
2.2.2	Protecting and Enhancing the Natural Environment	The proposed application is not subject to Section 2.2.2	**n/a**
2.2.3	Maintaining and Enhancing the Rural and Small Town Character	This application proposes to permit additional housing supply to the existing neighbourhood, in a compact and efficient form. The development will repurpose a parcel of land with a well designed building that will compliment and add diversity of housing choices the area. The development will also include a commercial component to serve the new residents of the apartment building and local area. The redevelopment will replace the old warehouse type buildings, add landscaping and paved parking surfaces, thereby enhancing the local area.	✓
2.2.4	Maintaining a High Quality of Life	The proposed development implements the objectives of this policy by providing housing options to people through a re-development and intensification opportunity on the subject lands. The project is designed to ensure resident safety in an aesthetically appropriate manner. The lands are near public transit routes and are adjacent to a sidewalk network which improve accessibility to parks, amenities, institutions, commercial, and employment lands in Waterford.	✓
2.2.5	Upgrading and Expanding Infrastructure	The proposed development will connect to the existing municipal water, wastewater and storm water systems thereby improving the efficient utilization of existing services.	✓
2.2.6	A Well Governed, Well Planned and Sustainable County	The proposed application is subject to a public process to gain information from the neighbourhood in addition to commenting agencies. The lands are urban and are efficiently designed in a compact form,	✓

		utilizing existing infrastructure, adding to the mix of residential units and types, and contributes to the long-term financial benefit of the County.	
Section	**Policy**	**Comments**	
Section 5.3 Housing			
5.3	The provision of housing is an essential part of planning in Norfolk County. It is desirable to have close cooperation between all levels of government and the private sector in order to provide for sufficient and affordable housing, and a stable residential housing market. The County shall ensure that a full range of housing types and densities are provided to meet the anticipated demand and demographic change. All forms of housing required to meet the social, health and well-being of current and future residents, including those with special needs shall be encouraged.		
b)	The County shall ensure that a full range of housing types and densities are provided to meet the anticipated demand and demographic change. All forms of housing required to meet the social, health and well-being of current and future residents, including those with special needs shall be encouraged. The County shall target that 15 percent of all new housing built in Norfolk County be multi-residential dwellings and 15 percent be semi-detached and townhouse dwellings.	The proposed re-development and intensification project seeks to add a 5 storey multiple unit residential apartment and commercial space to the area. This assists the County in reaching its goal of achieving 15 percent for new housing in the form of multi-residential dwellings.	✓
c)	The provision of housing that is affordable and accessible to low and moderate income households shall be a priority. The County shall encourage the provision of affordable housing through:		
	i) supporting increased residential densities in appropriate locations and a full range of housing types, adequate land supply, redevelopment and residential intensification, where practical;	The development proposes 1 and 2 bedroom apartment style dwelling units adding to the range of housing types in the area through redevelopment and intensification.	✓
	ii) the timely provision of infrastructure in the Urban Areas;	Municipal services already exist.	✓
	iii) supporting the reduction of housing costs by streamlining the development approvals process;	It is requested that this project be afforded a streamlined process. It is intended to make application for site plan approval either simultaneously as the Zoning By-law amendment or, during the zoning application process.	✓
	iv) negotiating agreements with the public and private sectors to address the provision of affordably priced housing through the draft plan of subdivision and condominium approval process;	This project is market based.	✓

	v) considering innovative and alternative residential development standards that facilitate affordable housing and more compact development form	The project incorporates residential development standards to promote affordability and a more compact urban form, ultimately designed to optimize land use and reduce overall costs.	✓
d)	The County may adopt a Municipal Housing Facilities By-law to develop affordable housing as a "community facility" under the Municipal Act. In an effort to facilitate affordable housing the County may: i) enter into capital facility agreements and/or partnerships with both private and non-profit organizations for affordable housing; and ii) use available grants and loans, including tax-equivalent grants or loans to encourage the construction of affordable housing.	Not applicable.	
e)	The County shall encourage innovative and appropriate housing development that exhibits design and adaptability characteristics, and may represent nontraditional additions to the County's housing stock.	Not applicable.	
g)	The County shall encourage that housing be considered when opportunities for redevelopment become available. This includes the redevelopment of existing single-use and underutilized areas with full municipal services, such as shopping plazas, business and employment sites and older commercial and residential areas, especially where the land is in close proximity to human services. Special attention shall be given to the design of buildings, the landscaping treatment and features of the site to ensure that the proposed redevelopment is physically compatible with the adjacent uses.	The area is not overly dense and includes a mix of residential, recreational, commercial, employment, and institutional land uses. The proposed development will be landscaped and has been sized to ensure compatibility with the surrounding area. The lands are within an older area of Waterford which the proposed design and setbacks are intended to be sympathetic to the existing location and character of the neighbourhood.	✓
l)	The County shall ensure that residential and/or commercial infill development in areas of cultural heritage value or interest is sympathetic to the existing building fabric and streetscape.	The building design is intended to blend in with the existing neighbourhood. This will be further developed through the site plan approvals process.	✓

Section	Policy	Comments	
Section 5.3.1 Residential Intensification			
5.3.1	The intensification of urban residential development reduces the need to use vacant designated land on the periphery of the Urban Areas. It also reduces the need for urban expansions encroaching into the Agricultural Area. Urban residential intensification, infilling and redevelopment of existing areas allows for the efficient provision of urban services thereby helping to minimize the costs of providing services while meeting an important component of the County's housing needs.		
a)	The following shall be the policy of the County:		
	iii) redevelopment which includes either the replacement of existing residential uses with compatible new residential developments at a high density or the replacement of non-residential uses with compatible residential or mixed use development with a residential component.	The development replaces non-residential uses with compatible residential mixed-use development.	✓
b)	The County shall target that a minimum 25 percent of its annual residential growth be accommodated through infill, intensification and redevelopment within the existing built-up areas in the Urban Areas with full municipal services.	The development will help achieve the County's target for re-development and intensification with the Urban Area on full municipal services.	✓
f)	The County shall consider applications for infill development, intensification and redevelopment of sites and buildings through intensification based on the following criteria:		
	i. the development proposal is within an Urban Area, and is appropriately located in the context of the residential intensification study;	Yes. The lands are located in the urban area. We are not aware if the County has conducted an intensification study.	✓
	ii. the existing water and sanitary sewer services can accommodate the additional development;	Yes. This is supported by a Functional Servicing Report. The County modelling will confirm. No issues anticipated.	✓
	iii. the road network can accommodate the traffic generated;	Yes. The traffic study demonstrates the road network can accommodate the proposed development.	✓
	iv. the proposed development is compatible with the existing development and physical character of the adjacent properties and surrounding neighbourhood; and	Yes. The proposed development is a continuation of housing adjacent to an existing neighbourhood and the inclusion of commercial uses permitted by the existing zone category. It does not conflict with surrounding land uses.	✓

	v. the proposed development is consistent with the policies of the appropriate Land Use Designation associated with the land.	Yes. The lands are intended for service commercial and residential development in accordance with the Official Plan.	✓
g)	The County shall monitor intensification activity and, through the development approvals and building permitting process, ensure that such proposals can be satisfactorily integrated with the physical characteristics of residential and commercial areas and proper health and safety standards are maintained. Land use compatibility and urban design assessments may be required as a component of the planning rationale report accompanying development applications, as outlined under Section 9.6.1 (Official Plan Amendments) of this Plan.	Yes. The project represents re-development and intensification of under utilized lands which implement appropriate setbacks, fencing and landscaping to improve compatibility with the proposed apartment building and parking area. The commercial uses permitted under the existing zoning are not proposed to change. The development is subject to site plan control where physical characteristics of the proposed development can be designed to ensure proper health and safety standards are maintained.	✓

Section	Policy	Comments	
Section 5.4 Community Design			
5.4	Safe and attractive neighbourhoods contribute to the overall community health of the County. Excellence in community design is essential to creating a physical environment where people have the appropriate places to interact, live, work, recreate and learn. The following policies relate to the physical design of communities, including new applications within the County for development, such as plans of subdivision, infill development proposals, and site plans. The following shall be the policy of the County:		
a)	Through implementation of this Plan, the County shall seek to maintain and improve the physical design characteristics of the Urban Areas in the context of new and existing development and stress a generally high quality of settlement design throughout the County.	The proposed development is well designed and will add to the character of the urban area including a landscaping schema to create an open space buffer interface with the existing residential lands to the north, the EMS and commercial land uses to the east, and the road frontage where appropriate.	✓
b)	Through the review of development applications, including plans of subdivision, site plans and other development proposals, the County:		
	i. shall ensure that new development is designed in keeping with the traditional character of the Urban	The proposed development will be designed to be in keeping with the character of the general area.	✓

	Areas, in a manner that both preserves the traditional image of the Urban Areas and enhances the sense of place within the County while maintaining the community image of existing settlement areas;	The new development will enhance the local character within a growing community.	
	ii. shall promote efficient and cost-effective development design patterns that minimize land consumption;	This is a re-development and intensification project that maximizes the use of the lands, while maintaining compatibility with adjacent land uses.	✓
	iii. shall promote the improvement of the physical character, appearance and safety of streetscapes, civic spaces, and parks;	This will be considered during site plan control.	✓
	iv. shall encourage tree retention and tree replacement;	Trees will be proposed through the site plan process for staff consideration.	✓
	v. shall ensure that design is sympathetic to the heritage character of an area, including the area's cultural heritage resources;	The adjacent neighbourhood is not of cultural heritage significance.	✓
	vi. shall strongly encourage design that considers and, wherever possible, continues existing and traditional street patterns and neighbourhood structure; and	The lands are part of the neighbourhood where residential development is proposed closest to existing residential development, buffered by appropriate setbacks and landscaping. The area has several mature trees to which the proposed development will add trees to a property that does not any significant landscaping.	✓
	vii. may require, at the County's sole discretion, that proponents submit design guidelines with development applications, establishing how the policies of this Section have been considered and addressed. Such guidelines may also be required to address related issues of residential streetscaping, landscaping, setbacks, sidewalks, signage, garage placement, and architectural treatment.	Not applicable. Such elements can be considered through the site plan process.	✓
c)	Adequate measures shall be taken to ensure that the permitted uses have no adverse effects on adjacent land uses. Adequate buffering shall be provided between any uses where land use conflicts might be expected, and such buffering may include provisions for grass strips and appropriate planting of trees and shrubs, berms or fence	No impacts are anticipated. The development is subject to site plan control. Setbacks, fencing and landscaping will improve compatibility with adjacent and future land uses. The land use compatibility study confirms that the 70 metre separate distance is sufficient for both the residential and employment	✓

	screening, and other means as appropriate. Modifications to building orientation may also be appropriate buffering measures, but not in replacement of appropriate plantings.	lands to the south. No reciprocal impacts are anticipated. The shadowing projections reveal that there are no unreasonable shadowing impacts to the property to the north and surrounding lands, as any long shadows are winter seasonal, move quickly, and are not impacting outdoor enjoyment during winter months. All other seasons, focusing on summer, have negligible impacts and are not affecting outdoor enjoyment of neighbouring amenity space.	
d)	Development design that establishes reverse lotting on Provincial Highways and County Roads will not be permitted. Development design that requires features such as noise attenuation or privacy fencing will be discouraged. Wherever possible, new development will be oriented toward streets or parks.	Not applicable.	✓
e)	The County shall require compatibly scaled and designed infill developments within areas designated as Downtown, which enhance the traditional character and economic viability of such centres.	Not applicable.	✓
f)	A high quality of architecture and site design for institutional uses such as schools, places of worship, libraries and other public service buildings is encouraged.	Not applicable.	✓
g)	Streetscaping that reflects the intended character of settlement areas is encouraged. In particular, traditional streetscaping in the Downtown Designations of the Urban Areas will be encouraged.	This will be considered through the site plan process.	✓
h)	A high quality of park and open space design is strongly encouraged. The land for parkland dedication shall be carefully selected to facilitate their use as a central focal point for new or existing neighbourhoods.	Cash in lieu of parkland will be required.	✓
i)	Public art in the County shall generally be encouraged to incorporate themes supporting and promoting local history, civic pride, businesses and technology. The provision of	Not applicable.	✓

	public art in the Downtown Designations shall be encouraged. The County may consider granting increases in height or density for a particular development proposal in exchange for the provision of public art, in accordance with Section 37 of the Planning Act.		
j)	The County may require the provision of certain pedestrian, cycling and trail linkages through the development approvals process.	Not applicable.	✓
k)	The County, in consultation with a development proponent(s) and the Norfolk Heritage Committee, shall define a style of street furnishing that should include shared and accessible bicycle racks, garbage receptacles, benches and street lamps to be used in a new development.	This can be considered during the site plan process.	✓
l)	The County may undertake the preparation of urban design guidelines to achieve the policies of this Section for all or parts of the County.	Not applicable.	✓
m)	The County shall encourage development design considering the principles of Crime Prevention Through Environmental Design (CPTED). Specifically, the County shall encourage proponents of new development to use appropriate lighting to deter crime and to situate buildings on lots to maximize natural surveillance.	The lands are located as an extension to the existing residential neighbourhood and is of a type and scale that affords visual surveillance of the premises, especially from upper storeys of the apartment. The lands have significant road presence in plain sight. The type of lighting will be determined through site plan control.	✓
n)	To promote environmental sustainable development, the County shall encourage the design of sustainable neighbourhoods in keeping with Leadership in Energy and Environmental Design – Neighbourhood Development (LEED ND) design principles in accordance with the policies under Section 11.8.2.1 Sustainable Neighbourhood Design of the Lakeshore Special Policy Area Secondary Plan.	Noted.	✓
o)	The County shall review site plans and drawings submitted in accordance with Section 41 of the Planning Act and Section 9.6.5 (Site Plan Control of this Plan) regarding accessibility for persons with disabilities including but not limited to areas of accessible parking, exterior paths of travel, lighting, ramps, entrances and street furniture.	The development is subject to site plan control.	✓

Section	Policy	Comments	
Section 6.4 Urban Areas			
6.4	The six Urban Areas within the County have historically functioned as the focal points for growth and development activity, as well as public and private sector investment. This role will continue in the future. The Urban Areas will accommodate the greatest amount of the targeted growth throughout the planning period, and will be the focus of residential, commercial, employment, government, institutional, office, entertainment, cultural, and health and social service activities. The following shall be the policy of the County:		
b)	It is the policy of this Plan that the Urban Areas will incorporate the following:		
	i. a full range of housing types, including affordable and special needs housing;	The proposed application adds to the type of housing available in the urban area.	✓
	ii. business opportunities at appropriate locations to provide a wide range of employment and services to residents, businesses and visitors;	The application proposes a mixed use which will provide commercial services in compliance with the permitted uses of the zone.	✓
	iii. full municipal services, as feasible and appropriate, and an appropriate level of transportation infrastructure;	The lands are fully serviced and located close to nearby transit stops.	✓
c)	The County shall ensure through its planning activities that each Urban Area develops with efficient land use patterns that minimize the extension of municipal services and infrastructure and will sustain the community and financial well-being of the County over the long-term.	The proposal achieves this policy as re-development and intensification are encouraged to make efficient use of existing services.	✓
e)	Boundaries of the Urban Areas are established on Schedules “B” and “G” to this Plan. Within these boundaries there is sufficient land to accommodate projected growth and development for the 20-year planning horizon to 2036.	The lands are within the urban area and are proposed to be re-developed with an intensification of a mixed residential use with a commercial component. This re-development is within the urban area, thus reducing pressure for growth of the next 20 years.	✓
iii)	Intensification, infill and redevelopment of designated and underutilized sites, and areas in transition in the Urban Areas will be encouraged. The intensification, infill and redevelopment of designated and underutilized sites that are contaminated, or suspected of contamination, shall be subject to the policies of Section 5.7 (Potentially Contaminated Sites). The County shall target 25 percent of its growth in the Urban Areas to be accommodated through infill, intensification and redevelopment.	The proposed application contributes to the County target of encouraging 25 percent of its growth in the Urban Areas through infill and intensification. A record of site condition will be a condition of site plan approval to ensure any contamination of the property is cleaned prior to final site plan approval or as a condition of the site plan agreement.	✓

Section	Policy	Comments	
Section 6.5.4 Waterford Urban Area			
6.5.4	The County will support and promote the continued development of Waterford as an important urban community and agricultural support centre in the County. The following shall be the policy of the County:		
a)	Waterford is the closest Urban Area to Highway No. 403. The County shall encourage employment growth and development in the Urban Area.	The development introduces additional housing types to the urban area. Increased population may contribute to employment opportunities.	✓
b)	Many of the historic residences in the Waterford Urban Area are of cultural heritage value or interest. The County will encourage the maintenance, rehabilitation, and adaptive reuse of the historic residences.	Not applicable.	
c)	Trail linkage opportunities exist in the Waterford Urban Area due to the presence of abandoned rail corridors and other linear open space features. The County will encourage the development of trails integrating Waterford with other areas of the County.	The trails lend support to an active community.	✓

Section	Policy	Comments	
Section 7.7 Urban Residential Designation (Not Applicable to Commercial Designation)			
7.7	The Urban Residential Designation applies to the Urban Areas of the County. The Urban Areas are expected to continue to accommodate attractive neighbourhoods which will provide for a variety of residential forms as well as neighbourhood facilities such as elementary schools, parks, places of worship and convenience commercial uses integral to and supportive of a residential environment. A variety of housing types are needed to meet the needs of a diverse population. Opportunities to provide housing for individuals or groups with special needs including the elderly and those with special physical, social or economic needs within the County will be encouraged.		
7.7.1	Subject to the other policies of this Plan, the following policies shall apply in determining uses permitted on land designated Urban Residential on Schedule “B”.		
b)	High density residential uses in development forms greater than those described in Subsections (a) and (b) shall be permitted subject to the policies of Section 7.7.2	The application proposes approximately 91 units per hectare.	✓

	(c) (Urban Residential Designation – Land Use Policies), save and except for in the Courtland Urban Area where high density residential uses shall not be permitted.		
7.7.2	**Land Use Policies**		
c)	High density residential uses in development forms greater than those described in Subsections (a) and (b) shall be permitted subject to the policies of Section 7.7.2 (c) (Urban Residential Designation – Land Use Policies), save and except for in the Courtland Urban Area where high density residential uses shall not be permitted.	The proposed density is 91 residential units per hectare.	✓
	i) the density, height and character of the development shall be compatible with adjacent uses;	Yes. The lands will be fenced and landscaped. The building will be designed to include a commercial façade that blends well with the existing commercial neighbourhood. The residential component will be designed appropriately and controlled through the site plan application process. There are minimal to no shadowing impacts. Other compatibility tests within this section are also addressed.	✓
	ii) the ability of the site to accommodate necessary facilities and amenities, such as garbage storage, parking and landscaped areas;	Yes. The concept plan includes parking and amenity space. Garbage collection will be included in the community garbage and recycle collection services.	✓
	iii) the height, form and density of the proposed development is such that no undue adverse impacts in terms of overshadowing, increased traffic or loss of amenity area are created for surrounding residential uses;	The proposed height of the building is higher than the existing height of the neighbourhood dwellings. However, the request is supported by buffering, setbacks and a shadow study. As such overshadowing will not occur. The lands are near a public transit route and are not anticipated to generate unacceptable levels of traffic. The traffic impact study supports the development. The site plan will have amenity area, however, community amenity spaces are within walking distance from the subject property.	✓
	iv) the relationship of the site to nearby lower density residential uses, in view of the desire to provide a	The height is addressed through setbacks, landscaping and fencing. Shadowing does not create significant impacts to adjacent properties.	✓

	gradual transition in height and density wherever possible;		
	v) the degree to which the site has access to significant open space amenities such as valleylands or major parks;	The property is located near recreation amenities in the form of a public park, natural areas and trails.	✓
	vi) municipal watermains and sanitary sewers shall be required and shall be capable of accommodating the development, or the proponent shall commit to extending services at no cost to the County;	The existing infrastructure is sufficient to service the proposed redevelopment.	✓
	vii) the proximity of the site to arterial or collector roads, and/or pedestrian accessibility to a Downtown Area or, in the case of the Simcoe Urban Area, a Secondary Centre, or other locations of supporting services and facilities;	The lands are near a public transit route to reduce walking distances to various public and private services.	✓
	viii) the adequacy of local services including schools and other community services. It is recognized that accessibility to such facilities, including health care services, may be particularly important to residents with special needs; and	The area has local services including schools, parks and places of worship. The EMS / Fire station is located adjacent to the lands. Other forms of medical services are within the community including a family health centre, eye care and general practitioner.	✓
	ix) the use shall be subject to site plan control, in accordance with the policies of Section 9.6.5 (Site Plan Control) of this Plan.	Yes. Site plan control is required.	✓

Section	Policy	Comments	
Section 7.11 Commercial Designation			
7.7	Commercial areas are accessible locations along the County's major transportation routes offering suitable accommodation for a specific range of commercial uses which have the following basic characteristics: a) highway-oriented uses which rely on exposure to the travelling public and require a location readily accessible to major transportation routes; b) destination uses, which are principally commercial in nature, provide a less diverse array of goods and services than the Downtown Designations, and provide a specialized product or service to persons coming specifically to the premises to do business and therefore do not require to locate in the Downtown Designations;		

	c) space-extensive uses having physical requirements in terms of the size or configuration of the site or building such that they cannot be accommodated within the Downtown Areas; and d) mixed residential and commercial uses that have historically located along the major transportation routes.		
7.11.1	Subject to the other policies of this Plan, the following policies shall apply in determining uses permitted on land designated Commercial on Schedule "B".		
	a) The primary permitted uses shall include retail establishments and commercial uses, which are destination oriented or are intended to serve the travelling public, including automobile parking depots, automobile service stations, vehicle sales and service, public garages, repair service and rental establishments, motels, hotels, convention centres, restaurants, animal hospitals, commercial recreation uses, private clubs, funeral homes, day care centres and similar uses.	Noted. The commercial component is subject to the uses permitted in the zoning by-law.	✓
	b) Category-specific retail establishments shall be limited to furniture, appliance, carpet, flooring, home electronics and/or garden centres, and building supply centres that are less than 3,000 square metres of gross leasable floor space.	Noted. The commercial component is subject to the uses permitted in the zoning by-law.	✓
	c) Food stores, drug stores, personal service shops and other similar uses intended for the Downtown and/or Shopping Centre Commercial Designations shall not be permitted.	Noted. The commercial component is subject to the uses permitted in the zoning by-law.	✓
	d) Large Retail Uses over 3,000 square metres of gross leasable floor space, such as department stores, retail warehouses, and other uses engaged in the retailing and/or wholesaling of goods, wares or products and other similar uses intended for the Downtown and/or Shopping Centre Commercial Designations shall not be permitted.	Noted. The commercial component is subject to the uses permitted in the zoning by-law.	✓
	e) Residential uses shall be permitted, provided that the uses do not negatively impact the planned function of the Commercial areas subject to the following provisions:	The addition of residential units on the periphery of the residential designation and neighbourhood is a logical extension of its residential composition and contributes to a complete community. The planned commercial	

	i) in a building of commercial character, residential uses shall only be permitted above the ground floor; and ii) in a building of residential character, either single detached or multiple dwelling, residential and/or commercial uses shall be permitted, provided the residential character of the building is maintained. For the purposes of this Policy, the residential or commercial character of a building may be determined in consultation with the Chief Building Official of the County.	function is retained through the construction of a new building, for a use permitted by the zoning by-law. The two provisions under Section 7.11.1 appear to anticipate scenarios where existing buildings are repurposed, and thus, where the original residential or commercial character is preserved to some extent. On the subject property, the existing buildings exhibit commercial character, but are no longer suitable for reuse due to their form, and inability to support a high-quality mixed-use redevelopment. To achieve the County's objectives for compact, well-designed development that integrates both residential and commercial functions, a new purpose-built structure is required. The proposed redevelopment introduces a building that includes commercial uses at grade and residential units above, consistent with the policy's direction to encourage mixed-use development within the Commercial designation. While the proposal does not preserve the character of the existing buildings, it maintains the spirit and intent of the Official Plan by delivering a functionally integrated, compatible, and high-quality built form. The policy should be interpreted as enabling redevelopment where it achieves a more appropriate and sustainable land use outcome. As such, an Official Plan amendment is not required. A site visit would confirm that redevelopment is preferable to adaptive reuse in this context. Through the Site Plan Control process, the building's character can be confirmed as residential with a commercial component, or as a compatible mixed-use typology in	✓

		keeping with the County's evolving approach to intensification within serviced Urban Areas.	
	f) Uses accessory to any of the permitted uses in the Commercial Designation are permitted.	Noted.	
7.11.2	**Land Use Policies** The following policies apply to land designated Commercial.		
a)	Commercial development shall be compatible with surrounding uses and shall be adequately buffered from adjacent sensitive land uses.	Yes. The setbacks, landscaping, fencing and minimal shadowing, combined adequately support the proposed mixed use development adjacent to the northerly sensitive land use.	✓
b)	Adequate off-street parking and loading spaces shall be provided in accordance with the Zoning By-law.	Yes. The parking is on-site. The reduction of the parking is appropriate and supported by a parking analysis completed by a qualified person.	✓
c)	Commercial uses shall only locate on Provincial Highways, subject to the approval of the Province and the County, or arterial or collector roads, subject to the approval of the County.	The lands are currently commercial and proposed to keep commercial uses on an arterial road.	✓
d)	A high standard of site design shall be required through site plan control.	Yes. Site Plan control will be required.	✓

Section	Policy	Comments	
Section 7.12 Protected Industrial Designation (Lands not designated Protected Industrial – policies reviewed)			
7.12	Protected Industrial areas are characterized by their high visual profile and accessibility and are generally comprised of industrial, employment, accessory commercial and related uses. Protected Industrial areas are located along Provincial Highways, and County arterial and collector roads. Generally, these areas are expected to accommodate a wide range of industrial uses requiring high visibility and good accessibility. High quality design will be essential in these areas and some restrictions on uses will be applied to ensure attractive streetscapes.		
7.12.1	Permitted Uses Subject to the other policies of this Plan, the following policies shall apply in determining uses permitted on land designated Protected Industrial on Schedule "B".		
	a) The predominant use of land shall be a wide range of employment and industrial uses, subject to the policies of this Section, including the following:	Noted.	✓

	i) manufacturing including processing, assembling, repairing; ii) warehousing, distribution, storage facilities; iii) trucking and transportation terminals; iv) pharmaceutical facilities; v) research and development facilities, including data processing establishments; vi) trade schools; vii) automobile service/repair stations, automobile and truck rental operations, automobile depots, auto and truck repair/body shops; viii) municipal works yards; ix) recycling operations; x) public uses and public and private utilities; xi) ancillary offices and limited retail sales of products manufactured, processed or assembled on the premises; and xii) crematoriums.		
	b) Office uses shall be permitted subject to the policies of Section 6.4.1(b) (Downtown Areas) of this Plan.	Noted.	✓
	c) The following ancillary uses may be permitted without an amendment to this Plan: i) commercial uses, provided that the use is associated with and clearly ancillary to the main Protected Industrial use; and ii) uses accessory to any of the permitted uses in the Protected Industrial Designation are permitted.	Noted.	✓
7.12.2	**Land Use Policies** The following policies apply to land designated Protected Industrial.		
	a) Industrial uses located adjacent to a Provincial Highway or arterial road shall generally be limited to self-contained uses that produce and/or store a product where there is a low probability of significant emissions. Access to a Provincial Highway shall require approval from the Province and the County.	Any future redevelopment or development of nearby lands are subject to achieving this policy.	✓

	Access to the arterial road shall require approval from the County.		
	b) Open storage shall be screened such that it is not visible from a Provincial Highway or arterial road.	Noted.	✓
	c) Those uses that create or potentially create extreme environmental stress as a result of air and/or noise emissions, and/or the generation and/or handling of solid or liquid wastes will only be considered based on the submission of an impact assessment satisfactory to the County. The applicant shall demonstrate the feasibility of the proposal and confirm the compatibility of the proposed use prior to receiving the required planning approvals.	Any future redevelopment or development of nearby lands are subject to achieving this policy.	
	d) A separation distance, determined in consultation with the Ministry of the Environment and Climate Change and the relevant guideline related to land use compatibility, shall be established between an industrial use and any sensitive land use. This separation distance shall be enforced through a site specific amendment to the Zoning By-law and site plan control through the use of a minimum building setback applied to any industrial use building adjacent to an established or approved sensitive land use.	Any future redevelopment or development of nearby lands are subject to achieving this policy. This policy serves to protect the existing nearby sensitive land uses that are closer to existing industrial uses. The subject lands are of greater separation than those existing sensitive land uses. (LaFarge and Norfolk Waste Disposal)	✓
	e) In locating any sensitive land use in the vicinity of any established or approved industrial use, the County shall establish appropriate separation distances in consultation with the Ministry of the Environment and Climate Change and the relevant guideline related to land use compatibility.	The proposed development is located approximately 70 metres from the nearest industrial use on the south side of Thompson Road West, and has been evaluated through a Land Use Compatibility Study prepared in accordance with MECP guidelines, including NPC-300. The study supports the application of a Class 4 Area designation, which allows for residential development near stationary noise sources (LaFarge) with appropriate building-level mitigation (e.g., upgraded windows, central air, and warning clauses). This approach ensures land use compatibility while maintaining the long-term viability of adjacent employment lands, and is	✓

		consistent with the policy intent to establish appropriate separation in consultation with provincial guidelines.	
	f) Deviation from the established separation distances shall require detailed supporting studies of the potential impacts on the sensitive land use by the Industrial use, and vice-versa, and any recommended mitigation measures.	A Land Use Compatibility Study has been completed by Sonair to support a reduction in the standard separation distance, consistent with NPC-300 guidelines. The study recommends a Class 4 Area designation and includes mitigation measures such as upgraded windows, central air, and warning clauses, satisfying the requirement for technical justification and ensuring compatibility with nearby industrial uses.	✓
	g) Separation distances between sensitive land uses and Protected Industrial uses, or for Protected Industrial uses abutting Provincial Highways or arterial roads shall be required to provide a higher standard of amenity in terms landscaping building materials and outdoor storage which shall be implemented through the Zoning By-law, as a condition of draft plan approval and/or through site plan control and may include measures such as: i) building orientation, design and setbacks; ii) landscaping and screening; iii) access controls; iv) road improvements and widenings; v) restrictions on the range of permitted uses; and vi) restrictions on outside storage.	This policy is intended to apply for lands designated Protected Industrial and does not affect the subject lands designated Commercial.	✓
	h) Adequate off-street parking and loading facilities shall be provided for all permitted uses for employees and visitors. Vehicle access shall be oriented such that industry-related traffic will be discouraged from using local roads where other options are available. Loading facilities and service areas shall be located to avoid conflict between pedestrian circulation, service vehicles and movement along the public rights-of-way.	Noted.	✓

	i) The provision of appropriate and adequate landscaping and/or other forms of buffering shall be provided to: i) enhance all parking lots, and outdoor loading, storage and service areas; and ii) provide separation between the use and any adjacent use, where appropriate.	Noted.	✓
	j) Industrial uses shall be developed in such a manner to ensure protection and screening of outdoor storage areas from all adjacent roads.	Noted.	✓

Appendix E
Community Context

Appendix E to Planning Justification Report – Community Context and Services
Leamon Street Midrise

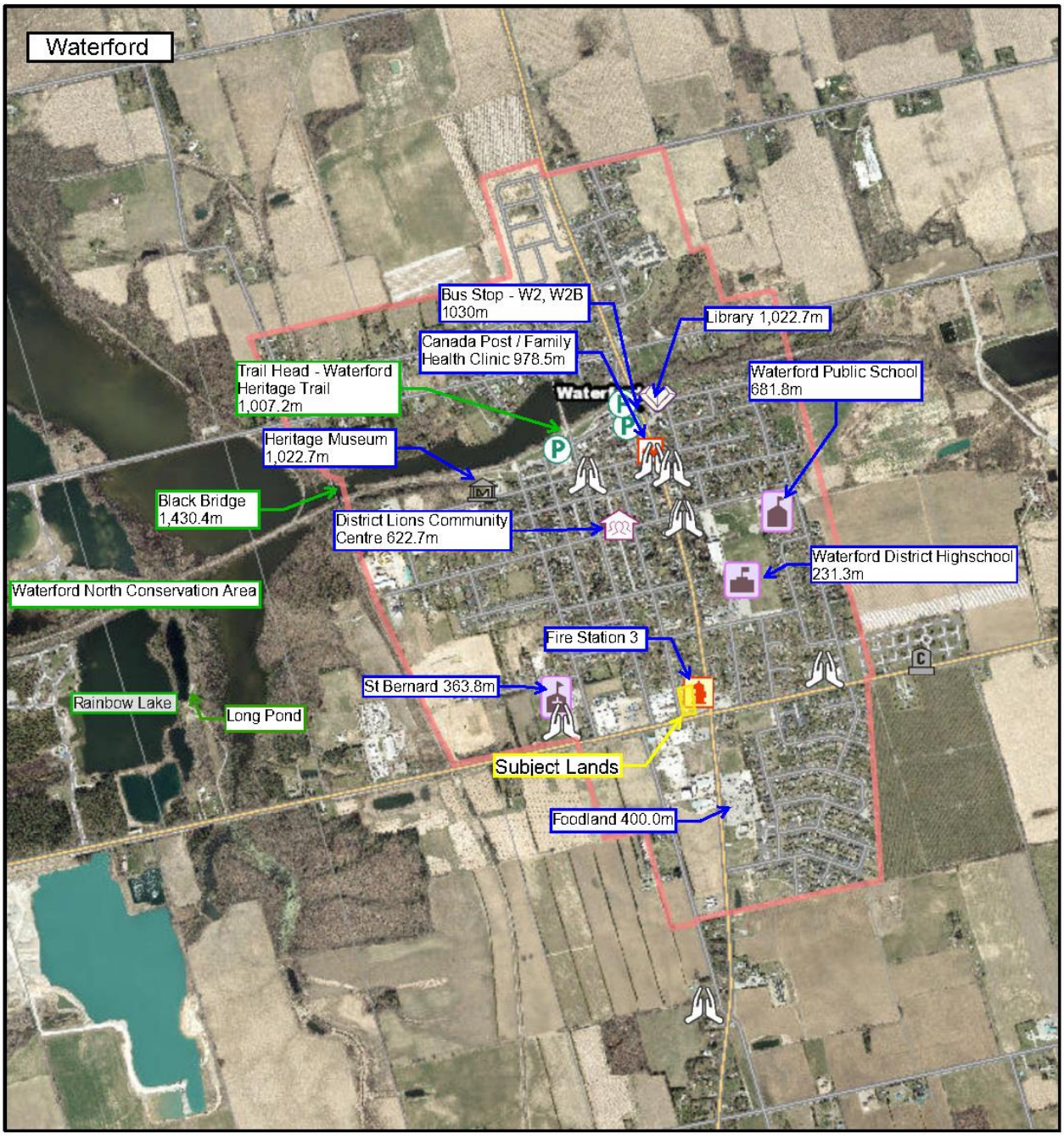
Category	Details
Transit Access	• Bus Stops W2/W2B within 1,030 m (approx. 16 min walk) • Providing service to Simcoe Downtown (26 min) • Brantford Bus Terminal (35 min)
Education	• Waterford District High School – 231.3 m • St. Bernard Elementary School – 363.8 m • Waterford Public School – 681.8 m
Child Care Services	• EduKids Daycare – 231.3 m • Waterford Before and After School Program – 681.8 m
Parks & Trails	• Yins Park – 152.7 m • Waterford Audrey S. Hellyer Dog Park – 493.7 m • Lions Park – 1,179.4 m • Deer Park – 1,245 m • Waterford Heritage Trail (Trailhead & Black Bridge)– within 1,430.4 m
Community Facilities	• Tricenturena Arena – 461.4 m • Waterford District Lions Community Centre – 622.7 m • Community Tennis Court – 458.9 m • Waterford Heritage & Agricultural Museum – 990.1 m • Norfolk Public Library – Waterford Branch – 1,022.7 m
Healthcare	• Waterford Family Health Centre / Post Office – 978.5 m • Waterford Dental – 470.9 m • Townsend Medical Centre – 1,307 m • Simcoe Hospital – 10,179.4 m (approx. 16 min drive)
Emergency Services	• Fire Station 3 – Adjacent to subject lands • Norfolk County OPP (Simcoe) – approx. 10.2 km
Grocery & Retail	• Foodland – 362.3 m • Waterford Antique Market – 924.9 m
Places of Worship	• Seven places of worship within 900 m of the subject lands
Long-Term Care	• Wellings of Waterford – 1,534.3 m

Category	Details
Social Services & Programs	• Access to County-wide services, including: • Child Care Fee Subsidy • Housing and Rent-Geared-to-Income Assistance • Homelessness Prevention • Health and Social Services programs (hnhousing.org)
Cultural Services	• Cultural programming offered through: • Waterford Heritage & Agricultural Museum • Library • Community Centre events

Map referenced: "MAP NORFOLK - Community Web Map" (Norfolk GIS, May 27, 2025)

See next page.

MAP NORFOLK - Community Web Map



5/27/2025, 10:28:30 AM

1:20,000

0 0.15 0.3 0.6 mi
0 0.275 0.55 1.1 km

Urban & Hamlet Boundaries
- Urban Area Boundary
- Hamlet Area Boundary
- Resort Area Boundary
- Cemeteries
- Community Centre
- Court House
- County Offices
- Firehalls
- Hospital
- Industrial Park
- Information Booth
- Library
- Marinas
- Museum and Art Galleries
- Parking Lots
- Place of Worship

Norfolk GIS
© Norfolk County

Appendix F
Class 4 Area

NPC - 300 – Class 4 Area

This appendix demonstrates the application is consistent with the applicable policies of the Ontario's Environmental Noise Guideline.

Overview: Application of NPC-300

The proposed Leamon Street Midrise development is located adjacent to designated Protected Industrial lands on the south side of Thompson Road West in Waterford. These lands are currently occupied by existing employment uses, including light manufacturing and logistics. To facilitate residential intensification in proximity to these operations while ensuring land use compatibility, the application seeks to have the subject lands designated as a Class 4 Area under Ontario's *Environmental Noise Guideline NPC-300*.

What is a Class 4 Area?

- A Class 4 Area is a noise compatibility category under Ontario's NPC-300 Environmental Noise Guideline.
- It applies to new noise-sensitive land uses (such as residential, institutional, or mixed-use buildings) located close to existing stationary noise sources like industrial operations, rail yards, or other facilities.
- Unlike the typical Class 1–3 areas, Class 4 recognizes that in some urban or employment-adjacent contexts, higher background noise is unavoidable.

Key thresholds (simplified):

- 60 dBA daytime and 55 dBA nighttime at the plane of window of a sensitive space (higher than Class 1–3 limits).
- Indoor limits still apply (45 dBA living spaces, 40 dBA bedrooms), but these can be achieved through building design measures (e.g., upgraded windows, ventilation).

Why is Class 4 Beneficial?

1. **Supports Intensification and Mixed Use:**
   Allows residential and other sensitive uses to coexist near existing industry, rail corridors, or arterial roads, consistent with provincial intensification goals.

2. **Protects Existing Industry:**
   Without Class 4, a new residential development could trigger costly noise mitigation requirements for a long-standing industry. Class 4 shifts responsibility to the new receptor (through building treatments and warning clauses), not the industry.

3. **Practical and Flexible:**
   It avoids sterilizing employment lands by offering a compatibility tool rather than forcing strict separation or rezoning battles.

Why Must the Municipality Approve Class 4?

- The decision rests with the land use planning authority (municipality or approval authority under the Planning Act).
- MECP does not unilaterally assign Class 4; instead, the municipality must designate it through the planning process (OPA, zoning, site plan, or subdivision approval).
- This ensures the municipality has policy control, balancing growth objectives with industrial protection and community well-being.

Why Should a Municipality Agree to Apply Class 4?

1. **Economic Development:** Protects key employers from noise complaints and retrofit orders while still allowing new housing supply.
2. **Complete Communities:** Supports compact, mixed-use growth in areas where strict noise limits would otherwise prohibit residential.
3. **Planning Control:** The municipality can impose conditions, such as façade upgrades, mechanical ventilation, and warning clauses in agreements of purchase and sale, to ensure residents understand the environment they are moving into.
4. **Consistency with Provincial Policy:** Aligns with the Provincial Planning Statement direction for efficient land use, intensification, and employment land compatibility.

Summary - A Class 4 designation is a planning tool that allows municipalities to balance growth and economic stability. It permits sensitive uses near noise sources while protecting existing industry, provided building-level mitigation and disclosure are in place. It is municipal council's decision because it is ultimately a land use compatibility trade-off between growth and industrial protection.

Consistency with the Provincial Planning Statement (PPS 2024)

The application of a Class 4 Area designation under NPC-300 supports the following key PPS policies:

Section	Policy	Comments	
Section 2.2 and 3.5 of the PPS 2024			
2.1	Planning for People and Homes:	Supports the addition of 44 residential units in a compact mixed-use format, contributing to the supply of housing in a designated Urban Area.	✓
2.2	Infrastructure and Public Service Facilities:	Located within a fully serviced settlement area, leveraging existing infrastructure with underground stormwater detention proposed.	✓
2.3	Settlement Areas:	Encourages compact, transit-supportive forms of development on underutilized parcels in urban areas.	✓
2.2.8	Economic Development and Employment:	Encourages compact, transit-supportive forms of development on underutilized parcels in urban areas.	✓
3.5	Land Use Compatibility:	Permits sensitive land uses near stationary noise sources where mitigation is in place. Includes a 70-metre setback, study support, and design mitigations.	✓

Conformity with the Norfolk County Official Plan (NCOP)

The Class 4 designation is supported by the following sections:

Section	Policy	Comments	
Conformity with the Norfolk County Official Plan (NCOP)			
2.2	Goals and Objectives:	Encourages intensification, infrastructure efficiency, and compatibility.	✓
5.3	Housing and Intensification:	Meets intensification targets with high-density, compact urban housing on full services.	✓
5.4	Community Design:	Supports transition between residential and employment lands.	✓
6.4	Urban Areas:	Directs growth to Urban Areas; Class 4 facilitates mixed-use infill.	✓
6.5.4	Waterford Urban Area:	Designated for intensification; Class 4 supports compact form and adjacent land use integration.	✓
7.11	Commercial Designation:	Maintains commercial viability with ground-floor commercial and parking; allows residential.	✓
7.12	Protected Industrial Designation:	Supports compatibility through mitigation without affecting nearby industry.	✓

Summary of Benefits and Recommendation

The Class 4 Area designation under NPC-300 is a pragmatic land use compatibility tool that enables Norfolk County to:

- Facilitate housing intensification in a serviced Urban Area;
- Preserve the viability of nearby employment lands;
- Implement PPS 2024 and Official Plan objectives;
- Enable a mixed-use infill project without impacting existing industrial uses.

The project includes appropriate site-specific mitigation measures supported by a Land Use Compatibility Study (Sonair). Implementation Conditions (at Site Plan Stage) may include:

- Upgraded window and wall assemblies;
- Mechanical ventilation;
- Warning clauses in purchase agreements;
- Mitigation to meet NPC-300 indoor noise standards.

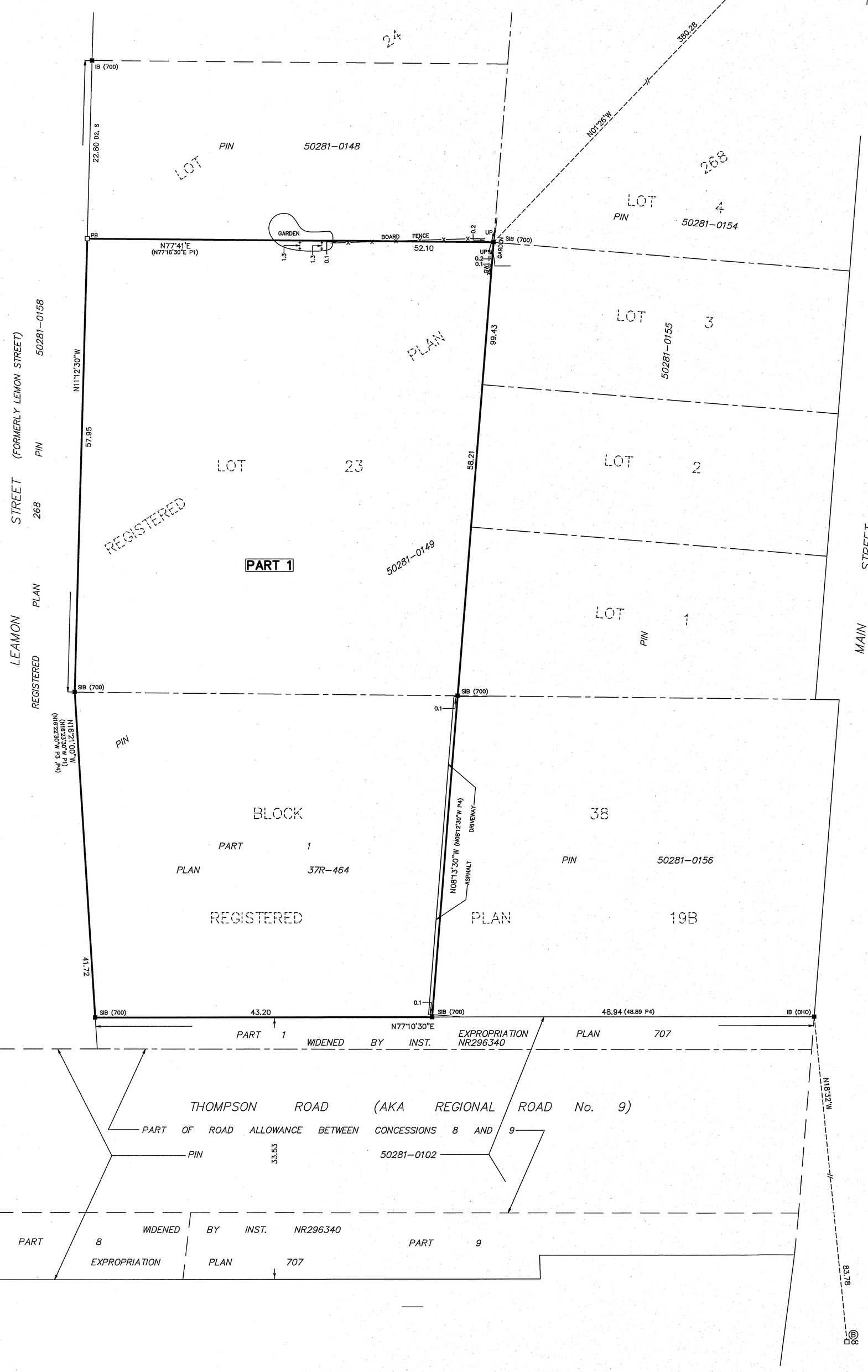
Recommendation

That Norfolk County Council approve the application of a Class 4 Area designation to the lands at 289 Leamon Street through the current Zoning By-law Amendment and Site Plan Control process. This designation reflects good planning practice and will facilitate compatible, intensification-based growth while protecting the integrity of nearby industrial lands.

METRIC
DISTANCES AND CO-ORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

SCHEDULE				
PART	LOT/ BLOCK	PLAN	PIN	AREA IN HECTARES
1	LOT 23	263	50281–0149	0.484
	PART OF BLOCK 38	19B		

PART 1 COMPRISES ALL OF PIN 50281–0149.



PLAN OF SURVEY OF
LOT 23
REGISTERED PLAN 298
AND
PART OF BLOCK 38
REGISTERED PLAN 19B
NORFOLK COUNTY

SCALE 1:300

0 10 20 30
METRES

THE INTENDED PLOT SIZE OF THIS PLAN IS 609mm IN WIDTH BY 457mm IN HEIGHT WHEN PLOTTED AT A SCALE OF 1:300

MacAULAY, WHITE & MUIR LTD.

LEGEND

SIB – STANDARD IRON BAR
SSIB – SHORT STANDARD IRON BAR
IB – IRON BAR
CC – CUT CROSS
PB – PLASTIC BAR
CP – CONCRETE PIN
□ – PLANTED
■ – FOUND
ø – ROUND
WIT – WITNESS
S – SET
UP – UTILITY POLE
GW – GUY WIRE
OU – ORIGIN UNKNOWN
700 – JEWITT AND DIXON LTD.
P1 – REGISTERED PLAN 268
P2 – REGISTERED PLAN 19B
P3 – EXPROPRIATION PLAN 707
P4 – PLAN 37R–464
D1 – PIN 50281–0156 (INST. 474455)
D2 – PIN 50281–0148 (INST. NR533797)

NOTE:

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS Ⓐ AND Ⓑ BY REAL TIME NETWORK OBSERVATION, UTM ZONE 17, NAD83 (CSRS) (2010).
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999608.
ALL DIMENSIONS ARE MEASURED UNLESS QUALIFIED.
ALL FENCES ARE "ON LINE" UNLESS TIES TO THE PROPERTY LINE ARE SHOWN.
ALL PINS ARE (LT) UNLESS NOTED (R).
FOR BEARING COMPARISONS, A ROTATION OF 0°43'30" COUNTER–CLOCKWISE WAS APPLIED TO BEARINGS ON PLAN P1 AND D1.
FOR BEARING COMPARISONS, A ROTATION OF 0°27'30" COUNTER–CLOCKWISE WAS APPLIED TO BEARINGS ON PLAN P3 AND P4.
ALL SET SSIB AND PB MONUMENTS WERE USED DUE TO LACK OF OVERBURDEN AND/OR PROXIMITY OF UNDERGROUND UTILITIES IN ACCORDANCE WITH SECTION 11 (4) OF O.REG. 525/91.

INTEGRATION DATA		
OBSERVED REFERENCE POINTS (ORP): UTM ZONE 17, NAD83 (CSRS) (2010) CO–ORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O. REG 216/10.		
POINT ID	NORTHING	EASTING
Ⓐ	4753237.57	558024.61
Ⓑ	4752690.73	558122.65
CO–ORDINATES CANNOT, IN THEMSELVES, BE USED TO RE–ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.		

THE RESULTANT TIE BETWEEN ORP Ⓐ AND ORP Ⓑ IS N10°10'W 555.81.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 25th DAY OF JUNE, 2025.

JUNE 26, 2025

JOHN W. MUIR
ONTARIO LAND SURVEYOR

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER V–

MacAulay, White & Muir Ltd.
ONTARIO LAND SURVEYORS – CANADA LANDS SURVEYORS
A Wholly Owned Subsidiary of J.D. Barnes Limited
440 HARDY ROAD, UNIT 2, BRANTFORD, ON N3T 5L8
T: (519) 752-0040 www.jdbarnes.com

DRAWN: LD
CHECKED: JW
Ref. No. 25–50–190–00

vallee

Consulting Engineers,
Architects & Planners

September 11, 2025

B&B Landco Inc.
245 King George Road, Suite 222
Brantford, Ontario
N3R 7N7

Attention: **Mr. Jesse Buchan**

Reference: **Stormwater Management Report**
Leamon Street Midrise
Waterford – Norfolk County
Our Project #25-120

Introduction

This Stormwater Management Report (SWM) has been prepared in support of the zoning amendment and site plan application for a five-storey midrise building located in Waterford, Norfolk County. This report outlines the overall stormwater management design for the proposed development. It is the intention to submit this report to Norfolk County for review and approval.

The 0.48 ha development site consists of two separate parcels located at 285 and 289 Leamon Street in Waterford, Norfolk County and is bound by Thompson Road to the south, Leamon Street to the west, existing residential dwelling to the north and Norfolk County Fire Station 3 and Kooi Trucking to the east. The site is currently occupied by several large commercial buildings. Refer to Figure 1.

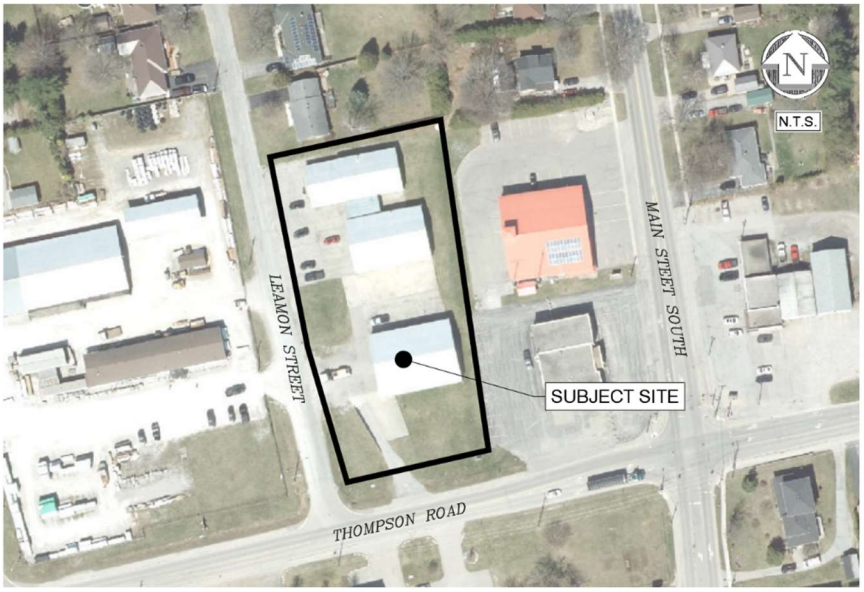


Figure 1 – Site Location

Stormwater Management Design Criteria

The Waterford South Municipal Drain (WSMD) system was constructed to provide a legal stormwater outlet for the southern portion of Waterford, Norfolk County. The system included three components, the Thompson Road storm sewer, a stormwater management facility, and the outlet which ultimately connects the system to the existing Waterford Ponds. Refer to the "*Revised Waterford South Municipal Drain Design Brief"* by G. Douglas Vallee Engineering Ltd, August 2024 in Appendix B for complete details.

The Thompson Road storm sewer was designed as a trunk sewer to collect stormwater from various future storm sewer connections and was designed to have hydraulic capacity to accept design flows from the 2-year storm event. Excess flows caused by larger storm events would continue to flow overland as they did prior to the construction of the sewer. The storm sewer was designed to begin at the intersection of Main Street and Thompson Road and flow west along Thompson Road for approximately 1045 metres before discharging into the proposed WSMD stormwater management facility. Along the length of the storm sewer, multiple storm sewer stubs were installed at intersection streets to allow for future connection to the WSMD outlet, including at the intersection of Leamon Street and Thompson Road.

The subject development site is located within the catchment areas contributing to the WSMD; therefore the design criteria for the proposed development are as follows:

- Quantity Control: Reduce or control the post-development peak flow rates from the development site to levels that do not exceed the 2-year pre-development flow rate (with pre-development drainage area characteristics as defined by the Revised Waterford South Municipal Drain Design Brief, dated August 20, 2024) for all storm events up to and including the 100-year storm event.
- Quality Control: Stormwater to be treated to an Enhanced Protection Level as defined in the Ministry of the Environment's Stormwater Management Practices Planning and Design Manual (March 2003).
-

A Visual Otthymo computer model has been used to simulate the subject development site drainage areas under pre-development conditions and post-development conditions. The simulations were conducted using the 4-hour Chicago Distribution design storm of the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year storm events, as outlined in the *Revised Waterford South Municipal Drain Design Brief* (August 2024*)*. The Norfolk County rainfall IDF curve data has been used for the storm analysis using the parameters in Table 1 below.

Table 1
Norfolk County Rainfall IDF Parameters

Event	A	B	C
2-year	529.711	4.501	0.745
5-year	583.017	3.007	0.703
10-year	670.324	3.007	0.698
25-year	721.533	2.253	0.679
50-year	766.038	1.898	0.668
100-year	801.041	1.501	0.657

Pre-Development

Under existing pre-development conditions, the subject development site is occupied by several large commercial buildings, a loading dock, and gravel, asphalt and concrete parking areas. The pre-development drainage areas are shown in Drawing PRE- Pre-Development Drainage Areas in Appendix A, and can generally be described as follows:

- Area PRE: Includes the complete 0.48 ha development site. Runoff from this area drains overland in a southwesterly direction towards Leamon Street and Thompson Road. Minor storm flows are collected by either the existing storm sewers along Leamon or the existing ditches and storm culverts along Thompson Road, both of which ultimately connect to the WSMD storm sewer along Thompson Road. Major storm flows are conveyed overland in a southwesterly direction towards Thompson Road.
- Area EXT: Approximately 0.38ha external area located northeast of the development site, which contains a portion of the rear yard of 277 Leamon Street, and a large portion of the Norfolk County Fire Station No. 3 parking lot and Kooi Trucking parking lot. Minor storm flows from the rear yard of 277 Leamon Street and the Kooi Trucking parking lot flow overland towards the development site, where they are collected by either the existing storm sewers along Leamon or the existing ditches and storm culverts along Thompson Road, both of which ultimately connect to the WSMD storm sewer along Thompson Road. Minor storm flows from the Norfolk County Fire Station No. 3 are collected by an existing catch basin located at the southwest corner of the fire station parking lot, which is assumed to be directly connected to the existing Leamon Street storm system. Major storm flows are conveyed overland in a southwesterly direction towards Thompson Road.

A Visual Otthymo computer model was used to simulate pre-development conditions for the above areas. The model uses a modified SCS procedure to estimate losses that occur naturally during a rainfall event such as evaporation and infiltration.

The pre-development drainage area parameters for the subject development site (Area PRE) were obtained from the *Revised Waterford South Municipal Drain Design Brief* (August 2024), and the pre-development drainage area parameters for the external catchment area (Area EXT) are based on existing site conditions. Soil parameters for both catchment areas were also obtained from the *Revised Waterford South Municipal Drain Design Brief* (August 2024). For Area EXT, the directly connected impervious area was assumed to include all impervious areas that are collected by the existing catch basin located at the southwest corner of the fire station parking lot, which is assumed to be directly connected to the existing Leamon Street storm system

Table 2 summarizes the pre-development catchment parameters with complete details included in Appendix C.

Table 2 Visual Otthymo Model Input – Pre-Development		
Parameter	**PRE**	**EXT**
Area	0.48 ha	0.38 ha
Hydrologic Soil Group	AB	
SCS Curve Number	Grass/Improved Land - 62	
Initial Abstraction	13.6 mm ($IA/S_{0.05}$ = 0.05, with $S_{0.05}$ = 1.33 * $S_{0.20}$^1.15 in inches and $S_{0.20}$ = 1000/CN-10 in inches)	
Impervious Percentage (%)	30%	68%
Directly Connected Impervious Percentage (%)	15%	45%

Table 3 summarizes the total peak pre-development runoff from Area PRE and Area EXT that is ultimately conveyed to the Waterford South Municipal Drain along Thompson Road, based on the pre-development drainage patterns identified above. Therefore, the total allowable release rate target for the post-development site is the 2-year pre-development peak flow rate of 0.049 m^3/s.

Table 3 Peak Pre-Development Runoff	
Event	**Pre-Dev Peak Flows (m^3/s)**
2-year	**0.049**
5-year	0.068
10-year	0.082
25-year	0.107
50-year	0.124
100-year	0.141

Post-Development

The overall stormwater management quantity control strategy from the proposed development is to reduce the total post-development peak flow rates from the site to less than or equal to the 2-year pre-development allowable release rate of 0.049 m^3/s. To meet this objective, runoff from the majority of the development site and the external catchment area will be detained in an underground storage facility at the south end of the site and released at a rate such that the peak flow allowance is not exceeded. No impermeable liner is proposed beneath the chamber system to promote groundwater infiltration. Minor and major storm events (2-year to 100-year storm) will be conveyed to the proposed SWM storage facility through a storm sewer network. Runoff released from the storage facility will be directed to the existing 825mm diameter municipal storm sewer along Leamon Street, which connects to the WSMD storm sewer along Thompson Road.

The post-development drainage areas are shown in Drawing POST- Post-Development Drainage Areas in Appendix A, and can generally be described as follows:

- Area POST 1: Approximately 0.44 ha of the development site. This area encompasses the majority of the proposed development. Minor and major storm flows from this area are conveyed to the proposed underground SWM chamber facility at the south side of the site via a proposed storm sewer network.
- Area POST 2: Approximately 0.04 ha of the development site. This area encompasses the frontage of the proposed development along Leamon Street and Thompson Road. Minor and major storm flows from this area will flow uncontrolled, overland towards Leamon Street and Thompson Road as they do under pre-development conditions.
- Area EXT: Approximately 0.38ha external area located northeast of the development site. This area remains unchanged from pre-development conditions. Minor and major storm flows from this area shall be collected and conveyed to the proposed underground SWM chamber facility at the south side of the site via the proposed storm sewer network within the development site.

Table 4 summarizes the post-development input parameters for the Visual OTTHYMO computer model with complete details included in Appendix C. The model uses a modified SCS procedure to estimate losses that occur naturally during a rainfall event such as evaporation and infiltration. Soil parameters for all post-development catchment areas were assumed to be the same as pre-development, which were obtained from the *Revised Waterford South Municipal Drain Design Brief* (August 2024). The directly connected impervious area was assumed to include all impervious surfaces that connect directly to storm sewer networks, such as rooftops, sidewalks, driveways, and parking areas.

Table 4
Visual Otthymo Model Input – Post-Development

Parameter	POST1	POST2	EXT
Area	0.44 ha	0.05 ha	0.38 ha
Hydrologic Soil Group	AB		
SCS Curve Number	Grass/Improved Land - 62		
Initial Abstraction	13.6 mm ($IA/S_{0.05}$ = 0.05, with $S_{0.05}$ = 1.33 * $S_{0.20}$^1.15 in inches and $S_{0.20}$ = 1000/CN-10 in inches)		
Impervious Percentage	90%	28%	68%
Directly Connected Impervious Percentage	90%	28%	45%

Stormwater Management Chamber Facility

An underground chamber system is proposed to provide stormwater storage for the subject site. To determine the storage volume required in the proposed system, the relationship between the storage volume and the discharge is defined by a rating curve. This rating curve is determined by calculating the expected discharge from the facility based on the water level in the system and the proposed outlet control configuration. Generally, orifices or weirs can control discharge from SWM facilities. Each of these control methods can be used by the singular control or they can be used in combination depending on the discharge characteristics desired. For this facility, a single orifice is proposed with the following equation used to estimate discharge.

Sharp-Crested Circular Orifice

$$Q = C * A * \sqrt{2 * g * h}$$

where: Q = Discharge in cms
C = constant, 0.63
A = orifice area in m^2
g = gravitational constant, 9.81 m/s^2
h = height above orifice, m

The proposed underground chamber system utilizes 30 StormTech MC-7200 chambers, with 6 end caps, a 305mm stone reservoir above the chambers, and a 300mm stone reservoir below, resulting in a total storage volume of 274m^3. Drawings and specifications for the proposed StormTech chamber facility are found in Appendix D. To control the release rate from the proposed facility, a 125mm orifice at an elevation of 240.00m, corresponding to the base of stone elevation beneath the chambers, will be installed in an outlet control structure. The complete discharge-to-storage rating curve is appended to this report as part of Appendix C.

No impermeable liner is proposed beneath the chamber system to promote groundwater infiltration and reduce the required chamber system storage volume. The depth of an infiltration basin is governed by the native soil infiltration rate, the porosity of the aggregate material used in the stone reservoir, and the targeted period to achieve complete drainage between storm events. As presented in the geotechnical investigation by GEMTEC Consulting Engineers and Scientists Limited, the infiltration rate of the native soil ranged between 30 and 300mm/hr. Conservatively taking the lower infiltration rate and applying a safety factor of 2.5, the design infiltration rate used in the Visual OTTHYMO model was taken as 12mm/hr. Therefore, the maximum recommended stone depth was determined to be 2.0, however, a 0.3m deep infiltration storage layer beneath the chamber system is proposed. Refer to the complete geotechnical investigation in Appendix F and design calculations in Appendix C.

Table 5 summarizes the peak post-development flow rates from the proposed SWM facility and the total peak post-development flow rates conveyed to the WSMD, and compares them to the allowable release rate target of 0.049 m^3/s. The utilized storage volumes in the StormTech chamber facility and corresponding ponding depths and drawdown times for each storm event are also presented in Table 5.

Table 5
Post-Development Flow Rates, Storage Volumes, Ponding Depths & Drawdown

Event	Allowable Release Rate (m^3/s)	Q (m^3/s)		Net Change	Utilized Storage Volume (m^3)	Ponding Elevation (m)
		From Chambers	Total			
2-year	0.049	0.026	0.028	-0.021	83	240.64
5-year		0.031	0.033	-0.016	123	240.88
10-year		0.034	0.036	-0.013	148	241.05
25-year		0.038	0.040	-0.009	186	241.29
50-year		0.041	0.044	-0.005	213	241.50
100-year		0.045	0.048	-0.001	245	241.79

As shown in Table 5, the total peak post-development flow rates conveyed to the WSMD are attenuated to less than or equal to the allowable release rate target of 0.049 m^3/s, for all storm events up to and including the 100-year event. Complete details of all SWM calculations and the results from the Visual OTTHYMO analysis are outlined in Appendix C and E, respectively.

Quality Control

Chamber Facility Quality Control

Stormwater from the proposed development site is conveyed to the existing WSMD storm sewer along Thompson Road, and ultimately the WSMD stormwater management facility. As described in the *Revised Waterford South Municipal Drain Design Brief* (August 2024), it was assumed that any future developments within the WSMD drainage areas would contain on-site water quality treatment measures. The WSMD stormwater management facility was designed to treat stormwater to an Enhanced Protection Level, corresponding to the long-term removal of 80% of total suspended solids per the Ministry of the Environment's *Stormwater Management Practices Planning and Design Manual* (March 2003), therefore, stormwater from the proposed development site shall also be treated to an Enhanced Protection Level.

Quality control will be provided by the StormTech Isolator PLUS Row, which is a row of standard StormTech chambers surrounded by filter fabric. The isolator row creates a detention basin that allows water to egress through the surrounding filter fabric while sediment is trapped within. In addition, a flared end ramp is attached to the inlet pipe inside of the chamber end cap to provide a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by distributing sediment and debris that would otherwise collect at the inlet.

Each MC-7200 isolator row chamber has an ETV-verified treated flow rate of 12.74L/s corresponding to greater than 81% TSS removal. The proposed chamber facility features 10 isolator row chambers, which allows for a total treated inlet flow rate of approximately 127 L/s. Using Visual OTTHYMO, the maximum flow rate entering the chambers during the 25mm storm event (quality control event) was determined to be 79 L/s. Consequently, it can be concluded that the proposed chamber facility provides sufficient capacity to provide an enhanced level of water quality protection, corresponding to 80% TSS removal. The StormTech Isolator Row Sizing Chart can be found in Appendix C.

Inspection and maintenance are fundamental to the long-term performance of any stormwater quality treatment device. StormTech recommends that the chamber system be inspected annually at a minimum, and every six months for the first year of operation to determine the sediment accumulation rate. In subsequent years inspections can be based on observations or local requirements. The unit should be inspected immediately after an oil, fuel or chemical spill, and a licensed waste management company should remove oil and sediment for proper disposal.

Minimum Orifice Size

A minimum orifice of 75mm is recommended per the MOE guidelines. For this facility, a 125mm orifice is proposed.

Erosion and Sediment Control
During construction, the contractor is required to protect the worksite and all adjacent lands from sediment and erosion regardless of the source, to the satisfaction of all applicable parties. The measures installed by the contractor are to remain in place until such time as there is no further threat of damage and all vegetation is established. Measures that are to be put into place as an absolute minimum include silt fences, mud mats, and filter cloths over catch basins onsite.

Proposed SWM Facility Summary

The following summarizes the proposed SWM Facility for the proposed development:

- Storm sewers will convey stormwater from Area POST 1 and Area EXT to the proposed underground SWM chamber facility located at the south side of the development.
- Runoff released from the SWM facility will be released to the existing 825mm storm sewer along Leamon Street, which connects to the existing WSMD storm sewer along Thompson Road.
- Runoff from area POST 2 will flow uncontrolled, overland to Leamon Street and Thompson Road, where it is collected and conveyed to the WSDM storm sewer along Thompson Road.
- The underground storage chamber facility uses 30 StormTech MC-7200 chambers and has a total storage volume of 274 m^3.
- The required storage volume in the chamber facility ranges between 83 m^3 to 245 m^3 for the 2-year and 100-year storm events, respectively.
- Discharge from the chamber facility is controlled by a 125mm diameter orifice at 240.00m.
- During events greater than the 100-year storm, runoff from the site will surcharge the SWM facility, and flow overland towards Leamon Street and Thompson Road as it does under pre-development conditions.
- The proposed StormTech Isolator PLUS Row shall be utilized to achieve an enhanced level of water quality protection, corresponding to 80% TSS removal.

Water Balance

A water balance is used to describe the hydrological cycle and provides an accounting of water across the system's boundaries over a specified time period. A continuous Visual OTTHYMO simulation was used to model the pre-development and post-development water balance for the subject site over a ten-year period. Historical climate data from the Brantford Airport station for the years 2015-2024 was obtained from the Government of Canada. This data includes daily precipitation (rainfall and/or snowfall) and daily minimum and maximum temperatures.

Table 6 presents the total average annual volume of precipitation (rainfall and/or snowfall), evapotranspiration, infiltration and runoff from the pre-development and post-development catchment areas. Note that for the purposes of the water balance analysis, the pre-development drainage areas parameters were based on existing site conditions as shown in Appendix C. To increase the volume of post-development infiltration, the proposed SWM chamber facility will not have an impermeable liner. Consequently, there is a 440% increase in infiltration, and 70% reduction in runoff from the pre-development to post-development condition.

Table 6 Average Annual Water Balance Volumes (without LID)			
Hydrologic Cycle Component	**Pre-Development (m^3)**	**Post-Development (m^3)**	**Δ Volume (%)**
Precipitation	3218	3164	-2%
Evapotranspiration	850	494	-42%
Infiltration	409	2209	440%
Runoff	1915	576	-70%

Conclusions and Recommendations

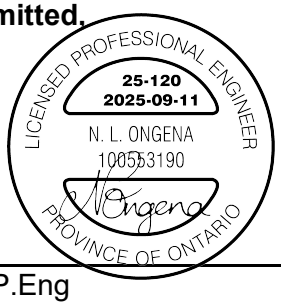
Based on the review presented by this Stormwater Management Report, it is concluded that:

- The total peak post-development flows from the development site have been controlled to less than the 2-year pre-development flow rate (with pre-development drainage area characteristics as defined by the *Revised Waterford South Municipal Drain Design Brief*, dated August 20, 2024) for all storm events up to and including the 100-year storm event.
- The proposed SWM design meets the design guidelines outlined by the MOE's Stormwater Management Practices Planning and Design Manual (March 2003) for an enhanced level of water quality protection.

It is recommended that this report be provided to Norfolk County in support of the zoning amendment and site plan application for the proposed development.

We trust that this information is complete and sufficient for submission. Should you have any questions or require further information please do not hesitate to contact us.

Respectfully submitted,



Natalie Ongena, P.Eng
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects and Planners

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List of Appendices

Appendix A
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Appendix C
– Soil and Pre-Development Parameters
– Post-Development Parameters
– Rating Curve
– Pre to Post Flows & Storage Volumes
– Quality Control
– Water Balance
– Chamber Stage Storage

Appendix D
– ADS StormTech Chamber Drawings & Specifications

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– Visual OTTHYMO Summary Outputs

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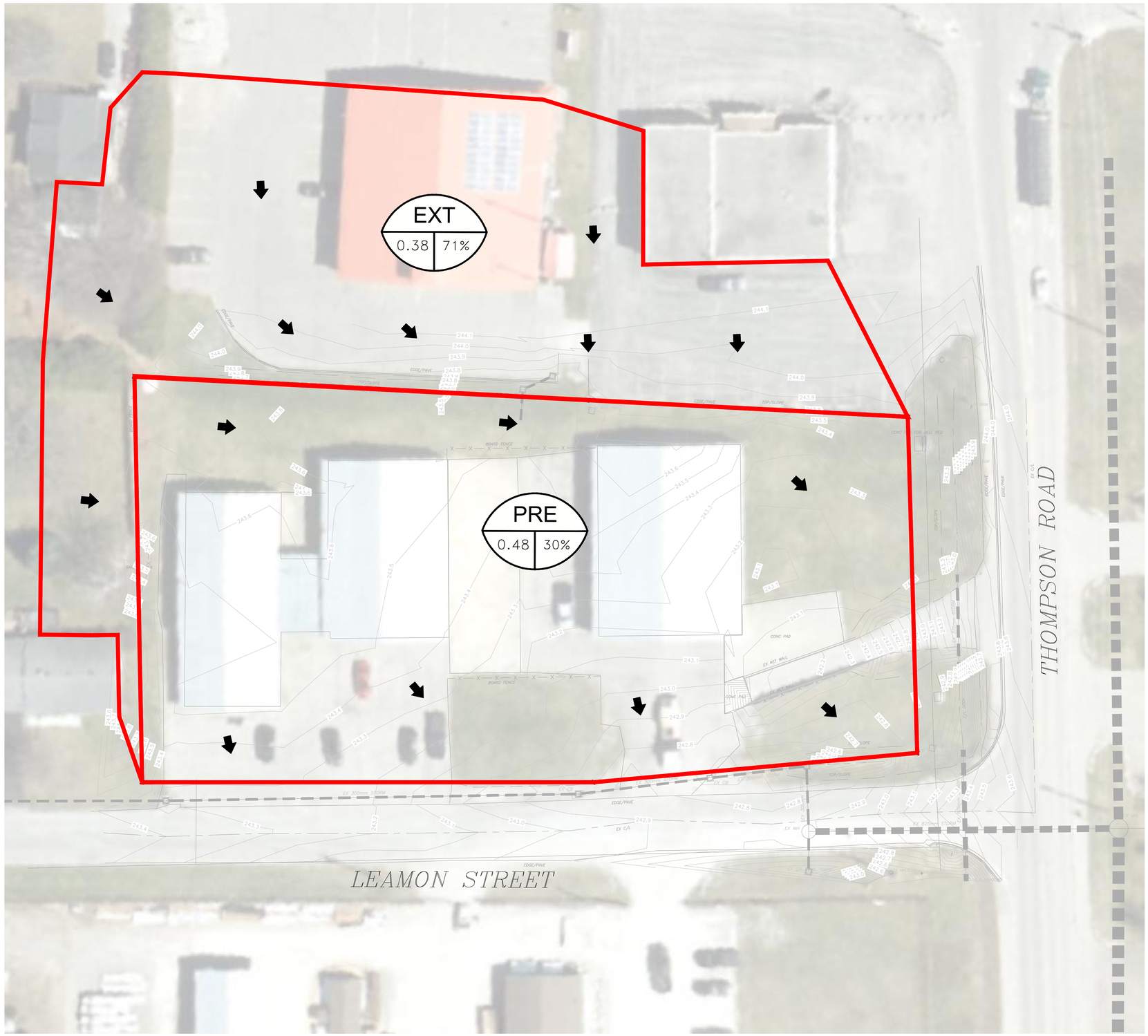
– Geotechnical Investigation *(GEMTEC Consulting Engineers and Scientists Limited, September 4, 2025)*

APPENDIX A

DWG PRE – Pre-Development Drainage Areas
DWG POST – Post-Development Drainage Areas



N

LEGEND

- OVERLAND FLOW (MAJOR)
- CATCHMENT BOUNDARY
- SWM — SWM DRAINAGE AREA
- 0.99 | 35.0% — TOTAL IMPERVIOUS PERCENTAGE (%)
- AREA (ha)

REV. No.	DATE	REVISION
0	MM/DD/YY	ISSUED FOR COUNTY REVIEW

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

SURVEY INFORMATION:
LEGAL SURVEY COMPLETED BY MACAULAY, WHITE & MUIR LTD. DATED 06/26/25, PART1 – PLAN OF SURVEY OF LOT 23 REGISTERED PLAN 298 PART OF BLOCK 38 REGISTERED PLAN 198

TOPOGRAPHIC SURVEY COMPLETED BY G. DOUGLAS. VALLEE DATED 05/30/2025 BASED ON THE FOLLOWING:

VERTICAL DATUM: 1928:1978 ADJUSTMENT (CGVD28: 78)

COORDINATE SYSTEM: WORLDWIDE UTM ZONE 17N, NAD83, GLOBAL REFERENCE EPOCH 2010, GEOID MODEL HTV2.0(2010)

SITE BENCHMARKS:

BM1: ELEV: 243.73m
SOUTHWEST CORNER OF CONCRETE PAD LOCATED ON THOMPSON ROAD BETWEEN 289 LEAMON ST AND 308 MAIN ST S

BM2:ELEV: 243.45
TOP OF LARGE PUMPER NOZZLE OF FIRE HYDRANT LOCATED ON LEAMON ST APPROXIMATELY 22M NORTH OF THOMPSON ROAD

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

SCALE:
5 15 25
HORIZONTAL : 1 : 500

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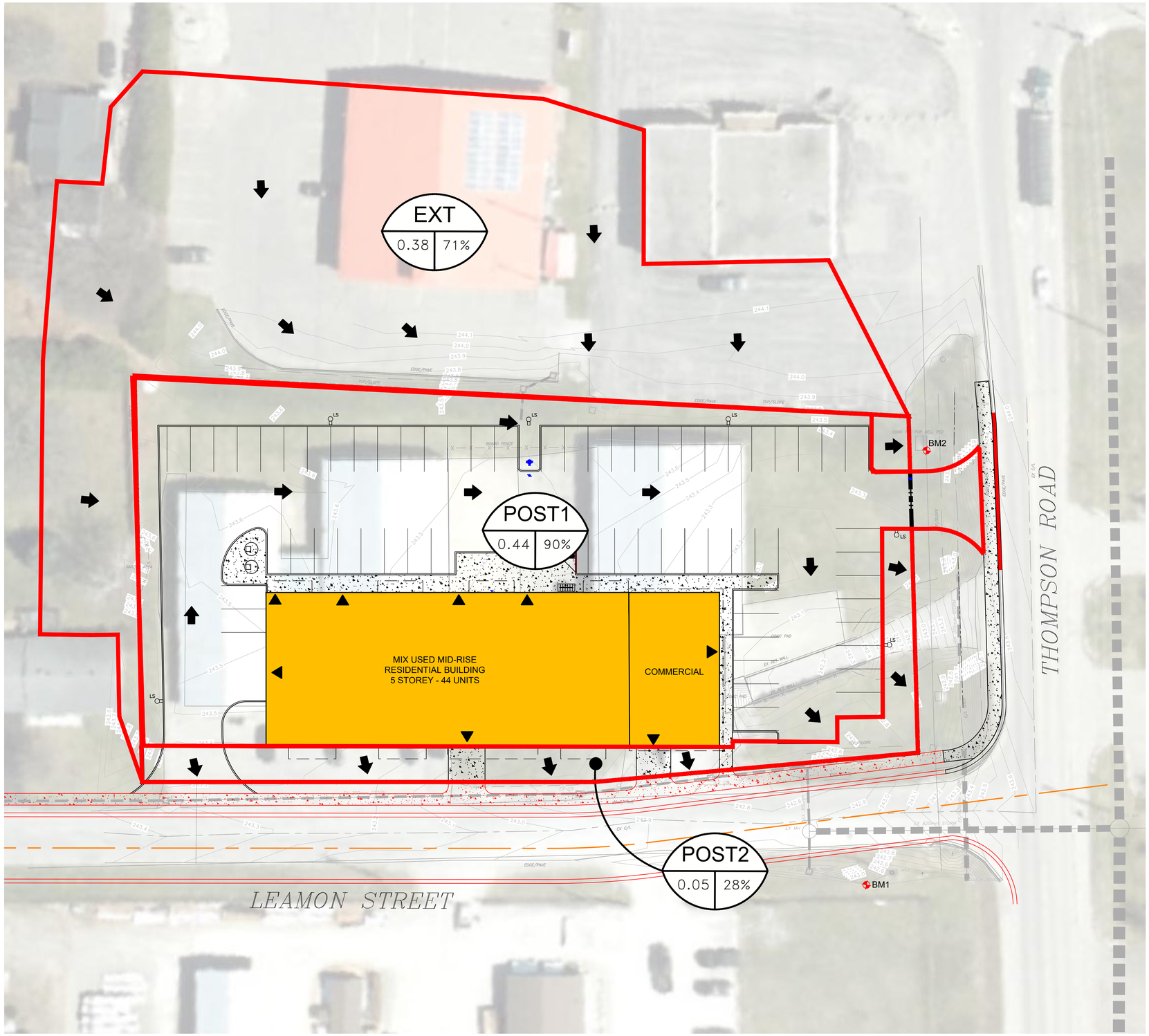
Stamp

Project Title
BUCHAN MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
PRE-DEVELOPMENT DRAINAGE AREAS

Designed by : NLO	Drawn By : NLO/NBN
Checked by : NLO/JTI	Date Started : July 3, 2025
Drawing Scale : AS NOTED	Drawing No. PRE
Project No. 25-120	



N

LEGEND

- OVERLAND FLOW (MAJOR)
- CATCHMENT BOUNDARY
- SWM — SWM DRAINAGE AREA
  - 0.99 | 35.0% — TOTAL IMPERVIOUS PERCENTAGE (%)
  - AREA (ha)

REV. No.	DATE	REVISION
0	07/15/2025	ISSUED FOR ZONING AMENDMENT

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.

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Stamp

Project Title
LEAMON STREET MIDRISE
289 LEAMON ST
WATERFORD
NORFOLK COUNTY

Drawing Title
POST-DEVELOPMENT DRAINAGE AREAS

Designed by : NLO	Drawn By : NLO/NBN
Checked by : NLO/JTI	Date Started : June 24, 2025
Drawing Scale : AS NOTED	Drawing No. POST
Project No. 25-120	

APPENDIX B

Revised Waterford South Municipal Drain Design Brief

(G. Douglas Vallee, August 20, 2024)

vallee

Consulting Engineers,
Architects & Planners

Rev 0 – May 24, 2022
Rev 1 – December 12, 2023
Rev 2 – August 20, 2024

Revised Waterford South Municipal Drain Design Brief

Waterford – Norfolk County

Introduction

This report has been prepared as a revision to the original "*Waterford South Municipal Drain Design Brief",* dated August 14, 1996, which outlines the design of the Waterford South Municipal Drain (WSMD) in Waterford, Norfolk County.

Since the completion of the original WSMD Design Brief, various road reconstruction projects have occurred, and multiple residential areas have been developed within the limits of WSMD drainage areas. In addition, two proposed residential developments (the Thompson Subdivision and the Charles Street Subdivision) require a legal stormwater outlet. This design brief will present a revised WSMD design, which includes updating the original drainage areas to reflect current conditions and adding the proposed residential developments to the WSMD system.

The intention is to submit this updated design brief to Norfolk County and the Long Point Region Conservation Authority (LPRCA) for review and approval of the revised design conditions and proposed functional storm servicing for the prospective residential developments. It is not intended to outline a detailed design for the proposed residential developments, but rather to confirm that each proposed site can be serviced with respect to stormwater management (SWM).

Background

The Waterford South Municipal Drain system was constructed to provide a legal stormwater outlet for the southern portion of Waterford, Norfolk County. The system included three components, the Thompson Road storm sewer, a stormwater management facility, and the outlet which ultimately connects the system to the existing Waterford Ponds. Refer to the "*Waterford South Municipal Drain Design Brief*" dated August 14th 1996 in Appendix A for complete details of the original WSMD design.

The Thompson Road storm sewer was designed as a trunk sewer to collect stormwater from various future storm sewer connections and was designed to have hydraulic capacity to accept design flows from the 2-year storm event. Excess flows caused by larger storm events would continue to flow overland as they did prior to the construction of the sewer. The storm sewer was designed to begin at the intersection of Main Street and Thompson Road and flow west along Thompson Road for approximately 1045 metres before discharging into the proposed WSMD stormwater management facility. Along the length of the storm sewer, multiple storm sewer stubs were installed at intersection streets to allow for future connection to the WSMD outlet.

The WSMD stormwater management facility was designed to reduce the peak flows entering the Waterford Ponds during the 2-year and 5-year storm event. In addition, the SWM facility provides water quality treatment of stormwater to prevent excess sediment and pollutants from entering the receiving watercourse and Waterford Ponds.

Original Drainage Areas

Per the original WSMD design, three drainage areas were considered in the design of the Thompson Road storm sewer and WSMD SWM facility, which included an existing residential area, a rural area allocated for future residential development, and an existing commercial area. Refer to the drainage area figure in the original "*Waterford South Municipal Drain Design Brief*" dated August 14th 1996 in Appendix A.

Using OTTHYMO'89 modeling software, stormwater flow rates from each of the three drainage areas, and the total peak flow to the storm sewer were determined. The design storm utilized in the original "*Waterford South Municipal Drain Design Brief*" dated August 14th, 1996, was a 2-year, 4-hour Chicago Distribution design storm. Table 1 summarizes the input parameters and the modeled 2-year peak flow associated with each drainage area.

Table 1
Input Parameters and Modelled Peak Flows

Parameter	Area 1: Existing Residential	Area 2: Future Residential	Area 3: Existing Commercial
Area	48 ha	24 ha	19 ha
Total Impervious	30%	30%	80%
Directly Connected Impervious	15%	15%	50%
Curve Number, CN	50	50	50
Initial Abstraction	1.5mm	1.5mm	1.5mm
2-Year Peak Flow	1.31 m^3/s	Uncontrolled = 0.70 m^3/s Controlled rate = 0.05 m^3/s	1.94 m^3/s

Area 2 was modeled as a future residential development, therefore, to reduce flows to the Thompson Road storm sewer, it was assumed that this future residential area would feature an on-site detention pond, which would regulate the release rate to a maximum of 0.05 m^3/s during the 2-year storm event.

The modeled summation of each of the drainage areas resulted in a peak flow of 3.25 m^3/s to the Thompson Road storm sewer during the 2-year storm event. Note that the total is not an algebraic sum due to the time lags and differences in the individual hydrograph peak times. Refer to the "*Waterford South Municipal Drain Design Brief*" dated August 14th, 1996, in Appendix A for complete details of the original WSMD design.

Revised Drainage Areas

Since the construction of the Thompson Road storm sewer, various road reconstruction projects have occurred within the limits of the original drainage areas. As part of these reconstruction projects, the storm sewer system has been extended eastward along Thompson Road and several of the intersecting streets, connecting the existing residential and commercial areas to the WSMD storm system. In addition, Area 2 has been developed into several residential subdivisions and features two stormwater management facilities. Consequently, the drainage areas utilized in the original WSMD design can be revised to reflect the current development conditions and actual stormwater management controls.

In addition, it should be noted that the original WSMD design utilized a very conservative initial abstraction (IA) value to model each of the drainage areas. Initial Abstraction is a measure of rainfall that is lost to interception, infiltration and surface storage. For the original model, the IA was set at an assumed value of 1.5mm. Since the completion of the initial WSMD design brief, a more refined approach to estimating initial abstraction has been adopted. This approach considers the selected curve number, which is based on soil type. The calculation for initial abstraction is as follows:

- Potential Maximum Soil Moisture Retention 20%, $S_{0.20} = 1000/CN – 10.0$ (in inches)
- Potential Maximum Soil Moisture Retention 5%, $S_{0.05} = 1.33 * S_{0.20}^{1.15}$ (in inches)
- Initial Abstraction IA = $(0.05 * S_{0.05}) * 25.4$mm/in

Therefore, low curve numbers associated with soil with good infiltration characteristics will have a higher initial abstraction than high curve numbers for soils with poor characteristics. The initial abstraction of 1.5mm used in the original WSMD design corresponds to a curve number of 91. A curve number of this magnitude is reflective of soils with poor to limited infiltration characteristics, which is not the case for the sandy soil with good infiltration characteristics that is native to Waterford. Therefore, the initial abstraction values used in the original WSMD should be revised to better reflect the actual soil conditions of the pervious areas with the WSMD drainage areas.

Using a Visual OTTHYMO computer model, the original WSMD drainage model was re-created, and revised to reflect the following changes. Refer to the “Revised WSMD Drainage Area Parameters” found in Appendix B and FIG1 – Revised WSMD Drainage Areas in Appendix C for complete details. The revisions to the original drainage areas can be summarized as follows:

Area 1: Existing Residential

- Area 1 is predominately occupied by single-family residential lots, with interspaced areas of vacant land and some commercial and institutional uses.
- Several road reconstruction projects within the Area 1 catchment area have resulted in a portion of the original drainage area being diverted northwards rather than south as originally designed. These road reconstruction projects include:
    - Washington Street Reconstruction
    - St. James Street Reconstruction
    - Main Street Reconstruction
    - Wellington Street Reconstruction
    - Brown Street Reconstruction

- Leamon Street from Church Street West to Green Street has not been reconstructed and will remain as part of Area 1 to allow for future storm sewers to be connected to the WSMD drainage system (scheduled for 2025 reconstruction).
- Washington Street from Green Street to Thompson Road has not been reconstructed but will be connected to the Thompson Road storm sewer in the future.
- Charles Street will be reconstructed as part of the Charles Street Subdivision and therefore has been added to the drainage area.
- The original area of Area 1 was taken as 48 hectares and has been revised to 39.4 hectares as a result of the above modifications.
- The total and directly connected impervious percentages remain unchanged.
- The curve number and initial abstraction value have been updated to reflect the actual soil characteristics of the pervious portion of the drainage area.

Table 2
Area 1 Revisions

	Original Design	Revised Design
Area	48.0 ha	39.4 ha
Total Impervious	30%	30%
Directly Connected Impervious	15%	15%
Curve Number, CN	50	62
Initial Abstraction	1.5 mm	13.6 mm

Area 2: Future Residential – Revised to Existing & Future Area 2A, 2B, 2C and 2D

- In the original WSMD design, Area 2 was designed as a future residential area with an assumed impervious and directly connected impervious percentage. It was also assumed that an on-site SWM facility would be constructed to reduce peak flows to the Thompson Road storm sewer.
- Under current conditions, Area 2 can be separated into four separate drainage areas:
    - Area 2A includes the Yin's Subdivision – Phase 2 and the Woodrow Estates Subdivision, and features an existing SWM facility.
    - Area 2B includes the Yin's Subdivision – Phase 5 and Yin's Subdivision – Phase 6, and features an existing SWM facility.
    - Six hectares of the Yin's Subdivision – Phase 5 and Yin's Subdivision – Phase 6 were included in the original Area 2 drainage area, and an additional 8.22 hectares were added.
    - Area 2C and 2D are not currently developed but were anticipated to be developed, and therefore, were each allocated a peak flow allowance as part of the "*Yin's Subdivision – Phase 5 Stormwater Management Report*" dated December 10, 2010 (Appendix E).
- The total and directly connected impervious percentages were updated to reflect the actual developed conditions.
- The curve numbers and initial abstraction values have also been updated to reflect the actual soil characteristics of the pervious portion of the drainage area.
- Refer to the "*Yin's Subdivision – Phase 2 Stormwater Management Design Brief*" dated April 2, 2002 and the "*Yin's Subdivision – Phase 5 Stormwater Management Report*" dated December 10, 2010 in Appendix D and E respectively, for complete details of each SWM design.

Table 3 Area 2 Revisions					
	Original Design	**Revised Design Area 2A**	**Revised Design Area 2B**	**Revised Design Area 2C**	**Revised Design Area 2D**
Area	24 ha	16.90 ha	11.82 ha	0.80 ha	1.40 ha
Total Impervious	30%	38%	47%	90%	90%
Directly Connected Impervious	15%	16%	22%	45%	45%
Curve Number, CN	50	58	58	58	58
Initial Abstraction	1.5 mm	16.5 mm	16.5 mm	16.5 mm	16.5 mm

Area 3: Existing Commercial

- Area 3 remains largely unchanged from the original WSMD design.
- Some sections of this area are commercially developed areas that are virtually 100% impervious, while other areas are vacant and naturally vegetated or agricultural land.
- Although much of Area 3 is undeveloped area, as a conservative approach, it is assumed that it may become fully commercially developed area in the future.
- The original area of Area 3 was taken as 19.0 hectares and has been revised to 19.2 hectares to account for the portion of Lam Boulevard that was left as an uncontrolled area.
- The total and directly connected impervious percentages, and curve number remain unchanged.
- The curve number and initial abstraction value have also been updated to reflect the actual soil characteristics of the pervious portion of the drainage area.

Table 4 Area 3 Revisions		
	Original Design	**Revised Design**
Area	19.0 ha	19.2 ha
Total Impervious	80%	80%
Directly Connected Impervious	50%	50%
Curve Number, CN	50	58
Initial Abstraction	1.5 mm	16.5 mm

Total Design Flow Under Current Conditions

Based on the aforementioned revisions to the WSMD drainage areas, a Visual OTTHYMO computer model was created to determine the resulting peak flow to the Thompson Road storm sewer. In addition to the revisions to the drainage areas, the storm events used to analyze the system have been updated to the current Norfolk County intensity-duration-frequency (IDF) curve data. The system was analyzed using the 4-hour Chicago Distribution design storm of the 2-year, 5-year, and 100-year storm events. The Norfolk County rainfall IDF parameters used for the analysis are presented in Table 1 below.

Table 1
Norfolk County Rainfall IDF Parameters

Event	A	B	C
2-year	529.711	4.501	0.745
5-year	583.017	3.007	0.703
100-year	801.041	1.501	0.657

The 100-year storm event was used to analyze the drainage systems, however, flows from the revised Area 1 and Area 3 are restricted to the 2-year event flow due to the capacity of the existing storm sewers connecting to the main Thompson Road trunk sewer. Flows during the 100-year event from Area 2A and Area 2B are controlled by each respective on-site stormwater management facility, prior to being released to the storm sewer system. Lastly, the 100-year peak flow from Area 2C and 2D have been limited to the allocated peak flow allowance of 0.015 m^3/s, as per the "*Yin's Subdivision – Phase 5 Stormwater Management Report*" dated December 10, 2010 (Appendix E).

In summary, under existing current conditions, the revised peak flow to the Thompson Road Storm sewer was determined to be 2.96 m^3/s, compared to 3.25 m^3/s as determined in the original WSMD design. Refer to Table 5. Note that the total is not an algebraic sum due to the time lags and differences in the individual hydrograph peak times. Refer to Appendix F for complete details of the revised Visual OTTHYMO model, and corresponding output file.

Table 5
Total Design Flow Under Current Conditions

	Original Design	Revised Design (Current Conditions)
Area 1	1.31 m^3/s	0.93 m^3/s
Area 2 (Split into Area 2A, 2B, 2C and 2D)	0.05 m^3/s	2A: 0.28 m^3/s
		2B: 0.029 m^3/s
		2C: 0.015 m^3/s
		2D: 0.015 m^3/s
Area 3	1.94 m^3/s	1.71 m^3/s
Total Peak Flow	3.25 m^3/s	2.96 m^3/s
Overall Time to Peak	1.53 hours	1.63 hours

Proposed Drainage Areas

G. Douglas Vallee has been retained to determine the technical feasibility of two proposed residential developments at the west edge of Waterford. As part of that process, it must be shown that each development can be functionally serviced in regard to stormwater management. It is proposed that each development will utilize the Thompson Road storm sewer as a legal stormwater outlet. Consequently, the proposed developments have been added to the revised WSMD Visual OTTHYMO model to confirm capacity within the Thompson Road storm sewer. The proposed developments include the Thompson Road Subdivision, located on the southwest corner of Thompson Road and Blueline Road, and the Charles Street Subdivision, located on the northwest corner of Charles Street and Washington Street.

Both the Thompson Road Subdivision and the Charles Street Subdivision are outside of the original WSMD drainage areas. Therefore, the 2-year pre-development peak flow rate from each site has been utilized as a stormwater quantity control target for the Thompson and Charles developments. Table 6 presents the pre-development drainage area parameters and peak flow allowance associated with each proposed development. Refer to Appendix B and FIG1 – Revised WSMD Drainage in Appendix C for complete details of the proposed drainage areas and the parameters utilized to calculate the 2-year pre-development flow rates from the Thomson Road and Charles Street sites.

Table 6
Proposed Pre-Development Drainage Areas

	Thompson Area 4	Charles Area 5
Area	7.85 ha	4.35 ha
Curve Number, CN	72	62
Initial Abstraction	8.1 mm	13.6 mm
Longest Flow Path	140 m	230 m
Average Slope	0.43 %	2.17 %
Runoff Coefficient	0.20	0.31
Time to Peak	0.46 hr	0.30 hr
2-Year Peak Flow Allowance	0.068 m^3/s	0.017 m^3/s

Refer to Appendix F for the revised Visual OTTHYMO model, and corresponding output file. To meet the proposed flow allowance for each prospective site, it is assumed that each development will feature an on-site stormwater management facility to control peak flows from up to and including the 100-year storm event to equal to or less than peak flow allowance.

Table 7 presents the total peak flow to the Thompson Road storm sewer prior to and after the addition of the proposed drainage areas to the WSMD system based on the revised drainage areas. In summary, the maximum peak flow to the Thomson Road storm sewer after the construction of the two proposed developments is 3.05 m^3/s.

Table 7
Total Peak Flow to the Thompson Road Storm Sewer

	Current Conditions	Proposed Conditions
Total Peak Flow	2.96 m^3/s	3.05 m^3/s

Thompson Road Storm Sewer Capacity

The lower runs of the Thompson Road storm sewer have a diameter of 1500mm and the lowest sloped run has a slope of 0.22%, which results in a full flow capacity of 3.31 m^3/s. As presented in the "*Yin's Subdivision – Phase 2 Stormwater Management Design Brief*" dated April 2, 2002 (Appendix D), the actual maximum capacity of a circular pipe is when the pipe is flowing at 94% full. As per the 2019 Norfolk County's Design Criteria, a design flow of a storm sewer shall not exceed 95% capacity. Considering this, the actual maximum capacity of the Thompson Road storm sewer at 95% capacity is 3.56 m^3/s, which is greater than the peak flow of 3.05 m^3/s experienced under the proposed development conditions.

Therefore, it can be concluded that the existing Thompson Road storm sewer provides adequate capacity to accommodate the additional flow from all four proposed developments. The maximum capacity flow calculations are presented in Appendix B.

WSMD Stormwater Management Facility

The Thompson Road storm sewer ultimately discharges to the WSMD stormwater management facility, located on the south side of Thompson Road, west of the Waterford Heritage Trail, as shown in FIG1 – Revised WSMD Drainage in Appendix C. The WSMD stormwater management facility was designed to reduce the peak flows entering the Waterford Ponds during the 2-year and 5-year storm event and provide water quality treatment to prevent excess sediment and pollutants from entering the receiving watercourse and Waterford Ponds.

Quantity Control

To confirm that the WSMD stormwater management facility has adequate capacity to support the additional proposed developments, the revised drainage areas and proposed drainage areas were routed through the existing WSMD stormwater management facility using the revised Visual OTTHYMO model. The rating curve for the WSMD SWM facility was obtained from the original WSMD Design Brief as shown in Appendix A. Table 8 presents the peak outflow from the pond, the required active storage during the 2-year and 5-year storm event, and the corresponding available freeboard depth, for the original WSMD design and the proposed design, which includes the revised drainage areas and proposed drainage areas. Refer to complete details on the Visual OTTHYMO model in Appendix F.

Table 8
Peak Outflow & Required Storage

Storm Event	Original Design			Proposed Design (Current + Proposed Conditions)		
	Peak Outflow	Required Active Storage	Available Freeboard	Peak Outflow	Required Active Storage	Available Freeboard
2-Year	0.24 m^3/s	0.80 ha.m	1.02 m	0.23 m^3/s	0.76 ha.m	1.06 m
5-Year	0.31 m^3/s	1.08 ha.m	0.76 m	0.34 m^3/s	1.20 ha.m	0.66 m

As presented in Table 8, the WSMD SWM Facility provides 1.06m and 0.66m of freeboard depth during the 2 and 5-year storm events, respectively, under the proposed design conditions. Consequently, it can be concluded that the WSMD SWM facility provides adequate capacity to support the additional proposed developments with only a small increase to the flow to the receiving watercourse during the 5-year storm event.

Quality Control

The WSMD stormwater management facility was designed as a wet pond with an enhanced water quality protection level, corresponding to the long-term removal of 80% of total suspended solids (TSS). The required permanent pool volume was determined to be 0.84 ha.m for the original WSMD design. Note that Area 2 was not included as part of this calculation as it was assumed that the future subdivision would contain a detention pond to address water quality on-site. The original permanent pool calculations are presented in the original "*Waterford South Municipal Drain Design Brief*" dated August 14, 1996.

Due to the revisions to Area 1 and Area 3, it is necessary to confirm that the permanent pool provided satisfies the revised design condition. Note that Area 2A, Area 2B and the proposed development drainage areas do not require stormwater quality control as each area will feature its own on-site detention facility and quality control. The revised permanent pool calculations are presented below:

39.4 ha @ 30% impervious (Area 1)
19.2 ha @ 80% impervious (Area 3)
58.6 ha @ 46% impervious total

From Table 3.2 (MOE, 2003)	35% Impervious Requires 140 m3/ha Storage
	55% Impervious Requires 190 m3/ha Storage
By Interpolation:	**46% Impervious Requires 168 m3/ha Storage**
Total Storage	168 m^3/ha
Less Detention Storage:	40 m^3/ha
Permanent Pool Volume:	**128 m^3/ha**

Permanent Pool Volume = 59.2 ha x 128 m^3/ha = 7578 m^3 = **0.76 ha.m**

Under the revised condition the required permanent pool volume is 0.76 ha.m, which is less than the permanent pool volume of 0.84 ha.m provided as part of the original WSMD design. Therefore, the existing WSMD SWM facility provides adequate water quality treatment to support the revised design condition.

Conclusions

Based on the review presented by this design brief, the revised WSMD design can be summarized as follows:

- The drainage areas utilized in the original WSMD design have been revised to reflect the current development conditions and stormwater management controls.
- The curve number and associated initial abstraction values used in the original WSMD have been revised to better reflect the actual soil conditions of the pervious areas with the WSMD drainage areas.
- Based on the revisions to the currently developed drainage areas, the revised total peak flow to the Thompson Road storm sewer was determined to be 2.96 m^3/s.
- Development of the two proposed residential areas results in a total peak flow of 3.05 m^3/s to the Thompson Road storm sewer.
- The 95% capacity of the lowest sloped run of the Thompson Road storm sewer was determined to be 3.56 m^3/s, confirming that the existing Thompson Road storm sewer provides adequate capacity to accommodate the additional flow from all four proposed developments.
- The existing WSMD stormwater management facility provides adequate stormwater quantity and quality control during the 2-year and 5-year storm events under the proposed design condition, ensuring no adverse impacts to the receiving watercourse downstream of the WSMD SWM facility.

It is recommended that this report be provided to the Norfolk County and the Long Point Region Conservation Authority for review and approval of the updated WSMD design conditions and the proposed functional storm servicing for the prospective residential developments.

We trust that this information is complete and sufficient for submission. Should you have any questions or require further information please do not hesitate to contact us.

Respectfully submitted,

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Appendix A
– *Waterford South Municipal Drain Design Brief (August 14, 1996)*

Appendix B
– Revised WSMD Drainage Area Parameters
– Thompson Road Storm Sewer Capacity Calculations
– WSMD Detention Pond Rating Curve

Appendix C
– FIG 1 – Revised WSMD Drainage Areas

Appendix D
– *Yin's Subdivision – Phase 2 Stormwater Management Design Brief (April 2, 2002)*

Appendix E
– *Yin's Subdivision – Phase 5 Stormwater Management Report (December 10, 2010)*

Appendix F
– Revised WSMD Visual OTTHYMO Model Output File

Appendix G
– Road Reconstruction Record Drawings

APPENDIX A

Waterford South Municipal Drain Design Brief (August 14, 1996)

DESIGN BRIEF

WATERFORD SOUTH MUNICIPAL DRAIN

Waterford, City of Nanticoke
Regional Municipality of Haldimand-Norfolk

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Project 94-021
August 14, 1996

DESIGN BRIEF
WATERFORD SOUTH MUNICIPAL DRAIN

August 14, 1996
Project 94-021

A. Background

The Waterford South Municipal Drain is proceeding under the authority of the Drainage Act, R.S.O. 1990 according to a petition signed in January 1992 by the City of Nanticoke and the Regional Municipality of Haldimand-Norfolk. The petition has been declared valid according to Section 4 (1) (c) of the Drainage Act.

The south portion of Waterford, City of Nanticoke, current does not have a legal stormwater outlet. No adequate municipal storm sewer system exists, and no legal outlet is available.

This Municipal Drainage project has been undertaken to provide that legal stormwater outlet for the south area of Waterford.

The Drain consists of three (3) components:

1. The Thompson Road Storm Sewer
2. The Stormwater Management Facility
3. The Outlet

B. Thompson Road Storm Sewer

The Thompson Road Storm Sewer has been designed as a trunk sewer to collect stormwater from various future storm sewer connections. The sewer itself has not been designed to collect stormwater from the south area of Waterford, but rather to provide an outlet for future storm sewer works in south Waterford.

The sewer has been designed to have hydraulic capacity to accept design flows from the two year storm (2:1 year event.) The upstream end of the sewer is located at the intersection of Main Street and Thompson Road (Regional Road 9) and the sewer flows to the west, past the rail road bridge for a total distance of approximately 1045 metres before discharging into the proposed stormwater management facility.

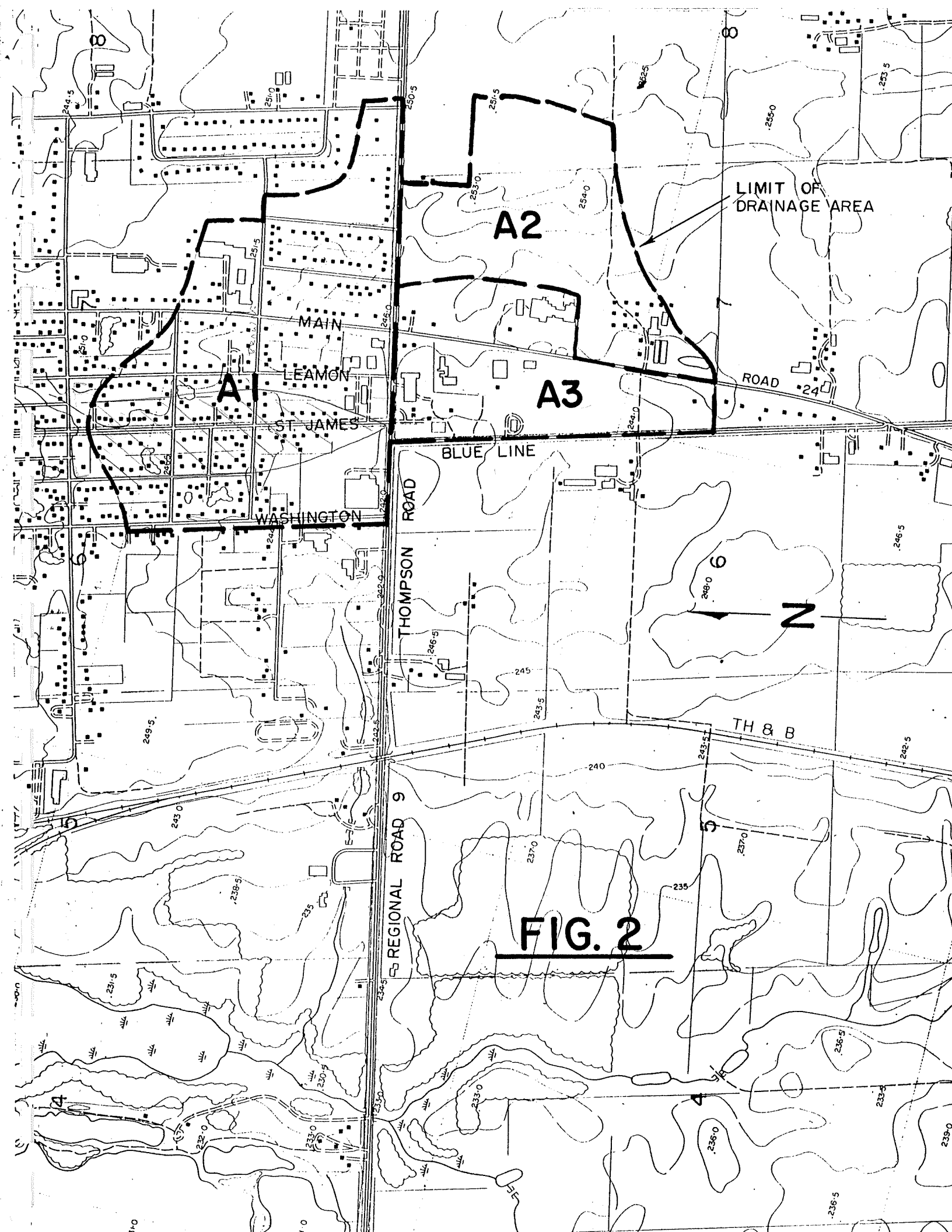
A1
A2
A3
LIMIT OF DRAINAGE AREA
MAIN
LEAMON
ST. JAMES
WASHINGTON
BLUE LINE
ROAD 24
THOMPSON ROAD
REGIONAL ROAD 9
TH & B
N

FIG. 2

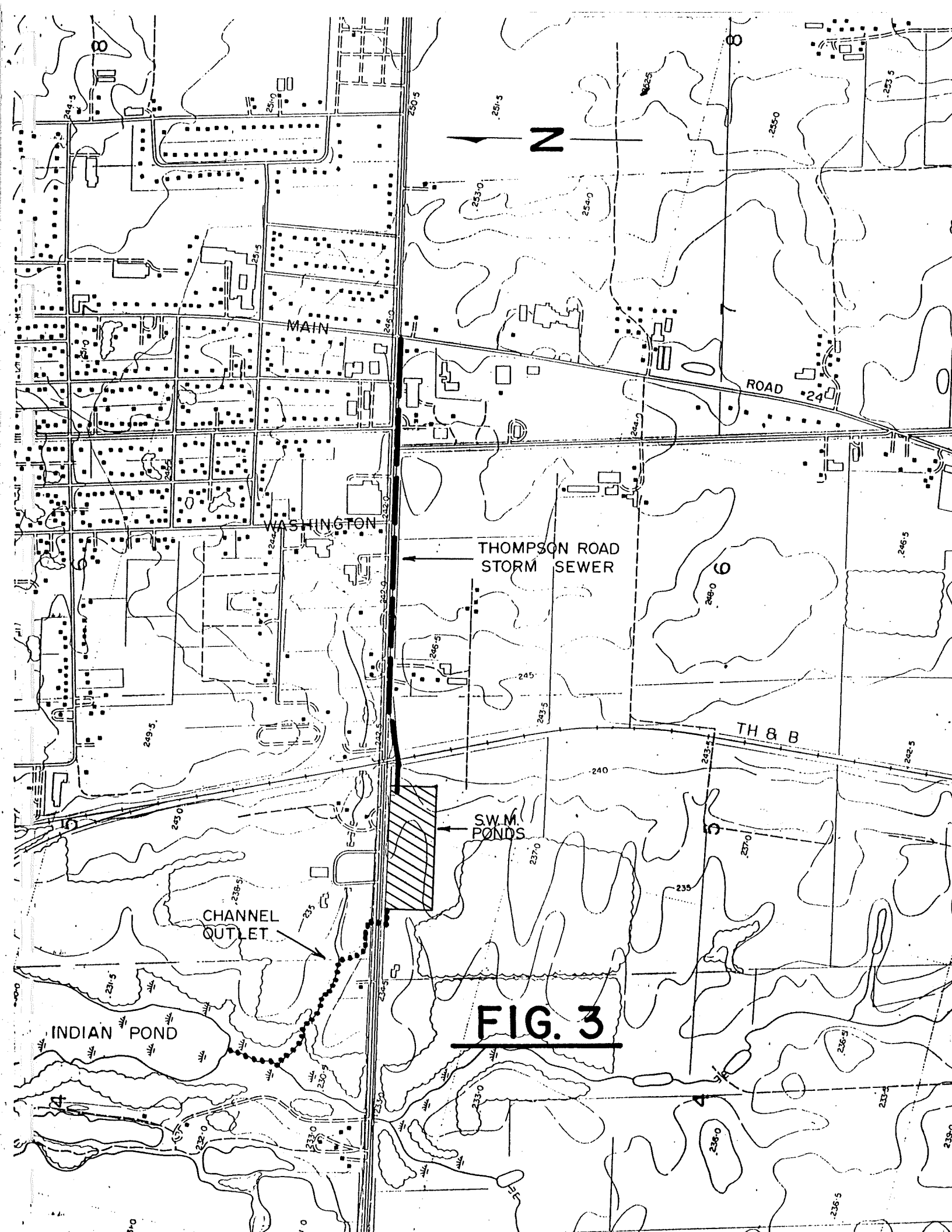
N
MAIN
ROAD 24
WASHINGTON
THOMPSON ROAD
STORM SEWER
TH 8 B
S.W.M.
PONDS
CHANNEL
OUTLET
INDIAN POND

FIG. 3

For the design of this sewer, three (3) drainage areas have been considered. These three areas have been modelled using the OTTHYMO'89 computer program to simulate stormwater runoff rates from these areas during the two (2) year storm event. The output printouts from this simulation are attached to this brief. The following summarizes the input values used to model the areas and this produced the associated calculated or output values:

Area 1: Existing Urban Residential:

Input	
Area:	48 ha
Total Impervious:	30%
Directly Connection Impervious:	15%
CN*:	50

Output	
Modelled Peak Flow:	1.31 m^3/s
Modelled Time to Peak:	1.53 hours
Modelled Runoff Coefficient:	0.27

Area 2: Rural Area with Potential for Future Residential Development

Input	
Area:	24 ha
Total Impervious:	30%
Directly Connection Impervious:	15%
CN*:	50

Output	
Modelled Peak Flow:	0.70 m^3/s
Modelled Time to Peak:	1.52 hours
Modelled Runoff Coefficient:	0.27

THIS AREA WAS ASSUMED TO BE DEVELOPED AS A RESIDENTIAL SUBDIVISION WITH AN ON-SITE DETENTION POND REGULATED TO A MAXIMUM RELEASE RATE OF 0.20 m^3/s. IT WAS ALSO NOTED THAT THE TIME TO PEAK FLOW LEAVING THE POND WAS CALCULATED BY THE MODEL AS 4.15 HOURS.

Area 3: Existing Commercial: 19 ha

Input	
Area:	19 ha
Total Impervious:	80%
Directly Connection Impervious:	50%
CN*:	50

Output	
Modelled Peak Flow:	1.94 m^3/s
Modelled Time to Peak:	1.52 hours
Modelled Runoff Coefficient:	0.63

Total Design Flows

The modelled summation of these hydrographs produced the following design flows:

PEAK DESIGN FLOW: 3.25 m^3/s
TIME TO PEAK: 1.53 hours

Sewer Hydraulic Capacity

Upper Runs: 1200mm diameter, min slope 0.85%
Capacity:3.59 m^3/s

Lower Runs: 1500mm diameter, min slope 0.22%
Capacity: 3.31 m^3/s

C. Intersection Street Sewers

Storm sewer stubs are proposed for some intersecting streets on the project. These sewer stubs have been sized as follows:

Washington Street
Area: 11ha
R: 0.30
Q: 0.53 m^3/s
Sewer: 675mm @ 0.5% Capacity=0.61m^3/s

St. James Street
Area: 11.6 ha
R: 0.30
Q: 0.56 m^3/s
Sewer: 675mm @ 1.0% Capacity=0.86m^3/s

Leamon Street
Area: 9 ha
R: 0.30
Q: 0.43 m^3/s

City Requested oversizing for possible alternative servicing layout.

Sewer: 825mm @ 1.0% Capacity=0.86m^3/s

Blue Line Road
Area: 9 ha
R: 0.65
Q: 1.0 m^3/s
Sewer: 825mm @ 0.5% Capacity=1.03m^3/s

C. Stormwater Management Facility

The stormwater management facility has been designed using concepts from the *"Stormwater Management Practices Planning and Design Manual"* June 1994, by the Ontario Ministry of the Environment and Energy. The pond has been basically designed as a Wet Pond to improve water quality treatment.

The main pond has been sized according to Table 4.1 "Water Quality Storage Requirements based on Receiving Waters" using the following figures:

Level 1: Wet Pond

48 ha @ 30% impervious
19 ha @ 80% impervious
67 ha @ 44% impervious total

(Note that Area 2 has not been considered as the future subdivision will contain its own on-site detention pond which will address water quality.

From Table 4.1 35% Impervious Requires 140 m^3/ha Storage
55% Impervious Requires 190 m^3/ha Storage
By Interpolation: 44% Impervious **Requires 165 m^3/ha Storage**

Therefore from Table 4.1 bottom note:

Total Storage	165 m^3/ha
Less Detention Storage:	40 m^3/ha
Permanent Pool Volume:	125 m^3/ha

Permanent Pool Volume

67 ha inputting "dirty water" @ 125 m^3/ha = 8,375 m^3 = 0.84 ha.m

Required Detention Volume

From OTTHYMO'89 model simulation: 8000 m^3 = 0.80 ha.m
(84 m^3/ha over whole 91 ha drainage area)

(5 Year storm requirement: 10,800 m^3 = 1.08 ha.m)

Total Required Volume

0.84 ha.m + 0.80 ha.m = 1.64 ha.m

Pond Geometry

L = 143 m (bottom length)
W = 40 m (bottom width)
L/W = 3.575 > 3 recommended.

Permanent Pool Depth = 1.2 metres

Interior Side Slopes = 6:1

Pond Volume Equation:

Volume = $5720d + 1098d^2$
At elevation 232.9 (d=1.2) Pond Volume is 8,445 m^3 = Perm. Pool Volume
At elevation 233.8 (d=2.1) Pond Volume is 16,854 m^3 = 2 Year Storage
At elevation 234.0 (d=2.3) Pond Volume is 18,964 m^3 = 5 Year Storage

Sediment Forebay

L = 50 m (bottom length)
W = 20 m (bottom width)
L/W = 2.5

Forebay Settling Length (Equ. 3.3 page 89)
r = L/W = 2.5
Qp = 0.24 (see OTTHYMO'89 output)
Vs = 0.0003 (as recommended on page 89)
Thus Dist = 45 m

Forebay Dispersion Length (Equ. 3.4 page 90)
Q = 3.25 m^3/s
d = 1.2 m
Vf = 0.5 m/s (recommended on page 90)
Dist = 43 m

Minimum Forebay Bottom Width (Equ. 3.5 page 90)
Dist = 45
Width = 45 / 8 = 6 m

Actual Pond Dimensions
Length = 50 m > 45 m
Width = 20 m > 6 m
Permanent Pool Depth = 1.2 m

Forebay - Pond Culverts

Design Inflow to Sediment Forebay: 3.25 m^3/s

975 mm concrete pipe @ 0.6%: Capacity = 1.76 m^3/s
2 - 975 mm concrete pipes @ 0.6%: Capacity = 3.52 m^3/s

Outlet Design: Perforated Riser

First Flush Volume: 67 ha x 13 mm x 0.27 runoff
2,351 m^3

Volume above Perm. Pool = $8562a + 1266a^2$

At Elevation 233.16 (a=0.26) Volume above Perm Pool = 2,311 m^3

Therefore set open outlet at elevation 233.16 and allow riser to operate below that elevation.

Drawdown time

First Flush Volume: 2,300 m^3 = 81,224 ft^3

Consider 6" Hickenbottom with 40 - 1" holes per foot
Q = 0.74 ft^3/s @ 2 feet of head

Time to Drain = 81,224 / 0.74 = 109,762 seconds = 30 hours

Open Discharge Pipe

See attached "Detention Pond Rating Curve" dated July 24, 1996

Planting

The entire pond and sediment Forebay will be topsoiled and seeded where possible with a grass mixture. Certain areas of the pond, particularly the sediment Forebay may be permanently submerged with groundwater, and there areas obviously can not be planted.

Although it is preferred to utilize a planting strategy based on average water depth and soil moisture regime, the immediate performance of this pond is unknown. It is anticipated that this pond will be constructed in 1996, but that no external sewers will be connected to the Municipal Drain until 1997 at the earliest. For this reason, the entire pond could remain dry for a period of approximately one year.

As time progresses, more and more external sewers may be constructed and connected to the Municipal Drain. As these sewers are connected, permanent water levels in the pond will increase.

It is therefore considered to be wasteful to plant specific species based on assumed water levels that will drastically change over the following years.

It is therefore proposed to plant the ponds with a grass mixture, and allow native species to naturally plant themselves in the appropriate areas.

It should also be noted that the Public Works Department of the City of Nanticoke has requested that the entire facility be fenced, and that due to the berms between the roadway and the facility, the ponds themselves will not be visible to the public.

D. Outlet

This existing outlet makes use of the existing drainage features located downstream of the stormwater management facility. In an effort to protect and preserve the natural environment and the existing landscape in this area, it is proposed to perform a minimum of construction in this area other than cleaning of areas that are silted in, replacement of crushed culvert ends, and some clearing of over-vegetated areas to permit access.

An analysis of the hydraulic capacity of this existing system has not been undertaken, however it is expected that the existing system will be capable of accepting discharge flows from the stormwater management facility. In the early life of the stormwater management facility, it is expected that only a small percentage of the upstream lands will be connected to the Thompson Road Storm Sewer, and therefore

only and small discharge downstream of the ponds is expected. It is anticipated that the existing downstream drainage system has the hydraulic capacity to accept flows from the ponds during this stage of partial connection to upstream areas.

As more and more of the upstream lands are connected to the Waterford South Municipal Drain, the flow rates and flow durations leaving the pond will increase. Over time, this may begin to cause problems in the existing downstream system. Flooding of the system and minor erosion may occur. Landowners will report these problems to the City of Nanticoke, and these problems can be addressed as maintenance items.

If these problems develop into serious concerns, it may be necessary to complete a formal design for this outlet area. Until that time, in the interest of preserving the existing landscape, not disturbing the natural environment, and minimizing costs, it is proposed to use the existing drainage outlet with the minimal alterations indicated on the drawings.

It must be realized that in the future a formal design may be required for this outlet area.

Waterford South Municipal Drain
Detention Pond Rating Curve

Project: 94–021
Date: July 24, 1996

Elevation of Permanent Pool:	232.90
Depth of First Flush Storage:	0.26
Invert of 375mm Outlet pipe:	233.16
Centreline of 375mm Outlet pipe:	233.35

Storage Above Perm. Pool = 8562*d + 1266*d*d

Water Elevation (m)	Water Above Perm. Pool (m)	Storage Volume Above Perm. Pool (m3)	Water Above Pipe C. Line (m)	Discharge Rate (m3/s)	Comment
232.90	0	0	n/a	0	Water @ Perm Pool
233.16	0.26	2,312	n/a	0	Water @ Pipe Invert
233.35	0.45	4,109	n/a	0.090	Water @ Pipe C.L.
233.54	0.64	5,998	n/a	0.180	Water @ Pipe Obvert
233.75	0.85	8,192	0.40	0.247	Pipe under Head
233.85	0.95	9,276	0.50	0.276	Pipe under Head
233.90	1	9,828	0.55	0.289	Pipe under Head
234.10	1.2	12,097	0.75	0.338	Pipe under Head
234.20	1.3	13,270	0.85	0.359	Pipe under Head

b:\ratecurv.wk1

Waterford South Municipal Drain: Otthymo Output: Final Design: 2 Year Storm p.1

```
================================================================================

     OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO   I N T E R H Y M O
    O   O   T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
    O   O   T      T    HHHHH    Y    M M M  O   O
    O   O   T      T    H   H    Y    M   M  O   O
     OOO    T      T    H   H    Y    M   M   OOO    cE/101051900024
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Distributed by the INTERHYMO Centre. Copyright (c), 1989. Paul Wisner & Assoc.

Input filename: 94021.dat
Output filename: 94021.out
Summary filename: 94021.sum

DATE: 08-14-1996 TIME: 15:53:27

COMMENTS: _____

```
--------------------------------------------------------------------------------
**********************************
*WATERFORD SOUTH MUNICIPAL DRAIN
*FINAL REPORT
*Project # 94-021
*Detention Pond Flow Simulation
*Chicago Storm
*4 Hour Distribution
*
*
*INPUT REVISED December 22, 1993
*****Area A2 reduced to 24 ha
*****Area A3 XIMP reduced to 0.40  TIMP reduced to 0.50
*****Area A4 reduced to 41 ha, Tp reduced to 0.51 hours
*****Area A5 reduced to 59 ha
*****Detention Pond Configurations and Rating Curves Revised
*
*INPUT REVISED JUNE 9, 1995
*****Area A3 TIMP increased to 0.80 and XIMP increased to 0.50
*
*INPUT REVISED JUNE 23, 1995
*****Revised main detention pond rating curve for pond with sediment forebay
*****Detention pond outlet reduced to 450 mm diameter at 0.5%
*****(See Rating Curve Caluculation Sheet)
*
```

Waterford South Municipal Drain: Otthymo Output: Final Design: 2 Year Storm p.2

*INPUT REVISED MAY 14, 1996
*****Pond relocated to west of railway tracks
*****Overland flow from adjacent farmland no longer enters pond
*
*INPUT REVISED JULY 24, 1996
*****Detention pond rating curve revised for new pond configuration
*****Farmland areas removed from drainage area
*
*
*

****
** SIMULATION NUMBER: 1 **
****

****
*USE CHICAGO STORM
****

¦ READ STORM ¦ Filename: CH2.STM
¦ Ptotal= 39.39 mm ¦ Comments: 2 YEAR CHICAGO 4 HOUR DESIGN STORM DISTR

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.25	1.17	8.94	2.17	8.15	3.17	4.39
.33	3.56	1.33	16.92	2.33	7.01	3.33	4.11
.50	3.96	1.50	78.82	2.50	6.20	3.50	3.89
.67	4.52	1.67	21.89	2.67	5.59	3.67	3.68
.83	5.31	1.83	13.00	2.83	5.11	3.83	3.51
1.00	6.55	2.00	9.88	3.00	4.72	4.00	3.35

Waterford South Municipal Drain: Otthymo Output: Final Design: 2 Year Storm p.4

****
*AREA 2 - FUTURE RESIDENTIAL SUBDIVISION
****

DESIGN		
STANDHYD (0102)	Area (ha)= 24.00	
ID= 2 DT= 1.0 min	Total Imp(%)= 30.00	Dir. Conn.(%)= 15.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	7.20	16.80	
Dep. Storage (mm)=	.80	1.50	
Average Slope (%)=	2.00	2.00	
Length (m)=	400.00	40.00	
Mannings n =	.013	.250	
Max.eff.Inten.(mm/hr)=	78.82	8.47	
over (min)	5.00	25.00	
Storage Coeff. (min)=	5.24 (ii)	24.19 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	.22	.05	
		TOTALS	
PEAK FLOW (cms)=	.65	.20	.70 (iii)
TIME TO PEAK (hrs)=	1.52	1.90	1.52
RUNOFF VOLUME (mm)=	38.59	5.88	10.78
TOTAL RAINFALL (mm)=	39.39	39.39	39.39
RUNOFF COEFFICIENT =	.98	.15	.27

***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 50.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Waterford South Municipal Drain: Otthymo Output: Final Design: 2 Year Storm p.5

****
*PRINT HYDROGRAPH OF UNRESTRICTED FLOW FROM NEW DEVELOPMENT
****

| PRINT HYD (0102) | AREA (ha)= 24.00
| ID= 2 PCYC= 10 | QPEAK (cms)= .70 (i)
| DT= 1.0 min | TPEAK (hrs)= 1.52
--- VOLUME (mm)= 10.78

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW
hrs	cms	hrs	cms	hrs	cms	hrs	cms	hrs	cms
.00	.00	1.00	.06	2.00	.31	3.00	.14	4.00	.10
.17	.00	1.17	.09	2.17	.26	3.17	.13	4.17	.06
.33	.02	1.33	.16	2.33	.23	3.33	.12	4.33	.05
.50	.04	1.50	.68	2.50	.20	3.50	.11	4.50	.03
.67	.04	1.67	.45	2.67	.18	3.67	.11	4.67	.02
.83	.05	1.83	.36	2.83	.16	3.83	.10	4.83	.01

****
*ROUTE FUTURE SUBDIVISION THROUGH ON SITE DETENTION POND
*ALLOWING FOR 0.14 ha.m FOR FIRST FLUSH STORAGE
*RATING CURVE REVISED: January 3, 1994 for new drainage areas
* and revised pond depth.
****

| RESERVOIR (0200) |
| IN= 2---> OUT= 3 |
DT= 1.0 min	OUTFLOW STORAGE	OUTFLOW STORAGE
	(cms) (ha.m.)	(cms) (ha.m.)
	.000 .000	.141 .400
	.000 .140	.200 .590
	.051 .230	.245 .780
	.101 .310	.000 .000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0102)	24.00	.70	1.52	10.78
OUTFLOW: ID= 3 (0200)	24.00	.05	4.32	4.64

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.94
TIME SHIFT OF PEAK FLOW (min)=168.00
MAXIMUM STORAGE USED (ha.m.)= .23

```
**********
*ADD EXISTING URBAN AREA AND FUTURE DETAINED SUBDIVISION
**********

--------------------
| ADD HYD   (0300) |
|  1 +  3 =  4   |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0101):    48.00     1.31     1.53    10.79
      + ID2= 3 (0200):    24.00      .05     4.32     4.64
        ================================================
        ID = 4 (0300):    72.00     1.31     1.53     8.74

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********
*AREA 3  -  INDUSTRIAL/COMMERCIAL
**********

--------------------
| DESIGN           |
| STANDHYD  (0103) |  Area    (ha)=  19.00
|ID= 5 DT= 1.0 min |  Total Imp(%)=  80.00   Dir. Conn.(%)=  50.00
--------------------
                         IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      15.20         3.80
    Dep. Storage     (mm)=        .80         1.50
    Average Slope     (%)=       2.00         2.00
    Length           (m)=     355.90        40.00
    Mannings n          =       .013         .250

    Max.eff.Inten.(mm/hr)=      78.82        46.45
             over (min)        5.00        11.00
    Storage Coeff.  (min)=      4.89 (ii)   10.27 (ii)
    Unit Hyd. Tpeak (min)=      5.00        11.00
    Unit Hyd. peak  (cms)=       .23          .11
                                              *TOTALS*
    PEAK FLOW       (cms)=      1.75          .30          1.94 (iii)
    TIME TO PEAK    (hrs)=      1.52         1.63          1.52
    RUNOFF VOLUME    (mm)=     38.58        10.72         24.65
    TOTAL RAINFALL   (mm)=     39.39        39.39         39.39
    RUNOFF COEFFICIENT   =       .98          .27           .63


     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* = 50.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
```

Waterford South Municipal Drain: Otthymo Output: Final Design: 2 Year Storm p.7

```
**********
*ADD INDUSTRIAL/COMMERCIAL AREA TO TOTAL
**********


--------------------
| ADD HYD   (0301) |
|  4 +  5 =  6   |        AREA    QPEAK    TPEAK     R.V.
--------------------       (ha)    (cms)    (hrs)     (mm)
        ID1= 4 (0300):    72.00     1.31     1.53     8.74
      + ID2= 5 (0103):    19.00     1.94     1.52    24.65
        ================================================
        ID = 6 (0301):    91.00     3.25     1.53    12.06

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
**********
*ROUTE TOTAL FLOWS THROUGH NEW DETENTION POND TO WEST OF RAILWAY TRACKS
*Rating Curve Revised for New Pond Design July 1996
**********
--------------------
| RESERVOIR (0200) |
| IN= 6---> OUT= 9 |
| DT=  1.0 min     |    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------     (cms)     (ha.m.)  |   (cms)     (ha.m.)
                          .000       .000    |    .276       .928
                          .000       .231    |    .289       .983
                          .090       .411    |    .338      1.210
                          .180       .600    |    .359      1.327
                          .247       .819    |    .000       .000

                            AREA     QPEAK     TPEAK      R.V.
                            (ha)     (cms)     (hrs)      (mm)
    INFLOW : ID= 6 (0301)    91.00     3.25      1.53      12.06
    OUTFLOW: ID= 9 (0200)    91.00      .24      4.15       8.53

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.44
                TIME SHIFT OF PEAK FLOW        (min)=157.00
                MAXIMUM  STORAGE  USED        (ha.m.)=   .80

------------------------------------------------------------------------------
```

Waterford South Municipal Drain: Otthymo Output: Final Design: 2 Year Storm p.8

****
*PRINT OUTFLOW HYD FROM POND
****

¦ PRINT HYD (0200) ¦ AREA (ha)= 91.00
¦ ID= 9 PCYC= 10 ¦ QPEAK (cms)= .24 (i)
¦ DT= 1.0 min ¦ TPEAK (hrs)= 4.15
---------- VOLUME (mm)= 8.53

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW
hrs	cms	hrs	cms	hrs	cms	hrs	cms	hrs	cms
.00	.00	3.50	.23	7.00	.19	10.50	.12	14.00	.07
.17	.00	3.67	.23	7.17	.19	10.67	.12	14.17	.07
.33	.00	3.83	.24	7.33	.19	10.83	.11	14.33	.07
.50	.00	4.00	.24	7.50	.18	11.00	.11	14.50	.06
.67	.00	4.17	.24	7.67	.18	11.17	.11	14.67	.06
.83	.00	4.33	.24	7.83	.18	11.33	.11	14.83	.06
1.00	.00	4.50	.24	8.00	.17	11.50	.10	15.00	.06
1.17	.00	4.67	.24	8.17	.17	11.67	.10	15.17	.06
1.33	.00	4.83	.23	8.33	.17	11.83	.10	15.33	.06
1.50	.00	5.00	.23	8.50	.16	12.00	.10	15.50	.05
1.67	.07	5.17	.23	8.67	.16	12.17	.09	15.67	.05
1.83	.12	5.33	.22	8.83	.15	12.33	.09	15.83	.05
2.00	.15	5.50	.22	9.00	.15	12.50	.09	16.00	.05
2.17	.17	5.67	.22	9.17	.15	12.67	.09	16.17	.05
2.33	.19	5.83	.21	9.33	.14	12.83	.08	16.33	.05
2.50	.20	6.00	.21	9.50	.14	13.00	.08	16.50	.05
2.67	.21	6.17	.21	9.67	.14	13.17	.08		
2.83	.21	6.33	.21	9.83	.13	13.33	.08		
3.00	.22	6.50	.20	10.00	.13	13.50	.08		
3.17	.22	6.67	.20	10.17	.13	13.67	.07		
3.33	.23	6.83	.20	10.33	.12	13.83	.07		

****

FINISH
==========

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================================================================================

     OOO  TTTTT  TTTTT  H   H  Y   Y  M   M   OOO   I N T E R H Y M O
    O   O   T      T    H   H   Y Y   MM MM  O   O  * * * 1989b * * *
    O   O   T      T    HHHHH    Y    M M M  O   O
    O   O   T      T    H   H    Y    M   M  O   O
     OOO    T      T    H   H    Y    M   M   OOO    cE/101051900023
```

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Input filename: 94021.dat
Output filename: 94021.out
Summary filename: 94021.sum

DATE: 08-14-1996 TIME: 15:46:53

COMMENTS: _____

```
--------------------------------------------------------------------------------
**********************************
*WATERFORD SOUTH MUNICIPAL DRAIN
*FINAL REPORT
*Project # 94-021
*Detention Pond Flow Simulation
*Chicago Storm
*4 Hour Distribution
*
*
*INPUT REVISED December 22, 1993
*****Area A2 reduced to 24 ha
*****Area A3 XIMP reduced to 0.40  TIMP reduced to 0.50
*****Area A4 reduced to 41 ha, Tp reduced to 0.51 hours
*****Area A5 reduced to 59 ha
*****Detention Pond Configurations and Rating Curves Revised
*
*INPUT REVISED JUNE 9, 1995
*****Area A3 TIMP increased to 0.80 and XIMP increased to 0.50
*
*INPUT REVISED JUNE 23, 1995
*****Revised main detention pond rating curve for pond with sediment forebay
*****Detention pond outlet reduced to 450 mm diameter at 0.5%
*****(See Rating Curve Caluculation Sheet)
*
```

*INPUT REVISED MAY 14, 1996
*****Pond relocated to west of railway tracks
*****Overland flow from adjacent farmland no longer enters pond
*
*INPUT REVISED JULY 24, 1996
*****Detention pond rating curve revised for new pond configuration
*****Farmland areas removed from drainage area
*
*
*

```
 ****************************
 ** SIMULATION NUMBER:   1 **
 ****************************

**********
*USE CHICAGO STORM
**********
```

READ STORM	Filename: CH5.STM
Ptotal= 48.48 mm	Comments: 5 YEAR CHICAGO 4 HOUR DESIGN DISTRIBUTIO

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.53	1.17	10.19	2.17	9.15	3.17	4.55
.33	3.66	1.33	21.62	2.33	7.70	3.33	4.22
.50	4.04	1.50	112.37	2.50	6.68	3.50	3.96
.67	4.67	1.67	27.76	2.67	5.94	3.67	3.73
.83	5.61	1.83	15.75	2.83	5.39	3.83	3.53
1.00	7.11	2.00	11.43	3.00	4.93	4.00	3.35

LEAMAN ST. JAMES WASHINGTON

****
*AREA 1 - EXISTING URBAN AREA DRAINING TO FUTURE POND
****

| DESIGN |
| STANDHYD (0101) | Area (ha)= 48.00
|ID= 1 DT= 1.0 min | Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	14.40	33.60
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	2.00	2.00
Length	(m)=	565.69	40.00
Mannings n	=	.013	.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

	IMPERVIOUS	PERVIOUS (i)	
Max.eff.Inten.(mm/hr)=	112.37	16.40	
over (min)	6.00	21.00	
Storage Coeff. (min)=	5.60 (ii)	20.15 (ii)	
Unit Hyd. Tpeak (min)=	6.00	21.00	
Unit Hyd. peak (cms)=	.20	.06	
		TOTALS	
PEAK FLOW (cms)=	1.77	.78	2.04 (iii)
TIME TO PEAK (hrs)=	1.53	1.82	1.53
RUNOFF VOLUME (mm)=	47.68	8.70	14.55
TOTAL RAINFALL (mm)=	48.48	48.48	48.48
RUNOFF COEFFICIENT =	.98	.18	.30

***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 50.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
*AREA 2 - FUTURE RESIDENTIAL SUBDIVISION
****

5 Yr

| DESIGN |
| STANDHYD (0102) | Area (ha)= 24.00
|ID= 2 DT= 1.0 min | Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	7.20	16.80	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	400.00	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)=		112.37	16.40	
over (min)		5.00	20.00	
Storage Coeff. (min)=		4.55 (ii)	19.10 (ii)	
Unit Hyd. Tpeak (min)=		5.00	20.00	
Unit Hyd. peak (cms)=		.24	.06	
			TOTALS	
PEAK FLOW	(cms)=	.96	.40	1.08 (iii)
TIME TO PEAK	(hrs)=	1.52	1.80	1.52
RUNOFF VOLUME	(mm)=	47.68	8.70	14.55
TOTAL RAINFALL	(mm)=	48.48	48.48	48.48
RUNOFF COEFFICIENT	=	.98	.18	.30

***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 50.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
**********
*PRINT HYDROGRAPH OF UNRESTRICTED FLOW FROM NEW DEVELOPMENT
**********

--------------------
¦ PRINT HYD (0102) ¦   AREA      (ha)=  24.00
¦ ID= 2   PCYC= 10 ¦   QPEAK     (cms)=   1.08 (i)
¦ DT= 1.0 min      ¦   TPEAK     (hrs)=   1.52
-------------------- VOLUME     (mm)=  14.55

    (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  TIME    FLOW ¦  TIME    FLOW ¦  TIME    FLOW ¦  TIME    FLOW ¦  TIME    FLOW
   hrs     cms ¦   hrs     cms ¦   hrs     cms ¦   hrs     cms ¦   hrs     cms
   .00     .00 ¦  1.00     .07 ¦  2.00     .47 ¦  3.00     .17 ¦  4.00     .11
   .17     .00 ¦  1.17     .10 ¦  2.17     .37 ¦  3.17     .15 ¦  4.17     .07
   .33     .02 ¦  1.33     .21 ¦  2.33     .30 ¦  3.33     .14 ¦  4.33     .04
   .50     .04 ¦  1.50    1.06 ¦  2.50     .25 ¦  3.50     .13 ¦  4.50     .03
   .67     .05 ¦  1.67     .73 ¦  2.67     .22 ¦  3.67     .12 ¦  4.67     .02
   .83     .06 ¦  1.83     .59 ¦  2.83     .19 ¦  3.83     .11 ¦
--------------------------------------------------------------------------------
**********
*ROUTE FUTURE SUBDIVISION THROUGH ON SITE DETENTION POND
*ALLOWING FOR 0.14 ha.m FOR FIRST FLUSH STORAGE
*RATING CURVE REVISED:  January 3, 1994 for new drainage areas
*                       and revised pond depth.
**********

--------------------
¦ RESERVOIR (0200) ¦
¦ IN= 2---> OUT= 3 ¦
¦ DT=  1.0 min     ¦     OUTFLOW    STORAGE   ¦ OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   ¦  (cms)     (ha.m.)
                          .000       .000     ¦   .141       .400
                          .000       .140     ¦   .200       .590
                          .051       .230     ¦   .245       .780
                          .101       .310     ¦   .000       .000

                              AREA     QPEAK     TPEAK      R.V.
                              (ha)     (cms)     (hrs)      (mm)
    INFLOW : ID= 2 (0102)     24.00     1.08      1.52      14.55
    OUTFLOW: ID= 3 (0200)     24.00      .09      4.10       8.22

              PEAK  FLOW  REDUCTION [Qout/Qin](%)=  7.89
              TIME SHIFT OF PEAK FLOW       (min)=155.00
              MAXIMUM  STORAGE  USED        (ha.m.)=  .29

--------------------------------------------------------------------------------
```

```
**********
*ADD EXISTING URBAN AREA AND FUTURE DETAINED SUBDIVISION
**********

-------------------
| ADD HYD  (0300) |
|  1 +  3 =  4    |        AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (0101):    48.00     2.04     1.53    14.55
      + ID2= 3 (0200):    24.00      .09     4.10     8.22
        ================================================
        ID = 4 (0300):    72.00     2.04     1.53    12.44

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********
*AREA 3  -  INDUSTRIAL/COMMERCIAL
**********
-------------------
| DESIGN          |
| STANDHYD  (0103)|  Area    (ha)=  19.00
|ID= 5 DT= 1.0 min|  Total Imp(%)=  80.00   Dir. Conn.(%)=  50.00
-------------------
                        IMPERVIOUS    PERVIOUS (i)
   Surface Area     (ha)=     15.20         3.80
   Dep. Storage     (mm)=       .80         1.50
   Average Slope     (%)=      2.00         2.00
   Length           (m)=    355.90        40.00
   Mannings n          =      .013         .250

   Max.eff.Inten.(mm/hr)=    112.37        79.78
            over (min)       5.00         9.00
   Storage Coeff.  (min)=     4.24 (ii)    8.91 (ii)
   Unit Hyd. Tpeak (min)=     5.00         9.00
   Unit Hyd. peak  (cms)=      .25          .13
                                          *TOTALS*
   PEAK FLOW       (cms)=     2.57          .54          2.99 (iii)
   TIME TO PEAK    (hrs)=     1.52         1.60          1.52
   RUNOFF VOLUME    (mm)=    47.68        15.34         31.50
   TOTAL RAINFALL   (mm)=    48.48        48.48         48.48
   RUNOFF COEFFICIENT   =     .98          .32           .65


    (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
        CN* = 50.0    Ia = Dep. Storage  (Above)
   (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
        THAN THE STORAGE COEFFICIENT.
  (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
```

BLUE LINE / 24

```
**********
*ADD INDUSTRIAL/COMMERCIAL AREA TO TOTAL
**********

-------------------
¦ ADD HYD   (0301) ¦
¦  4 +  5 =  6   ¦        AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 4 (0300):    72.00     2.04     1.53    12.44
      + ID2= 5 (0103):    19.00     2.99     1.52    31.50
        ================================================
        ID = 6 (0301):    91.00     5.00     1.53    16.42

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********
*ROUTE TOTAL FLOWS THROUGH NEW DETENTION POND TO WEST OF RAILWAY TRACKS
*Rating Curve Revised for New Pond Design July 1996
**********

-------------------
¦ RESERVOIR (0200) ¦
¦ IN= 6---> OUT= 9 ¦
¦ DT=  1.0 min     ¦    OUTFLOW    STORAGE   ¦ OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   ¦  (cms)     (ha.m.)
                         .000       .000     ¦   .276       .928
                         .000       .231     ¦   .289       .983
                         .090       .411     ¦   .338      1.210
                         .180       .600     ¦   .359      1.327
                         .247       .819     ¦   .000       .000

                           AREA     QPEAK     TPEAK       R.V.
                           (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 6 (0301)    91.00      5.00      1.53      16.42
    OUTFLOW: ID= 9 (0200)    91.00       .31      4.13      12.22

              PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.19
              TIME SHIFT OF PEAK FLOW        (min)=156.00
              MAXIMUM  STORAGE  USED        (ha.m.)=  1.08

--------------------------------------------------------------------------------
```

****
PRINT OUTFLOW HYD FROM POND
****

PRINT HYD (0200) | AREA (ha)= 91.00
ID= 9 PCYC= 10 | QPEAK (cms)= .31 (i)
DT= 1.0 min | TPEAK (hrs)= 4.13
---------- VOLUME (mm)= 12.22

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW
hrs	cms	hrs	cms	hrs	cms	hrs	cms	hrs	cms
.00	.00	3.50	.30	7.00	.26	10.50	.19	14.00	.11
.17	.00	3.67	.30	7.17	.26	10.67	.19	14.17	.11
.33	.00	3.83	.31	7.33	.25	10.83	.18	14.33	.11
.50	.00	4.00	.31	7.50	.25	11.00	.18	14.50	.11
.67	.00	4.17	.31	7.67	.25	11.17	.18	14.67	.10
.83	.00	4.33	.31	7.83	.24	11.33	.17	14.83	.10
1.00	.00	4.50	.31	8.00	.24	11.50	.17	15.00	.10
1.17	.00	4.67	.30	8.17	.24	11.67	.16	15.17	.10
1.33	.00	4.83	.30	8.33	.23	11.83	.16	15.33	.09
1.50	.03	5.00	.30	8.50	.23	12.00	.16	15.50	.09
1.67	.15	5.17	.30	8.67	.23	12.17	.15	15.67	.09
1.83	.20	5.33	.29	8.83	.22	12.33	.15	15.83	.09
2.00	.23	5.50	.29	9.00	.22	12.50	.14	16.00	.08
2.17	.25	5.67	.29	9.17	.22	12.67	.14	16.17	.08
2.33	.26	5.83	.28	9.33	.21	12.83	.14	16.33	.08
2.50	.27	6.00	.28	9.50	.21	13.00	.13	16.50	.08
2.67	.28	6.17	.28	9.67	.21	13.17	.13		
2.83	.29	6.33	.28	9.83	.20	13.33	.13		
3.00	.29	6.50	.27	10.00	.20	13.50	.12		
3.17	.30	6.67	.27	10.17	.20	13.67	.12		
3.33	.30	6.83	.26	10.33	.19	13.83	.12		

****

FINISH

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APPENDIX B

Revised WSMD Drainage Area Parameters
Thompson Road Storm Sewer Capacity Calculations
WSMD Detention Pond Rating Curve

vallee
Consulting Engineers, Architects & Planners

Subject: Revised WSMD Drainage Areas Parameters
Date: Jul-24 By: NLO
Project #: Page

EXISTING DEVELOPED AREAS

	ORIGINAL (1996)	UPDATED (2024)		
AREA 1 - EXISTING RESIDENTIAL				
Area	48.00	39.40	ha	*Revised to reflect past road reconstruction projects.*
Total Impervious	30	30	%	
Directly Connected Impervious	15	15	%	
CN	50	62		*Revised to match the Charles Street Subdivision Parameters*
IA	1.5	13.6	mm	
AREA 2A - EXISTING RESIDENTIAL - YIN PHASE 2 & WOODROW				
Area	16.90	16.9	ha	
Total Impervious	38	38	%	
Directly Connected Impervious	16	16	%	
CN	50	58		*Revised to match Yin Phase 5 & 6*
IA	1.5	16.5	mm	
Peak Flow Allowance	0.028	0.028	m^3/s	*Per 00-026 Yin Phase 2 Design*
AREA 2B - EXISTING RESIDENTIAL - YIN PHASE 5 & PHASE 6				
Area	11.82	11.82	ha	*6.0 ha of Yin Phase 5 & 6 was included in orginal Area 2 drainage area, and an addditional 8.22 ha was added per 10-034 Yin Phase 5*
Total Impervious	47	47	%	
Directly Connected Impervious	22	22	%	
CN	58	58		
IA	1.5	16.5	mm	*Revised to match specified CN*
AREA 2C - PROPOSED RESIDENTIAL - YIN PHASE 5 BLOCK 3 - LAM BOULEVARD				
Area	0.80	0.80	ha	
Total Impervious	90	90	%	
Directly Connected Impervious	45	45	%	
CN	58	58		
IA	1.5	16.5	mm	*Revised to match specified CN*
Peak Flow Allowance	0.015		m^3/s	*Per 10-034 Yin Phase 5 Design*
AREA 2D - PROPOSED RESIDENTIAL - YIN PHASE 5 BLOCK 4 - ORCHARD SQUARE				
Area	1.40	1.40	ha	
Total Impervious	90	90	%	
Directly Connected Impervious	45	45	%	
CN	58	58		
IA	1.5	16.5	mm	*Revised to match specified CN*
Peak Flow Allowance	0.015		m^3/s	*Per 10-034 Yin Phase 5 Design*
AREA 3 - EXISTING COMMERCIAL				
Original Area	19.00	19.20	ha	*Uncontrolled road added to Area 3 per 10-034 Yin Phase 5 Design*
Total Impervious	80	80	%	
Directly Connected Impervious	50	50	%	
CN	50	58		*Revised to match Yin Phase 5 & 6*
IA	1.5	16.5	mm	

PRE-DEVELOPMENT AREAS

AREA 4 - THOMPSON - PRE-DEVELOPMENT

Area	7.85	ha
CN	72	
IA	8.1	mm
Drainage Length	140.0	m
Upstream Elevation	240.4	m
Downstream Elevation	239.8	m
Slope	0.43	%
Runoff Coefficient	0.2	
Time of Concentration	45.92	min
Time to Peak (0.6*tc)	0.46	hr
2-YR Peak Flow (4 hour)	0.068	m^3/s

Airport Formula

Tc = 3.26 * (1.1 - C) * L^0.5 /Sw^0.33

Tc = Time of Concentration (minutes)
C = Runoff Coefficient (dimensionless)
L = Watershed Length (metres)
Sw = Watershed Slope % (m/m)

AREA 5 - CHARLES - PRE-DEVELOPMENT

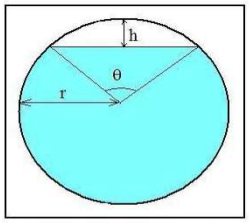
Area	4.35	ha
CN	62	
IA	13.6	mm
Drainage Length	230.0	m
Upstream Elevation	245.5	m
Downstream Elevation	240.5	m
Slope	2.17	%
Runoff Coefficient	0.31	
Time of Concentration	30.23	min
Time to Peak (0.6*tc)	0.30	hr
2-YR Peak Flow (4 hour)	0.017	m^3/s

THOPMSON ROAD STORM SEWER CAPACITY

Pipe Flowing 100% Full

Diameter	1500	mm
Slope	0.22	%
Manning 'n' coeff.	0.013	
Radius	0.75	m
Area	1.77	m
Rh	0.375	m
Capacity (100% Full)	**3.316**	**m^3/s**

$$Q = \frac{1}{n} A R^{2/3} s^{1/2}$$



$r = D/2$ $\quad h = 2r - y$

$\theta = 2 \arccos\left(\frac{r-h}{r}\right)$

$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$

$P = 2\pi r - r\theta$

$R_h = A/P$

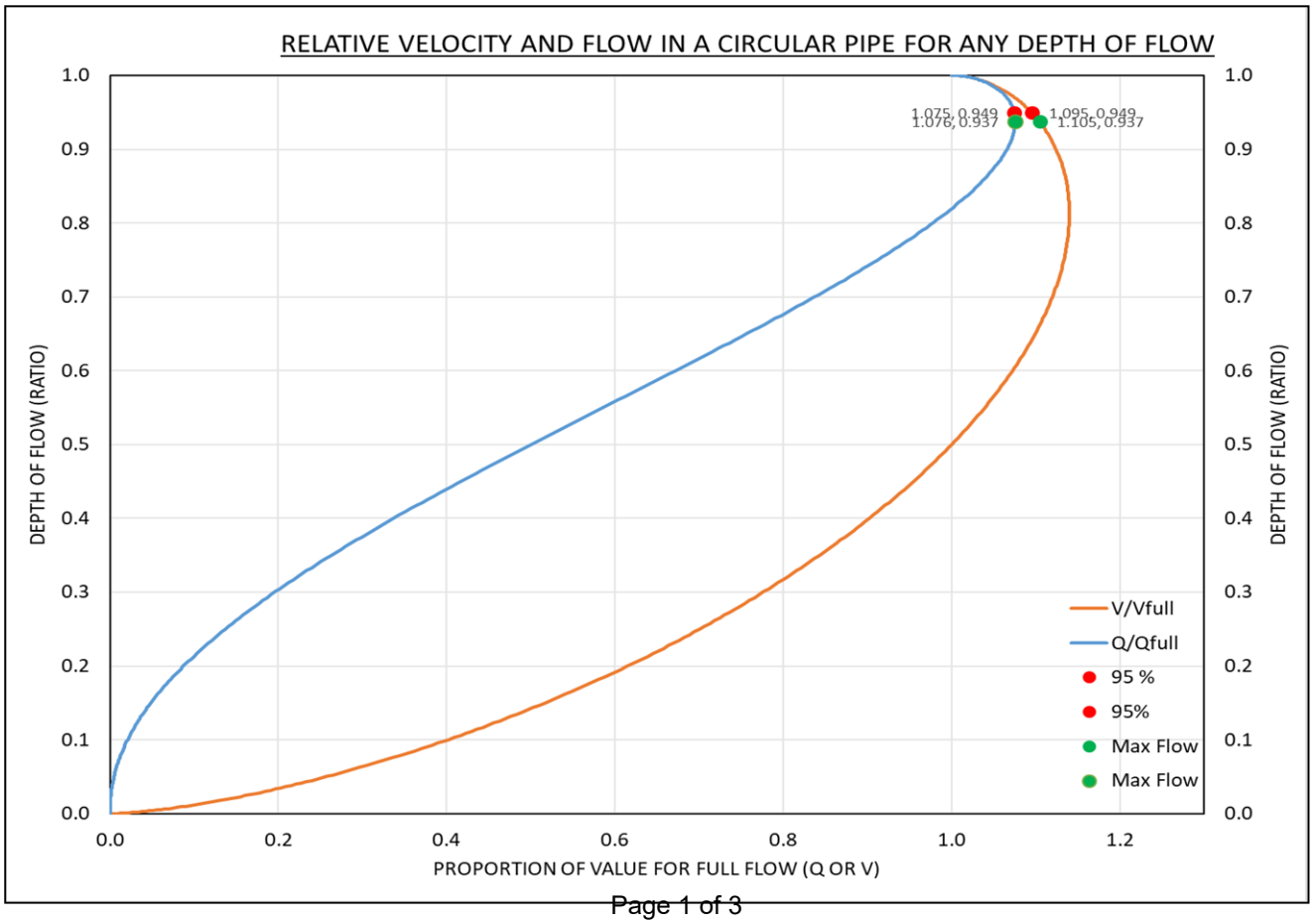
Figure 2. Partially Full Pipe Flow Parameters (more than half full)

Pipe Flowing 94% Full

Diameter	1500	mm
Slope	0.22	
Manning 'n' coeff.	0.013	
Radius	0.75	m
Percent Full	94%	
h	0.09	m
Flow Depth (D-h)	1.41	m
θ	0.99	
Area (at 94% full)	1.72	m
P	3.97	m
Rh (A/P)	0.434	m
Capacity (94% Full)	**3.567**	**m^3/s**

Pipe Flowing 95% Full

Diameter	1500	mm
Slope	0.22	
Manning 'n' coeff.	0.013	
Radius	0.75	m
Percent Full	95%	
h	0.075	m
Flow Depth (D-h)	1.43	m
θ	0.90	
Area (at 95% full)	1.73	m
P	4.04	m
Rh (A/P)	0.430	m
Capacity (95% Full)	**3.563**	**m^3/s**



SUMMARY

THOPMSON ROAD STORM SEWER CAPACITY

Full Flow Capacity	3.32	m3/s
95% Depth Capacity	3.56	m3/s

PEAK FLOWS TO THOMPSON ROAD STORM SEWER

Original WSMD Design Brief (1996)	✓	3.25	m3/s	**1996 WSMD 4 Hr Design Storm*
Revised WSMD (REV2 - 2024)				**Current Norfolk IDF Parameters*
Prior to Proposed Developments (Charles & Thompson)	✓	2.96	m3/s	*4 Hr Design Storm*
Including Proposed Developments (Charles & Thompson)	✓	3.05	m3/s	

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Subject:	Thompson Road SWM Pond		
Date:	Jul-24	By:	NLO
Project #:		Page	

WSMD DETENTION POND RATING CURVE

Elevation of Permanent Pool	232.9	m
Invert of 375mm Outlet	233.16	m
Top of Pond	234.75	m

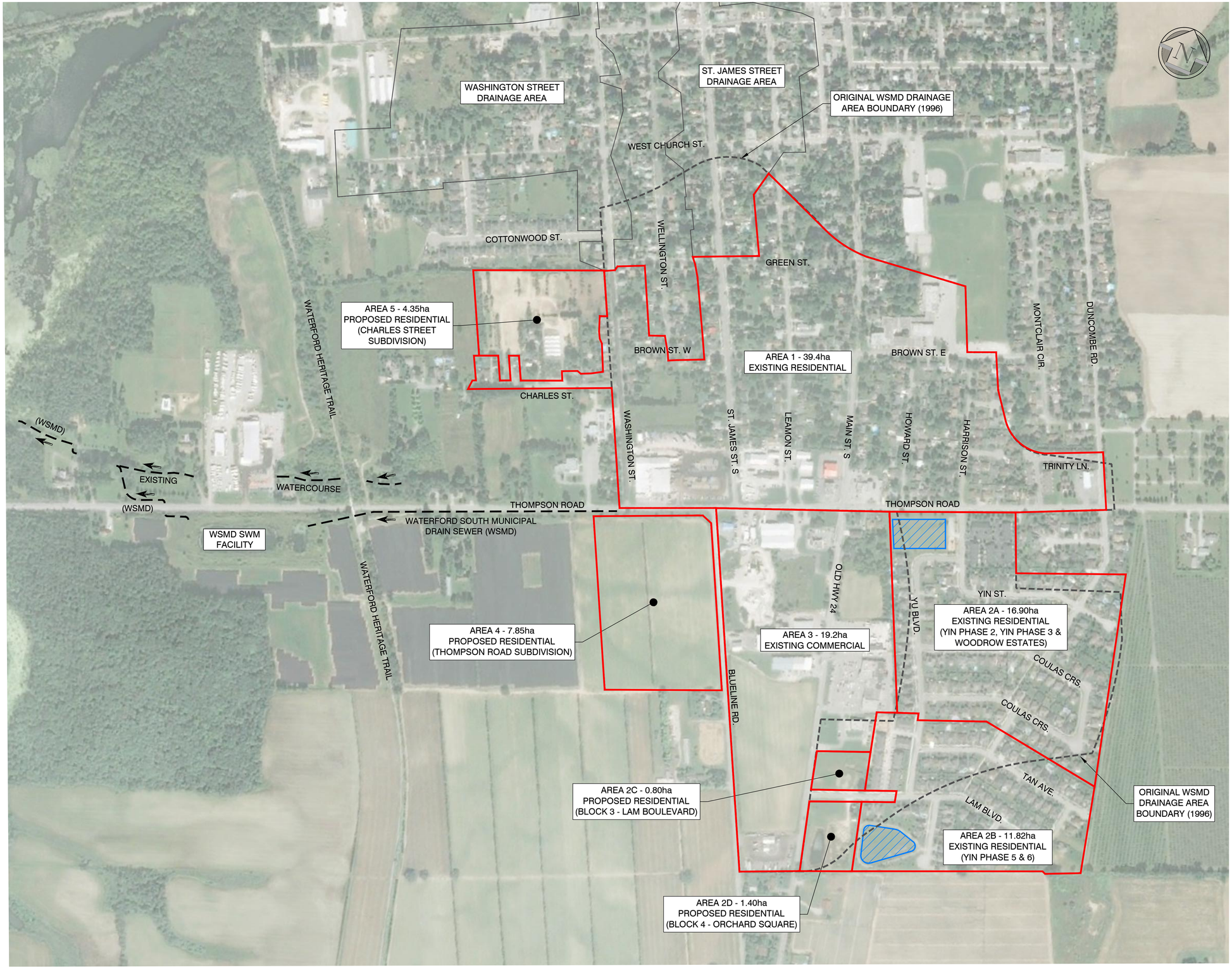
Description	Elevation (m)	Stage (m)	Storage Volume (m3)	Discharge Q (m3/s)
Water @ Perm Pool	232.90	0	0	0.000
Water @ Pipe Invert	233.16	0.26	2312	0.000
Water @ Pipe CL	233.35	0.45	4109	0.090
Water @ Pipe Obvert	233.54	0.64	5998	0.180
	233.75	0.85	8192	0.247
	233.85	0.95	9276	0.276
	233.90	1.00	9828	0.289
	234.10	1.20	12097	0.338
	234.20	1.30	13270	0.359

**Storage volumes and discharge rates from 1996 WSMD Design Brief*

Design Storm	Design Storm	Utilized Storage (m3)	Ponding Depth (m)	Elev. (m)	Available Freeboard (m)
Original Design (1996)	2 Year 4 Hour	8000	0.83	233.73	1.02
	5 Year 4 Hour	10800	1.09	233.99	0.76
Proposed Design (Current IDF)	2 Year 4 Hour	7592	0.79	233.69	1.06
	5 Year 4 Hour	11958	1.19	234.09	0.66

APPENDIX C

FIG 1 – Revised WSMD Drainage Areas



REV. No.	DATE	REVISION
0	MAY 11, 2022	REVISED DESIGN BRIEF
1	DEC 12, 2023	REVISED DESIGN BRIEF
1	DEC 12, 2023	REVISED DESIGN BRIEF

LEGEND

- DRAINAGE FLOW DIRECTION
- ORIGINAL DRAINAGE WSMD BOUNDARY (1994)
- WASHINGTON STREET AND ST. JAMES STREET DRAINAGE AREAS
- REVISED & PROPOSED WSMD DRAINAGE AREAS
- EXISTING SWM FACILITY

SCALE:
50 100 150
HORIZONTAL : 1 : 3500

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G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp

Project Title
REVISED WSMD DESIGN
WATERFORD - NORFOLK COUNTY

Drawing Title
REVISED WSMD DRAINAGE AREAS

Designed by : JI	Drawn By : NLB
Checked by : JI	Date Started : MAY 2022
Drawing Scale : AS NOTED	Drawing No. FIG1
Project No. -	

DATE LAST PLOTTED :

APPENDIX D

Yin's Subdivision – Phase 2 Stormwater Management Design Brief (April 2, 2002)

Storm Water Management Design Brief

YIN SUBDIVISION - PHASE 2

NORFOLK COUNTY - WATERFORD

G. DOUGLAS VALLEE LIMITED
CONSULTING ENGINEERS AND ARCHITECT
51 Park Road, R.R.1, Simcoe, Ontario N3Y 4J9
Telephone 519-426-6270 Fax 519-426-6277

PROJECT N0. 00-026

REVISED APRIL 2, 2002

G. DOUGLAS VALLEE LIMITED
Consulting Engineers and Architect

G. Douglas Vallee, P.Eng., O.A.A.
John D. Vallee, P.Eng.

April 2, 2002

Mr. Tony Yin
R.R.#4
Waterford, Ontario
N0E 1Y0

Dear Sir:

Reference: REVISED Storm Water Management Design Brief
Proposed Residential Subdivision
South of Thompson Road and East of Main Street
Waterford, Norfolk County, Ontario
Our Project Number 00-026

This report presents our storm water management design for the proposed development of approximately 17 ha of land as a residential subdivision in Waterford, Norfolk County. The subdivision lands are bounded by the road allowance between Concessions 8 and 9, being County Road No. 9, to the north, and are located in the south east corner of Waterford. The site location and subdivision layout are indicated in attached maps.

This report forms our submission package to Norfolk County, Long Point Region Conservation Authority, and the Ministry of the Environment for their review and approval.

Background

The subject lands are located just east of the east (upstream) limit of the Waterford South Municipal Drain (WSM Drain). This drain consists of storm sewers constructed under MOE Certificate of Approval # 3-1100-96-006 and a storm water quality and quantity pond constructed under MOE Certificate of Approval # 3-1037-96-006. It is proposed that the subdivision will drain to existing municipal storm sewers and subsequently to the WSM Drain. This provides a legal and adequate outlet for the subdivision.

Given the quality control aspects of the WSM Drain pond, no water quality control aspects have been designed into the subdivision pond.

The Waterford South Municipal Drain storm sewer pipe was designed for a 2 year storm. Therefore this storm sewer will surcharge in during more severe rainfall events. This has been anticipated in the design of the subdivision storm water works.

51 Park Road, R.R. 1 Simcoe, Ontario, N3Y 4J9
Phone 519-426-6270 Fax 519-426-6277 vallee@kwic.com

Soil and Ground Conditions

Soil maps of the area were used to determine that the native soil is classified as Brady, Fox, and Granby. The soil is mainly lacustrine sand and loamy sand. This sand is classified into hydrologic soil group "AB." In the pre-development condition, being pasture and other improved land, this soil is given a soil/land use curve number of 62 for the AMCIII condition. This converts to a CN value of 42 for the AMCII condition. Therefore a CN value of 50 has been used for modelling purposes. This is consistent with the design values used in the Waterford South Municipal Drain. The supporting documentation for these determinations are found in Appendix "A."

Water Quantity Limitations

The Waterford South Municipal Drain was sized to accommodate flows from the 2 year storm. The model that was used for the design of the drain provided a modest allowance for flows from the subdivision. During rainfall events in excess of the 2 year storm, the theoretical discharge from the subdivision pond will be in excess of the allowance for it in the WSM Drain design.

Therefore, the pond has been sized to accommodate all of the runoff from the subdivision without any outlet. This simulates a surcharged WSM Drain, or clogged outlet. It is expected that in actual fact, the discharge rate from the subdivision pond will be controlled by the available capacity of the WSM Drain.

Post-Development Flows and Retention

Post-development flows are routed to the proposed detention pond. In order to model the performance of this facility, a stage / storage / discharge table was prepared. This table calculates the storage volume, and discharge rate for various water elevations in the pond. Calculations were performed at 0.1 m intervals of water elevation. Volumes were calculated using the proposed contours and the end-area method.

The orifice equation was used to determine the discharge rates for the various water elevations above the pipe invert. The manning equation has been used to calculate discharge rates for water elevations with the pipe flowing partially full. The calculations are detailed in Appendix "B." It has been assumed that once the outlet pipe is submerged, it will operate under head in accordance with this equation.

$$Q = C * A * (2 * g * h)^{0.5}$$

The attached stage / storage / discharge table indicates the results of these calculations.

The performance of the SWM pond was modelled using the OTTHYMO'89 computer program. The modelling was completed by modifying the original WSM Drain data file to represent the proposed design of the subdivision SWM pond. Output data for the post-development condition are attached in Appendix "C" and are summarized as follows:

Two rainfall events were considered.

a) **The 2 year storm** was modelled to review the impact of the subdivision on the WSM Drain during the drain's design storm. This model output indicates the following key performance indicators:
Maximum Inflow Rate to the SWM Pond.....0.55 m^3/s
Maximum Outflow Rate from SWM Pond to WSM Drain .....0.27 m^3/s
Peak Downstream Flow in WSM Drain sewer.....3.49 m^3/s
Design Capacity of WSM Drain upper run sewers .....3.59 m^3/s
Design Capacity of WSM Drain lower run sewers.....3.31 m^3/s

This would indicate that the lower runs will be slightly surcharged during the 2 year storm, however, this design capacity of 3.31 m^3/s is based on the pipe flowing full. The actual maximum capacity is with the pipe flowing 94% full. Considering this case, the capacity of the 1500mm lower runs is actually 3.56 m^3/s, being slightly above the peak flow in the WSM Drain of 3.43 m^3/s. The maximum capacity flow calculation is presented in Appendix "B."

b) **The 100 year storm** was modelled to review the performance of the subdivision SWM pond in extreme event. Given the fact that the WSM Drain was only sized for the 2 year storm, it does not provide an adequate outlet for major storm events. **There is no clear overland flow route that is available to the subdivision.**

Therefore, the model for the 100 year storm has assumed that the WSM Drain is completely surcharged, and that there is absolutely no outlet capacity for the subdivision. The model has assumed no release from the pond during this extreme event.

In this very conservative and extreme condition, the model indicates that the maximum storage required is 0.58 ha.m. This volume is contained in the proposed SWM pond.

It must be recalled that the 100 years storm was modelled considering no release from the SWM pond. This is considered a worst case scenario for the performance of the pond.

Water Quality Management

A water quality management pond currently exists at the downstream end of the WSM Drain. This pond contains a sediment forebay and permanent pools. This WSM Drain pond was designed to accommodate storm water runoff from the proposed subdivision, and **therefore no water quality aspects have been included in the design of the subdivision pond.**

Storm Sewer Design

Storm sewers have been designed using the rational method with a two year design storm. Details of this design are presented in a separate design brief. This separation is the result of the separate Ministry of the Environment approval processes for sewer and water works and stormwater management works

Summary

Storm water management designs for this project have been completed in accordance with standard design procedures.

Storm sewers have been sized for a two year storm in accordance with the rational method of design considering local design standards.

The detention pond discharges to existing municipal storm sewers and subsequently to the existing Waterford South Municipal Drain.

The Otthymo'89 model for the WSM Drain has been modified to include the stage / storage / discharge curve from the proposed detention pond in the Subdivision. This

model has confirmed that in the 2 year storm, the release from the proposed facility will not surcharge the WSM Drain. It has also demonstrated that in the 100 year storm, the entire storm can be detained in the proposed pond, even without outlet to the presumably surcharged WSM Drain.

Storm water quality is addressed by the existing SWM facility near the downstream end of the WSM Drain. That quality control pond was designed to accept runoff from this site, and therefore no water quality control measures have been incorporated into the design of the subdivision facility.

This report is respectfully submitted.

John D. Vallee, P.Eng.
G. DOUGLAS VALLEE LIMITED

Distribution:

Norfolk County Engineering Department
Long Point Region Conservation Authority
MOE Approval Branch - Toronto
MOE District Office - Hamilton

\\Reception\c\DATA\Projects\2000\00-026 Yin Subd. Phase 2\SWM Design Brief.wpd

Appendix C
Post Development Flow Model

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================================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
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       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO    cE/101051900333

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DATE: 05-02-2001                      TIME: 14:33:55


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
*****
*POST DEVELOPMENT FLOW SIMULATION
*YIN SUBDIVISION - WATERFORD, NORFOLK COUNTY
*****
  ***************************
  ** SIMULATION NUMBER:   1 **
  ***************************

*****

--------------------
|    READ STORM    |    Filename: CH2.STM
| Ptotal= 39.39 mm |    Comments: 2 YEAR CHICAGO 4 HOUR DESIGN STORM DISTR
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .17    3.25 |  1.17    8.94 |  2.17    8.15 |  3.17    4.39
                 .33    3.56 |  1.33   16.92 |  2.33    7.01 |  3.33    4.11
                 .50    3.96 |  1.50   78.82 |  2.50    6.20 |  3.50    3.89
                 .67    4.52 |  1.67   21.89 |  2.67    5.59 |  3.67    3.68
                 .83    5.31 |  1.83   13.00 |  2.83    5.11 |  3.83    3.51
                1.00    6.55 |  2.00    9.88 |  3.00    4.72 |  4.00    3.35

--------------------------------------------------------------------------------

*****
*CONSIDER ENTIRE AREA TO BE DEVELOPED









*****
--------------------
| DESIGN           |
| STANDHYD  (0101) |   Area    (ha)=  16.90
|ID= 1 DT= 5.0 min |   Total Imp(%)=  38.00   Dir. Conn.(%)=  16.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.42        10.48
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     335.66        40.00
     Mannings n           =       .013         .250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

                            IMPERVIOUS    PERVIOUS (i)
     Max.eff.Inten.(mm/hr)=      78.82        10.28
               over (min)        5.00        25.00
     Storage Coeff.  (min)=       4.72 (ii)   22.26 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .22          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .54          .17           .58 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.83          1.50
     RUNOFF VOLUME    (mm)=      38.58         6.49         11.62
     TOTAL RAINFALL   (mm)=      39.39        39.39         39.39
     RUNOFF COEFFICIENT   =        .98          .16           .29

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*****
--------------------
| PRINT HYD (0101) |   AREA       (ha)=  16.90
| ID= 1   PCYC=  1 |   QPEAK     (cms)=    .58 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  11.62

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms
   .00     .00 |  1.00     .05 |  2.00     .23 |  3.00     .11 |  4.00     .07
   .08     .00 |  1.08     .06 |  2.08     .21 |  3.08     .10 |  4.08     .05
   .17     .00 |  1.17     .07 |  2.17     .20 |  3.17     .10 |  4.17     .04
   .25     .00 |  1.25     .11 |  2.25     .18 |  3.25     .09 |  4.25     .04
   .33     .02 |  1.33     .13 |  2.33     .17 |  3.33     .09 |  4.33     .03
   .42     .03 |  1.42     .45 |  2.42     .16 |  3.42     .09 |  4.42     .03
   .50     .03 |  1.50     .58 |  2.50     .15 |  3.50     .08 |  4.50     .02
   .58     .03 |  1.58     .37 |  2.58     .14 |  3.58     .08 |  4.58     .02
   .67     .03 |  1.67     .32 |  2.67     .13 |  3.67     .08 |  4.67     .01
   .75     .04 |  1.75     .28 |  2.75     .12 |  3.75     .08 |  4.75     .01
   .83     .04 |  1.83     .28 |  2.83     .12 |  3.83     .08 |
   .92     .05 |  1.92     .25 |  2.92     .11 |  3.92     .07 |
--------------------------------------------------------------------------------
*****
*COMPUTE VOLUME      ID=1  STRATE=-100  RELRATE=0.47
*****
--------------------
| RESERVOIR (0102) |
| IN= 1---> OUT= 2 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |     .390       .082
                           .000       .000    |     .430       .109
                           .020       .000    |     .530       .199
                           .080       .002    |     .580       .267
                           .210       .016    |     .636       .342
                           .300       .033    |     .000       .000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 1 (0101)     16.90       .58      1.50      11.62
     OUTFLOW: ID= 2 (0102)     16.90       .28      1.83      11.62

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.58
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .03

--------------------------------------------------------------------------------
*****

 FINISH
================================================================================
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================================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO    cE/101051900336

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DATE: 05-02-2001                      TIME: 14:36:30


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
*****
*POST DEVELOPMENT FLOW SIMULATION
*YIN SUBDIVISION - WATERFORD, NORFOLK COUNTY
*****
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*****

--------------------
|    READ STORM    |    Filename: CH100.STM
| Ptotal= 83.90 mm |    Comments: 100 YEAR CHICAGO 4 HOUR DESIGN STORM DIS
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .17    4.50 |  1.17   16.86 |  2.17   14.83 |  3.17    6.60
                 .33    5.05 |  1.33   41.07 |  2.33   12.12 |  3.33    6.10
                 .50    5.82 |  1.50  205.92 |  2.50   10.31 |  3.50    5.66
                 .67    6.83 |  1.67   54.56 |  2.67    9.02 |  3.67    5.28
                 .83    8.41 |  1.83   29.17 |  2.83    8.03 |  3.83    4.98
                1.00   11.07 |  2.00   19.28 |  3.00    7.24 |  4.00    4.70

--------------------------------------------------------------------------------

*****
*CONSIDER ENTIRE AREA TO BE DEVELOPED









*****
--------------------
| DESIGN           |
| STANDHYD  (0101) |   Area    (ha)=  16.90
|ID= 1 DT= 5.0 min |   Total Imp(%)=  38.00   Dir. Conn.(%)=  16.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.42        10.48
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     335.66        40.00
     Mannings n           =       .013         .250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

                           IMPERVIOUS    PERVIOUS (i)
     Max.eff.Inten.(mm/hr)=     205.92        75.39
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.21 (ii)   11.12 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .27          .09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.49         1.27          2.13 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.67          1.50
     RUNOFF VOLUME    (mm)=      83.10        25.36         34.60
     TOTAL RAINFALL   (mm)=      83.90        83.90         83.90
     RUNOFF COEFFICIENT   =        .99          .30           .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*****
--------------------
| PRINT HYD (0101) |   AREA       (ha)=  16.90
| ID= 1   PCYC=  1 |   QPEAK     (cms)=   2.13 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  34.60

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms
   .00     .00 |  1.00     .09 |  2.00     .78 |  3.00     .22 |  4.00     .14
   .08     .00 |  1.08     .13 |  2.08     .64 |  3.08     .21 |  4.08     .10
   .17     .00 |  1.17     .15 |  2.17     .55 |  3.17     .20 |  4.17     .07
   .25     .03 |  1.25     .31 |  2.25     .47 |  3.25     .19 |  4.25     .05
   .33     .04 |  1.33     .38 |  2.33     .42 |  3.33     .18 |  4.33     .03
   .42     .04 |  1.42    1.54 |  2.42     .37 |  3.42     .17 |  4.42     .02
   .50     .04 |  1.50    2.13 |  2.50     .34 |  3.50     .17 |  4.50     .01
   .58     .05 |  1.58    1.70 |  2.58     .30 |  3.58     .16 |
   .67     .05 |  1.67    1.72 |  2.67     .28 |  3.67     .16 |
   .75     .06 |  1.75    1.35 |  2.75     .26 |  3.75     .15 |
   .83     .07 |  1.83    1.16 |  2.83     .25 |  3.83     .15 |
   .92     .09 |  1.92     .92 |  2.92     .23 |  3.92     .14 |
--------------------------------------------------------------------------------
*****
*COMPUTE VOLUME      ID=1  STRATE=-100  RELRATE=0.47
*****
--------------------
| RESERVOIR (0102) |
| IN= 1---> OUT= 2 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |     .390       .082
                           .000       .000    |     .430       .109
                           .020       .000    |     .530       .199
                           .080       .002    |     .580       .267
                           .210       .016    |     .636       .342
                           .300       .033    |     .000       .000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 1 (0101)     16.90      2.13      1.50      34.60
     OUTFLOW: ID= 2 (0102)     16.90       .56      2.17      34.61

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.43
                   TIME SHIFT OF PEAK FLOW         (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .24

--------------------------------------------------------------------------------
*****

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        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO    cE/101051900338

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  Input   filename: 94021mod.dat
  Output  filename: 940212.out
  Summary filename: 940212.sum



DATE: 05-02-2001                      TIME: 15:25:02


COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
*********************************
*WATERFORD SOUTH MUNICIPAL DRAIN
*FINAL REPORT
*Project # 94-021
*Detention Pond Flow Simulation
*Chicago Storm
*4 Hour Distribution
*
*
*INPUT REVISED December 22, 1993
*****Area A2 reduced to 24 ha
*****Area A3 XIMP reduced to 0.40  TIMP reduced to 0.50
*****Area A4 reduced to 41 ha, Tp reduced to 0.51 hours
*****Area A5 reduced to 59 ha
*****Detention Pond Configurations and Rating Curves Revised
*
*INPUT REVISED JUNE 9, 1995
*****Area A3 TIMP increased to 0.80 and XIMP increased to 0.50
*
*INPUT REVISED JUNE 23, 1995
*****Revised main detention pond rating curve for pond with sediment forebay
*****Detention pond outlet reduced to 450 mm diameter at 0.5%
*****(See Rating Curve Caluculation Sheet)
*
*INPUT REVISED MAY 14, 1996
*****Pond relocated to west of railway tracks
*****Overland flow from adjacent farmland no longer enters pond
*
*INPUT REVISED JULY 24, 1996
*****Detention pond rating curve revised for new pond configuration
*****Farmland areas removed from drainage area
*
*INPUT REVISED APRIL 6, 2001
*****Yin Subdivision - Area 2 - on site stormwater pond routing curve
*****modified to actual design.
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

**********
*USE CHICAGO STORM
**********

--------------------
|    READ STORM    |    Filename: CH2.STM
| Ptotal= 39.39 mm |    Comments: 2 YEAR CHICAGO 4 HOUR DESIGN STORM DISTR
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .17    3.25 |  1.17    8.94 |  2.17    8.15 |  3.17    4.39
                 .33    3.56 |  1.33   16.92 |  2.33    7.01 |  3.33    4.11
                 .50    3.96 |  1.50   78.82 |  2.50    6.20 |  3.50    3.89
                 .67    4.52 |  1.67   21.89 |  2.67    5.59 |  3.67    3.68
                 .83    5.31 |  1.83   13.00 |  2.83    5.11 |  3.83    3.51
                1.00    6.55 |  2.00    9.88 |  3.00    4.72 |  4.00    3.35

--------------------------------------------------------------------------------

**********
*AREA 1 - EXISTING URBAN AREA DRAINING TO FUTURE POND
**********
--------------------
| DESIGN           |
| STANDHYD  (0101) |   Area    (ha)=  48.00
|ID= 1 DT= 1.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.40        33.60
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     565.69        40.00
     Mannings n           =       .013         .250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.

                           IMPERVIOUS    PERVIOUS (i)
     Max.eff.Inten.(mm/hr)=      78.82         8.47
               over (min)        6.00        26.00
     Storage Coeff.  (min)=       6.46 (ii)   25.41 (ii)
     Unit Hyd. Tpeak (min)=       6.00        26.00
     Unit Hyd. peak  (cms)=        .18          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.20          .40        1.31 (iii)
     TIME TO PEAK    (hrs)=       1.53         1.92        1.53
     RUNOFF VOLUME    (mm)=      38.59         5.88       10.79
     TOTAL RAINFALL   (mm)=      39.39        39.39       39.39
     RUNOFF COEFFICIENT   =        .98          .15         .27

***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
**********
*AREA 2  -  FUTURE RESIDENTIAL SUBDIVISION
**********
--------------------
| DESIGN           |
| STANDHYD  (0102) |   Area    (ha)=  16.90
|ID= 2 DT= 1.0 min |   Total Imp(%)=  38.00   Dir. Conn.(%)=  16.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.42        10.48
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     335.66        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      78.82        10.71
               over (min)        5.00        22.00
     Storage Coeff.  (min)=       4.72 (ii)   21.97 (ii)
     Unit Hyd. Tpeak (min)=       5.00        22.00
     Unit Hyd. peak  (cms)=        .23          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .50          .17         .55 (iii)
     TIME TO PEAK    (hrs)=       1.52         1.85        1.52
     RUNOFF VOLUME    (mm)=      38.58         6.49       11.62
     TOTAL RAINFALL   (mm)=      39.39        39.39       39.39
     RUNOFF COEFFICIENT   =        .98          .16         .29

***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
**********
*PRINT HYDROGRAPH OF UNRESTRICTED FLOW FROM NEW DEVELOPMENT
**********
--------------------
| PRINT HYD (0102) |   AREA       (ha)=  16.90
| ID= 2   PCYC= 10 |   QPEAK     (cms)=    .55 (i)
| DT= 1.0 min      |   TPEAK     (hrs)=   1.52
--------------------   VOLUME     (mm)=  11.62

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms
   .00     .00 |  1.00     .05 |  2.00     .24 |  3.00     .11 |  4.00     .07
   .17     .00 |  1.17     .07 |  2.17     .20 |  3.17     .10 |  4.17     .05
   .33     .01 |  1.33     .12 |  2.33     .17 |  3.33     .09 |  4.33     .03
   .50     .03 |  1.50     .54 |  2.50     .15 |  3.50     .08 |  4.50     .02
   .67     .03 |  1.67     .35 |  2.67     .13 |  3.67     .08 |  4.67     .01
   .83     .04 |  1.83     .29 |  2.83     .12 |  3.83     .08 |
--------------------------------------------------------------------------------
**********
*ROUTE SUBDIVISION THROUGH PROPOSED YIN SUBDIVISION SITE DETENTION POND
**********
--------------------
| RESERVOIR (0200) |
| IN= 2---> OUT= 3 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |    .460       .137
                           .020       .000    |    .530       .200
                           .160       .007    |    .580       .267
                           .300       .033    |    .640       .341
                           .380       .082    |    .710       .481

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0102)     16.90       .55      1.52      11.62
     OUTFLOW: ID= 3 (0200)     16.90       .28      1.85      11.62

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 51.27
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .03

--------------------------------------------------------------------------------
***********
*ADD EXISTING URBAN AREA AND FUTURE DETAINED SUBDIVISION
**********
```

```
--------------------
| ADD HYD   (0300) |
|   1 +  3 =  4    |          AREA    QPEAK    TPEAK     R.V.
--------------------           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0101):    48.00     1.31     1.53    10.79
        + ID2= 3 (0200):    16.90      .28     1.85    11.62
          ================================================
          ID = 4 (0300):    64.90     1.54     1.55    11.00

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********
*AREA 3  -  INDUSTRIAL/COMMERCIAL
**********
--------------------
| DESIGN           |
| STANDHYD  (0103) |   Area    (ha)=  19.00
|ID= 5 DT= 1.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  50.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      15.20         3.80
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     355.90        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      78.82        46.45
               over (min)        5.00        11.00
     Storage Coeff.  (min)=       4.89 (ii)   10.27 (ii)
     Unit Hyd. Tpeak (min)=       5.00        11.00
     Unit Hyd. peak  (cms)=        .23          .11
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.75          .30          1.94 (iii)
     TIME TO PEAK    (hrs)=       1.52         1.63          1.52
     RUNOFF VOLUME    (mm)=      38.58        10.72         24.65
     TOTAL RAINFALL   (mm)=      39.39        39.39         39.39
     RUNOFF COEFFICIENT   =        .98          .27           .63


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
**********
*ADD INDUSTRIAL/COMMERCIAL AREA TO TOTAL
**********









--------------------
| ADD HYD   (0301) |
|   4 +  5 =  6    |          AREA    QPEAK    TPEAK     R.V.
--------------------           (ha)    (cms)    (hrs)     (mm)
          ID1= 4 (0300):    64.90     1.54     1.55    11.00
        + ID2= 5 (0103):    19.00     1.94     1.52    24.65
          ================================================
          ID = 6 (0301):    83.90     3.47     1.53    14.09

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********
*ROUTE TOTAL FLOWS THROUGH NEW DETENTION POND TO WEST OF RAILWAY TRACKS
*Rating Curve Revised for New Pond Design July 1996
**********
--------------------
| RESERVOIR (0200) |
| IN= 6---> OUT= 9 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000        .000   |     .276       .928
                           .000        .231   |     .289       .983
                           .090        .411   |     .338      1.210
                           .180        .600   |     .359      1.327
                           .247        .819   |     .000       .000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 6 (0301)     83.90      3.47      1.53      14.09
     OUTFLOW: ID= 9 (0200)     83.90       .28      4.13      10.30

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.00
                  TIME SHIFT OF PEAK FLOW         (min)=156.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .93

--------------------------------------------------------------------------------
**********
*PRINT OUTFLOW HYD FROM POND
**********
--------------------
| PRINT HYD (0200) |   AREA       (ha)=  83.90
| ID= 9   PCYC= 10 |   QPEAK     (cms)=    .28 (i)
| DT= 1.0 min      |   TPEAK     (hrs)=   4.13
--------------------   VOLUME     (mm)=  10.30

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  TIME     FLOW |  TIME     FLOW |  TIME     FLOW |  TIME     FLOW |  TIME     FLOW
   hrs      cms |   hrs      cms |   hrs      cms |   hrs      cms |   hrs      cms
   .00      .00 |  3.50      .27 |  7.00      .21 | 10.50      .13 | 14.00      .07
   .17      .00 |  3.67      .27 |  7.17      .21 | 10.67      .13 | 14.17      .07
   .33      .00 |  3.83      .27 |  7.33      .21 | 10.83      .12 | 14.33      .07
   .50      .00 |  4.00      .28 |  7.50      .20 | 11.00      .12 | 14.50      .06
   .67      .00 |  4.17      .28 |  7.67      .20 | 11.17      .12 | 14.67      .06
   .83      .00 |  4.33      .28 |  7.83      .20 | 11.33      .11 | 14.83      .06
  1.00      .00 |  4.50      .27 |  8.00      .19 | 11.50      .11 | 15.00      .06
  1.17      .00 |  4.67      .27 |  8.17      .19 | 11.67      .11 | 15.17      .06
  1.33      .00 |  4.83      .27 |  8.33      .19 | 11.83      .10 | 15.33      .06
  1.50      .00 |  5.00      .26 |  8.50      .18 | 12.00      .10 | 15.50      .05
  1.67      .09 |  5.17      .26 |  8.67      .18 | 12.17      .10 | 15.67      .05
  1.83      .14 |  5.33      .26 |  8.83      .17 | 12.33      .09 | 15.83      .05
  2.00      .18 |  5.50      .25 |  9.00      .17 | 12.50      .09 | 16.00      .05
  2.17      .20 |  5.67      .25 |  9.17      .16 | 12.67      .09 | 16.17      .05
  2.33      .22 |  5.83      .24 |  9.33      .16 | 12.83      .09 | 16.33      .05
  2.50      .23 |  6.00      .24 |  9.50      .15 | 13.00      .08 | 16.50      .04
  2.67      .24 |  6.17      .24 |  9.67      .15 | 13.17      .08 |
  2.83      .25 |  6.33      .23 |  9.83      .15 | 13.33      .08 |
  3.00      .26 |  6.50      .23 | 10.00      .14 | 13.50      .08 |
  3.17      .26 |  6.67      .22 | 10.17      .14 | 13.67      .07 |
  3.33      .27 |  6.83      .22 | 10.33      .13 | 13.83      .07 |
--------------------------------------------------------------------------------
**********

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APPENDIX E

Yin's Subdivision – Phase 5 Stormwater Management Report (December 10, 2010)

vallee

Consulting Engineers, Architects & Planners

December 10, 2010

Tony Yin
204 McMichael Rd
RR#4
Waterford, ON N0E 1Y0

Attention: **Mr. Tony Yin**

Dear Sir:

Reference: **Storm Water Management Report**
Yin's Subdivision – Phase 5
Waterford – Norfolk County
Our File 10034

1.0 Introduction

This storm water report has been completed to summarize the storm water management design for Phase 5 of the Yin's Subdivision in Waterford, Norfolk County, Ontario. It is the intention to submit this report to the Norfolk County and the Long Point Region Conservation Authority for review and approval.

Yin's Subdivision Phase 5 is a single family residential development located at the southern end of Waterford along Main Street (Old Highway 24). The site is bordered by agricultural lands to the south and west; single-family residences to the north and Main Street to the west. Figure 1 shows the overall development. This report will outline the SWM plan for the overall development.

The SWMHYMO computer model has been used to simulate the sub watershed under pre and post development conditions. The simulations were conducted using the 4-hour Chicago Distribution design storm of the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year storm events.

The receiver for the discharge from the development is the Waterford South Municipal Drain. This municipal drain is a storm sewer system and also includes a dry pond facility at the down stream end of the system. Therefore, a basic level of protection is proposed with respect to water quality enhancement.

2.0 Pre-Development

Typically, it is requirement for development sites to reduce or control the post development runoff from the site to levels that do not exceed pre-development conditions. This is achieved by directing the majority of runoff to a retention area or areas. The release from these areas is controlled by means of orifice plates and/or weirs.

However, in this case the outlet for the proposed SWM facility will be the Waterford South Municipal Drain, which is a storm sewer system. Therefore, the Drain has a finite design capacity and the capacity attributable to the portion of the site within the drainage area of the municipal drain will be the limiting factor for the total discharge from the site, post development. Figure 2 shows the overall development site along with the portion of the site that is within the Waterford South Municipal Drain. Design information for the storm sewer along Main Street is unavailable from Norfolk County. However, this office completed the design of the Waterford South Municipal Drain and it is known the 2-year design storm was used.

The total site area is approximately 14.0 ha and the portion within the Waterford South Municipal drain is approximately 6.0 ha.

The SWMHYMO computer model was used to simulate pre-development conditions the portion of the site within the municipal drain's drainage area. The model uses a modified SCS procedure to estimate losses that occur naturally during a rainfall event such as evaporation and infiltration. For the areas with rural runoff characteristics, Table 1 summarizes the background information and input parameters for the computer model with complete notes included with this report as Appendix A.

Table 1
SWMHYMO Model Input – Pre Development

Parameters	Value
Area (ha)	6.0 ha
Soil Type	Fox – sand and loamy sand Granby – sand and loamy sand Wilsonville – sandy textures over gravelly sand
Hydrologic Soil Group	A
SCS Curve Number	58
Longest Flow Path (m)	429m
Average Slope (%)	1.63%
Runoff Coeff	0.2
Time to Peak (hrs)	0.52

The estimated peak pre-development storm water runoff generated from portion of the site within the Waterford South Municipal Drain is 0.064 cms.

3.0 Post-Development

Due the topography of the existing site, specifically the low elevation of Main Street relative to the elevation of the proposed SWM facility, Blocks 3 and 4 as well as small portion of Street B will not be able to drain to the SWM facility. These areas will connect directly to the proposed outlet sewer along Main Street. Therefore to achieve the required reduction in post development discharge to the identified criteria for the site, these two blocks will have a limiting post development discharge of 0.015 cms each. Both Blocks 3 and 4 will be subject to a site plan approval process with Norfolk County and as part of any submissions for these sites a SWM plan will need to be included demonstrating that the limiting discharge is achieved for these sites.

Professional Engineers Ontario
Authorized by the Association of Professional Engineers of Ontario to offer professional engineering services.

As was indicated previously the total development site is approximately 14 ha. Therefore the contributing area to the proposed SWM facility can be estimated by reducing the total area by the areas of Blocks 3 and 4 as will as the portion of Street A (approximately 2.18 ha). This results in a contributing area to the SWM facility of 11.82 ha.

Post development, impervious land areas will be introduced to each of these areas to differing degrees. For the areas within the development the following assumptions have been made with respect to impervious surfaces introduced post development.

- Assumed roof and driveway area per town single family unit $230m^2$
- Municipal Road (includes sidewalk one side) $11m^2/m$
  (Road area considered directly connected to storm sewers)

The impervious land area introduced on the town house block and the apartment block has been assumed to be 75% of the total area of these blocks. Of this impervious area, 50% has been attributed to the parking/drive areas and therefore is considered directly connected.

For the commercial blocks, the impervious land area has assumed to 90% of total block areas with 50% of this impervious area corresponding to the parking/drive areas of the sites.

Table 2 summarizes the anticipated impervious land areas for the development.

Table 2
Post Development Impervious Areas

Area	Total Area (ha)	Impervious Area (ha)	Directly Connected (ha)
SFD	9.3	3.47	1.52
Block 1 – TWNHSE	0.57	0.43	0.21
Block 2 – Apartments	0.69	0.52	0.26
Block 3 - Commercial	0.8	0.72	0.36
Block 4 – Commercial	1.4	1.26	0.63
Block 5 – SWM	1.26	1.13	0.57
TOTAL	14.02	3.55	7.53

Discharge to Storage Relationship
To determine the required level of storage for a storm water detention pond, the post-development conditions were modeled, again using the SWMHYMO computer model. In order for the computer model to determine the storage volume required the relationship between the storage volume of the pond and the discharge must be defined and is referred to as the pond-rating curve. This rating curve is determined by calculating volume of the proposed pond facility up to a proposed contour elevation and then calculating the expected discharge from the facility based on the water level at this contour elevation and the proposed outlet control configuration.

Generally orifices or weirs can control discharge from SWM facilities. Each of these control methods can be used by the singular control or they can be used in combination depending on the discharge characteristics desired. For this facility only an orifice and weir will be used to control with the following equations used to estimate discharge

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1. Orifice
   - $Q = C * A * \sqrt{2 * g * h}$

   where: Q = Discharge in cms
   C = constant, 0.63
   A = orifice area in m^2
   g = gravitational constant, 9.81 m/s^2
   h = height above orifice, m

For this facility a 125mm orifice will be used as the outlet control beginning at elevation 243.25. The complete rating curve is appended to this report as Appendix B.

Post Development Model
The post development model developed for this report as included as Appendix C. Table 3 summarizes the post development conditions for the storm events analyzed.

Table 3
Post Development Discharge

Event	Post Development to WSMD (cms)	Allowable Discharge to WSMD (cms)
2-Year	0.047	0.064
5-Year	0.050	
10-Year	0.053	
25-Year	0.055	
50-Year	0.057	
100-Year	0.060	

For all storm events the peak post development discharge to the WSMD has been controlled to less than the estimated peak pre development runoff from the contributing area to the WSMD.

4.0 Proposed SWM Facility

The Ministry of the Environment's document titled **Stormwater Management Practices Planning and Design Manual** (March 2003) was used in conjunction with requirements of the Norfolk County to determine the design for the storm water ponds for Yin's Subdivision. The following summarizes the design guidelines presented by the manual along with the corresponding value for the proposed facility. The complete calculations are provided as Appendix D.

a) Storage Sizing: Table 3.2 of the MOE design manual provides levels of storage volume required dependent on the percent impervious land area to provide basic protection. For a dry pond facility based on 54% impervious area of the contributing area to the facility, the required volume of storage is $147 m^3/ha$ of contributing area. For the contributing area of 11.82 ha this results in a required storage of 1,738 m^3 and compares to the 1,768 m^3 provided during the quality storm (2-year event).

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b) Detention Time: During the quality storm the design manual indicates a 24 hr detention time as a minimum requirement for dry pond facilities with 48 hr preferred. For the proposed facility the runoff stored during the quality storm (2-year event) is estimated to be between 26 and 35 hours.

c) Minimum Orifice Size: A minimum orifice of 75mm is recommended for wet pond facilities and compares to the 125mm provided by this facility.

d) Active Storage Depth: The MOE guideline recommends a maximum active storage depth of 2.0m. The active storage depth ranges between 0.3m and 0.9m depending on the storm event.

e) Side Slopes: Average side slopes are recommended to be at 4(h):1(v) or flatter. The exposed side slopes of the proposed facility are proposed to be 5(h):1(v).

f) Forebay Settling Length: The design manual outlines the calculation of the required length for the forebay to allow a certain size of particle to settle. The calculation is based on the peak flow rate from the pond during the quality storm, the length to width ratio of the forebay and settling velocity of the particle size (0.0003 m/s). The resulting length is 11m and compares to the 50m provided depending on the pond inlet.

g) Forebay Dispersion Length: The design manual also outlines a calculation to determine the length of forebay required to slow a discharge. This calculation is based on the inlet flow rate during the quality storm (2-year), the depth of the permanent pool in the forebay and the desired velocity in the forebay (0.5 m/s). This results in a target forebay length of 8m and compares to the 38m provided.

h) Sediment Accumulation: Based on the anticipated sediment loading rates outlined by Table 6.3 of the MOE guidelines, the estimated sediment accumulation can be determined based on the impervious land area within the catchment area along with the target removal efficiency of the proposed facility. For the estimated 54% impervious land of the contributing area, sediment accumulation is estimated to be approximately 130m^3 over a 10-year period. This compares to the forebay volume of 444m^3.

5.0 Outlet Capacity

The proposed outlet for the SWM facility outlined by this report is the Waterford South Municipal Drain. The main branch of this drain was constructed along Thompson Road in Waterford and was designed based on the 2-year storm event. Following construction of this drain, the former Regional Municipality of Haldimand Norfolk constructed a storm sewer south along Main Street. The purpose of this storm sewer was to provide an outlet to lands identified within the drainage area of the WSMD. It is unclear as to the genesis of this extension, however it appears that drainage report was not completed to bring this extension under the umbrella of the WSMD.

As was noted previously by this report, the design information for the storm sewer extension along Main Street is unavailable. Therefore to determine if the Main Street storm sewer provides sufficient capacity, design calculations were completed based on the contributing drainage area and at the 2-year storm event, the design event for the WSMD. These calculations, which are appended to this report, indicate that the existing system has insufficient capacity to service the existing drainage area.

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Furthermore, a review of the existing system profile has indicated that the system would have insufficient depth to service the proposed development site.

Therefore, it is proposed to reconstruct this system beginning at the intersection of Thompson Road and proceeding southerly along Main Street with a new storm system of sufficient depth and capacity to service the existing drainage area and the development site. As the design of the WSMD is based on the 2-year event, the design of this new system is based on the 2-year event as well as the controlled discharges from the development site up to the 100-year event. The complete calculations for this system are appended to this report.

6.0 Emergency Overflow

As part of the outlet structure for the proposed SWM facility, a 1.8m square precast concrete catch basin structure has been placed with its top corresponding to the anticipated water level of the proposed SWM facility during the 100-year storm event (244.09 +/-). In the event that a storm event in excess of the 100-year storm occurs or the primary outlet is blocked, discharge from the facility will begin to occur over the top of this structure prior to overflowing the top of bank surrounding the SWM facility.

7.0 Proposed SWM Facility Summary

The following summarizes the proposed SWM Facility, shown drawings SWM1, for the Phase 5 of the Yin's Subdivision in Waterford.

- A dry pond facility with a permanent pool elevation in the sediment forebay of 243.25, pond bottom of elevation in the sediment forebay of 242.00 and top of slope 244.25.
- Permanent pool depth of 1.25m in the sediment forebay with a volume of 896m^3
- Total storage volume provided for the 100-year storm event is 5,0690m^3.
- Discharge from the proposed facility controlled by a 125mm diameter orifice at elevation 234.25.
- Outlet from the proposed facility to be provided by an extension of the WSMD along Main Street to the site. The design of this system to based on the 2-year event for the contributing area along Main Street and the controlled discharge from the development site as follows:
    - SWM Facility - 0.03 cms
    - Block 3 Commercial - 0.015 cms
    - Block 4 Commercial - 0.015 cms
- Emergency overflow flow provided by catch basin structure with top of casting elevation placed at the approximate 100-year storage level (244.09 +/-).

8.0 Erosion and Sediment Control

During construction, the contractor is required to protect the work site and all adjacent lands from sediment and erosion regardless of the source to the satisfaction of all applicable parties. The measures installed by the contractor are to remain in place until such time as there is no further threat of damage.

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9.0 The Drainage Act

During the draft plan approval stage of this development, County staff recognized that the development site was within the drainage area of the WSMD. Therefore, the following draft plan condition was stipulated:

> " 5. The applicant covenants and agrees to pay all costs related to the Corporation of Norfolk County hiring and engineer on behalf of the applicant as per Section 4(1) of the Drainage Act for the purpose of constructing an extension to the existing municipal drain or to construct an entirely new municipal drainage system to service the severed property(s)."

To begin this process a formal request needs to provided by the applicant to Norfolk County.

11.0 Conclusions and Recommendations

It is concluded that:

1. Post development flows from the development site have been controlled to less then the current discharge of the portion of the site within the drainage area of the WSMD.
2. The proposed storm water pond has sufficient capacity and meets the design guidelines outlined by the MOE's document titled **Stormwater Management Practices Planning and Design Manual** (March 2003) for basic protection and requirements Norfolk County.
3. The existing storm sewer along Main Street has insufficient capacity during the 2-year event for the current contributing area to this system.

It is recommended that:

1. This report is provided to the Norfolk County and the Long Point Region Conservation Authority as part of the engineering approval package for the development.
2. Pending approval by the municipality and receipt of the required Ministry of the Environment approvals, the Facility and associated appurtenances be constructed as outlined by this report.
3. The applicant formally request of Norfolk County the appointment of an engineer under the Drainage Act to address the extension of the WSMD to the development site.

We trust that this is the information for submission. Should you have any questions or require further information please do not hesitate to call. Thank you.

Yours truly,

T. Gregory Smith, P.Eng.
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects and Planners

H:\Projects\2010\10-034 Yin Phase 5 Design\DESIGN\10034 Stormwater Report November 2010.doc

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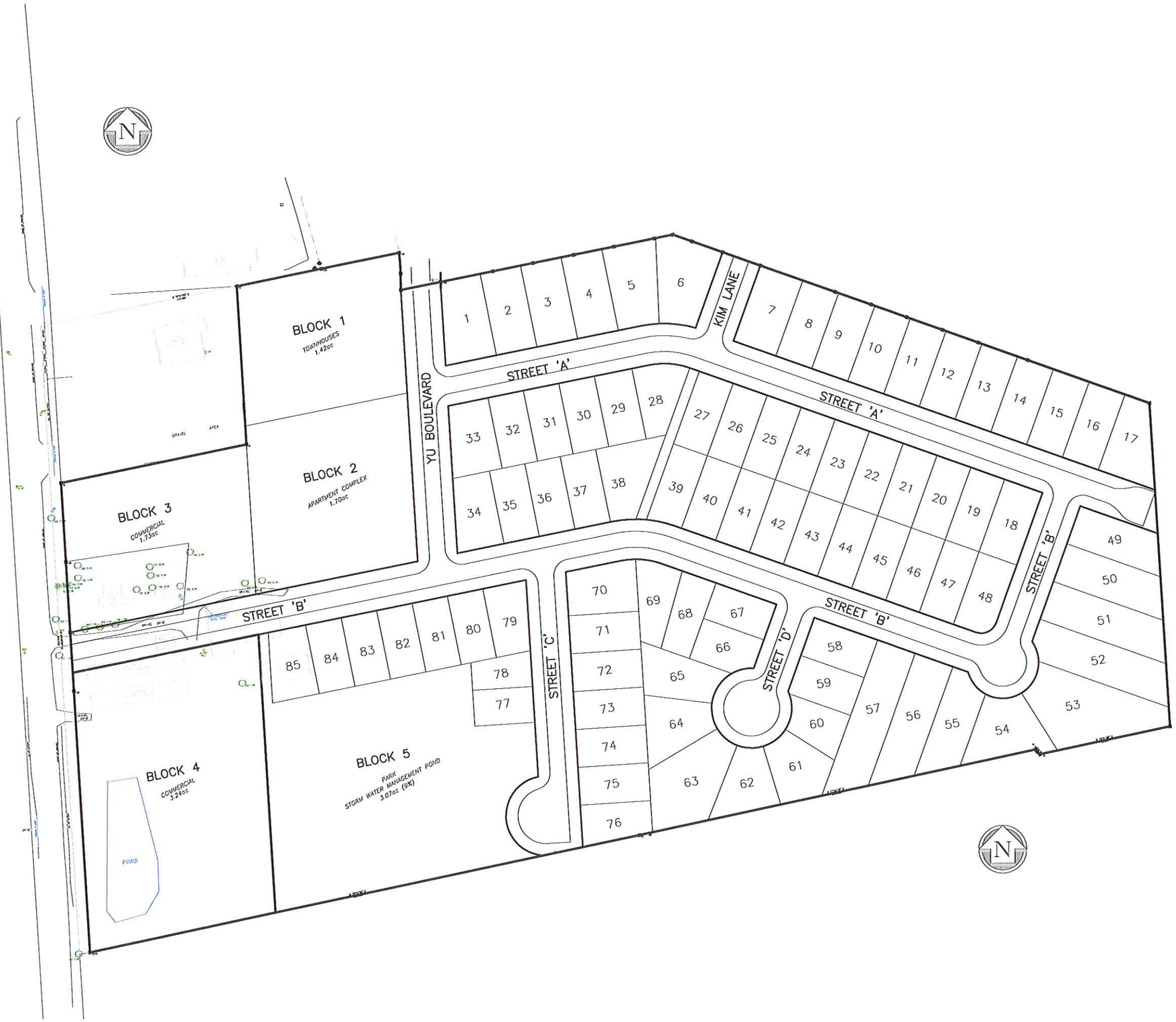
Appendix C: Post Development Model
Appendix D: Miscellaneous Pond Design Calculations
Appendix E: Main Street Storm Sewer Design Calculations (Existing and Proposed)

List of Drawings

10034 SWM1 – Plan and Section Details



DATE	REVISION

Stamp

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SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

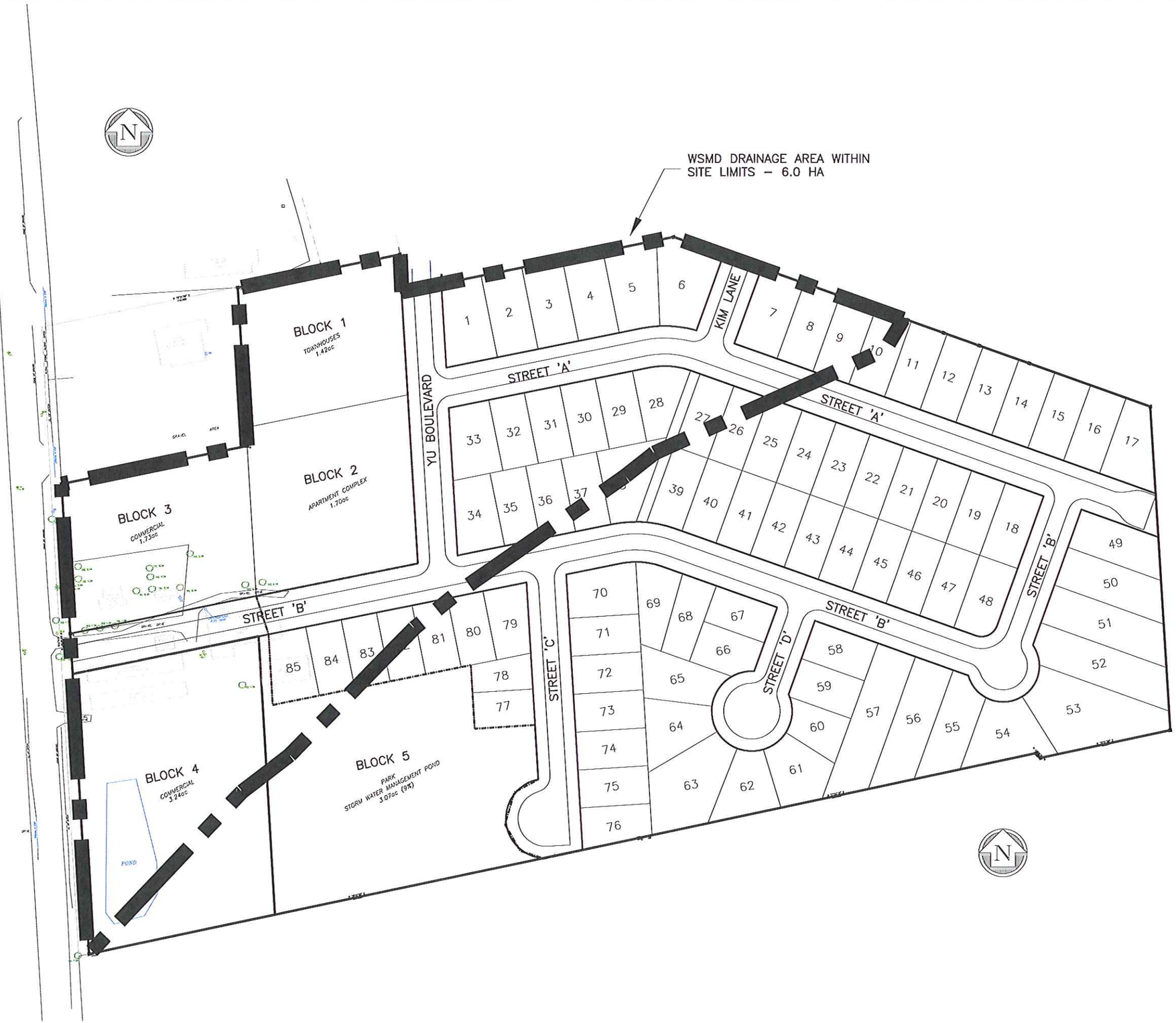
Project Title

YIN'S SUDIVISION
PHASE 5

Drawing Title

FIGURE 1
DEVELOPMENT LAYOUT

Designed by :	Drawn By :	Checked By :
TGS	TGS	
Scale : 1:2000	Date : DEC 2010	Drawing No. F1
Project No. 10034		



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(519) 426-6270

Project Title

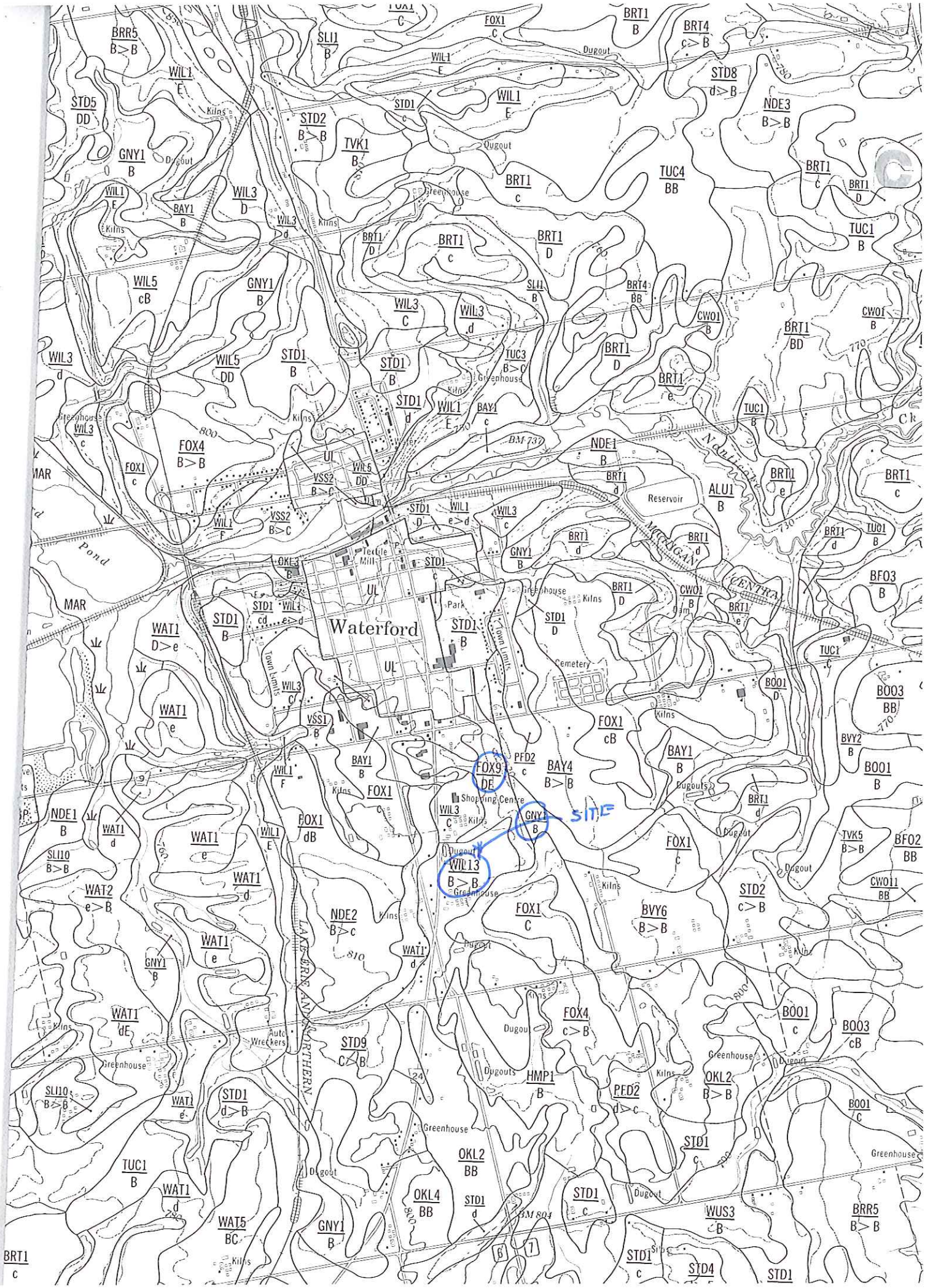
YIN'S SUDIVISION
PHASE 5

Drawing Title

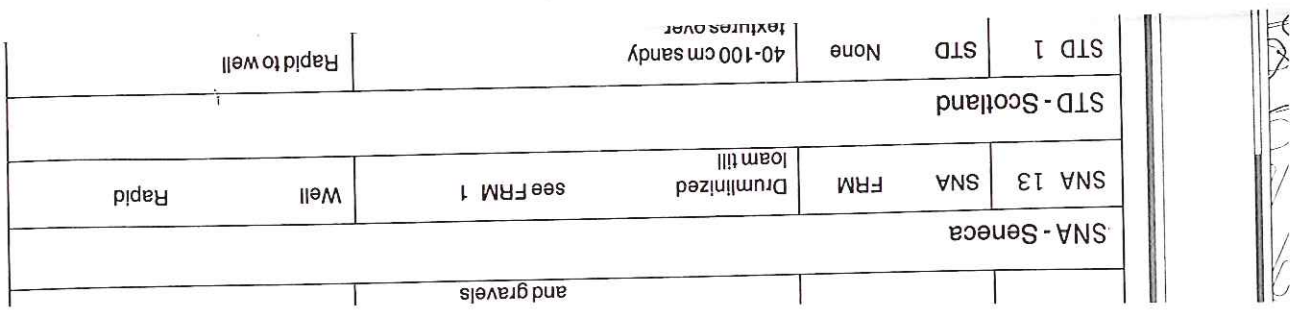
FIGURE 2
WSMD DRAINAGE AREA

Designed by :	Drawn By :	Checked By :
TGS	TGS	
Scale : 1:2000	Date : DEC 2010	Drawing No. F2
Project No. 10034		

Appendix A: Pre-Development Model


Waterford
SITE
Reservoir
Pond
Cemetery
Shopping Centre
Textile Mill
Auto Wreckers
Greenhouse
Kilns
Dugouts
Park
Town Limits
LAKE ERIE AND NORTHERN
MICHIGAN CENTRAL
BM 737
BM 804
MAR
BRR5 B>B
SLI1 B
FOX1 C
BRT1 B
BRT4 c>B
STD8 d>B
NDE3 B>B
STD5 DD
GNY1 B
STD2 B>B
TVK1 B
TUC4 BB
BRT1 c
BRT1 D
TUC1 B
WIL1 E
WIL3 D
BAY1 B
WIL5 cB
WIL3 C
WIL3 d
BRT4 BB
CWO1 B
BRT1 BD
STD1 B
TUC3 B>C
BRT1 e
WIL5 DD
STD1 d
BAY1 c
FOX4 B>B
VSS2 B>C
NDE1 B
ALU1 B
BRT1 d
STD1 D
WIL1 e>d
GNY1 B
BFO3 B
WAT1 D>e
STD1 cd
WIL1 e>d
VSS1 B
BOO1 D
BOO3 BB
WAT1 e
FOX1 cB
BAY1 B
FOX9 DE
PFD2 c
BAY4 B>B
BVY2 B
BOO1 B
NDE1 B
WAT1 d
FOX1 dB
WIL13 B>B
TVK5 B>B
BFO2 BB
SLI10 B>B
WAT2 e>B
WAT1 d
STD2 c>B
NDE2 B>c
FOX1 C
BVY6 B>B
CWO11 BB
WAT1 e
GNY1 B
WAT1 dE
STD9 C>B
FOX4 c>B
BOO1 c
BOO3 cB
HMP1 B
OKL2 B>B
PFD2 d>c
STD1 d>B
TUC1 B
WAT1 d
OKL2 BB
OKL4 BB
STD1 d
STD1 c
WUS3 cB
BRR5 B>B
WAT5 BC
GNY1 B
BRT1 c
STD4
STD1

CWO 20	CWO.C	BRR	15-40 cm sandy textures over lacustrine silt loam	see BRR 1	Poor	Imperfect
CWO 22	CWO.P	HMP	15-40 cm organic materials over lacustrine silt loam	see HMP 1	Poor	Very poor
FOX - Fox						
FOX 1	FOX	None	Mainly lacustrine sand and loamy sand		Rapid to well	
FOX 3	FOX	GNY	see FOX 1	see GNY 1	Rapid to well	Poor
FOX 4	FOX	BAY	see FOX 1	see BAY 1	Rapid to well	Imperfect
FOX 8	FOX	BRR	see FOX 1	see BRR 1	Rapid to well	Imperfect
FOX 9	FOX	STD	see FOX 1	see STD 1	Rapid to well	Well
FOX 10	FOX	OKL	see FOX 1	see OKL 1	Rapid to well	Imperfect
FOX 13	FOX	CWO	see FOX 1	see CWO 1	Rapid to well	Poor
FRM - Farmington						
FRM 1	FRM	None	Less than 20 cm variable textures over bedrock		Rapid	
GNY - Granby						
GNY 1	GNY	None	Mainly lacustrine sand and loamy sand		Poor	
GNY 3	GNY.P	None	15-40 cm organic materials over lacustrine sand and loamy sand		Very poor	
GNY 4	GNY	BAY	see GNY 1	see BAY 1	Poor	Imperfect
GNY 6	GNY	FOX	see GNY 1	see FOX 1	Poor	Rapid to well
GNY 7	GNY	CWO	see GNY 1	see CWO 1	Poor	Poor
GNY 11	GNY	GNY.P	see GNY 1	see GNY 3	Poor	Very poor
GNY 15	GNY	OKL	see GNY 1	see OKL 1	Poor	Imperfect
GNY 17	GNY	BRR	see GNY 1	see BRR 1	Poor	Imperfect
GNY 18	GNY.P	TLD.C	see GNY 3	see TLD 2	Very poor	Poor



RAINAGE MPONENTS No. 2
Rapid
Variable
Rapid
Rapid to well
Rapid
Rapid to well

ll

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mate proportions, and the

ents in the map unit. The
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ent has been mapped in

the slope symbols appear
s, a "greater than" symbol
hat occupies at least 80%

ls B, c, C, d, D, e, E, f, F,

tand that many soil bound-
everal hectares, of uniden-
cs to a depth of about 100

MAP UNIT SYMBOL	MAP UNIT COMPONENTS No. 1	No. 2	PARENT MATERIAL COMPONENTS No. 1	No. 2	DRAINAGE COMPONENTS No. 1	No. 2
WIL - Wilsonville						
WIL 1	WIL	None	Mainly gravelly sandy till		Rapid to well	
WIL 3	WIL.C	None	15-40 cm sandy textures over gravelly sandy till		Rapid to well	
WIL 5	WIL	WIL.C	see WIL 1	see WIL 3	Rapid to well	Rapid to well
WIL 9	WIL.L	WIL	15-40 cm loamy textures over gravelly sandy till	see WIL 1	Rapid to well	Rapid to well
WIL 10	WIL.L	BRT	see WIL 9	see BRT 1	Rapid to well	Well
WIL 11	WIL.C	WIL	see WIL 3	see WIL 1	Rapid to well	Rapid to well
WIL 12	WIL.C	STD	see WIL 3	see STD 1	Rapid to well	Rapid to well
WIL 13	WIL.C	NDE	see WIL 3	see NDE 1	Rapid to well	Imperfect
WIL 14	WIL.C	OKL	see WIL 3	see OKL 1	Rapid to well	Imperfect
WSH - Walsher						
WSH 1	WSH	None	40-100 cm sandy textures over lacustrine silt loam		Well	
WUS - Wauseon						
WUS 1	WUS	None	40-100 cm sandy textures over lacustrine silty clay		Poor	
WUS 3	WUS.P	None	15-40 cm organic materials over lacustrine silty clay		Very poor	
WUS 4	WUS	BRR	see WUS 1	see BRR 1	Poor	Imperfect
WUS 6	WUS	TLD.C	see WUS 1	see TLD 2	Poor	Poor
WUS 9	WUS	SLI	see WUS 1	see SLI 1	Poor	Poor
WUS 10	WUS	TUC.C	see WUS 1	15-40 cm sandy textures over lacustrine silt loam	Poor	Imperfect

TVK - Ta
TVK 1
TVK 2
TVK 3
TVK 4
TVK 5
TVK 7
TVK 9
VSS - Va
VSS 1
VSS 2
WAT - V
WAT 1
WAT 2
WAT 3
WAT 4
WAT 5
WAT 8
WAT 1

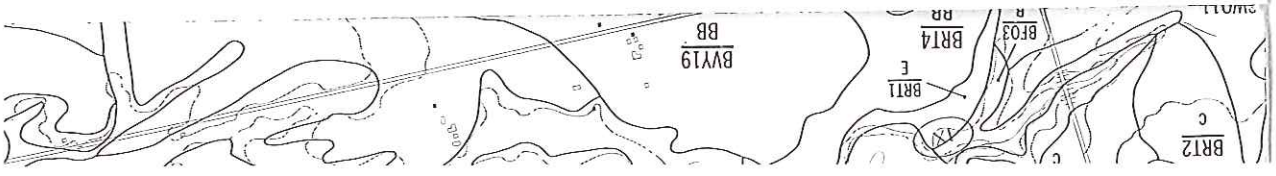


CHART C2-6 -continued

Soil Series	Soil Type	Hyd. Soil Grp.	Soil Series	Soil Type	Hyd. Soil Grp.	Soil Series	Soil Type	Hyd. Soil Grp.
Crombie	s l	B	Englehart	s l	B	Harriston	l	BC
"	si l	BC	Evanturel	si l	BC	"	si l	BC
Dack	c	D	"	si c l	C	Harrow	s	A
Dalton	s	AB	Falardeau	si l	BC	"	s l	AB
Darlington	s	B	"	si c l	C	"	l	B
"	l	C	Farmington	s l	A	Havelock	s /g	A
Dawson	s l	A	"	l	B	Hawkesvi.	l	B
"	l	B	"	c l	C	Haysville	s l	AB
Deloro	l	B	Ferndale	si l	BC	Heidelburg	f. s l	B
Devlin	si c /}	C	"	c l	C	Hendrie	s /g	AB
	c l }		Flamboro	s	B	Henwood	s /g	A
Dinorwic	c	BC	Floradale	l	B	Hespeler	s l	B
Dobie	c /l	BC	Fonthill	g	A	Hillier	c	C
Doe	s l	B	Font	g s l	A	Hillsburgh	s l	A
"	si l	BC	Forbes	c	D	Himsworth	si l	BC
Donald	l	B	Fox	s	A	Hinchinbr.	s l	B
Donnybrook	s g	A	"	s l	AB	"	l	BC
"	s l	AB	Foxboro	s	A	"	si l	BC
Dorion	c /l	C	Franktown	l	B	Honeywood	s l	AB
Dorking	si c l	BC	Freeport	s l	B	"	si l	BC
Dumfries	s l	A	Galesburg	s l	A	Howland	s l	B
"	l	AB	"	l	AB	"	l	BC
Dummer	s l	A	Gameland	s /g	AB	Huron	s l	B
"	l	B	Gananoque	c	C	"	l	BC
Dundonald	s l	AB	Gerow	c l	C	"	si l	BC
Dunedin	c	D	Gilford	s l	B	"	c l	CorD
Dymond	s l	AB	"	l	B	Innisville	s l	B
"	l	B	Gordon	si c	C	Jeddo	l	BC
Eagle Lake	s /g	AB	Granby	s	B	"	c l	C
Eamer	l	BC	"	s l	B	Kagawong	si l	BC
Earlton	si l	B	Grand	l	B	Kars	s /g	A
"	c l	C	Grenville	s l	A	Kemble	si l	BC
Eastport	s	A	"	l	BC	"	si c l	C
Edenvale	s	AB	Grimsby	s l	A	"	c l	D
Eganville	l	B	Guelph	s l	A	Kenabeek	s	B
Elderslie	si l	BC	"	l	BC	"	s l	B
"	si c l	C	"	si l	BC	Killean	l/s l	AB
"	c l	C	Guerin	s l	AB	King	si l	BC
Eldorado	s l	A	"	l	B	"	c l	C
"	l	B	Gwillimb.	g	AB	Kirkland	s l	A
Elk Pit	s g	A	Haileybury	si c l	C	Kossuth	s l	B
Ellwood	c l	C	"	si c	C	L'Achigan	s	AB
Elmbrook	si l	BC	"	c	CD	Lambton	l	BC
"	c l	C	Haldimand	si l	BC	"	si l	BC
"	c	C	"	si c l	C	Lanark	c	C
Elmira	l	B	"	c	CorD	Lansdowne	c /si l	C
Elmsley	s l	B	Hanbury	si c l	C	Leech	si c l	C
Embro	s l	BC	"	si c	C	"	c l	D
"	s l	C	"	c	D	Leitrim	g	B
Emily	l	B	Harkaway	l	B	Leith	si l	BC
Emo	c & p	C	"	si l	BC	Lily	l/s l	B

CHART C2-6

CHART C2-6 - continued

Soil Series	Soil Type	Hyd. Soil Grp.	Soil Series	Soil Type	Hyd. Soil Grp.	Soil Series Late	Soil Type Addit.	Hyd. Soil Grp.
Smithville	l	BC	Uplands	s	A	Percy	f s l	B
"	si c l	C	"	s l	A	Brisbane	l	B
"	si l	BC	Upsala	f s	AB	Donnybrook	l	B
Snedden	si c l	C	Vars	l	B			
Solmesville	c l	C	Vasey	s l	AB			
South Bay	c l	D	"	l	B			
"	c	D	Vergennes	si l	BC			
Spohn	s /g / c	BC	"	l	BC			
			"	c	C			
Springvale	s l	A	Vincent	si l	BC			
Stafford	l	B	"	si c l	C			
Stockdale	si l/f		"	c l	D			
	s	B	Vineland	s l	AB			
St, Clem.	s l	A	Wabi	s l	A			
"	si c l	C	"	l	B			
St. Jacobs	l	B	Wabigoon	c	C			
St. Peter	s /g	A	Waterloo	s	A			
St. Rosalie	c	C	"	s l	A			
St. Samuel	s	B	Watrin	s	B			
"	s l	B	Waupoos	c l	D			
St. Thomas	s	A	"	c	D			
Sullivan	s	A	Wauseon	s l	B			
"	s l	A	Wayside	s	AB			
Sutton Bay	s	B	Welland	c	C			
"	s l	B	Wellesley	s l	AB			
Tansley	c	D	"	si c l	C			
Tavistock	s l	AB	Wemyss	s l	AB			
"	si l	BC	Wendigo	s	A			
Tecumseth	s	AB	"	s l+r	AB			
Teeswater	si l	B	Wendover	c l	D			
Tennyson	s l	A	Westmeath	s	A			
Thames	c l	D	Whitby	l	BC			
Thorah	s	B	White Lake	s /g	A			
Thornloe	c	C	Whitfield	si l	B			
Thwaites	si l	BC	Wiarton	l	B			
Tioga	s	A	"	si l	BC			
"	s l	A	Wilmot	s l	B			
Toledo	si l	BC	"	si c l	C			
"	si c l	C	Winona	s l	AB			
"	c l	C	Woburn	s l	A			
"	c	C	"	l	B*			
Trafalgar	c	D	Wolford	c l	D			
Trent	s	AB	Wolsey	si c	C			
Tuscola	s l	AB	Wooler	si l/f				
"	si l	BC		s	AB			
Tweed	s l	A	Woolwich	l	BC			
Undiffer'd	s l +r	AB or B (dep. on depth)	Worthing.	s /g /c	BC			
			Wyevale	s /g	A			

WILSONVILLE NOT LISTED - SANDY => GROUP A.

*Rev. 79 06 01

CHART C2-8 - SOIL/LAND USE CURVE NUMBERS

Land Use	Hydrologic Soil Group						
	A	AB	B	BC	C	CD	D
Fallow (special cases only)	77	82	86	89	91	93	94
Crop and other improved land	66*	70	74	78	82	84	86
Pasture & other unimproved land	58*	62*	65	71	76	79	81
Woodlots and forest	50*	54*	58	65	71	74	77
Impervious areas (paved)		98					
Bare rock draining directly to stream		98					
Bare rock draining indirectly to stream		70					
Water surfaces		100	(use in special cases only)				

Notes

1. Figures are based on average antecedent moisture condition (AMC II) except those marked *, which are initially wet (AMC III) or an intermediate condition. For definition of AMC's see Chart C2-10.
2. Table is not applicable to frozen soils or to periods in which snowmelt contributes to runoff.
3. For detailed values in urban areas see Table 2.2 of ref. 14.
4. Source: SCS Handbook of Hydrology, Chapter 9 (9), with modifications.

CHART C2-9 - PERCENT IMPERVIOUSNESS OF URBAN AREAS

Urban Land Use	% Imperviousness
Business - Commercial	40 - 90
Industrial - Light	45 - 65
Industrial - Heavy	50 - 70
Residential - Low density	20 - 30
Residential - Medium density	25 - 35
Residential - High density	30 - 40

Source: SCS Handbook of Hydrology, Chapter 15 (9)

vallee
Consulting Engineers, Architects & Planners

Subject: Yin Phase 5
Date: Nov 2/10 By: TGS
Project #: 10034 Page

High Density - predevelopment and current state

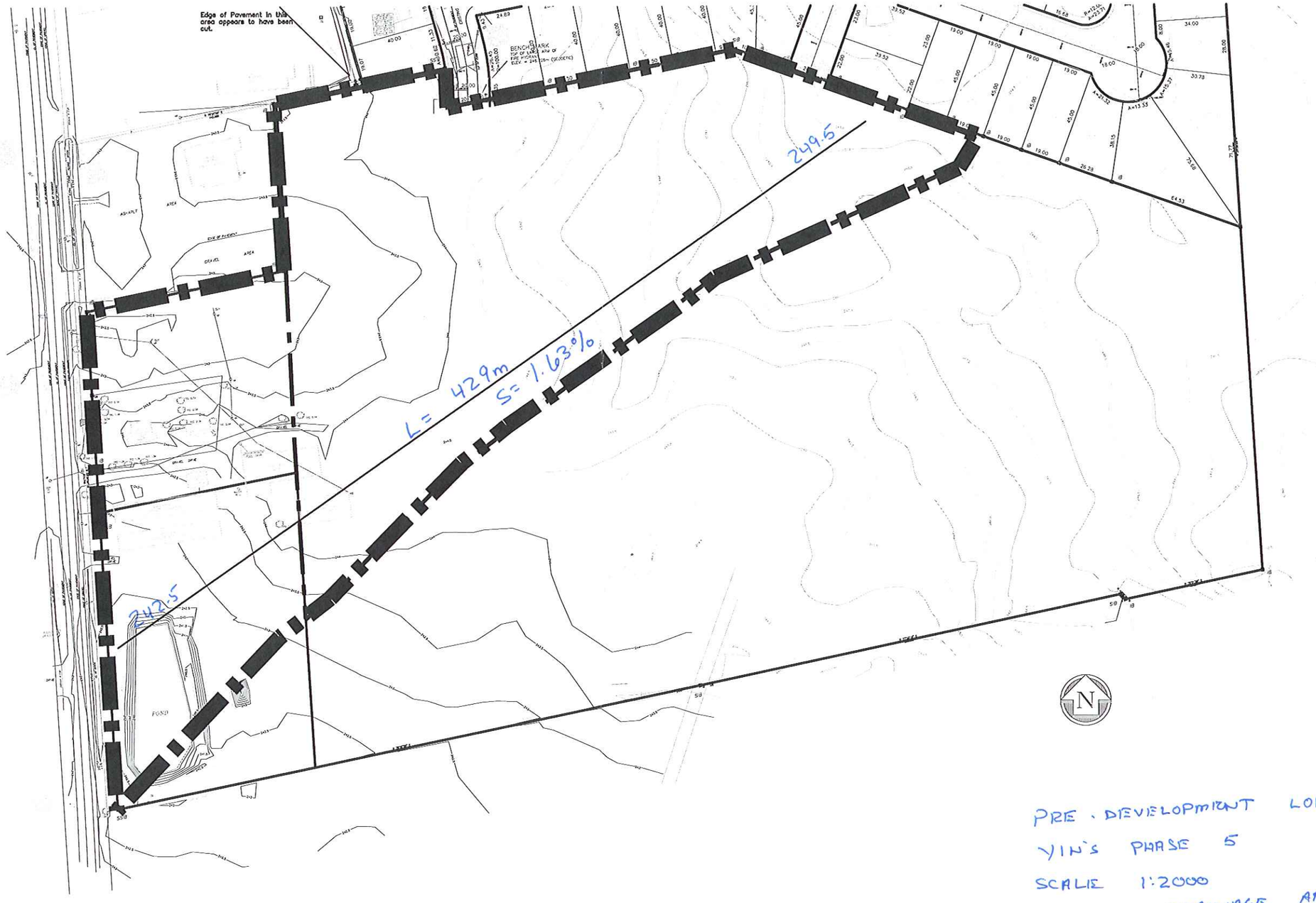
tc calc for upstream drainage area

tc = 3.26*(1.1-C)*L^(0.5)/S^0.333 (airport formula)

L as above	429 m
S as above but as percent	1.63 %
C, rational Runoff Coefficient (Pre dev)	0.2

tc = 52 min 0.86 hrs

tp = 0.6 *tc tp = 0.52 hrs



PRE - DEVELOPMENT LONGIEST FLOWPATH

YIN'S PHASE 5

SCALE 1:2000

PRE-DEV DRAINAGE AREA TO WATERFORD SOUTH MUNICIPAL DRAIN.

```
================================================================================

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   000        999    999  ==========
 S      W W W  MM MM  H   H   Y Y   MM MM  0   0      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  0   0  ##  9   9  9   9 Ver. 4.02
     S   W W   M   M  H   H    Y    M   M  0   0       9999   9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   000            9      9 ==========
                                                      9   9  9   9 # 3568969
      StormWater Management HYdrologic Model           999    999  ==========

 ********************************************************************************
 ************************** SWMHYMO-99 Ver/4.02 *********************************
 *******  A single event and continuous hydrologic simulation model  ********
 ********     based on the principles of HYMO and its successors      ********
 ********                  OTTHYMO-83 and OTTHYMO-89.                 ********
 ********************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.           ********
 *******                   Ottawa,  Ontario: (613) 727-5199          ********
 *******                   Gatineau, Quebec: (819) 243-6858          ********
 *******                   E-Mail: swmhymo@jfsa.Com                  ********
 ********************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: G. Douglas Vallee Limited                        +++++++
 +++++++                Simcoe                 SERIAL#:3568969          +++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 ********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++              ********
 ********          Maximum value for ID numbers  :     10             ********
 ********          Max. number of rainfall points:  15000             ********
 ********          Max. number of flow points    :  15000             ********
 ********************************************************************************


 ********************   D E T A I L E D   O U T P U T   ********************
 ********************************************************************************
 *       DATE: 2010-11-22     TIME: 14:14:54     RUN COUNTER: 001100       *
 ********************************************************************************
 * Input   filename: H:\SWMHYM~1\10034Y~1\PREDEV.DAT                         *
 * Output  filename: H:\SWMHYM~1\10034Y~1\PREDEV.out                         *
 * Summary filename: H:\SWMHYM~1\10034Y~1\PREDEV.sum                         *
 * User comments:                                                           *
 * 1:_______________________________________________________________________*
 * 2:_______________________________________________________________________*
 * 3:_______________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [YINS PHASE 5]    Project Number: [101034]
*#  Date        : 02-11-2010
*#  Modeller    : [TGS]
*#  Company     : G. Douglas Vallee Limited
*#  License #   :  3568969
*#*****************************************************************************
---------------------
| START             |  Project dir.: H:\SWMHYM~1\10034Y~1\
---------------------  Rainfall dir.: H:\SWMHYM~1\10034Y~1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
          #  1=CH2.STM
--------------------------------------------------------------------------------
001:0002----------------------------------------------------------------------
---------------------
| READ STORM        |    Filename: H:\SWMHYM~1\10034Y~1\CH2.STM
| Ptotal=  39.39 mm |    Comments: 2 YEAR CHICAGO 4 HOUR DESIGN STORM DISTR
---------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             .17   3.250 |   1.17   8.940 |   2.17   8.150 |   3.17   4.390
             .33   3.560 |   1.33  16.920 |   2.33   7.010 |   3.33   4.110
             .50   3.960 |   1.50  78.820 |   2.50   6.200 |   3.50   3.890
             .67   4.520 |   1.67  21.890 |   2.67   5.590 |   3.67   3.680
             .83   5.310 |   1.83  13.000 |   2.83   5.110 |   3.83   3.510
            1.00   6.550 |   2.00   9.880 |   3.00   4.720 |   4.00   3.350

--------------------------------------------------------------------------------
001:0003----------------------------------------------------------------------
********************************************************************************
*
*
*  PRE DEVELOPMENT MODEL - ENTIRE SITE
*
*
********************************************************************************
----------------------
| DESIGN NASHYD      |   Area     (ha)=   14.00   Curve Number   (CN)=58.00
| 01:PREDEV DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .670

     Unit Hyd Qpeak  (cms)=     .798

     PEAK FLOW       (cms)=     .111 (i)
     TIME TO PEAK    (hrs)=    2.400
     RUNOFF VOLUME    (mm)=    6.471
     TOTAL RAINFALL   (mm)=   39.385
     RUNOFF COEFFICIENT   =     .164

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004----------------------------------------------------------------------
********************************************************************************
*
*
*  PORTION OF SITE THAT DRAINS TO WSMD AND WILL DRAIN TO POND
*
*
********************************************************************************
----------------------
| DESIGN NASHYD      |   Area     (ha)=    4.12   Curve Number   (CN)=58.00
| 02:WSMD   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .520

     Unit Hyd Qpeak  (cms)=     .303

     PEAK FLOW       (cms)=     .038 (i)
     TIME TO PEAK    (hrs)=    2.167
     RUNOFF VOLUME    (mm)=    6.471
     TOTAL RAINFALL   (mm)=   39.385
     RUNOFF COEFFICIENT   =     .164

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005----------------------------------------------------------------------
********************************************************************************
*
*
* PRE DEVELOPMENT TO WSMD
*
*
********************************************************************************
----------------------
| DESIGN NASHYD      |   Area     (ha)=    6.02   Curve Number   (CN)=62.00
| 03:WSMD   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .520

     Unit Hyd Qpeak  (cms)=     .442

     PEAK FLOW       (cms)=     .064 (i)
     TIME TO PEAK    (hrs)=    2.167
     RUNOFF VOLUME    (mm)=    7.415
     TOTAL RAINFALL   (mm)=   39.385
     RUNOFF COEFFICIENT   =     .188

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006----------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2010-11-22     at 14:14:54
================================================================================
```

Appendix B: Pond Rating Curves

vallee
Consulting Engineers, Architects & Planners

Subject: Yins Phase 5
Date: Dec-10 By: TGS
Project #: 10034 Page

Orifgice Elevation 243.25 m
Orifice Dia 0.125 m
Orifice Area 0.012272 m2

Discharge Coeff 0.63

	Forebay m2	Main m2	Total m2	Incr Vol m3	Cum Vol m3	H above Orifice m	Orifice Q cms	Storage ha*m	Incr Time to Drain hr	Cum. Time to Drain hr
243.25	717	4485	5202	0	0	0	0	0	0	
243.35	778	4626	5404	530	530	0.0375	0.006632	0.05303		
243.45	841	4769	5610	551	1081	0.1375	0.012698	0.1081	15.8	15.8
243.55	906	4913	5819	571	1652	0.2375	0.016689	0.165245	10.8	26.6
243.65		6042	6042	593	2245	0.3375	0.019895	0.22455	9.0	35.6
243.75		6196	6196	612	2857	0.4375	0.022651	0.28574	8.0	43.6
243.85		6351	6351	627	3485	0.5375	0.025107	0.348475	7.3	50.9
243.95		6508	6508	643	4128	0.6375	0.027343	0.41277	6.8	57.7
244.05		6667	6667	659	4786	0.7375	0.029409	0.478645	6.4	64.2
244.15		6827	6827	675	5461	0.8375	0.03134	0.546115	6.2	70.4
244.25		6989	6989	691	6152	0.9375	0.033158	0.615195	6.0	76.3

244.15 0.5461
244.05 0.4786

244.09 0.5069 Elevation at 100-year storage

Appendix C: Post Development Model

vallee

Consulting Engineers, Architects & Planners

Subject: YIN PHASE 5
Date: NOV 2/10 By: TGS
Project #: 10034 Page

IMPERVIOUS AREA ASSUMPTIONS:

AVERAGE DWELLING ROOF AREA:	185	m2	
AVERAGE DWELLING DRIVEWAY AREA:	45	m2	
TOTAL IMPERVIOUS AREA PER DWELLING:	230	m2	0.023 ha
ROADWAY AND ONE SIDE SIDEWALK AREA PER METRE LENGTH OF ROAD:	11	m2	0.0011 ha

Area No.	Total Area (ha)	No. of Dwell	Dwellling Imp Area (ha)	Street Lenth (m)	Street Imp Area (ha)	Dir Conn Ratio	Total Imp Area (ha)	Imp Area Ratio
SFD	9.3	85	1.96	1380	1.52	0.16	3.47	0.37
BLOCK 1 TOWN HOUSES	0.57				0.21	0.38	0.43	0.75
BLOCK 2 APARTMENTS	0.69				0.26	0.38	0.52	0.75
BLOCK 3 COMMERCIAL	0.8				0.36	0.45	0.72	0.90
BLOCK 4 COMMERCIAL	1.4				0.63	0.45	1.26	0.90
BLOCK 5 SWM	1.26				0.57	0.45	1.13	0.90
	14.02				3.5475	0.25	7.532	0.54

1) IMPERVIOUS AREAS FOR BLOCKS 1 THOUGH 5 HAVE BEEN ASSUMED BASED ON RUNOFF COEFFICIENTS FOR APPLICABLE LAND USE PER NORFOLK COUNTY'S CURRENT DESIGN CRITERIA.
2) FOR DIRECTLY CONNECTED AREAS (IE DRIVES AND PARKING) OF BLOCKS 1 THROUGH 5, 50% OF THE TOTAL IMPERVIOUS AREA HAS BEEN ASSUMED.
3) TOTAL AREA DOES NOT EQUAL TOTAL SITE AREA AS APPROXIMATELY 0.2 HA OF STREET B WILL NOT FLOW TO SWM FACILITY.

TOTAL STREET LENGTH

580
150
80
370
50
150
1380m

1:2000

```
 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9 =========
                                                      9   9  9   9 # 3568969
      StormWater Management HYdrologic Model          999    999  =========

 ********************************************************************
 ************************ SWMHYMO-99 Ver/4.02 ***********************
 *******  A single event and continuous hydrologic simulation model  *******
 *******       based on the principles of HYMO and its successors    *******
 *******                  OTTHYMO-83 and OTTHYMO-89.                 *******
 ********************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.          *******
 *******                   Ottawa,  Ontario: (613) 727-5199         *******
 *******                   Gatineau, Quebec: (819) 243-6858         *******
 *******                   E-Mail: swmhymo@jfsa.Com                 *******
 ********************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: G. Douglas Vallee Limited                  +++++++
 +++++++                Simcoe                 SERIAL#:3568969    +++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *******
 *******          Maximum value for ID numbers  :     10          *******
 *******          Max. number of rainfall points:  15000          *******
 *******          Max. number of flow points    :  15000          *******
 ********************************************************************


 ******************  D E T A I L E D   O U T P U T  *****************
 ********************************************************************
 *       DATE: 2010-11-22     TIME: 14:15:43     RUN COUNTER: 001101   *
 ********************************************************************
 * Input   filename: H:\SWMHYM~1\10034Y~1\PSTDEV.DAT                  *
 * Output  filename: H:\SWMHYM~1\10034Y~1\PSTDEV.out                  *
 * Summary filename: H:\SWMHYM~1\10034Y~1\PSTDEV.sum                  *
 * User comments:                                                     *
 * 1:_____________________________________________________________    *
 * 2:_____________________________________________________________    *
 * 3:_____________________________________________________________    *
 ********************************************************************
```

001:0001

```
*#*****************************************************************
*#  Project Name: [YINS PHASE 5]    Project Number: [10034]
*#  Date        : 02-11-2010
*#  Modeller    : [TGS]
*#  Company     : G. Douglas Vallee Limited
*#  License #   :  3568969
*#*****************************************************************
```

```
| START            |  Project  dir.: H:\SWMHYM~1\10034Y~1\
|------------------|  Rainfall dir.: H:\SWMHYM~1\10034Y~1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
         #  1=CH2.STM
```

001:0002

```
| READ STORM       |    Filename: H:\SWMHYM~1\10034Y~1\CH2.STM
| Ptotal=  39.39 mm|    Comments: 2 YEAR CHICAGO 4 HOUR DESIGN STORM DISTR
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.250	1.17	8.940	2.17	8.150	3.17	4.390
.33	3.560	1.33	16.920	2.33	7.010	3.33	4.110
.50	3.960	1.50	78.820	2.50	6.200	3.50	3.890
.67	4.520	1.67	21.890	2.67	5.590	3.67	3.680
.83	5.310	1.83	13.000	2.83	5.110	3.83	3.510
1.00	6.550	2.00	9.880	3.00	4.720	4.00	3.350

001:0003

```
*****************************************************************
*
*
* SFD
*
*
*****************************************************************
```

```
| DESIGN STANDHYD    |  Area    (ha)=    9.30
| 01:SFD    DT= 1.00 |  Total Imp(%)=   37.00   Dir. Conn.(%)=   16.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.44	5.86
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	249.00	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		78.82	11.25
over (min)		5.00	26.00
Storage Coeff. (min)=		4.86 (ii)	25.68 (ii)
Unit Hyd. Tpeak (min)=		5.00	26.00
Unit Hyd. peak (cms)=		.23	.04
			TOTALS
PEAK FLOW	(cms)=	.27	.11 .301 (iii)
TIME TO PEAK	(hrs)=	1.52	1.92 1.517
RUNOFF VOLUME	(mm)=	38.58	8.31 13.152
TOTAL RAINFALL	(mm)=	39.38	39.38 39.385
RUNOFF COEFFICIENT	=	.98	.21 .334

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004

```
*****************************************************************
*
*
* BLOCK 1 TOWNHOUSES
*
*
*****************************************************************
```

```
| DESIGN STANDHYD    |  Area    (ha)=     .57
| 02:BLK1   DT= 1.00 |  Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.43	.14
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	61.64	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		78.82	48.36
over (min)		2.00	14.00
Storage Coeff. (min)=		2.10 (ii)	13.72 (ii)
Unit Hyd. Tpeak (min)=		2.00	14.00
Unit Hyd. peak (cms)=		.54	.08
			TOTALS
PEAK FLOW	(cms)=	.05	.01 .052 (iii)
TIME TO PEAK	(hrs)=	1.50	1.70 1.500
RUNOFF VOLUME	(mm)=	38.58	13.32 22.918
TOTAL RAINFALL	(mm)=	39.38	39.38 39.385
RUNOFF COEFFICIENT	=	.98	.34 .582

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005

```
*****************************************************************
*
*
* BLOCK 2 APARTMENTS
*
*
*****************************************************************
```

```
| DESIGN STANDHYD    |  Area    (ha)=     .69
| 03:BLK2   DT= 1.00 |  Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.52	.17
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	67.82	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		78.82	48.36
over (min)		2.00	14.00
Storage Coeff. (min)=		2.23 (ii)	13.85 (ii)
Unit Hyd. Tpeak (min)=		2.00	14.00
Unit Hyd. peak (cms)=		.52	.08
			TOTALS
PEAK FLOW	(cms)=	.06	.01 .063 (iii)
TIME TO PEAK	(hrs)=	1.50	1.70 1.500
RUNOFF VOLUME	(mm)=	38.58	13.32 22.918
TOTAL RAINFALL	(mm)=	39.38	39.38 39.385
RUNOFF COEFFICIENT	=	.98	.34 .582

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0006

```
*****************************************************************
*
*
* BLOCK 5 SWM
*
*
*****************************************************************
```

```
| DESIGN STANDHYD    |  Area    (ha)=    1.26
| 06:BLK5   DT= 1.00 |  Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.13	.13
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	91.65	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		78.82	6.11
over (min)		3.00	29.00
Storage Coeff. (min)=		2.67 (ii)	29.24 (ii)
Unit Hyd. Tpeak (min)=		3.00	29.00
Unit Hyd. peak (cms)=		.40	.04
			TOTALS
PEAK FLOW	(cms)=	.24	.00 .241 (iii)
TIME TO PEAK	(hrs)=	1.50	1.97 1.500
RUNOFF VOLUME	(mm)=	38.58	6.47 35.374
TOTAL RAINFALL	(mm)=	39.38	39.38 39.385
RUNOFF COEFFICIENT	=	.98	.16 .898

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0007

```
*****************************************************************
*
*
* DETERMINE INFLOW TO POND
*
*
```

```
**********************************************************************
---------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
-------------------- ID1 01:SFD     (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 01:SFD       9.30      .301     1.52   13.15      .000
                 +ID2 02:BLK1      .57       .052     1.50   22.92      .000
                 +ID3 03:BLK2      .69       .063     1.50   22.92      .000
                 +ID4 06:BLK5     1.26       .241     1.50   35.37      .000
                  ==========================================================
                  SUM 07:PSTDEV   11.82       .651     1.50   16.56      .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
001:0008--------------------------------------------------------------------
**********************************************************************
*
*
* ROUTE THROUGH POND
*
*
**********************************************************************
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>07:(PSTDEV)    |
| OUT<08:(PNDOUT)    |    =========  OUTFLOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .025  .3535E+00
                            .007  .5520E-01    |     .027  .4178E+00
                            .013  .1118E+00    |     .029  .4837E+00
                            .017  .1700E+00    |     .031  .5512E+00
                            .020  .2296E+00    |     .033  .6203E+00
                            .023  .2908E+00    |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (PSTDEV)       11.82      .651     1.500     16.562
     OUTFLOW<08: (PNDOUT)       11.82      .017     4.533     16.561
    OVERFLOW<09: (PNDOVR)         .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    2.623
                  TIME SHIFT OF PEAK FLOW          (min)=   182.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1768E+00

------------------------------------------------------------------------------
001:0009--------------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 3 COMMERCIAL
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=      .80
| 04:BLK3    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .72         .08
     Dep. Storage     (mm)=       .80        1.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=     73.03       40.00
     Mannings n           =      .013        .250

     Max.eff.Inten.(mm/hr)=     78.82      230.54
               over (min)        2.00        9.00
     Storage Coeff.  (min)=     2.33 (ii)   8.55 (ii)
     Unit Hyd. Tpeak (min)=     2.00        9.00
     Unit Hyd. peak  (cms)=      .51         .13
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .08         .03        .102 (iii)
     TIME TO PEAK    (hrs)=     1.50        1.60       1.500
     RUNOFF VOLUME    (mm)=    38.58       21.08      28.960
     TOTAL RAINFALL   (mm)=    39.38       39.38      39.385
     RUNOFF COEFFICIENT   =      .98         .54        .735

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage   (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0010--------------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON BLOCK 3 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>04:(BLK3  )    |
| OUT<01:(B3CTRL)    |    =========  OUTFLOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .015  .1000E+01
                            .015  .1000E-03    |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (BLK3  )         .80      .102     1.500      28.960
     OUTFLOW<01: (B3CTRL)         .80      .015     1.233      28.960
    OVERFLOW<02: (3OVR  )         .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   14.763
                  TIME SHIFT OF PEAK FLOW          (min)=  -16.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9246E-02

------------------------------------------------------------------------------
001:0011--------------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 4 COMMERCIAL
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=     1.40
| 05:BLK4    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      1.26         .14
     Dep. Storage     (mm)=       .80        1.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=     96.61       40.00
     Mannings n           =      .013        .250

     Max.eff.Inten.(mm/hr)=     78.82      230.54
               over (min)        3.00        9.00
     Storage Coeff.  (min)=     2.75 (ii)   8.97 (ii)
     Unit Hyd. Tpeak (min)=     3.00        9.00
     Unit Hyd. peak  (cms)=      .40         .13
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .13         .06        .174 (iii)
     TIME TO PEAK    (hrs)=     1.50        1.60       1.500
     RUNOFF VOLUME    (mm)=    38.58       21.08      28.960
     TOTAL RAINFALL   (mm)=    39.38       39.38      39.385
     RUNOFF COEFFICIENT   =      .98         .54        .735

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage   (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
001:0012--------------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON 4 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>05:(BLK4  )    |
| OUT<03:(B4CTRL)    |    =========  OUTFLOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .015  .1000E+01
                            .015  .1000E-03    |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (BLK4  )        1.40      .174     1.500      28.960
     OUTFLOW<03: (B4CTRL)        1.40      .015     1.067      28.960
    OVERFLOW<04: (4OVR  )         .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    8.616
                  TIME SHIFT OF PEAK FLOW          (min)=   -26.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2211E-01

------------------------------------------------------------------------------
001:0013--------------------------------------------------------------------
**********************************************************************
*
*
* TOTAL POST DEVELOPMENT FROM SITE
*
*
**********************************************************************
--------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
-------------------- ID1 08:PNDOUT (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 08:PNDOUT    11.82      .017     4.53   16.56      .000
                 +ID2 09:PNDOVR      .00      .000      .00     .00      .000 **DRY**
                 +ID3 01:B3CTRL      .80      .015     1.23   28.96      .000
                 +ID4 02:3OVR        .00      .000      .00     .00      .000 **DRY**
                 +ID5 03:B4CTRL     1.40      .015     1.07   28.96      .000
                 +ID6 04:4OVR        .00      .000      .00     .00      .000 **DRY**
                  ==========================================================
                  SUM 05:PSTDEV    14.02      .047     4.53   18.51      .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
001:0014--------------------------------------------------------------------
  ** END OF RUN :   1

**********************************************************************




--------------------
| START            |  Project dir.: H:\SWMHYM-1\10034Y-1\
--------------------  Rainfall dir.: H:\SWMHYM-1\10034Y-1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
            #  1=CH5.STM
------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------
*#**********************************************************************
*#  Project Name: [YINS PHASE 5]    Project Number: [10034]
*#  Date        : 02-11-2010
*#  Modeller    : [TGS]
*#  Company     : G. Douglas Vallee Limited
```

```
*#  License #   :  3568969
*#*************************************************************************
-------------------------------------------------------------------------------
002:0002---------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: H:\SWMHYM-1\10034Y-1\CH5.STM
| Ptotal=  48.48 mm|    Comments: 5 YEAR CHICAGO 4 HOUR DESIGN DISTRIBUTIO
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.529 |   1.17  10.190 |   2.17   9.150 |   3.17   4.550
               .33   3.658 |   1.33  21.620 |   2.33   7.700 |   3.33   4.220
               .50   4.040 |   1.50 112.370 |   2.50   6.680 |   3.50   3.960
               .67   4.670 |   1.67  27.760 |   2.67   5.940 |   3.67   3.730
               .83   5.610 |   1.83  15.750 |   2.83   5.390 |   3.83   3.530
              1.00   7.110 |   2.00  11.430 |   3.00   4.930 |   4.00   3.350

-------------------------------------------------------------------------------
002:0003---------------------------------------------------------------------
*************************************************************************
*
*
* SFD
*
*
*************************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=    9.30
| 01:SFD    DT= 1.00 |   Total Imp(%)=   37.00   Dir. Conn.(%)=   16.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      3.44          5.86
     Dep. Storage     (mm)=       .80          1.50
     Average Slope     (%)=      1.00          1.00
     Length            (m)=    249.00         40.00
     Mannings n            =      .013          .250

     Max.eff.Inten.(mm/hr)=    112.37         22.33
               over (min)        4.00         20.00
     Storage Coeff.  (min)=     4.22 (ii)    20.04 (ii)
     Unit Hyd. Tpeak (min)=     4.00         20.00
     Unit Hyd. peak  (cms)=      .27           .06
                                              *TOTALS*
     PEAK FLOW       (cms)=      .41           .21          .475 (iii)
     TIME TO PEAK    (hrs)=     1.50          1.50         1.517
     RUNOFF VOLUME    (mm)=    47.68         12.10        17.793
     TOTAL RAINFALL   (mm)=    48.48         48.48        48.478
     RUNOFF COEFFICIENT    =     .98           .25          .367

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
002:0004---------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 1 TOWNHOUSES
*
*
*************************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=     .57
| 02:BLK1   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .43           .14
     Dep. Storage     (mm)=       .80          1.50
     Average Slope     (%)=      1.00          1.00
     Length            (m)=     61.64         40.00
     Mannings n            =      .013          .250

     Max.eff.Inten.(mm/hr)=    112.37         93.55
               over (min)        2.00         11.00
     Storage Coeff.  (min)=     1.82 (ii)    10.75 (ii)
     Unit Hyd. Tpeak (min)=     2.00         11.00
     Unit Hyd. peak  (cms)=      .59           .10
                                              *TOTALS*
     PEAK FLOW       (cms)=      .07           .02          .080 (iii)
     TIME TO PEAK    (hrs)=     1.50          1.63         1.500
     RUNOFF VOLUME    (mm)=    47.68         18.78        29.761
     TOTAL RAINFALL   (mm)=    48.48         48.48        48.478
     RUNOFF COEFFICIENT    =     .98           .39          .614

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
002:0005---------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 2 APARTMENTS
*
*
*************************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=     .69
| 03:BLK2   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .52           .17
     Dep. Storage     (mm)=       .80          1.50
     Average Slope     (%)=      1.00          1.00
     Length            (m)=     67.82         40.00
     Mannings n            =      .013          .250

     Max.eff.Inten.(mm/hr)=    112.37         93.55
               over (min)        2.00         11.00
     Storage Coeff.  (min)=     1.93 (ii)    10.86 (ii)
     Unit Hyd. Tpeak (min)=     2.00         11.00
     Unit Hyd. peak  (cms)=      .57           .10
                                              *TOTALS*
     PEAK FLOW       (cms)=      .08           .03          .097 (iii)
     TIME TO PEAK    (hrs)=     1.50          1.63         1.500
     RUNOFF VOLUME    (mm)=    47.68         18.78        29.761
     TOTAL RAINFALL   (mm)=    48.48         48.48        48.478
     RUNOFF COEFFICIENT    =     .98           .39          .614

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
002:0006---------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 5 SWM
*
*
*************************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=    1.26
| 06:BLK5   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      1.13           .13
     Dep. Storage     (mm)=       .80          1.50
     Average Slope     (%)=      1.00          1.00
     Length            (m)=     91.65         40.00
     Mannings n            =      .013          .250

     Max.eff.Inten.(mm/hr)=    112.37         11.89
               over (min)        2.00         23.00
     Storage Coeff.  (min)=     2.31 (ii)    22.68 (ii)
     Unit Hyd. Tpeak (min)=     2.00         23.00
     Unit Hyd. peak  (cms)=      .51           .05
                                              *TOTALS*
     PEAK FLOW       (cms)=      .35           .00          .350 (iii)
     TIME TO PEAK    (hrs)=     1.50          1.85         1.500
     RUNOFF VOLUME    (mm)=    47.68          9.56        43.866
     TOTAL RAINFALL   (mm)=    48.48         48.48        48.478
     RUNOFF COEFFICIENT    =     .98           .20          .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
002:0007---------------------------------------------------------------------
*************************************************************************
*
*
* DETERMINE INFLOW TO POND
*
*
*************************************************************************
--------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA      QPEAK    TPEAK    R.V.     DWF
--------------------                (ha)      (cms)    (hrs)    (mm)    (cms)
                  ID1 01:SFD       9.30      .475     1.52    17.79    .000
                 +ID2 02:BLK1      .57       .080     1.50    29.76    .000
                 +ID3 03:BLK2      .69       .097     1.50    29.76    .000
                 +ID4 06:BLK5      1.26      .350     1.50    43.87    .000
                  ==========================================================
                  SUM 07:PSTDEV    11.82     .995     1.50    21.85    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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002:0008---------------------------------------------------------------------
*************************************************************************
*
*
* ROUTE THROUGH POND
*
*
*************************************************************************
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>07: (PSTDEV)   |
| OUT<08: (PNDOUT)   |    ========= OUTFLOW STORAGE TABLE =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00     |     .025  .3535E+00
                           .007  .5520E-01     |     .027  .4178E+00
                           .013  .1118E+00     |     .029  .4837E+00
                           .017  .1700E+00     |     .031  .5512E+00
                           .020  .2296E+00     |     .033  .6203E+00
                           .023  .2908E+00     |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (PSTDEV)       11.82      .995     1.500      21.848
     OUTFLOW<08: (PNDOUT)       11.82      .020     4.400      21.847
    OVERFLOW<09: (PNDOVR)        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     2.034
                  TIME SHIFT OF PEAK FLOW          (min)=   174.00
                  MAXIMUM  STORAGE  USED        (ha.m.)=.2367E+00

-------------------------------------------------------------------------------
002:0009---------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 3 COMMERCIAL
*
*
*************************************************************************
---------------------
| DESIGN STANDHYD    |   Area     (ha)=     .80
| 04:BLK3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.72	.08	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	1.00	1.00	
Length	(m)=	73.03	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)=		112.37	389.75	
over (min)		2.00	7.00	
Storage Coeff. (min)=		2.02 (ii)	7.06 (ii)	
Unit Hyd. Tpeak (min)=		2.00	7.00	
Unit Hyd. peak (cms)=		.56	.16	
				TOTALS
PEAK FLOW	(cms)=	.11	.06	.160 (iii)
TIME TO PEAK	(hrs)=	1.50	1.57	1.500
RUNOFF VOLUME	(mm)=	47.68	28.46	37.108
TOTAL RAINFALL	(mm)=	48.48	48.48	48.478
RUNOFF COEFFICIENT	=	.98	.59	.765

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0010

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* SIMULATE STORAGE ON BLOCK 3 TO RELEASE AT CONTROLLED RATE

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| ROUTE RESERVOIR | Requested routing time step = 1.0 min.

| IN>04:(BLK3) |

| OUT<01:(B3CTRL) | ========= OUTFLOW STORAGE TABLE =========

| OUTFLOW STORAGE | OUTFLOW STORAGE

| (cms) (ha.m.) | (cms) (ha.m.)

| .000 .0000E+00 | .015 .1000E+01

| .015 .1000E-03 | .000 .0000E+00

ROUTING RESULTS	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW >04: (BLK3)	.80	.160	1.500	37.108
OUTFLOW<01: (B3CTRL)	.80	.015	1.200	37.108
OVERFLOW<02: (3OVR)	.00	.000	.000	.000

TOTAL NUMBER OF SIMULATED OVERFLOWS = 0
CUMULATIVE TIME OF OVERFLOWS (hours)= .00
PERCENTAGE OF TIME OVERFLOWING (%)= .00

PEAK FLOW REDUCTION [Qout/Qin](%)= 9.363
TIME SHIFT OF PEAK FLOW (min)= -18.00
MAXIMUM STORAGE USED (ha.m.)=.1520E-01

002:0011

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* BLOCK 4 COMMERCIAL

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| DESIGN STANDHYD | Area (ha)= 1.40

| 05:BLK4 DT= 1.00 | Total Imp(%)= 90.00 Dir. Conn.(%)= 45.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	1.26	.14	
Dep. Storage (mm)=	.80	1.50	
Average Slope (%)=	1.00	1.00	
Length (m)=	96.61	40.00	
Mannings n =	.013	.250	
Max.eff.Inten.(mm/hr)=	112.37	389.75	
over (min)	2.00	7.00	
Storage Coeff. (min)=	2.39 (ii)	7.43 (ii)	
Unit Hyd. Tpeak (min)=	2.00	7.00	
Unit Hyd. peak (cms)=	.50	.16	
			TOTALS
PEAK FLOW (cms)=	.19	.10	.277 (iii)
TIME TO PEAK (hrs)=	1.50	1.57	1.500
RUNOFF VOLUME (mm)=	47.68	28.46	37.108
TOTAL RAINFALL (mm)=	48.48	48.48	48.478
RUNOFF COEFFICIENT =	.98	.59	.765

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0012

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*

* SIMULATE STOPAGE ON 4 TO RELEASE AT CONTROLLED PATE

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| ROUTE RESERVOIR | Requested routing time step = 1.0 min.

| IN>05:(BLK4) |

| OUT<03:(B4CTRL) | ========= OUTFLOW STOPAGE TABLE =========

| OUTFLOW STORAGE | OUTFLOW STORAGE

| (cms) (ha.m.) | (cms) (ha.m.)

| .000 .0000E+00 | .015 .1000E+01

| .015 .1000E-03 | .000 .0000E+00

ROUTING RESULTS	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW >05: (BLK4)	1.40	.277	1.500	37.108
OUTFLOW<03: (B4CTRL)	1.40	.015	1.017	37.108
OVERFLOW<04: (4OVR)	.00	.000	.000	.000

TOTAL NUMBER OF SIMULATED OVERFLOWS = 0
CUMULATIVE TIME OF OVERFLOWS (hours)= .00
PERCENTAGE OF TIME OVERFLOWING (%)= .00

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.425
TIME SHIFT OF PEAK FLOW (min)= -29.00
MAXIMUM STORAGE USED (ha.m.)=.3323E-01

002:0013

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* TOTAL POST DEVELOPMENT FROM SITE

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ADD HYD (PSTDEV)	ID: NHYD	AREA	QPEAK	TPEAK	R.V.	DWF	
		(ha)	(cms)	(hrs)	(mm)	(cms)	
ID1	08:ENDOUT	11.82	.020	4.40	21.85	.000	
+ID2	09:ENDOVR	.00	.000	.00	.00	.000	**DRY**
+ID3	01:B3CTRL	.80	.015	1.20	37.11	.000	
+ID4	02:3OVR	.00	.000	.00	.00	.000	**DRY**
+ID5	03:B4CTRL	1.40	.015	1.02	37.11	.000	
+ID6	04:4OVR	.00	.000	.00	.00	.000	**DRY**
SUM	05:PSTDEV	14.02	.050	4.40	24.24	.000	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

002:0014

002:0002

** END OF RUN : 2

****

| START | Project dir.: H:\SWMHYM-1\10034Y-1\

| Rainfall dir.: H:\SWMHYM-1\10034Y-1\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 003
NSTORM= 1
# 1=CH10.STM

003:0002

*#***

*# Project Name: [YINS PHASE 5] Project Number: [10034]
*# Date : 02-11-2010
*# Modeller : [TGS]
*# Company : G. Douglas Vallee Limited
*# License # : 3568969

*#***

003:0002

| READ STORM | Filename: H:\SWMHYM-1\10034Y-1\CH10.STM

| Ptotal= 56.08 mm| Comments: 10 YEAR CHICAGO 4 HOURS DESIGN DISTRIBUT

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.580	1.17	11.510	2.17	10.310	3.17	5.050
.33	3.990	1.33	25.320	2.33	8.660	3.33	4.700
.50	4.500	1.50	133.600	2.50	7.520	3.50	4.394
.67	5.210	1.67	32.000	2.67	6.650	3.67	4.140
.83	6.270	1.83	19.730	2.83	5.380	3.83	3.910
1.00	8.000	2.00	12.954	3.00	5.490	4.00	3.632

003:0003

****

*

*

* SFD

*

*

****

| DESIGN STANDHYD | Area (ha)= 9.30

| 01:SFD DT= 1.00 | Total Imp(%)= 37.00 Dir. Conn.(%)= 16.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	3.44	5.86	
Dep. Storage (mm)=	.80	1.50	
Average Slope (%)=	1.00	1.00	
Length (m)=	249.00	40.00	
Mannings n =	.013	.250	
Max.eff.Inten.(mm/hr)=	133.60	31.29	
over (min)	4.00	18.00	
Storage Coeff. (min)=	3.93 (ii)	17.76 (ii)	
Unit Hyd. Tpeak (min)=	4.00	18.00	
Unit Hyd. peak (cms)=	.29	.06	
			TOTALS
PEAK FLOW (cms)=	.50	.31	.601 (iii)
TIME TO PEAK (hrs)=	1.50	1.77	1.517
RUNOFF VOLUME (mm)=	55.28	15.66	21.998
TOTAL RAINFALL (mm)=	56.08	56.08	56.083
RUNOFF COEFFICIENT =	.99	.28	.392

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

003:0004

****

*

*

* BLOCK 1 TOWNHOUSES

```
*
*
*******************************************************************************
---------------------
| DESIGN STANDHYD   |   Area     (ha)=     .57
| 02:BLK1   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .43          .14
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     61.64        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    133.60       136.37
               over (min)        2.00         9.00
     Storage Coeff.  (min)=     1.70 (ii)    9.38 (ii)
     Unit Hyd. Tpeak (min)=     2.00         9.00
     Unit Hyd. peak  (cms)=      .62          .12
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .08          .03          .102 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.60         1.500
     RUNOFF VOLUME    (mm)=    55.28        23.74        35.727
     TOTAL RAINFALL   (mm)=    56.08        56.08        56.083
     RUNOFF COEFFICIENT   =      .99          .42          .637

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
003:0005---------------------------------------------------------------------
*******************************************************************************
*
*
* BLOCK 2 APARTMENTS
*
*
*******************************************************************************
---------------------
| DESIGN STANDHYD   |   Area     (ha)=     .69
| 03:BLK2   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .52          .17
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     67.82        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    133.60       131.26
               over (min)        2.00        10.00
     Storage Coeff.  (min)=     1.80 (ii)    9.60 (ii)
     Unit Hyd. Tpeak (min)=     2.00        10.00
     Unit Hyd. peak  (cms)=      .60          .12
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .10          .04          .121 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.62         1.500
     RUNOFF VOLUME    (mm)=    55.28        23.74        35.727
     TOTAL RAINFALL   (mm)=    56.08        56.08        56.083
     RUNOFF COEFFICIENT   =      .99          .42          .637

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
003:0006---------------------------------------------------------------------
*******************************************************************************
*
*
* BLOCK 5 SWM
*
*
*******************************************************************************
---------------------
| DESIGN STANDHYD   |   Area     (ha)=    1.26
| 06:BLK5   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      1.13          .13
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     91.65        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    133.60        17.53
               over (min)        2.00        20.00
     Storage Coeff.  (min)=     2.16 (ii)   19.59 (ii)
     Unit Hyd. Tpeak (min)=     2.00        20.00
     Unit Hyd. peak  (cms)=      .53          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .42          .00          .417 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.80         1.500
     RUNOFF VOLUME    (mm)=    55.28        12.49        51.004
     TOTAL RAINFALL   (mm)=    56.08        56.08        56.083
     RUNOFF COEFFICIENT   =      .99          .22          .909

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
003:0007---------------------------------------------------------------------
*******************************************************************************
*
*
* DETERMINE INFLOW TO POND
*
*
*******************************************************************************
--------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA      QPEAK    TPEAK    R.V.     DWF
--------------------                (ha)      (cms)    (hrs)    (mm)     (cms)
                    ID1 01:SFD      9.30      .601     1.52    22.00     .000
                   +ID2 02:BLK1      .57      .102     1.50    35.73     .000
                   +ID3 03:BLK2      .69      .121     1.50    35.73     .000
                   +ID4 06:BLK5     1.26      .417     1.50    51.00     .000
                    ==========================================================
                    SUM 07:PSTDEV  11.82     1.231     1.50    26.55     .000

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
003:0008---------------------------------------------------------------------
*******************************************************************************
*
*
* ROUTE THPOUGH POND
*
*
*******************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>07:(PSTDEV)   |
| OUT<08:(PNDOUT)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
                          (cms)      (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00     |     .025  .3535E+00
                           .007  .5520E-01     |     .027  .4178E+00
                           .013  .1118E+00     |     .029  .4837E+00
                           .017  .1700E+00     |     .031  .5512E+00
                           .020  .2296E+00     |     .033  .6203E+00
                           .023  .2908E+00     |     .000  .0000E+00

     ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
     ---------------              (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (PSTDEV)        11.82     1.231     1.500     26.553
     OUTFLOW<08: (PNDOUT)        11.82      .023     4.367     26.552
    OVERFLOW<09: (PNDOVR)          .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =       0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.841
                  TIME SHIFT OF PEAK FLOW         (min)=   172.00
                  MAXIMUM  STORAGE  USED        (ha.m.)=.2900E+00

-------------------------------------------------------------------------------
003:0009---------------------------------------------------------------------
*******************************************************************************
*
*
* BLOCK 3 COMMERCIAL
*
*
*******************************************************************************
---------------------
| DESIGN STANDHYD   |   Area     (ha)=     .80
| 04:BLK3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .72          .08
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     73.03        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    133.60       504.85
               over (min)        2.00         6.00
     Storage Coeff.  (min)=     1.88 (ii)    6.43 (ii)
     Unit Hyd. Tpeak (min)=     2.00         6.00
     Unit Hyd. peak  (cms)=      .58          .18
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .13          .08          .202 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.55         1.500
     RUNOFF VOLUME    (mm)=    55.28        34.90        44.072
     TOTAL RAINFALL   (mm)=    56.08        56.08        56.083
     RUNOFF COEFFICIENT   =      .99          .62          .786

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
003:0010---------------------------------------------------------------------
*******************************************************************************
*
*
* SIMULATE STORAGE ON BLOCK 3 TO RELEASE AT CONTROLLED RATE
*
*
*******************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>04:(BLK3  )   |
| OUT<01:(B3CTRL)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
                          (cms)      (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00     |     .015  .1000E+01
                           .015  .1000E-03     |     .000  .0000E+00

     ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
     ---------------              (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (BLK3  )          .80      .202     1.500     44.072
     OUTFLOW<01: (B3CTRL)          .80      .015     1.183     44.072
    OVERFLOW<02: (3OVR  )          .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =       0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    7.411
                  TIME SHIFT OF PEAK FLOW         (min)=   -19.00
                  MAXIMUM  STORAGE  USED        (ha.m.)=.1986E-01

-------------------------------------------------------------------------------
003:0011---------------------------------------------------------------------
*******************************************************************************
```

```
*
*
* BLOCK 4 COMMERCIAL
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD     |   Area     (ha)=    1.40
| 05:BLK4   DT= 1.00  |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      1.26          .14
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     96.61        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    133.60       494.86
               over (min)        2.00         7.00
     Storage Coeff.  (min)=    2.23 (ii)    6.81 (ii)
     Unit Hyd. Tpeak (min)=    2.00         7.00
     Unit Hyd. peak  (cms)=     .52          .16
                                                    *TOTALS*
     PEAK FLOW       (cms)=     .23          .13        .342 (iii)
     TIME TO PEAK    (hrs)=    1.50         1.57       1.500
     RUNOFF VOLUME    (mm)=   55.28        34.90      44.072
     TOTAL RAINFALL   (mm)=   56.08        56.08      56.083
     RUNOFF COEFFICIENT   =     .99          .62        .786

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
003:0012--------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON 4 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>05:(BLK4  )     |
| OUT<03:(B4CTRL)     |    ==========  OUTFLOW STORAGE TABLE  ==========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .015  .1000E+01
                            .015  .1000E-03    |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK      R.V.
     ---------------             (ha)     (cms)     (hrs)      (mm)
     INFLOW >05: (BLK4  )        1.40      .342     1.500    44.072
     OUTFLOW<03: (B4CTRL)        1.40      .015      .917    44.072
    OVERFLOW<04: (4OVR  )         .00      .000      .000      .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.387
                    TIME SHIFT OF PEAK FLOW          (min)=   -35.00
                    MAXIMUM  STORAGE  USED        (ha.m.)=.4236E-01

------------------------------------------------------------------------
003:0013--------------------------------------------------------------
**********************************************************************
*
*
* TOTAL POST DEVELOPMENT FROM SITE
*
*
**********************************************************************
---------------------
| ADD HYD (PSTDEV)  | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
---------------------              (ha)     (cms)    (hrs)    (mm)    (cms)
                  ID1 08:ENDOUT    11.82     .023    4.37   26.55     .000
                 +ID2 09:ENDOVR      .00     .000     .00     .00     .000 **DRY**
                 +ID3 01:B3CTRL      .80     .015    1.18   44.07     .000
                 +ID4 02:3OVR        .00     .000     .00     .00     .000 **DRY**
                 +ID5 03:B4CTRL     1.40     .015     .92   44.07     .000
                 +ID6 04:4OVR        .00     .000     .00     .00     .000 **DRY**
                  ==========================================================
                  SUM 05:PSTDEV    14.02     .053    4.37   29.30     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------
003:0014--------------------------------------------------------------
------------------------------------------------------------------------
003:0002--------------------------------------------------------------
------------------------------------------------------------------------
003:0002--------------------------------------------------------------
  ** END OF RUN :   3

**********************************************************************




---------------------
| START               |  Project dir.: H:\SWMHYM~1\10034Y~1\
---------------------  Rainfall dir.: H:\SWMHYM~1\10034Y~1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
          #  1=CHZ5.STM
------------------------------------------------------------------------
004:0002--------------------------------------------------------------
*#**********************************************************************
*#  Project Name: [YINS PHASE 5]    Project Number: [10034]
*#  Date        : 02-11-2010
*#  Modeller    : [TGS]
*#  Company     : G. Douglas Vallee Limited
*#  License #   : 3568969
*#**********************************************************************
------------------------------------------------------------------------
004:0002--------------------------------------------------------------
---------------------
| READ STORM        |    Filename: H:\SWMHYM~1\10034Y~1\CH25.STM
| Ptotal=  66.02 mm |    Comments: 25 YEAR CHICAGO 4 HOUR DESIGN DISTRIBUTI
---------------------
      TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
      hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
      .17   4.500 |   1.17  13.670 |   2.17  12.320 |   3.17   6.270
      .33   4.980 |   1.33  27.690 |   2.33  10.440 |   3.33   5.000
      .50   5.613 |   1.50 158.850 |   2.50   9.144 |   3.50   5.840
      .67   6.450 |   1.67  35.080 |   2.67   8.150 |   3.67   5.180
      .83   7.700 |   1.83  20.600 |   2.83   7.390 |   3.83   4.900
     1.00   9.700 |   2.00  15.240 |   3.00   6.780 |   4.00   4.650

------------------------------------------------------------------------
004:0003--------------------------------------------------------------
**********************************************************************
*
*
* SFD
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD     |   Area     (ha)=    9.30
| 01:SFD    DT= 1.00  |   Total Imp(%)=   37.00   Dir. Conn.(%)=   16.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      3.44         5.86
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    249.00        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    158.85        44.51
               over (min)        4.00        16.00
     Storage Coeff.  (min)=    3.67 (ii)   15.68 (ii)
     Unit Hyd. Tpeak (min)=    4.00        16.00
     Unit Hyd. peak  (cms)=     .30          .07
                                                    *TOTALS*
     PEAK FLOW       (cms)=     .60          .44        .775 (iii)
     TIME TO PEAK    (hrs)=    1.50         1.73       1.517
     RUNOFF VOLUME    (mm)=   65.22        20.76      27.877
     TOTAL RAINFALL   (mm)=   66.02        66.02      66.023
     RUNOFF COEFFICIENT   =     .99          .31        .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
004:0004--------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 1 TOWNHOUSES
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD     |   Area     (ha)=     .57
| 02:BLK1   DT= 1.00  |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .43          .14
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     61.64        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    158.85       186.82
               over (min)        2.00         8.00
     Storage Coeff.  (min)=    1.59 (ii)    8.36 (ii)
     Unit Hyd. Tpeak (min)=    2.00         8.00
     Unit Hyd. peak  (cms)=     .64          .14
                                                    *TOTALS*
     PEAK FLOW       (cms)=     .10          .05        .130 (iii)
     TIME TO PEAK    (hrs)=    1.50         1.58       1.500
     RUNOFF VOLUME    (mm)=   65.22        30.66      43.793
     TOTAL RAINFALL   (mm)=   66.02        66.02      66.023
     RUNOFF COEFFICIENT   =     .99          .46        .663

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
004:0005--------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 2 APARTMENTS
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD     |   Area     (ha)=     .69
| 03:BLK2   DT= 1.00  |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .52          .17
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     67.82        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    158.85       186.82
               over (min)        2.00         8.00
     Storage Coeff.  (min)=    1.68 (ii)    8.45 (ii)
     Unit Hyd. Tpeak (min)=    2.00         8.00
     Unit Hyd. peak  (cms)=     .62          .14
                                                    *TOTALS*
     PEAK FLOW       (cms)=     .12          .05        .157 (iii)
```

```
     TIME TO PEAK     (hrs)=       1.50         1.58         1.500
     RUNOFF VOLUME    (mm)=       65.22        30.66        43.793
     TOTAL RAINFALL   (mm)=       66.02        66.02        66.023
     RUNOFF COEFFICIENT   =         .99          .46          .663

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
004:0006----------------------------------------------------------------------
******************************************************************************
*
*
* BLOCK 5 SWM
*
*
******************************************************************************
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.26
| 06:BLK5   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.13          .13
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      91.65        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     158.85        25.55
           over      (min)        2.00        17.00
     Storage Coeff.  (min)=       2.01 (ii)   17.01 (ii)
     Unit Hyd. Tpeak (min)=       2.00        17.00
     Unit Hyd. peak  (cms)=        .56          .07
                                                    *TOTALS*
     PEAK FLOW        (cms)=       .50          .01        .498 (iii)
     TIME TO PEAK     (hrs)=      1.50         1.75        1.500
     RUNOFF VOLUME    (mm)=      65.22        16.76       60.376
     TOTAL RAINFALL   (mm)=      66.02        66.02       66.023
     RUNOFF COEFFICIENT   =        .99          .25         .914

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
004:0007----------------------------------------------------------------------
******************************************************************************
*
*
* DETERMINE INFLOW TO POND
*
*
******************************************************************************
--------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
--------------------                (ha)     (cms)    (hrs)    (mm)    (cms)
                ID1 01:SFD         9.30      .775     1.52   27.88     .000
               +ID2 02:BLK1         .57      .130     1.50   43.79     .000
               +ID3 03:BLK2         .69      .157     1.50   43.79     .000
               +ID4 06:BLK5        1.26      .498     1.50   60.38     .000
                ==========================================================
                SUM 07:PSTDEV     11.82     1.542     1.50   33.04     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
004:0008----------------------------------------------------------------------
******************************************************************************
*
*
* ROUTE THROUGH POND
*
*
******************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>07:(PSTDEV)   |
| OUT<08:(PNDOUT)   |    ==========  OUTFLOW STORAGE TABLE  ==========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .025  .3535E+00
                            .007  .5520E-01    |     .027  .4178E+00
                            .013  .1118E+00    |     .029  .4837E+00
                            .017  .1700E+00    |     .031  .5512E+00
                            .020  .2296E+00    |     .033  .6203E+00
                            .023  .2908E+00    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (PSTDEV)      11.82     1.542     1.500     33.038
     OUTFLOW<08: (PNDOUT)      11.82      .025     4.383     33.036
    OVERFLOW<09: (PNDOVR)        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     1.651
                  TIME SHIFT OF PEAK FLOW         (min)=    173.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3637E+00

------------------------------------------------------------------------------
004:0009----------------------------------------------------------------------
******************************************************************************
*
*
* BLOCK 3 COMMERCIAL
*
*
******************************************************************************
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .80
| 04:BLK3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72          .08
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      73.03        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     158.85       639.53
           over      (min)        2.00         6.00
     Storage Coeff.  (min)=       1.76 (ii)    5.89 (ii)
     Unit Hyd. Tpeak (min)=       2.00         6.00
     Unit Hyd. peak  (cms)=        .61          .19
                                                    *TOTALS*
     PEAK FLOW        (cms)=       .16          .10        .251 (iii)
     TIME TO PEAK     (hrs)=      1.50         1.53        1.500
     RUNOFF VOLUME    (mm)=      65.22        43.58       53.321
     TOTAL RAINFALL   (mm)=      66.02        66.02       66.023
     RUNOFF COEFFICIENT   =        .99          .66         .808

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
004:0010----------------------------------------------------------------------
******************************************************************************
*
*
* SIMULATE STORAGE ON BLOCK 3 TO RELEASE AT CONTROLLED RATE
*
*
******************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>04:(BLK3  )   |
| OUT<01:(B3CTRL)   |    ==========  OUTFLOW STORAGE TABLE  ==========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .015  .1000E+01
                            .015  .1000E-03    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (BLK3  )        .80      .251     1.500     53.321
     OUTFLOW<01: (B3CTRL)        .80      .015     1.067     53.321
    OVERFLOW<02: (3OVR  )        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     5.978
                  TIME SHIFT OF PEAK FLOW         (min)=   -26.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2536E-01

------------------------------------------------------------------------------
004:0011----------------------------------------------------------------------
******************************************************************************
*
*
* BLOCK 4 COMMERCIAL
*
*
******************************************************************************
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.40
| 05:BLK4   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.26          .14
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      96.61        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     158.85       639.53
           over      (min)        2.00         6.00
     Storage Coeff.  (min)=       2.08 (ii)    6.22 (ii)
     Unit Hyd. Tpeak (min)=       2.00         6.00
     Unit Hyd. peak  (cms)=        .54          .18
                                                    *TOTALS*
     PEAK FLOW        (cms)=       .28          .17        .434 (iii)
     TIME TO PEAK     (hrs)=      1.50         1.55        1.500
     RUNOFF VOLUME    (mm)=      65.22        43.58       53.321
     TOTAL RAINFALL   (mm)=      66.02        66.02       66.023
     RUNOFF COEFFICIENT   =        .99          .66         .808

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
004:0012----------------------------------------------------------------------
******************************************************************************
*
*
* SIMULATE STORAGE ON 4 TO RELEASE AT CONTROLLED RATE
*
*
******************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>05:(BLK4  )   |
| OUT<03:(B4CTRL)   |    ==========  OUTFLOW STORAGE TABLE  ==========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .015  .1000E+01
                            .015  .1000E-03    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (BLK4  )       1.40      .434     1.500     53.321
     OUTFLOW<03: (B4CTRL)       1.40      .015      .750     53.321
    OVERFLOW<04: (4OVR  )        .00      .000      .000       .000
```

```
                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.459
                    TIME SHIFT OF PEAK FLOW          (min)=   -45.00
                    MAXIMUM  STORAGE  USED        (ha.m.)=.5446E-01
```

004:0013

```
*****************************************************************************
*
*
* TOTAL POST DEVELOPMENT FROM SITE
*
*
*****************************************************************************
```

ADD HYD (PSTDEV)	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)	
ID1	08:ENDOUT	11.82	.025	4.38	33.04	.000	
+ID2	09:ENDOVR	.00	.000	.00	.00	.000	**DRY**
+ID3	01:B3CTRL	.80	.015	1.07	53.32	.000	
+ID4	02:3OVR	.00	.000	.00	.00	.000	**DRY**
+ID5	03:B4CTRL	1.40	.015	.75	53.32	.000	
+ID6	04:4OVR	.00	.000	.00	.00	.000	**DRY**
SUM	05:PSTDEV	14.02	.055	4.38	36.22	.000	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

004:0014

004:0002

004:0002

004:0002

```
  ** END OF RUN :   4

*****************************************************************************
```

```
| START              |  Project  dir.: H:\SWMHYM~1\10034Y~1\
|                    |  Rainfall dir.: H:\SWMHYM~1\10034Y~1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
          #  1=CH50.STM
```

005:0002

```
*#*************************************************************************
*#  Project Name: [YINS PHASE 5]     Project Number: [10034]
*#  Date        : 02-11-2010
*#  Modeller    : [TGS]
*#  Company     : G. Douglas Vallee Limited
*#  License #   :  3568969
*#*************************************************************************
```

005:0002

```
| READ STORM       |    Filename: H:\SWMHYM~1\10034Y~1\CH50.STM
| Ptotal=  72.96 mm|    Comments: 50 YEAR CHICAGO 4 HOUR DESIGN DISTRIBUTI
```

TIME hrs	PAIN mm/hr	TIME hrs	PAIN mm/hr	TIME hrs	PAIN mm/hr	TIME hrs	PAIN mm/hr
.17	3.990	1.17	14.270	2.17	12.620	3.17	5.790
.33	4.450	1.33	33.900	2.33	10.390	3.33	5.330
.50	5.080	1.50	186.560	2.50	8.890	3.50	4.980
.67	5.970	1.67	44.810	2.67	7.800	3.67	4.650
.83	7.290	1.83	23.440	2.83	6.960	3.83	4.370
1.00	9.530	2.00	16.260	3.00	6.300	4.00	4.140

005:0003

```
*****************************************************************************
*
*
* SFD
*
*
*****************************************************************************
```

```
| DESIGN STANDHYD    |   Area     (ha)=    9.30
| 01:SFD    DT= 1.00 |   Total Imp(%)=   37.00   Dir. Conn.(%)=   16.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.44	5.86
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	249.00	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		186.56	61.99
over (min)		3.00	14.00
Storage Coeff. (min)=		3.44 (ii)	13.96 (ii)
Unit Hyd. Tpeak (min)=		3.00	14.00
Unit Hyd. peak (cms)=		.34	.08
			TOTALS
PEAK FLOW	(cms)=	.72	.62 .987 (iii)
TIME TO PEAK	(hrs)=	1.50	1.70 1.517
RUNOFF VOLUME	(mm)=	72.16	24.60 32.209
TOTAL RAINFALL	(mm)=	72.96	72.96 72.962
RUNOFF COEFFICIENT	=	.99	.34 .441

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0004

```
*****************************************************************************
*
*
* BLOCK 1 TOWNHOUSES
*
*
*****************************************************************************
```

```
| DESIGN STANDHYD    |   Area     (ha)=     .57
| 02:BLK1   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.43	.14
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	61.64	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		186.56	234.31
over (min)		1.00	8.00
Storage Coeff. (min)=		1.49 (ii)	7.67 (ii)
Unit Hyd. Tpeak (min)=		1.00	8.00
Unit Hyd. peak (cms)=		.83	.15
			TOTALS
PEAK FLOW	(cms)=	.11	.06 .157 (iii)
TIME TO PEAK	(hrs)=	1.50	1.58 1.500
RUNOFF VOLUME	(mm)=	72.16	35.73 49.575
TOTAL RAINFALL	(mm)=	72.96	72.96 72.962
RUNOFF COEFFICIENT	=	.99	.49 .679

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0005

```
*****************************************************************************
*
*
* BLOCK 2 APARTMENTS
*
*
*****************************************************************************
```

```
| DESIGN STANDHYD    |   Area     (ha)=     .69
| 03:BLK2   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.52	.17
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	67.82	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		186.56	234.31
over (min)		2.00	8.00
Storage Coeff. (min)=		1.58 (ii)	7.76 (ii)
Unit Hyd. Tpeak (min)=		2.00	8.00
Unit Hyd. peak (cms)=		.65	.14
			TOTALS
PEAK FLOW	(cms)=	.14	.07 .190 (iii)
TIME TO PEAK	(hrs)=	1.50	1.58 1.500
RUNOFF VOLUME	(mm)=	72.16	35.73 49.575
TOTAL RAINFALL	(mm)=	72.96	72.96 72.962
RUNOFF COEFFICIENT	=	.99	.49 .679

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0006

```
*****************************************************************************
*
*
* BLOCK 5 SWM
*
*
*****************************************************************************
```

```
| DESIGN STANDHYD    |   Area     (ha)=    1.26
| 06:BLK5   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.13	.13
Dep. Storage	(mm)=	.80	1.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	91.65	40.00
Mannings n	=	.013	.250
Max.eff.Inten.(mm/hr)=		186.56	35.64
over (min)		2.00	15.00
Storage Coeff. (min)=		1.89 (ii)	15.02 (ii)
Unit Hyd. Tpeak (min)=		2.00	15.00
Unit Hyd. peak (cms)=		.58	.08
			TOTALS
PEAK FLOW	(cms)=	.58	.01 .587 (iii)
TIME TO PEAK	(hrs)=	1.50	1.72 1.500
RUNOFF VOLUME	(mm)=	72.16	20.00 66.945
TOTAL RAINFALL	(mm)=	72.96	72.96 72.962
RUNOFF COEFFICIENT	=	.99	.27 .918

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0007

```
*****************************************************************************
*
*
* DETERMINE INFLOW TO POND
*
*
```

```
**********************************************************************
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
                                  (ha)     (cms)    (hrs)    (mm)    (cms)
                 ID1 01:SFD       9.30     .987     1.52    32.21     .000
                +ID2 02:BLK1      .57      .157     1.50    49.58     .000
                +ID3 03:BLK2      .69      .190     1.50    49.58     .000
                +ID4 06:BLK5     1.26      .587     1.50    66.95     .000
                 ==========================================================
                 SUM 07:PSTDEV   11.82     1.905    1.50    37.76     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0008-------------------------------------------------------------------
**********************************************************************
*
*
* ROUTE THROUGH POND
*
*
**********************************************************************
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
| IN>07:(PSTDEV)    |
| OUT<08:(PNDOUT)   |    =========  OUTFLOW STORAGE TABLE  =========
                         OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00     |     .025  .3535E+00
                           .007  .5520E-01     |     .027  .4178E+00
                           .013  .1118E+00     |     .029  .4837E+00
                           .017  .1700E+00     |     .031  .5512E+00
                           .020  .2296E+00     |     .033  .6203E+00
                           .023  .2908E+00     |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (PSTDEV)       11.82     1.905     1.500     37.763
     OUTFLOW<08: (PNDOUT)       11.82      .027     4.300     37.761
    OVERFLOW<09: (PNDOVR)         .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     1.434
                  TIME SHIFT OF PEAK FLOW          (min)=   168.00
                  MAXIMUM  STORAGE  USED        (ha.m.)=.4182E+00

005:0009-------------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 3 COMMERCIAL
*
*
**********************************************************************
| DESIGN STANDHYD    |   Area     (ha)=     .80
| 04:BLK3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      .72          .08
     Dep. Storage     (mm)=      .80         1.50
     Average Slope     (%)=     1.00         1.00
     Length            (m)=    73.03        40.00
     Mannings n             =   .013         .250

     Max.eff.Inten.(mm/hr)=   186.56       792.82
           over      (min)      2.00         5.00
     Storage Coeff.  (min)=     1.65 (ii)    5.44 (ii)
     Unit Hyd. Tpeak (min)=     2.00         5.00
     Unit Hyd. peak  (cms)=      .63          .21
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .19          .13        .310 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.53       1.500
     RUNOFF VOLUME    (mm)=    72.16        49.78      59.854
     TOTAL RAINFALL   (mm)=    72.96        72.96      72.962
     RUNOFF COEFFICIENT    =     .99          .68        .820

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0     Ia = Dep. Storage   (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0010-------------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON BLOCK 3 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
| IN>04:(BLK3  )    |
| OUT<01:(B3CTRL)   |    =========  OUTFLOW STORAGE TABLE  =========
                         OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00     |     .015  .1000E+01
                           .015  .1000E-03     |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (BLK3  )          .80      .310     1.500     59.854
     OUTFLOW<01: (B3CTRL)          .80      .015     1.067     59.854
    OVERFLOW<02: (3OVR  )          .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     4.840
                  TIME SHIFT OF PEAK FLOW          (min)=   -26.00
                  MAXIMUM  STORAGE  USED        (ha.m.)=.3117E-01

005:0011-------------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 4 COMMERCIAL
*
*
**********************************************************************
| DESIGN STANDHYD    |   Area     (ha)=     1.40
| 05:BLK4   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=     1.26          .14
     Dep. Storage     (mm)=      .80         1.50
     Average Slope     (%)=     1.00         1.00
     Length            (m)=    96.61        40.00
     Mannings n             =   .013         .250

     Max.eff.Inten.(mm/hr)=   186.56       780.67
           over      (min)      2.00         6.00
     Storage Coeff.  (min)=     1.95 (ii)    5.77 (ii)
     Unit Hyd. Tpeak (min)=     2.00         6.00
     Unit Hyd. peak  (cms)=      .57          .19
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .32          .22        .525 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.53       1.500
     RUNOFF VOLUME    (mm)=    72.16        49.78      59.854
     TOTAL RAINFALL   (mm)=    72.96        72.96      72.962
     RUNOFF COEFFICIENT    =     .99          .68        .820

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0     Ia = Dep. Storage   (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0012-------------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON 4 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
| IN>05:(BLK4  )    |
| OUT<03:(B4CTRL)   |    =========  OUTLFOW STORAGE TABLE  =========
                         OUTFLOW     STORAGE   |  OUTFLOW     STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00     |     .015  .1000E+01
                           .015  .1000E-03     |     .000  .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (BLK4  )         1.40      .525     1.500     59.854
     OUTFLOW<03: (B4CTRL)         1.40      .015      .833     59.854
    OVERFLOW<04: (4OVR  )          .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     2.859
                  TIME SHIFT OF PEAK FLOW          (min)=   -40.00
                  MAXIMUM  STORAGE  USED        (ha.m.)=.6394E-01

005:0013-------------------------------------------------------------------
**********************************************************************
*
*
* TOTAL POST DEVELOPMENT FROM SITE
*
*
**********************************************************************
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
                                  (ha)     (cms)    (hrs)    (mm)    (cms)
                 ID1 08:PNDOUT   11.82     .027     4.30    37.76     .000
                +ID2 09:PNDOVR     .00     .000      .00      .00     .000 **DRY**
                +ID3 01:B3CTRL     .80     .015     1.07    59.85     .000
                +ID4 02:3OVR       .00     .000      .00      .00     .000 **DRY**
                +ID5 03:B4CTRL    1.40     .015      .83    59.85     .000
                +ID6 04:4OVR       .00     .000      .00      .00     .000 **DRY**
                 ==========================================================
                 SUM 05:PSTDEV   14.02     .057     4.30    41.23     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0014-------------------------------------------------------------------
005:0002-------------------------------------------------------------------
005:0002-------------------------------------------------------------------
005:0002-------------------------------------------------------------------
005:0002-------------------------------------------------------------------
005:0002-------------------------------------------------------------------
  ** END OF RUN :   5
**********************************************************************




--------------------
| START            |  Project  dir.: H:\SWMHYM~1\10034Y~1\
--------------------  Painfall dir.: H:\SWMHYM~1\10034Y~1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
```

```
          #  1=CH100.STM
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
*#*************************************************************************
*#  Project Name: [YINS PHASE 5]     Project Number: [10034]
*#  Date        : 02-11-2010
*#  Modeller    : [TGS]
*#  Company     : G. Douglas Vallee Limited
*#  License #   :  3568969
*#*************************************************************************
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
--------------------
| READ STORM       |     Filename: H:\SWMHYM~1\10034Y~1\CH100.STM
| Ptotal=  83.90 mm|     Comments: 100 YEAR CHICAGO 4 HOUR DESIGN STORM DIS
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.500 |   1.17  16.860 |   2.17  14.830 |   3.17   6.600
               .33   5.050 |   1.33  41.070 |   2.33  12.120 |   3.33   6.100
               .50   5.820 |   1.50 205.920 |   2.50  10.310 |   3.50   5.660
               .67   6.830 |   1.67  54.560 |   2.67   9.020 |   3.67   5.280
               .83   8.410 |   1.83  29.170 |   2.83   8.030 |   3.83   4.980
              1.00  11.070 |   2.00  19.280 |   3.00   7.240 |   4.00   4.700

--------------------------------------------------------------------------------
006:0003----------------------------------------------------------------------
*************************************************************************
*
*
* SFD
*
*
*************************************************************************
----------------------
| DESIGN STANDHYD    |   Area     (ha)=    9.30
| 01:SFD    DT= 1.00 |   Total Imp(%)=   37.00   Dir. Conn.(%)=   16.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.44          5.86
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     249.00         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     205.92         79.53
               over (min)          3.00         13.00
     Storage Coeff.  (min)=       3.31 (ii)    12.83 (ii)
     Unit Hyd. Tpeak (min)=       3.00         13.00
     Unit Hyd. peak  (cms)=        .35           .09
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .80           .80          1.192 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.68          1.517
     RUNOFF VOLUME    (mm)=      83.10         31.04         39.372
     TOTAL RAINFALL   (mm)=      83.90         83.90         83.902
     RUNOFF COEFFICIENT   =        .99           .37           .469

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0004----------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 1 TOWNHOUSES
*
*
*************************************************************************
----------------------
| DESIGN STANDHYD    |   Area     (ha)=     .57
| 02:BLK1   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .43           .14
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=      61.64         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     205.92        286.05
               over (min)          1.00          7.00
     Storage Coeff.  (min)=       1.43 (ii)     7.14 (ii)
     Unit Hyd. Tpeak (min)=       1.00          7.00
     Unit Hyd. peak  (cms)=        .85           .16
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .12           .07           .185 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.57          1.500
     RUNOFF VOLUME    (mm)=      83.10         44.06         58.898
     TOTAL RAINFALL   (mm)=      83.90         83.90         83.902
     RUNOFF COEFFICIENT   =        .99           .53           .702

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0005----------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 2 APARTMENTS
*
*
*************************************************************************
----------------------
| DESIGN STANDHYD    |   Area     (ha)=     .69
| 03:BLK2   DT= 1.00 |   Total Imp(%)=   75.00   Dir. Conn.(%)=   38.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .52           .17
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=      67.82         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     205.92        286.05
               over (min)          2.00          7.00
     Storage Coeff.  (min)=       1.52 (ii)     7.22 (ii)
     Unit Hyd. Tpeak (min)=       2.00          7.00
     Unit Hyd. peak  (cms)=        .66           .16
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .15           .09           .224 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.57          1.500
     RUNOFF VOLUME    (mm)=      83.10         44.06         58.898
     TOTAL RAINFALL   (mm)=      83.90         83.90         83.902
     RUNOFF COEFFICIENT   =        .99           .53           .702

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0006----------------------------------------------------------------------
*************************************************************************
*
*
* BLOCK 5 SWM
*
*
*************************************************************************
----------------------
| DESIGN STANDHYD    |   Area     (ha)=    1.26
| 06:BLK5   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.13           .13
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=      91.65         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     205.92         46.00
               over (min)          2.00         14.00
     Storage Coeff.  (min)=       1.82 (ii)    13.67 (ii)
     Unit Hyd. Tpeak (min)=       2.00         14.00
     Unit Hyd. peak  (cms)=        .59           .08
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .65           .01           .650 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.70          1.500
     RUNOFF VOLUME    (mm)=      83.10         25.49         77.341
     TOTAL RAINFALL   (mm)=      83.90         83.90         83.902
     RUNOFF COEFFICIENT   =        .99           .30           .922

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0007----------------------------------------------------------------------
*************************************************************************
*
*
* DETERMINE INFLOW TO POND
*
*
*************************************************************************
--------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.     DWF
--------------------                (ha)     (cms)    (hrs)    (mm)    (cms)
                  ID1 01:SFD       9.30     1.192     1.52   39.37    .000
                 +ID2 02:BLK1       .57      .185     1.50   58.90    .000
                 +ID3 03:BLK2       .69      .224     1.50   58.90    .000
                 +ID4 06:BLK5      1.26      .650     1.50   77.34    .000
                  ==========================================================
                  SUM 07:PSTDEV   11.82     2.221     1.50   45.50    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
006:0008----------------------------------------------------------------------
*************************************************************************
*
*
* ROUTE THROUGH POND
*
*
*************************************************************************
----------------------
| ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
|  IN>07:(PSTDEV)    |
| OUT<08:(PNDOUT)    |     =========  OUTFLOW STORAGE TABLE  ==========
----------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                             (cms)     (ha.m.)  |    (cms)    (ha.m.)
                              .000  .0000E+00    |     .025  .3535E+00
                              .007  .5520E-01    |     .027  .4178E+00
                              .013  .1118E+00    |     .029  .4837E+00
                              .017  .1700E+00    |     .031  .5512E+00
                              .020  .2296E+00    |     .033  .6203E+00
                              .023  .2908E+00    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK      R.V.
     ---------------            (ha)     (cms)     (hrs)      (mm)
     INFLOW >07: (PSTDEV)      11.82     2.221     1.500     45.501
     OUTFLOW<08: (PNDOUT)      11.82      .030     4.300     45.500
    OVERFLOW<09: (PNDOVR)        .00      .000      .000      .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =       0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=     .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=     .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   1.353
                    TIME SHIFT OF PEAK FLOW          (min)=  168.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.5069E+00

--------------------------------------------------------------------------------
006:0009----------------------------------------------------------------------
*************************************************************************
*
*
```

```
* BLOCK 3 COMMERCIAL
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD     |   Area     (ha)=     .80
| 04:BLK3   DT= 1.00  |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=       .72          .08
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     73.03        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    205.92       907.51
           over      (min)      2.00         5.00
     Storage Coeff.  (min)=     1.58 (ii)    5.18 (ii)
     Unit Hyd. Tpeak (min)=     2.00         5.00
     Unit Hyd. peak  (cms)=      .64          .22
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .21          .15        .353 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.53       1.500
     RUNOFF VOLUME    (mm)=    83.10        59.74      70.253
     TOTAL RAINFALL   (mm)=    83.90        83.90      83.902
     RUNOFF COEFFICIENT   =      .99          .71        .837

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
006:0010---------------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON BLOCK 3 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>04:(BLK3  )     |
| OUT<01:(B3CTRL)     |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)    |    (cms)    (ha.m.)
                            .000  .0000E+00     |     .015  .1000E+01
                            .015  .1000E-03     |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (BLK3  )        .80      .353     1.500     70.253
     OUTFLOW<01: (B3CTRL)        .80      .015     1.033     70.253
    OVERFLOW<02: (3OVR  )        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.253
                  TIME SHIFT OF PEAK FLOW          (min)=   -28.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3841E-01

------------------------------------------------------------------------------
006:0011---------------------------------------------------------------------
**********************************************************************
*
*
* BLOCK 4 COMMERCIAL
*
*
**********************************************************************
---------------------
| DESIGN STANDHYD     |   Area     (ha)=    1.40
| 05:BLK4   DT= 1.00  |   Total Imp(%)=   90.00   Dir. Conn.(%)=   45.00
---------------------
                          IMPERVIOUS     PERVIOUS (i)
     Surface Area     (ha)=      1.26          .14
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     96.61        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    205.92       907.51
           over      (min)      2.00         5.00
     Storage Coeff.  (min)=     1.87 (ii)    5.47 (ii)
     Unit Hyd. Tpeak (min)=     2.00         5.00
     Unit Hyd. peak  (cms)=      .58          .21
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .36          .27        .610 (iii)
     TIME TO PEAK    (hrs)=     1.50         1.53       1.500
     RUNOFF VOLUME    (mm)=    83.10        59.74      70.253
     TOTAL RAINFALL   (mm)=    83.90        83.90      83.902
     RUNOFF COEFFICIENT   =      .99          .71        .837

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
006:0012---------------------------------------------------------------------
**********************************************************************
*
*
* SIMULATE STORAGE ON 4 TO RELEASE AT CONTROLLED RATE
*
*
**********************************************************************
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>05:(BLK4  )     |
| OUT<03:(B4CTRL)     |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)    |    (cms)    (ha.m.)
                            .000  .0000E+00     |     .015  .1000E+01
                            .015  .1000E-03     |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (BLK4  )       1.40      .610     1.500     70.253
     OUTFLOW<03: (B4CTRL)       1.40      .015      .717     70.253
    OVERFLOW<04: (4OVR  )        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    2.457
                  TIME SHIFT OF PEAK FLOW          (min)=   -47.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7812E-01

------------------------------------------------------------------------------
006:0013---------------------------------------------------------------------
**********************************************************************
*
*
* TOTAL POST DEVELOPMENT FROM SITE
*
*
**********************************************************************
---------------------
| ADD HYD (PSTDEV) | ID: NHYD     AREA     QPEAK    TPEAK    R.V.    DWF
---------------------              (ha)     (cms)    (hrs)    (mm)    (cms)
                    ID1 08:ENDOUT   11.82     .030    4.30   45.50    .000
                  +ID2 09:ENDOVR      .00     .000     .00     .00    .000 **DRY**
                  +ID3 01:B3CTRL      .80     .015    1.03   70.25    .000
                  +ID4 02:3OVR        .00     .000     .00     .00    .000 **DRY**
                  +ID5 03:B4CTRL     1.40     .015     .72   70.25    .000
                  +ID6 04:4OVR        .00     .000     .00     .00    .000 **DRY**
                   ==========================================================
                   SUM 05:PSTDEV    14.02     .060    4.30   49.38    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
006:0014---------------------------------------------------------------------
------------------------------------------------------------------------------
006:0002---------------------------------------------------------------------
------------------------------------------------------------------------------
006:0002---------------------------------------------------------------------
------------------------------------------------------------------------------
006:0002---------------------------------------------------------------------
------------------------------------------------------------------------------
006:0002---------------------------------------------------------------------
------------------------------------------------------------------------------
006:0002---------------------------------------------------------------------
      FINISH
------------------------------------------------------------------------------
**********************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2010-11-22     at 14:15:45
======================================================================
```

Appendix D: Miscellaneous Pond Design Calculations

vallee
Consulting Engineers, Architects & Planners

Subject: Yin's Phase 5
Date: Nov 4/10 By: TGS
Project #: 10034 Page

Water Quality Sizing

35% Impervious	90
55% Impervious	150
54% Impervious	147
Contributing Area	11.82
Volume Req.	1738

1) Forebay Design: Settling

Equation 4.5 Dist= sqrt(r*Qp/Vs)

Dist = forebay length
r = length to width of forebay
Qp = peak flow rate from pond during quality storm
Vs= target settling velocity, recommended at 0.0003 m/s

Given	r=	2	Target 2:1
	Qp =	0.017	
	Vs=	0.0003	
	Dist=	11	

2) Forebary Design: Dispersion Length

Equation 4.6 Dist = 8*Q/(d*Vf)

Dist = forebay length
Q= inlet flow rate for quality storm
d= depth of perm pool
Vf = desired velocity in forebay (<0.5m/s)

Given	Q=	0.651	SYMHYMO results to pond for 2-year event
	d=	1.25	
	Vf=	0.5	
	dist=	8	

3) Forebay Design: Bottom Width

Equation 4.7 Width=Dist/8

Given Dist= 11

width= 1.375

4) Forebay Design: Cleanout Frequency

Table 6.3 of SWM Planning and Design Manual

35% Impervious	0.6	m3/ha, annual sediment loading
55% Impervious	1.9	m3/ha, annual sediment loading

Reference Calculation of Impervious areas spreadsheet for this development==> 39% impervious
Therefore extrapolate

54%	1.835	m3/ha

Total site area, including external contributing area 11.82 ha

Sediment Accummulation	21.6897	m3/year
Target Removal eff. For basic protection	60%	
Anticipate Accumulation	13.01382	m3/year
Clean Frequency	10	year
Total Anticipated Accumulation	130.1382	m3

Contour	Area	Incr V	Volume
242	73	0	
242.45	187	59	59
242.65	380	57	115
243.25	717	329	444

Appendix E: Main Street Storm Sewer Design Calculations (Existing and Proposed)

vallee
Consulting Engineers, Architects & Planners

Subject: Yins Phase 5 Main Street Ex Storm
Date: Dec-10 By: TGS
Project #: 10034 Page

Existing storm services drainage area from Thompson Road to Area 4-3.

	Area	Runoff C	C*A
1-ex	1.26	0.45	0.567
2-1	1.71	0.45	0.7695
3-2	1.81	0.9	1.629
4-3	2.09	0.9	1.881
			4.8465

WSMD Designed for 2-year storm

Norfolk County Design criteria for 2-year storm, I = A/(t+B)^C

A	529.711
B	4.501
C	0.745

Assume and inlet time of 10 min to account for initial estimate of 5.0min per design criteria for commercial areas and some transit time in system

I	72.243	mm/hr
Q	973	L/s

Existing storm sewer along Main Street is all 525mm at 0.4%

Dia	0.525	m
n	0.013	
Hyd R	0.13125	m
Slope	0.4%	
C/S A	0.21647537	m2
Q	272	L/s

Therefore insufficient capacity to service drainage area for the 2-year event.

REV. No.	DATE	REVISION
0	DEC 8/10	SUBMIT TO COUNTY FOR REVIEW

(10) STORM MANHOLE AND NUMBER

10-10A
0.69 | 0.75
AREA NUMBER
RUNOFF COEFF.
AREA (Ha)

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project Title
YIN PHASE 5
NORFOLK COUNTY - WATERFORD

Drawing Title
STORM DRAINAGE AREAS

Designed by : DJB	Drawn By : TJC
Checked by : TGS	Date Started : SEPTEMBER 2010
Drawing Scale : 1:100	Drawing No. ST1
Project No. 10-034	

DATE LAST PLOTTED :

STORM SEWER DESIGN SHEET

Storm 2-year Simcoe
A= 529.71 B= 4.501 C= 0.745
Pipe Material PVC<=450, Concrete >450
n 0.013

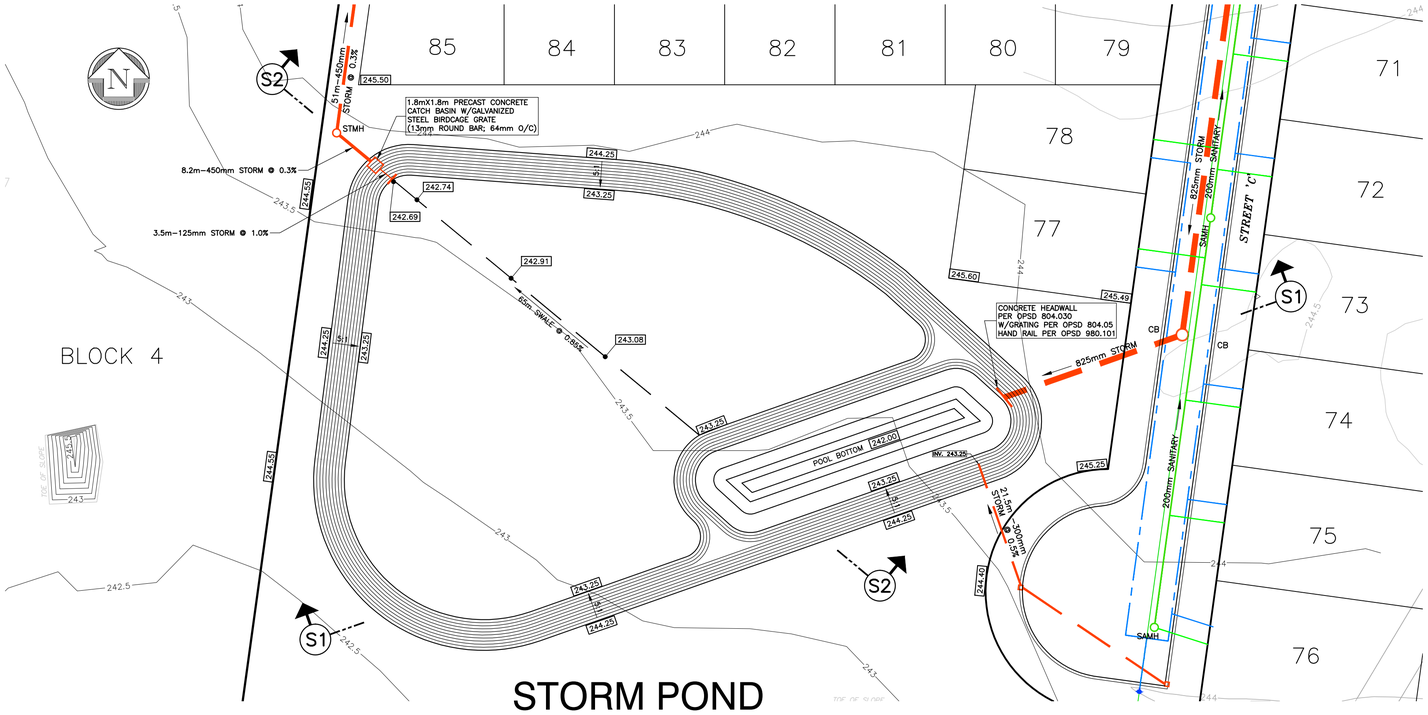
Project 10034 Yin's Phase 5 - Main Street Storm
Town/County Waterford - Norfolk County

Date Nov 24/10
Designed by TGS
Checked by JDV
Sheet of : 1 of

Location			Area			Cumlative	Time	Rainfall	Flow	Sewer Design					
Area	From	To			TOTAL	R*A	of		2.78*I*A*R	Size	Slope	Cap	Vel	Length	Time
			Ha	Ha	Ha		Concentration	mm/hr							
			0.45	0.9			min		L/s	mm	%	L/s	m/s	m	min
Pond	Pond	7	0		0.00	0	0.00	N/A	30.0	450	0.30%	156.2	0.982	59.2	1
7-6	7	6	0.37		0.17	0.17	15.00	57.94	56.8	450	0.40%	180.3	1.134	104.5	1.54
6-5	6	5	0		0.00	0.17	16.54	54.75	85.3	600	0.20%	274.6	0.971	114	1.96
5-4	5	4		1.34	1.21	1.37	18.49	51.24	255.5	600	0.20%	274.6	0.971	119	2.04
4-3	4	3		2.09	1.88	3.25	20.53	48.10	495.0	750	0.25%	556.6	1.26	119.4	1.58
3-2	3	2		1.81	1.63	4.88	22.11	45.95	683.7	825	0.25%	717.7	1.343	84	1.04
2-1	2	1	1.71		0.77	5.65	23.16	44.66	761.7	825	0.30%	786.2	1.471	29.9	0.34
1-EX	1	EX	1.26		0.57	6.22	23.50	44.25	825.1	825	0.35%	849.2	1.589	107	1.12

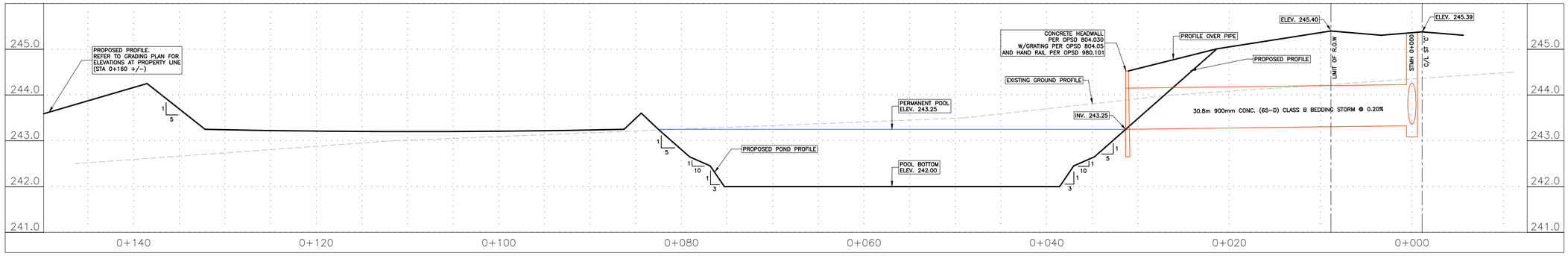
Note:

Peak Discharge from Pond (100-yr storm)	0.03	Applied at Area POND
Peak Dischare from Block 3	0.015	Applied at Area 6-5
Peak Discharge from Block 4	0.015	Applied at Area 6-6



STORM POND

SCALE 1:500



SECTION S1-S1

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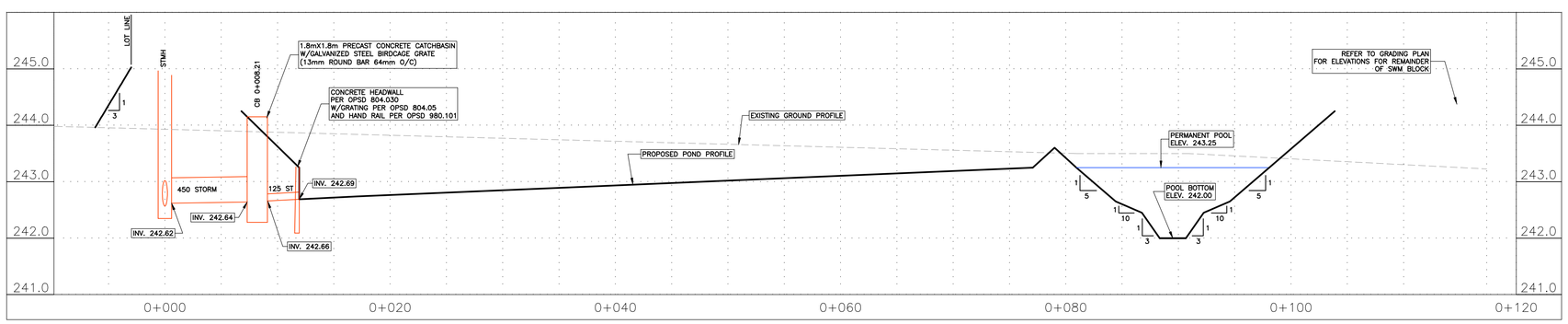
VERTICAL=1:50



SECTION S2-S2

SCALE HORIZONTAL=1:250
VERTICAL=1:50

REV. No.	DATE	REVISION
0	DEC 8/10	SUBMIT TO COUNTY FOR REVIEW

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project Title
YIN PHASE 5
NORFOLK COUNTY - WATERFORD

Drawing Title
PLAN AND SECTION DETAILS

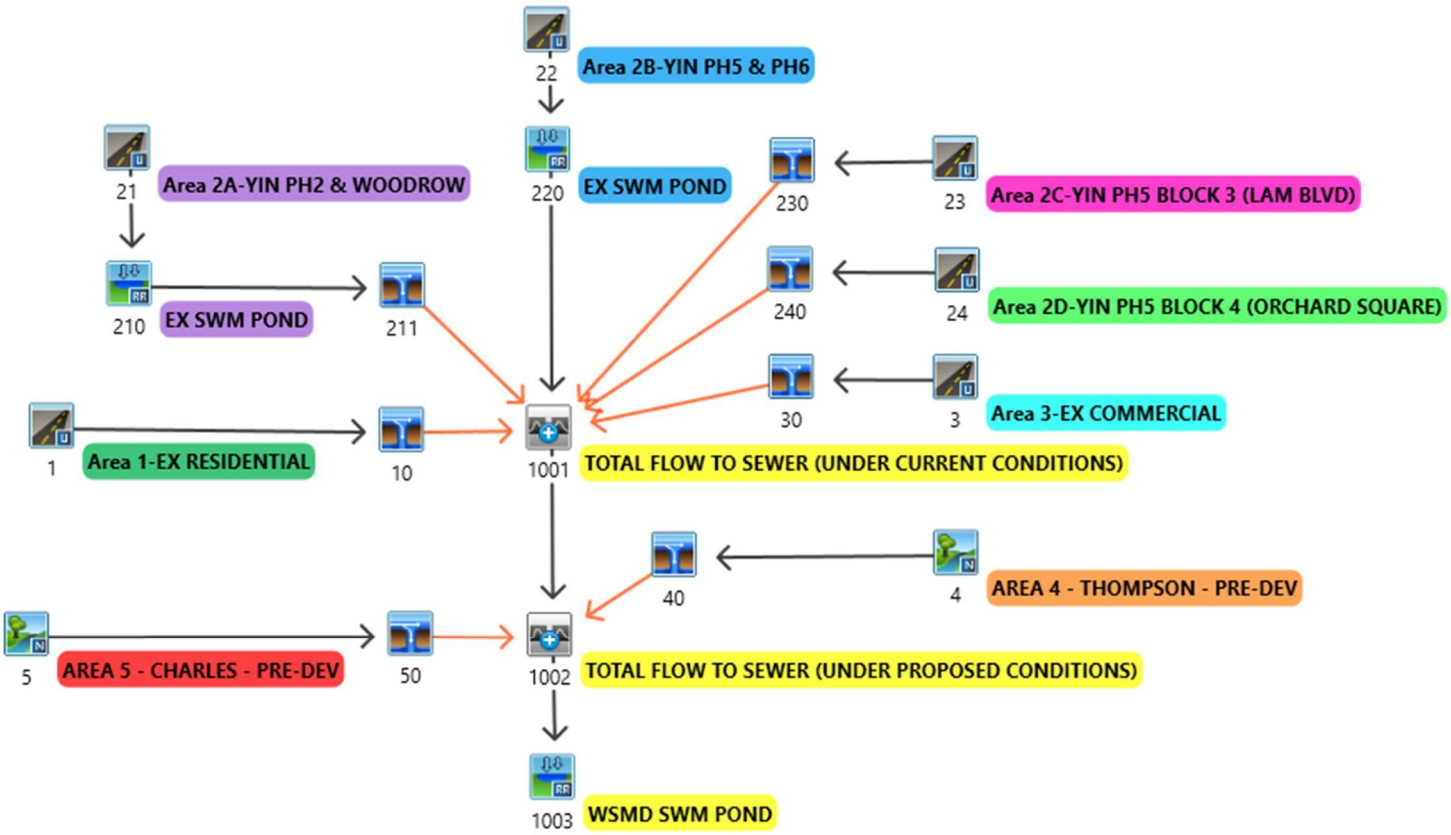
Designed by : GRB	Drawn By : TJC
Checked by : TGS	Date Started : NOVEMBER 2010
Drawing Scale : AS NOTED	Drawing No. SWM1
Project No. 10-034	

DATE LAST PLOTTED :

APPENDIX F

Revised WSMD Visual OTTHYMO Model Output Files

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL



2-Year Storm Event

```
================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M M M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                 *****  D E T A I L E D   O U T P U T *****


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DATE: 08/20/2024                          TIME: 04:18:40

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 01_2-Year Norfolk             **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 529.711
| Ptotal= 35.21 mm |                          B=   4.501
--------------------                          C=   0.745
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.00    2.68 |  1.00   17.69 |  2.00    5.90 |  3.00    3.14
               0.17    3.04 |  1.17   72.24 |  2.17    5.09 |  3.17    2.94
               0.33    3.53 |  1.33   22.78 |  2.33    4.50 |  3.33    2.76
               0.50    4.26 |  1.50   12.62 |  2.50    4.04 |  3.50    2.60
               0.67    5.49 |  1.67    8.98 |  2.67    3.68 |  3.67    2.47
               0.83    8.02 |  1.83    7.08 |  2.83    3.39 |  3.83    2.35

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area     (ha)=   4.35   Curve Number    (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  13.60   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.30

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.68 | 1.083   17.69 | 2.083    5.90 |  3.08    3.14
               0.167    2.68 | 1.167   17.69 | 2.167    5.90 |  3.17    3.14
               0.250    3.04 | 1.250   72.24 | 2.250    5.09 |  3.25    2.94
               0.333    3.04 | 1.333   72.24 | 2.333    5.09 |  3.33    2.94
               0.417    3.53 | 1.417   22.78 | 2.417    4.50 |  3.42    2.76
               0.500    3.53 | 1.500   22.78 | 2.500    4.50 |  3.50    2.76
               0.583    4.26 | 1.583   12.62 | 2.583    4.04 |  3.58    2.60
               0.667    4.26 | 1.667   12.62 | 2.667    4.04 |  3.67    2.60
               0.750    5.49 | 1.750    8.98 | 2.750    3.68 |  3.75    2.47
               0.833    5.49 | 1.833    8.98 | 2.833    3.68 |  3.83    2.47
               0.917    8.02 | 1.917    7.08 | 2.917    3.39 |  3.92    2.35
               1.000    8.02 | 2.000    7.08 | 3.000    3.39 |  4.00    2.35

    Unit Hyd Qpeak  (cms)=   0.554

    PEAK FLOW       (cms)=   0.017 (i)
    TIME TO PEAK    (hrs)=   1.917
    RUNOFF VOLUME    (mm)=   2.633
    TOTAL RAINFALL   (mm)=  35.210
    RUNOFF COEFFICIENT   =   0.075

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0050)|
| Inlet Cap.= 0.017|
| #of Inlets=    1|
| Total(cms)=  0.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
    TOTAL HYD.(ID= 1):   4.35      0.02      1.92     2.63
    ================================================
    MAJOR SYS.(ID= 2):   0.00      0.00      1.92     2.63
    MINOR SYS.(ID= 3):   4.35      0.02      1.83     2.63

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
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Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

2-Year Storm Event

```
---------------------
| CALIB             |
| NASHYD   (  0004)|   Area     (ha)=   7.85   Curve Number    (CN)= 72.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.10   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=   0.46
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

```
    Unit Hyd Qpeak  (cms)=   0.652

    PEAK FLOW       (cms)=   0.068 (i)
    TIME TO PEAK    (hrs)=   2.000
    RUNOFF VOLUME    (mm)=   5.838
    TOTAL RAINFALL   (mm)=  35.210
    RUNOFF COEFFICIENT   =   0.166

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
---------------------
| DUHYD    (  0040)|
| Inlet Cap.= 0.068|
| #of Inlets=     1|
| Total(cms)=   0.1|      AREA     QPEAK     TPEAK     R.V.
---------------------      (ha)     (cms)     (hrs)     (mm)
    TOTAL HYD.(ID= 1):   7.85      0.07      2.00      5.84
    ================================================
    MAJOR SYS.(ID= 2):   0.00      0.00      0.00      0.00
    MINOR SYS.(ID= 3):   7.85      0.07      2.00      5.84
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
---------------------
| CALIB             |
| STANDHYD (  0001)|   Area     (ha)=  39.40
|ID= 1 DT= 1.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
---------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      11.82         27.58
    Dep. Storage     (mm)=       0.80         13.60
    Average Slope     (%)=       2.00          2.00
    Length            (m)=     512.51         40.00
    Mannings n           =      0.013         0.250
```

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	2.68	1.017	17.69	2.017	5.90	3.02	3.14
0.033	2.68	1.033	17.69	2.033	5.90	3.03	3.14
0.050	2.68	1.050	17.69	2.050	5.90	3.05	3.14
0.067	2.68	1.067	17.69	2.067	5.90	3.07	3.14
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.100	2.68	1.100	17.69	2.100	5.90	3.10	3.14
0.117	2.68	1.117	17.69	2.117	5.90	3.12	3.14
0.133	2.68	1.133	17.69	2.133	5.90	3.13	3.14
0.150	2.68	1.150	17.69	2.150	5.90	3.15	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.183	3.04	1.183	72.24	2.183	5.09	3.18	2.94
0.200	3.04	1.200	72.24	2.200	5.09	3.20	2.94
0.217	3.04	1.217	72.24	2.217	5.09	3.22	2.94
0.233	3.04	1.233	72.24	2.233	5.09	3.23	2.94
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.267	3.04	1.267	72.24	2.267	5.09	3.27	2.94
0.283	3.04	1.283	72.24	2.283	5.09	3.28	2.94
0.300	3.04	1.300	72.24	2.300	5.09	3.30	2.94
0.317	3.04	1.317	72.24	2.317	5.09	3.32	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.350	3.53	1.350	22.78	2.350	4.50	3.35	2.76
0.367	3.53	1.367	22.78	2.367	4.50	3.37	2.76
0.383	3.53	1.383	22.78	2.383	4.50	3.38	2.76
0.400	3.53	1.400	22.78	2.400	4.50	3.40	2.76
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.433	3.53	1.433	22.78	2.433	4.50	3.43	2.76
0.450	3.53	1.450	22.78	2.450	4.50	3.45	2.76
0.467	3.53	1.467	22.78	2.467	4.50	3.47	2.76
0.483	3.53	1.483	22.78	2.483	4.50	3.48	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.517	4.26	1.517	12.62	2.517	4.04	3.52	2.60
0.533	4.26	1.533	12.62	2.533	4.04	3.53	2.60
0.550	4.26	1.550	12.62	2.550	4.04	3.55	2.60
0.567	4.26	1.567	12.62	2.567	4.04	3.57	2.60
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.600	4.26	1.600	12.62	2.600	4.04	3.60	2.60
0.617	4.26	1.617	12.62	2.617	4.04	3.62	2.60
0.633	4.26	1.633	12.62	2.633	4.04	3.63	2.60
0.650	4.26	1.650	12.62	2.650	4.04	3.65	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.683	5.49	1.683	8.98	2.683	3.68	3.68	2.47
0.700	5.49	1.700	8.98	2.700	3.68	3.70	2.47
0.717	5.49	1.717	8.98	2.717	3.68	3.72	2.47
0.733	5.49	1.733	8.98	2.733	3.68	3.73	2.47
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.767	5.49	1.767	8.98	2.767	3.68	3.77	2.47
0.783	5.49	1.783	8.98	2.783	3.68	3.78	2.47
0.800	5.49	1.800	8.98	2.800	3.68	3.80	2.47
0.817	5.49	1.817	8.98	2.817	3.68	3.82	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.850	8.02	1.850	7.08	2.850	3.39	3.85	2.35
0.867	8.02	1.867	7.08	2.867	3.39	3.87	2.35
0.883	8.02	1.883	7.08	2.883	3.39	3.88	2.35
0.900	8.02	1.900	7.08	2.900	3.39	3.90	2.35
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
0.933	8.02	1.933	7.08	2.933	3.39	3.93	2.35
0.950	8.02	1.950	7.08	2.950	3.39	3.95	2.35
0.967	8.02	1.967	7.08	2.967	3.39	3.97	2.35
0.983	8.02	1.983	7.08	2.983	3.39	3.98	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

```
    Max.Eff.Inten.(mm/hr)=      72.24          3.94
              over (min)         6.00         33.00
    Storage Coeff.  (min)=       6.30 (ii)    32.03 (ii)
    Unit Hyd. Tpeak (min)=       6.00         33.00
    Unit Hyd. peak  (cms)=       0.18          0.04
                                                        *TOTALS*
    PEAK FLOW       (cms)=       0.92          0.16       0.927 (iii)
    TIME TO PEAK    (hrs)=       1.37          2.15       1.37
    RUNOFF VOLUME    (mm)=      34.41          3.79       8.38
    TOTAL RAINFALL   (mm)=      35.21         35.21      35.21
    RUNOFF COEFFICIENT   =       0.98          0.11       0.24
```

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN* = 62.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
---------------------
| DUHYD    (  0010)|
| Inlet Cap.= 0.927|
| #of Inlets=     1|
| Total(cms)=   0.9|      AREA     QPEAK     TPEAK     R.V.
---------------------      (ha)     (cms)     (hrs)     (mm)
    TOTAL HYD.(ID= 1):  39.40      0.93      1.37      8.38
    ================================================
    MAJOR SYS.(ID= 2):   0.00      0.00      1.37      8.38
    MINOR SYS.(ID= 3):  39.40      0.93      1.37      8.38
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
---------------------
| CALIB             |
| STANDHYD (  0022)|   Area     (ha)=  11.82
|ID= 1 DT= 1.0 min |   Total Imp(%)=  47.00   Dir. Conn.(%)=  22.00
---------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       5.56          6.26
    Dep. Storage     (mm)=       0.80         16.50
    Average Slope     (%)=       1.00          1.00
    Length            (m)=     280.71         40.00
    Mannings n           =      0.013         0.250
```

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	2.68	1.017	17.69	2.017	5.90	3.02	3.14
0.033	2.68	1.033	17.69	2.033	5.90	3.03	3.14
0.050	2.68	1.050	17.69	2.050	5.90	3.05	3.14
0.067	2.68	1.067	17.69	2.067	5.90	3.07	3.14
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.100	2.68	1.100	17.69	2.100	5.90	3.10	3.14
0.117	2.68	1.117	17.69	2.117	5.90	3.12	3.14
0.133	2.68	1.133	17.69	2.133	5.90	3.13	3.14
0.150	2.68	1.150	17.69	2.150	5.90	3.15	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.183	3.04	1.183	72.24	2.183	5.09	3.18	2.94
0.200	3.04	1.200	72.24	2.200	5.09	3.20	2.94
0.217	3.04	1.217	72.24	2.217	5.09	3.22	2.94
0.233	3.04	1.233	72.24	2.233	5.09	3.23	2.94
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.267	3.04	1.267	72.24	2.267	5.09	3.27	2.94
0.283	3.04	1.283	72.24	2.283	5.09	3.28	2.94
0.300	3.04	1.300	72.24	2.300	5.09	3.30	2.94
0.317	3.04	1.317	72.24	2.317	5.09	3.32	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.350	3.53	1.350	22.78	2.350	4.50	3.35	2.76
0.367	3.53	1.367	22.78	2.367	4.50	3.37	2.76
0.383	3.53	1.383	22.78	2.383	4.50	3.38	2.76
0.400	3.53	1.400	22.78	2.400	4.50	3.40	2.76
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.433	3.53	1.433	22.78	2.433	4.50	3.43	2.76
0.450	3.53	1.450	22.78	2.450	4.50	3.45	2.76
0.467	3.53	1.467	22.78	2.467	4.50	3.47	2.76
0.483	3.53	1.483	22.78	2.483	4.50	3.48	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.517	4.26	1.517	12.62	2.517	4.04	3.52	2.60
0.533	4.26	1.533	12.62	2.533	4.04	3.53	2.60
0.550	4.26	1.550	12.62	2.550	4.04	3.55	2.60
0.567	4.26	1.567	12.62	2.567	4.04	3.57	2.60
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.600	4.26	1.600	12.62	2.600	4.04	3.60	2.60
0.617	4.26	1.617	12.62	2.617	4.04	3.62	2.60
0.633	4.26	1.633	12.62	2.633	4.04	3.63	2.60
0.650	4.26	1.650	12.62	2.650	4.04	3.65	2.60

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0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.683	5.49	1.683	8.98	2.683	3.68	3.68	2.47
0.700	5.49	1.700	8.98	2.700	3.68	3.70	2.47
0.717	5.49	1.717	8.98	2.717	3.68	3.72	2.47
0.733	5.49	1.733	8.98	2.733	3.68	3.73	2.47
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.767	5.49	1.767	8.98	2.767	3.68	3.77	2.47
0.783	5.49	1.783	8.98	2.783	3.68	3.78	2.47
0.800	5.49	1.800	8.98	2.800	3.68	3.80	2.47
0.817	5.49	1.817	8.98	2.817	3.68	3.82	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.850	8.02	1.850	7.08	2.850	3.39	3.85	2.35
0.867	8.02	1.867	7.08	2.867	3.39	3.87	2.35
0.883	8.02	1.883	7.08	2.883	3.39	3.88	2.35
0.900	8.02	1.900	7.08	2.900	3.39	3.90	2.35
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
0.933	8.02	1.933	7.08	2.933	3.39	3.93	2.35
0.950	8.02	1.950	7.08	2.950	3.39	3.95	2.35
0.967	8.02	1.967	7.08	2.967	3.39	3.97	2.35
0.983	8.02	1.983	7.08	2.983	3.39	3.98	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

			TOTALS
Max.Eff.Inten.(mm/hr)=	72.24	4.57	
over (min)	5.00	36.00	
Storage Coeff. (min)=	5.40 (ii)	35.25 (ii)	
Unit Hyd. Tpeak (min)=	5.00	36.00	
Unit Hyd. peak (cms)=	0.21	0.03	
PEAK FLOW (cms)=	0.43	0.04	0.431 (iii)
TIME TO PEAK (hrs)=	1.35	2.22	1.35
RUNOFF VOLUME (mm)=	34.41	3.87	10.58
TOTAL RAINFALL (mm)=	35.21	35.21	35.21
RUNOFF COEFFICIENT =	0.98	0.11	0.30

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0220)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 1.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0251	0.3540
	0.0066	0.0550	0.0273	0.4180
	0.0127	0.1120	0.0294	0.4840
	0.0167	0.1700	0.0313	0.5510
	0.0199	0.2300	0.0332	0.6200
	0.0226	0.2910	0.0000	0.0000

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW :	ID= 2 (0022)	11.820	0.431	1.35	10.58
OUTFLOW:	ID= 1 (0220)	11.820	0.012	4.65	7.76

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.89
TIME SHIFT OF PEAK FLOW (min)=198.00
MAXIMUM STORAGE USED (ha.m.)= 0.1100

CALIB			
STANDHYD (0003)	Area (ha)= 19.20		
ID= 1 DT= 1.0 min	Total Imp(%)= 80.00	Dir. Conn.(%)= 50.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	15.36	3.84	
Dep. Storage (mm)=	0.80	16.50	
Average Slope (%)=	2.00	2.00	
Length (m)=	357.77	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	2.68	1.017	17.69	2.017	5.90	3.02	3.14
0.033	2.68	1.033	17.69	2.033	5.90	3.03	3.14
0.050	2.68	1.050	17.69	2.050	5.90	3.05	3.14
0.067	2.68	1.067	17.69	2.067	5.90	3.07	3.14
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.100	2.68	1.100	17.69	2.100	5.90	3.10	3.14
0.117	2.68	1.117	17.69	2.117	5.90	3.12	3.14
0.133	2.68	1.133	17.69	2.133	5.90	3.13	3.14
0.150	2.68	1.150	17.69	2.150	5.90	3.15	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.183	3.04	1.183	72.24	2.183	5.09	3.18	2.94
0.200	3.04	1.200	72.24	2.200	5.09	3.20	2.94
0.217	3.04	1.217	72.24	2.217	5.09	3.22	2.94
0.233	3.04	1.233	72.24	2.233	5.09	3.23	2.94
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.267	3.04	1.267	72.24	2.267	5.09	3.27	2.94
0.283	3.04	1.283	72.24	2.283	5.09	3.28	2.94
0.300	3.04	1.300	72.24	2.300	5.09	3.30	2.94
0.317	3.04	1.317	72.24	2.317	5.09	3.32	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.350	3.53	1.350	22.78	2.350	4.50	3.35	2.76
0.367	3.53	1.367	22.78	2.367	4.50	3.37	2.76
0.383	3.53	1.383	22.78	2.383	4.50	3.38	2.76
0.400	3.53	1.400	22.78	2.400	4.50	3.40	2.76
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.433	3.53	1.433	22.78	2.433	4.50	3.43	2.76
0.450	3.53	1.450	22.78	2.450	4.50	3.45	2.76
0.467	3.53	1.467	22.78	2.467	4.50	3.47	2.76
0.483	3.53	1.483	22.78	2.483	4.50	3.48	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.517	4.26	1.517	12.62	2.517	4.04	3.52	2.60
0.533	4.26	1.533	12.62	2.533	4.04	3.53	2.60
0.550	4.26	1.550	12.62	2.550	4.04	3.55	2.60
0.567	4.26	1.567	12.62	2.567	4.04	3.57	2.60
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.600	4.26	1.600	12.62	2.600	4.04	3.60	2.60
0.617	4.26	1.617	12.62	2.617	4.04	3.62	2.60
0.633	4.26	1.633	12.62	2.633	4.04	3.63	2.60
0.650	4.26	1.650	12.62	2.650	4.04	3.65	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.683	5.49	1.683	8.98	2.683	3.68	3.68	2.47
0.700	5.49	1.700	8.98	2.700	3.68	3.70	2.47
0.717	5.49	1.717	8.98	2.717	3.68	3.72	2.47
0.733	5.49	1.733	8.98	2.733	3.68	3.73	2.47
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.767	5.49	1.767	8.98	2.767	3.68	3.77	2.47
0.783	5.49	1.783	8.98	2.783	3.68	3.78	2.47
0.800	5.49	1.800	8.98	2.800	3.68	3.80	2.47
0.817	5.49	1.817	8.98	2.817	3.68	3.82	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.850	8.02	1.850	7.08	2.850	3.39	3.85	2.35
0.867	8.02	1.867	7.08	2.867	3.39	3.87	2.35
0.883	8.02	1.883	7.08	2.883	3.39	3.88	2.35
0.900	8.02	1.900	7.08	2.900	3.39	3.90	2.35
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
0.933	8.02	1.933	7.08	2.933	3.39	3.93	2.35
0.950	8.02	1.950	7.08	2.950	3.39	3.95	2.35
0.967	8.02	1.967	7.08	2.967	3.39	3.97	2.35
0.983	8.02	1.983	7.08	2.983	3.39	3.98	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

			TOTALS
Max.Eff.Inten.(mm/hr)=	72.24	29.97	
over (min)	5.00	11.00	
Storage Coeff. (min)=	5.08 (ii)	10.65 (ii)	
Unit Hyd. Tpeak (min)=	5.00	11.00	
Unit Hyd. peak (cms)=	0.22	0.11	
PEAK FLOW (cms)=	1.61	0.20	1.706 (iii)
TIME TO PEAK (hrs)=	1.35	1.50	1.35
RUNOFF VOLUME (mm)=	34.41	8.01	21.21
TOTAL RAINFALL (mm)=	35.21	35.21	35.21
RUNOFF COEFFICIENT =	0.98	0.23	0.60

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0030)					
Inlet Cap.= 1.706					
#of Inlets= 1					
Total(cms)= 1.7		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):		19.20	1.71	1.35	21.21
MAJOR SYS.(ID= 2):		0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):		19.20	1.71	1.35	21.21

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
STANDHYD (0021)	Area (ha)= 16.90		
ID= 1 DT= 5.0 min	Total Imp(%)= 38.00	Dir. Conn.(%)= 16.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	6.42	10.48	
Dep. Storage (mm)=	0.80	16.50	
Average Slope (%)=	2.00	2.00	
Length (m)=	335.66	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

			TOTALS
Max.Eff.Inten.(mm/hr)=	72.24	3.49	
over (min)	5.00	35.00	
Storage Coeff. (min)=	4.89 (ii)	31.88 (ii)	
Unit Hyd. Tpeak (min)=	5.00	35.00	
Unit Hyd. peak (cms)=	0.22	0.03	
PEAK FLOW (cms)=	0.49	0.06	0.491 (iii)
TIME TO PEAK (hrs)=	1.33	2.17	1.33
RUNOFF VOLUME (mm)=	34.41	3.34	8.31
TOTAL RAINFALL (mm)=	35.21	35.21	35.21
RUNOFF COEFFICIENT =	0.98	0.09	0.24

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

2-Year Storm Event

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            YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0210)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.3900      0.0820
                          0.0200      0.0000   |    0.4300      0.1090
                          0.0800      0.0020   |    0.5800      0.2670
                          0.2100      0.0160   |    0.6360      0.3420
                          0.3000      0.0330   |    0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0021)     16.900     0.491      1.33       8.31
   OUTFLOW: ID= 1 (  0210)     16.900     0.238      1.50       8.31

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 48.46
                  TIME SHIFT OF PEAK FLOW          (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0215

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--------------------
| DUHYD    (  0211)|
| Inlet Cap.= 0.280|
| #of Inlets=     1|
| Total(cms)=   0.3|      AREA     QPEAK     TPEAK     R.V.
--------------------      (ha)     (cms)     (hrs)     (mm)
     TOTAL HYD.(ID= 1):  16.90      0.24      1.50     8.31
     ==================================================
     MAJOR SYS.(ID= 2):   0.00      0.00      0.00     0.00
     MINOR SYS.(ID= 3):  16.90      0.24      1.50     8.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0023)|   Area    (ha)=   0.80
|ID= 1 DT= 1.0 min |   Total Imp(%)=  90.00   Dir. Conn.(%)=  45.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.72         0.08
     Dep. Storage     (mm)=       0.80        16.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      73.03        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.

                    ---- TRANSFORMED HYETOGRAPH ----
  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
 0.017    2.68 | 1.017   17.69 | 2.017    5.90 |  3.02    3.14
 0.033    2.68 | 1.033   17.69 | 2.033    5.90 |  3.03    3.14
 0.050    2.68 | 1.050   17.69 | 2.050    5.90 |  3.05    3.14
 0.067    2.68 | 1.067   17.69 | 2.067    5.90 |  3.07    3.14
 0.083    2.68 | 1.083   17.69 | 2.083    5.90 |  3.08    3.14
 0.100    2.68 | 1.100   17.69 | 2.100    5.90 |  3.10    3.14
 0.117    2.68 | 1.117   17.69 | 2.117    5.90 |  3.12    3.14
 0.133    2.68 | 1.133   17.69 | 2.133    5.90 |  3.13    3.14
 0.150    2.68 | 1.150   17.69 | 2.150    5.90 |  3.15    3.14
 0.167    2.68 | 1.167   17.69 | 2.167    5.90 |  3.17    3.14
 0.183    3.04 | 1.183   72.24 | 2.183    5.09 |  3.18    2.94
 0.200    3.04 | 1.200   72.24 | 2.200    5.09 |  3.20    2.94
 0.217    3.04 | 1.217   72.24 | 2.217    5.09 |  3.22    2.94
 0.233    3.04 | 1.233   72.24 | 2.233    5.09 |  3.23    2.94
 0.250    3.04 | 1.250   72.24 | 2.250    5.09 |  3.25    2.94
 0.267    3.04 | 1.267   72.24 | 2.267    5.09 |  3.27    2.94
 0.283    3.04 | 1.283   72.24 | 2.283    5.09 |  3.28    2.94
 0.300    3.04 | 1.300   72.24 | 2.300    5.09 |  3.30    2.94
 0.317    3.04 | 1.317   72.24 | 2.317    5.09 |  3.32    2.94
 0.333    3.04 | 1.333   72.24 | 2.333    5.09 |  3.33    2.94
 0.350    3.53 | 1.350   22.78 | 2.350    4.50 |  3.35    2.76
 0.367    3.53 | 1.367   22.78 | 2.367    4.50 |  3.37    2.76
 0.383    3.53 | 1.383   22.78 | 2.383    4.50 |  3.38    2.76
 0.400    3.53 | 1.400   22.78 | 2.400    4.50 |  3.40    2.76
 0.417    3.53 | 1.417   22.78 | 2.417    4.50 |  3.42    2.76
 0.433    3.53 | 1.433   22.78 | 2.433    4.50 |  3.43    2.76
 0.450    3.53 | 1.450   22.78 | 2.450    4.50 |  3.45    2.76
 0.467    3.53 | 1.467   22.78 | 2.467    4.50 |  3.47    2.76
 0.483    3.53 | 1.483   22.78 | 2.483    4.50 |  3.48    2.76
 0.500    3.53 | 1.500   22.78 | 2.500    4.50 |  3.50    2.76
 0.517    4.26 | 1.517   12.62 | 2.517    4.04 |  3.52    2.60
 0.533    4.26 | 1.533   12.62 | 2.533    4.04 |  3.53    2.60
 0.550    4.26 | 1.550   12.62 | 2.550    4.04 |  3.55    2.60
 0.567    4.26 | 1.567   12.62 | 2.567    4.04 |  3.57    2.60
 0.583    4.26 | 1.583   12.62 | 2.583    4.04 |  3.58    2.60
 0.600    4.26 | 1.600   12.62 | 2.600    4.04 |  3.60    2.60
 0.617    4.26 | 1.617   12.62 | 2.617    4.04 |  3.62    2.60
 0.633    4.26 | 1.633   12.62 | 2.633    4.04 |  3.63    2.60
 0.650    4.26 | 1.650   12.62 | 2.650    4.04 |  3.65    2.60
 0.667    4.26 | 1.667   12.62 | 2.667    4.04 |  3.67    2.60
 0.683    5.49 | 1.683    8.98 | 2.683    3.68 |  3.68    2.47
 0.700    5.49 | 1.700    8.98 | 2.700    3.68 |  3.70    2.47
 0.717    5.49 | 1.717    8.98 | 2.717    3.68 |  3.72    2.47
 0.733    5.49 | 1.733    8.98 | 2.733    3.68 |  3.73    2.47
 0.750    5.49 | 1.750    8.98 | 2.750    3.68 |  3.75    2.47
 0.767    5.49 | 1.767    8.98 | 2.767    3.68 |  3.77    2.47
 0.783    5.49 | 1.783    8.98 | 2.783    3.68 |  3.78    2.47
 0.800    5.49 | 1.800    8.98 | 2.800    3.68 |  3.80    2.47
 0.817    5.49 | 1.817    8.98 | 2.817    3.68 |  3.82    2.47
 0.833    5.49 | 1.833    8.98 | 2.833    3.68 |  3.83    2.47
 0.850    8.02 | 1.850    7.08 | 2.850    3.39 |  3.85    2.35
 0.867    8.02 | 1.867    7.08 | 2.867    3.39 |  3.87    2.35
 0.883    8.02 | 1.883    7.08 | 2.883    3.39 |  3.88    2.35
 0.900    8.02 | 1.900    7.08 | 2.900    3.39 |  3.90    2.35
 0.917    8.02 | 1.917    7.08 | 2.917    3.39 |  3.92    2.35
 0.933    8.02 | 1.933    7.08 | 2.933    3.39 |  3.93    2.35
 0.950    8.02 | 1.950    7.08 | 2.950    3.39 |  3.95    2.35
 0.967    8.02 | 1.967    7.08 | 2.967    3.39 |  3.97    2.35
 0.983    8.02 | 1.983    7.08 | 2.983    3.39 |  3.98    2.35
 1.000    8.02 | 2.000    7.08 | 3.000    3.39 |  4.00    2.35

     Max.Eff.Inten.(mm/hr)=      72.24       162.49
               over (min)         5.00         8.00
     Storage Coeff.  (min)=      2.41 (ii)    7.83 (ii)
     Unit Hyd. Tpeak (min)=      5.00         8.00
     Unit Hyd. peak  (cms)=      0.34         0.14
                                                      *TOTALS*
     PEAK FLOW       (cms)=      0.07         0.03       0.089 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.42       1.35
     RUNOFF VOLUME    (mm)=     34.41        15.80      24.17
     TOTAL RAINFALL   (mm)=     35.21        35.21      35.21
     RUNOFF COEFFICIENT   =      0.98         0.45       0.69

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0230)|
| Inlet Cap.= 0.015|
| #of Inlets=     1|
| Total(cms)=   0.0|      AREA     QPEAK     TPEAK     R.V.
--------------------      (ha)     (cms)     (hrs)     (mm)
     TOTAL HYD.(ID= 1):   0.80      0.09      1.35    24.17
     ==================================================
     MAJOR SYS.(ID= 2):   0.31      0.07      1.35    24.17
     MINOR SYS.(ID= 3):   0.49      0.01      1.10    24.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0024)|   Area    (ha)=   1.40
|ID= 1 DT= 1.0 min |   Total Imp(%)=  90.00   Dir. Conn.(%)=  45.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.26         0.14
     Dep. Storage     (mm)=       0.80        16.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      96.61        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.

                    ---- TRANSFORMED HYETOGRAPH ----
  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
 0.017    2.68 | 1.017   17.69 | 2.017    5.90 |  3.02    3.14
 0.033    2.68 | 1.033   17.69 | 2.033    5.90 |  3.03    3.14
 0.050    2.68 | 1.050   17.69 | 2.050    5.90 |  3.05    3.14
 0.067    2.68 | 1.067   17.69 | 2.067    5.90 |  3.07    3.14
 0.083    2.68 | 1.083   17.69 | 2.083    5.90 |  3.08    3.14
 0.100    2.68 | 1.100   17.69 | 2.100    5.90 |  3.10    3.14
 0.117    2.68 | 1.117   17.69 | 2.117    5.90 |  3.12    3.14
 0.133    2.68 | 1.133   17.69 | 2.133    5.90 |  3.13    3.14
 0.150    2.68 | 1.150   17.69 | 2.150    5.90 |  3.15    3.14
 0.167    2.68 | 1.167   17.69 | 2.167    5.90 |  3.17    3.14
 0.183    3.04 | 1.183   72.24 | 2.183    5.09 |  3.18    2.94
 0.200    3.04 | 1.200   72.24 | 2.200    5.09 |  3.20    2.94
 0.217    3.04 | 1.217   72.24 | 2.217    5.09 |  3.22    2.94
 0.233    3.04 | 1.233   72.24 | 2.233    5.09 |  3.23    2.94
 0.250    3.04 | 1.250   72.24 | 2.250    5.09 |  3.25    2.94
 0.267    3.04 | 1.267   72.24 | 2.267    5.09 |  3.27    2.94
 0.283    3.04 | 1.283   72.24 | 2.283    5.09 |  3.28    2.94
 0.300    3.04 | 1.300   72.24 | 2.300    5.09 |  3.30    2.94
 0.317    3.04 | 1.317   72.24 | 2.317    5.09 |  3.32    2.94
 0.333    3.04 | 1.333   72.24 | 2.333    5.09 |  3.33    2.94
 0.350    3.53 | 1.350   22.78 | 2.350    4.50 |  3.35    2.76
 0.367    3.53 | 1.367   22.78 | 2.367    4.50 |  3.37    2.76
 0.383    3.53 | 1.383   22.78 | 2.383    4.50 |  3.38    2.76
 0.400    3.53 | 1.400   22.78 | 2.400    4.50 |  3.40    2.76
 0.417    3.53 | 1.417   22.78 | 2.417    4.50 |  3.42    2.76
 0.433    3.53 | 1.433   22.78 | 2.433    4.50 |  3.43    2.76
 0.450    3.53 | 1.450   22.78 | 2.450    4.50 |  3.45    2.76
 0.467    3.53 | 1.467   22.78 | 2.467    4.50 |  3.47    2.76
 0.483    3.53 | 1.483   22.78 | 2.483    4.50 |  3.48    2.76
 0.500    3.53 | 1.500   22.78 | 2.500    4.50 |  3.50    2.76
 0.517    4.26 | 1.517   12.62 | 2.517    4.04 |  3.52    2.60
 0.533    4.26 | 1.533   12.62 | 2.533    4.04 |  3.53    2.60
 0.550    4.26 | 1.550   12.62 | 2.550    4.04 |  3.55    2.60
 0.567    4.26 | 1.567   12.62 | 2.567    4.04 |  3.57    2.60
 0.583    4.26 | 1.583   12.62 | 2.583    4.04 |  3.58    2.60
 0.600    4.26 | 1.600   12.62 | 2.600    4.04 |  3.60    2.60
 0.617    4.26 | 1.617   12.62 | 2.617    4.04 |  3.62    2.60
 0.633    4.26 | 1.633   12.62 | 2.633    4.04 |  3.63    2.60
 0.650    4.26 | 1.650   12.62 | 2.650    4.04 |  3.65    2.60
 0.667    4.26 | 1.667   12.62 | 2.667    4.04 |  3.67    2.60
 0.683    5.49 | 1.683    8.98 | 2.683    3.68 |  3.68    2.47
 0.700    5.49 | 1.700    8.98 | 2.700    3.68 |  3.70    2.47
 0.717    5.49 | 1.717    8.98 | 2.717    3.68 |  3.72    2.47
 0.733    5.49 | 1.733    8.98 | 2.733    3.68 |  3.73    2.47
 0.750    5.49 | 1.750    8.98 | 2.750    3.68 |  3.75    2.47
 0.767    5.49 | 1.767    8.98 | 2.767    3.68 |  3.77    2.47
 0.783    5.49 | 1.783    8.98 | 2.783    3.68 |  3.78    2.47
```

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

2-Year Storm Event

```
              0.800    5.49 | 1.800    8.98 | 2.800    3.68 |  3.80    2.47
              0.817    5.49 | 1.817    8.98 | 2.817    3.68 |  3.82    2.47
              0.833    5.49 | 1.833    8.98 | 2.833    3.68 |  3.83    2.47
              0.850    8.02 | 1.850    7.08 | 2.850    3.39 |  3.85    2.35
              0.867    8.02 | 1.867    7.08 | 2.867    3.39 |  3.87    2.35
              0.883    8.02 | 1.883    7.08 | 2.883    3.39 |  3.88    2.35
              0.900    8.02 | 1.900    7.08 | 2.900    3.39 |  3.90    2.35
              0.917    8.02 | 1.917    7.08 | 2.917    3.39 |  3.92    2.35
              0.933    8.02 | 1.933    7.08 | 2.933    3.39 |  3.93    2.35
              0.950    8.02 | 1.950    7.08 | 2.950    3.39 |  3.95    2.35
              0.967    8.02 | 1.967    7.08 | 2.967    3.39 |  3.97    2.35
              0.983    8.02 | 1.983    7.08 | 2.983    3.39 |  3.98    2.35
              1.000    8.02 | 2.000    7.08 | 3.000    3.39 |  4.00    2.35

     Max.Eff.Inten.(mm/hr)=      72.24       162.49
               over (min)         5.00         9.00
     Storage Coeff.  (min)=       2.85 (ii)    8.27 (ii)
     Unit Hyd. Tpeak (min)=       5.00         9.00
     Unit Hyd. peak  (cms)=       0.32         0.13
                                                    *TOTALS*
     PEAK FLOW       (cms)=       0.12         0.04          0.151 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.43           1.35
     RUNOFF VOLUME    (mm)=      34.41        15.80          24.17
     TOTAL RAINFALL   (mm)=      35.21        35.21          35.21
     RUNOFF COEFFICIENT   =       0.98         0.45           0.69


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-------------------
| DUHYD    (  0240)|
| Inlet Cap.= 0.015|
| #of Inlets=     1|
| Total(cms)=   0.0|      AREA     QPEAK     TPEAK    R.V.
-------------------      (ha)      (cms)     (hrs)     (mm)
     TOTAL HYD.(ID= 1):   1.40      0.15      1.35   24.17
     ==========================================================
     MAJOR SYS.(ID= 2):   0.73      0.14      1.35   24.17
     MINOR SYS.(ID= 3):   0.67      0.01      1.03   24.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 1 (  0010):    39.40   0.927     1.37     8.38
     + ID2= 2 (  0211):    16.90   0.238     1.50     8.31
       ==================================================
       ID = 3 (  1001):    56.30   1.144     1.37     8.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1001)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 3 (  1001):    56.30   1.144     1.37     8.36
     + ID2= 2 (  0220):    11.82   0.012     4.65     7.76
       ==================================================
       ID = 1 (  1001):    68.12   1.148     1.37     8.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 1 (  1001):    68.12   1.148     1.37     8.26
     + ID2= 2 (  0230):     0.49   0.015     1.10    24.17
       ==================================================
       ID = 3 (  1001):    68.61   1.163     1.37     8.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1001)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 3 (  1001):    68.61   1.163     1.37     8.37
     + ID2= 2 (  0240):     0.67   0.015     1.03    24.17
       ==================================================
       ID = 1 (  1001):    69.28   1.178     1.37     8.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 1 (  1001):    69.28   1.178     1.37     8.52
     + ID2= 2 (  0030):    19.20   1.706     1.35    21.21
       ==================================================
       ID = 3 (  1001):    88.48   2.882     1.37    11.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 1 (  1001):    88.48   2.882     1.37    11.28
     + ID2= 2 (  0040):     7.85   0.068     2.00     5.84
       ==================================================
       ID = 3 (  1002):    96.33   2.894     1.37    10.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

-------------------
| ADD HYD  (  1002)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)      (mm)
       ID1= 3 (  1002):    96.33   2.894     1.37    10.83
     + ID2= 2 (  0050):     4.35   0.017     1.83     2.63
       ==================================================
       ID = 1 (  1002):   100.68   2.896     1.37    10.48

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
-------------------
| RESERVOIR(  1003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          0.0000      0.0000   |    0.2760      0.9276
                          0.0000      0.2312   |    0.2890      0.9828
                          0.0900      0.4109   |    0.3380      1.2097
                          0.1800      0.5998   |    0.3590      1.3270
                          0.2470      0.8192   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1002)    100.677     2.896      1.37      10.48
   OUTFLOW: ID= 1 (  1003)    100.677     0.229      4.13       8.05
   OVERFLOW:ID= 3 (  0003)      0.000     0.000      0.00       0.00

                TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.90
                TIME SHIFT OF PEAK FLOW          (min)=166.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.7592

     **** WARNING : SELECTED ROUTING TIME STEP DENIED.
--------------------------------------------------------------------------------

FINISH
================================================================================
```

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

5-Year Storm Event

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================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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a5ec-7ff64ecb31ab\3dbb0a9c-2df4-46db-8231-a45222cc9768\scen


DATE: 08/20/2024                          TIME: 04:18:40

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 02_5-Year Norfolk             **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 583.017
| Ptotal= 49.03 mm |                          B=   3.007
--------------------                          C=   0.703
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.20 |  1.00   23.22 |  2.00    8.64 |  3.00    4.87
                0.17    4.72 |  1.17   96.03 |  2.17    7.56 |  3.17    4.58
                0.33    5.42 |  1.33   29.33 |  2.33    6.76 |  3.33    4.32
                0.50    6.44 |  1.50   17.13 |  2.50    6.13 |  3.50    4.10
                0.67    8.09 |  1.67   12.62 |  2.67    5.63 |  3.67    3.90
                0.83   11.39 |  1.83   10.19 |  2.83    5.22 |  3.83    3.72


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area    (ha)=   4.35   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  13.60   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.30

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.20 | 1.083   23.22 | 2.083    8.64 |  3.08    4.87
               0.167    4.20 | 1.167   23.22 | 2.167    8.64 |  3.17    4.87
               0.250    4.72 | 1.250   96.03 | 2.250    7.56 |  3.25    4.58
               0.333    4.72 | 1.333   96.03 | 2.333    7.56 |  3.33    4.58
               0.417    5.42 | 1.417   29.33 | 2.417    6.76 |  3.42    4.32
               0.500    5.42 | 1.500   29.33 | 2.500    6.76 |  3.50    4.32
               0.583    6.44 | 1.583   17.13 | 2.583    6.13 |  3.58    4.10
               0.667    6.44 | 1.667   17.13 | 2.667    6.13 |  3.67    4.10
               0.750    8.09 | 1.750   12.62 | 2.750    5.63 |  3.75    3.90
               0.833    8.09 | 1.833   12.62 | 2.833    5.63 |  3.83    3.90
               0.917   11.39 | 1.917   10.19 | 2.917    5.22 |  3.92    3.72
               1.000   11.39 | 2.000   10.19 | 3.000    5.22 |  4.00    3.72

    Unit Hyd Qpeak  (cms)=   0.554

    PEAK FLOW       (cms)=   0.045 (i)
    TIME TO PEAK    (hrs)=   1.750
    RUNOFF VOLUME    (mm)=   6.567
    TOTAL RAINFALL   (mm)=  49.033
    RUNOFF COEFFICIENT   =   0.134

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0050)|
| Inlet Cap.= 0.017|
| #of Inlets=    1|
| Total(cms)=  0.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
    TOTAL HYD.(ID= 1):   4.35      0.05      1.75    6.57
    ================================================
    MAJOR SYS.(ID= 2):   1.51      0.03      1.75    6.57
    MINOR SYS.(ID= 3):   2.84      0.02      1.42    6.57

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0004)|   Area    (ha)=   7.85   Curve Number   (CN)= 72.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.10   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.46

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.20 | 1.083   23.22 | 2.083    8.64 |  3.08    4.87
               0.167    4.20 | 1.167   23.22 | 2.167    8.64 |  3.17    4.87
               0.250    4.72 | 1.250   96.03 | 2.250    7.56 |  3.25    4.58
               0.333    4.72 | 1.333   96.03 | 2.333    7.56 |  3.33    4.58
               0.417    5.42 | 1.417   29.33 | 2.417    6.76 |  3.42    4.32
               0.500    5.42 | 1.500   29.33 | 2.500    6.76 |  3.50    4.32
               0.583    6.44 | 1.583   17.13 | 2.583    6.13 |  3.58    4.10
               0.667    6.44 | 1.667   17.13 | 2.667    6.13 |  3.67    4.10
               0.750    8.09 | 1.750   12.62 | 2.750    5.63 |  3.75    3.90
               0.833    8.09 | 1.833   12.62 | 2.833    5.63 |  3.83    3.90
               0.917   11.39 | 1.917   10.19 | 2.917    5.22 |  3.92    3.72
               1.000   11.39 | 2.000   10.19 | 3.000    5.22 |  4.00    3.72

    Unit Hyd Qpeak  (cms)=   0.652

    PEAK FLOW       (cms)=   0.139 (i)
    TIME TO PEAK    (hrs)=   1.917
    RUNOFF VOLUME    (mm)=  11.991
    TOTAL RAINFALL   (mm)=  49.033
    RUNOFF COEFFICIENT   =   0.245

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| DUHYD    (  0040)|
| Inlet Cap.= 0.068|
| #of Inlets=    1|
| Total(cms)=  0.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
    TOTAL HYD.(ID= 1):   7.85      0.14      1.92   11.99
    ================================================
    MAJOR SYS.(ID= 2):   1.92      0.07      1.92   11.99
    MINOR SYS.(ID= 3):   5.93      0.07      1.50   11.99

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  39.40
|ID= 1 DT= 1.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------

                          IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=    11.82         27.58
    Dep. Storage     (mm)=     0.80         13.60
    Average Slope     (%)=     2.00          2.00
    Length            (m)=   512.51         40.00
    Mannings n            =    0.013         0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.017    4.20 | 1.017   23.22 | 2.017    8.64 |  3.02    4.87
               0.033    4.20 | 1.033   23.22 | 2.033    8.64 |  3.03    4.87
               0.050    4.20 | 1.050   23.22 | 2.050    8.64 |  3.05    4.87
               0.067    4.20 | 1.067   23.22 | 2.067    8.64 |  3.07    4.87
               0.083    4.20 | 1.083   23.22 | 2.083    8.64 |  3.08    4.87
               0.100    4.20 | 1.100   23.22 | 2.100    8.64 |  3.10    4.87
               0.117    4.20 | 1.117   23.22 | 2.117    8.64 |  3.12    4.87
               0.133    4.20 | 1.133   23.22 | 2.133    8.64 |  3.13    4.87
               0.150    4.20 | 1.150   23.22 | 2.150    8.64 |  3.15    4.87
               0.167    4.20 | 1.167   23.22 | 2.167    8.64 |  3.17    4.87
               0.183    4.72 | 1.183   96.03 | 2.183    7.56 |  3.18    4.58
               0.200    4.72 | 1.200   96.03 | 2.200    7.56 |  3.20    4.58
               0.217    4.72 | 1.217   96.03 | 2.217    7.56 |  3.22    4.58
               0.233    4.72 | 1.233   96.03 | 2.233    7.56 |  3.23    4.58
               0.250    4.72 | 1.250   96.03 | 2.250    7.56 |  3.25    4.58
               0.267    4.72 | 1.267   96.03 | 2.267    7.56 |  3.27    4.58
               0.283    4.72 | 1.283   96.03 | 2.283    7.56 |  3.28    4.58
               0.300    4.72 | 1.300   96.03 | 2.300    7.56 |  3.30    4.58
               0.317    4.72 | 1.317   96.03 | 2.317    7.56 |  3.32    4.58
               0.333    4.72 | 1.333   96.03 | 2.333    7.56 |  3.33    4.58
               0.350    5.42 | 1.350   29.33 | 2.350    6.76 |  3.35    4.32
               0.367    5.42 | 1.367   29.33 | 2.367    6.76 |  3.37    4.32
               0.383    5.42 | 1.383   29.33 | 2.383    6.76 |  3.38    4.32
               0.400    5.42 | 1.400   29.33 | 2.400    6.76 |  3.40    4.32
               0.417    5.42 | 1.417   29.33 | 2.417    6.76 |  3.42    4.32
               0.433    5.42 | 1.433   29.33 | 2.433    6.76 |  3.43    4.32
               0.450    5.42 | 1.450   29.33 | 2.450    6.76 |  3.45    4.32
               0.467    5.42 | 1.467   29.33 | 2.467    6.76 |  3.47    4.32
               0.483    5.42 | 1.483   29.33 | 2.483    6.76 |  3.48    4.32
               0.500    5.42 | 1.500   29.33 | 2.500    6.76 |  3.50    4.32
               0.517    6.44 | 1.517   17.13 | 2.517    6.13 |  3.52    4.10
               0.533    6.44 | 1.533   17.13 | 2.533    6.13 |  3.53    4.10
               0.550    6.44 | 1.550   17.13 | 2.550    6.13 |  3.55    4.10
               0.567    6.44 | 1.567   17.13 | 2.567    6.13 |  3.57    4.10
               0.583    6.44 | 1.583   17.13 | 2.583    6.13 |  3.58    4.10
               0.600    6.44 | 1.600   17.13 | 2.600    6.13 |  3.60    4.10
               0.617    6.44 | 1.617   17.13 | 2.617    6.13 |  3.62    4.10
               0.633    6.44 | 1.633   17.13 | 2.633    6.13 |  3.63    4.10
               0.650    6.44 | 1.650   17.13 | 2.650    6.13 |  3.65    4.10
               0.667    6.44 | 1.667   17.13 | 2.667    6.13 |  3.67    4.10
               0.683    8.09 | 1.683   12.62 | 2.683    5.63 |  3.68    3.90
               0.700    8.09 | 1.700   12.62 | 2.700    5.63 |  3.70    3.90
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Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

5-Year Storm Event

0.717	8.09	1.717	12.62	2.717	5.63	3.72	3.90
0.733	8.09	1.733	12.62	2.733	5.63	3.73	3.90
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.767	8.09	1.767	12.62	2.767	5.63	3.77	3.90
0.783	8.09	1.783	12.62	2.783	5.63	3.78	3.90
0.800	8.09	1.800	12.62	2.800	5.63	3.80	3.90
0.817	8.09	1.817	12.62	2.817	5.63	3.82	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.850	11.39	1.850	10.19	2.850	5.22	3.85	3.72
0.867	11.39	1.867	10.19	2.867	5.22	3.87	3.72
0.883	11.39	1.883	10.19	2.883	5.22	3.88	3.72
0.900	11.39	1.900	10.19	2.900	5.22	3.90	3.72
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
0.933	11.39	1.933	10.19	2.933	5.22	3.93	3.72
0.950	11.39	1.950	10.19	2.950	5.22	3.95	3.72
0.967	11.39	1.967	10.19	2.967	5.22	3.97	3.72
0.983	11.39	1.983	10.19	2.983	5.22	3.98	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=	96.03	11.30	
over (min)	6.00	23.00	
Storage Coeff. (min)=	5.62 (ii)	22.51 (ii)	
Unit Hyd. Tpeak (min)=	6.00	23.00	
Unit Hyd. peak (cms)=	0.20	0.05	
			TOTALS
PEAK FLOW (cms)=	1.26	0.44	1.332 (iii)
TIME TO PEAK (hrs)=	1.37	1.83	1.37
RUNOFF VOLUME (mm)=	48.23	8.62	14.56
TOTAL RAINFALL (mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT =	0.98	0.18	0.30

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0010)	
Inlet Cap.= 0.927	
#of Inlets= 1	
Total(cms)= 0.9	

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	39.40	1.33	1.37	14.56
MAJOR SYS.(ID= 2):	1.30	0.41	1.37	14.56
MINOR SYS.(ID= 3):	38.10	0.93	1.28	14.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	
STANDHYD (0022)	Area (ha)= 11.82
ID= 1 DT= 1.0 min	Total Imp(%)= 47.00 Dir. Conn.(%)= 22.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.56	6.26
Dep. Storage	(mm)=	0.80	16.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	280.71	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	4.20	1.017	23.22	2.017	8.64	3.02	4.87
0.033	4.20	1.033	23.22	2.033	8.64	3.03	4.87
0.050	4.20	1.050	23.22	2.050	8.64	3.05	4.87
0.067	4.20	1.067	23.22	2.067	8.64	3.07	4.87
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.100	4.20	1.100	23.22	2.100	8.64	3.10	4.87
0.117	4.20	1.117	23.22	2.117	8.64	3.12	4.87
0.133	4.20	1.133	23.22	2.133	8.64	3.13	4.87
0.150	4.20	1.150	23.22	2.150	8.64	3.15	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.183	4.72	1.183	96.03	2.183	7.56	3.18	4.58
0.200	4.72	1.200	96.03	2.200	7.56	3.20	4.58
0.217	4.72	1.217	96.03	2.217	7.56	3.22	4.58
0.233	4.72	1.233	96.03	2.233	7.56	3.23	4.58
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.267	4.72	1.267	96.03	2.267	7.56	3.27	4.58
0.283	4.72	1.283	96.03	2.283	7.56	3.28	4.58
0.300	4.72	1.300	96.03	2.300	7.56	3.30	4.58
0.317	4.72	1.317	96.03	2.317	7.56	3.32	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.350	5.42	1.350	29.33	2.350	6.76	3.35	4.32
0.367	5.42	1.367	29.33	2.367	6.76	3.37	4.32
0.383	5.42	1.383	29.33	2.383	6.76	3.38	4.32
0.400	5.42	1.400	29.33	2.400	6.76	3.40	4.32
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.433	5.42	1.433	29.33	2.433	6.76	3.43	4.32
0.450	5.42	1.450	29.33	2.450	6.76	3.45	4.32
0.467	5.42	1.467	29.33	2.467	6.76	3.47	4.32
0.483	5.42	1.483	29.33	2.483	6.76	3.48	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.517	6.44	1.517	17.13	2.517	6.13	3.52	4.10
0.533	6.44	1.533	17.13	2.533	6.13	3.53	4.10
0.550	6.44	1.550	17.13	2.550	6.13	3.55	4.10
0.567	6.44	1.567	17.13	2.567	6.13	3.57	4.10
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.600	6.44	1.600	17.13	2.600	6.13	3.60	4.10
0.617	6.44	1.617	17.13	2.617	6.13	3.62	4.10
0.633	6.44	1.633	17.13	2.633	6.13	3.63	4.10
0.650	6.44	1.650	17.13	2.650	6.13	3.65	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.683	8.09	1.683	12.62	2.683	5.63	3.68	3.90
0.700	8.09	1.700	12.62	2.700	5.63	3.70	3.90
0.717	8.09	1.717	12.62	2.717	5.63	3.72	3.90
0.733	8.09	1.733	12.62	2.733	5.63	3.73	3.90
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.767	8.09	1.767	12.62	2.767	5.63	3.77	3.90
0.783	8.09	1.783	12.62	2.783	5.63	3.78	3.90
0.800	8.09	1.800	12.62	2.800	5.63	3.80	3.90
0.817	8.09	1.817	12.62	2.817	5.63	3.82	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.850	11.39	1.850	10.19	2.850	5.22	3.85	3.72
0.867	11.39	1.867	10.19	2.867	5.22	3.87	3.72
0.883	11.39	1.883	10.19	2.883	5.22	3.88	3.72
0.900	11.39	1.900	10.19	2.900	5.22	3.90	3.72
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
0.933	11.39	1.933	10.19	2.933	5.22	3.93	3.72
0.950	11.39	1.950	10.19	2.950	5.22	3.95	3.72
0.967	11.39	1.967	10.19	2.967	5.22	3.97	3.72
0.983	11.39	1.983	10.19	2.983	5.22	3.98	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=	96.03	12.91	
over (min)	5.00	25.00	
Storage Coeff. (min)=	4.82 (ii)	24.53 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.23	0.05	
			TOTALS
PEAK FLOW (cms)=	0.59	0.12	0.603 (iii)
TIME TO PEAK (hrs)=	1.35	1.87	1.35
RUNOFF VOLUME (mm)=	48.23	8.79	17.46
TOTAL RAINFALL (mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT =	0.98	0.18	0.36

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0220)		OVERFLOW IS OFF
IN= 2---> OUT= 1		
DT= 1.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0251	0.3540
	0.0066	0.0550	0.0273	0.4180
	0.0127	0.1120	0.0294	0.4840
	0.0167	0.1700	0.0313	0.5510
	0.0199	0.2300	0.0332	0.6200
	0.0226	0.2910	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0022)	11.820	0.603	1.35	17.46
OUTFLOW: ID= 1 (0220)	11.820	0.018	4.60	12.32

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.91
TIME SHIFT OF PEAK FLOW (min)=195.00
MAXIMUM STORAGE USED (ha.m.)= 0.1861

CALIB	
STANDHYD (0003)	Area (ha)= 19.20
ID= 1 DT= 1.0 min	Total Imp(%)= 80.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	15.36	3.84
Dep. Storage	(mm)=	0.80	16.50
Average Slope	(%)=	2.00	2.00
Length	(m)=	357.77	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	4.20	1.017	23.22	2.017	8.64	3.02	4.87
0.033	4.20	1.033	23.22	2.033	8.64	3.03	4.87
0.050	4.20	1.050	23.22	2.050	8.64	3.05	4.87
0.067	4.20	1.067	23.22	2.067	8.64	3.07	4.87
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.100	4.20	1.100	23.22	2.100	8.64	3.10	4.87
0.117	4.20	1.117	23.22	2.117	8.64	3.12	4.87
0.133	4.20	1.133	23.22	2.133	8.64	3.13	4.87
0.150	4.20	1.150	23.22	2.150	8.64	3.15	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.183	4.72	1.183	96.03	2.183	7.56	3.18	4.58
0.200	4.72	1.200	96.03	2.200	7.56	3.20	4.58
0.217	4.72	1.217	96.03	2.217	7.56	3.22	4.58
0.233	4.72	1.233	96.03	2.233	7.56	3.23	4.58
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.267	4.72	1.267	96.03	2.267	7.56	3.27	4.58
0.283	4.72	1.283	96.03	2.283	7.56	3.28	4.58
0.300	4.72	1.300	96.03	2.300	7.56	3.30	4.58
0.317	4.72	1.317	96.03	2.317	7.56	3.32	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.350	5.42	1.350	29.33	2.350	6.76	3.35	4.32
0.367	5.42	1.367	29.33	2.367	6.76	3.37	4.32
0.383	5.42	1.383	29.33	2.383	6.76	3.38	4.32
0.400	5.42	1.400	29.33	2.400	6.76	3.40	4.32
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.433	5.42	1.433	29.33	2.433	6.76	3.43	4.32
0.450	5.42	1.450	29.33	2.450	6.76	3.45	4.32
0.467	5.42	1.467	29.33	2.467	6.76	3.47	4.32

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

5-Year Storm Event

0.483	5.42	1.483	29.33	2.483	6.76	3.48	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.517	6.44	1.517	17.13	2.517	6.13	3.52	4.10
0.533	6.44	1.533	17.13	2.533	6.13	3.53	4.10
0.550	6.44	1.550	17.13	2.550	6.13	3.55	4.10
0.567	6.44	1.567	17.13	2.567	6.13	3.57	4.10
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.600	6.44	1.600	17.13	2.600	6.13	3.60	4.10
0.617	6.44	1.617	17.13	2.617	6.13	3.62	4.10
0.633	6.44	1.633	17.13	2.633	6.13	3.63	4.10
0.650	6.44	1.650	17.13	2.650	6.13	3.65	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.683	8.09	1.683	12.62	2.683	5.63	3.68	3.90
0.700	8.09	1.700	12.62	2.700	5.63	3.70	3.90
0.717	8.09	1.717	12.62	2.717	5.63	3.72	3.90
0.733	8.09	1.733	12.62	2.733	5.63	3.73	3.90
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.767	8.09	1.767	12.62	2.767	5.63	3.77	3.90
0.783	8.09	1.783	12.62	2.783	5.63	3.78	3.90
0.800	8.09	1.800	12.62	2.800	5.63	3.80	3.90
0.817	8.09	1.817	12.62	2.817	5.63	3.82	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.850	11.39	1.850	10.19	2.850	5.22	3.85	3.72
0.867	11.39	1.867	10.19	2.867	5.22	3.87	3.72
0.883	11.39	1.883	10.19	2.883	5.22	3.88	3.72
0.900	11.39	1.900	10.19	2.900	5.22	3.90	3.72
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
0.933	11.39	1.933	10.19	2.933	5.22	3.93	3.72
0.950	11.39	1.950	10.19	2.950	5.22	3.95	3.72
0.967	11.39	1.967	10.19	2.967	5.22	3.97	3.72
0.983	11.39	1.983	10.19	2.983	5.22	3.98	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	60.97	
over (min)		5.00	10.00	
Storage Coeff. (min)=		4.53 (ii)	9.50 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.24	0.12	
				TOTALS
PEAK FLOW	(cms)=	2.21	0.42	2.470 (iii)
TIME TO PEAK	(hrs)=	1.35	1.47	1.35
RUNOFF VOLUME	(mm)=	48.23	15.52	31.88
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.32	0.65

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0030)				
Inlet Cap.= 1.706				
#of Inlets= 1				
Total(cms)= 1.7	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	19.20	2.47	1.35	31.88
MAJOR SYS.(ID= 2):	1.01	0.76	1.35	31.88
MINOR SYS.(ID= 3):	18.19	1.71	1.27	31.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
STANDHYD (0021)	Area (ha)= 16.90			
ID= 1 DT= 5.0 min	Total Imp(%)= 38.00	Dir. Conn.(%)= 16.00		
	IMPERVIOUS	PERVIOUS (i)		
Surface Area (ha)=	6.42	10.48		
Dep. Storage (mm)=	0.80	16.50		
Average Slope (%)=	2.00	2.00		
Length (m)=	335.66	40.00		
Mannings n =	0.013	0.250		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	9.98	
over (min)		5.00	25.00	
Storage Coeff. (min)=		4.36 (ii)	22.10 (ii)	
Unit Hyd. Tpeak (min)=		5.00	25.00	
Unit Hyd. peak (cms)=		0.23	0.05	
				TOTALS
PEAK FLOW	(cms)=	0.67	0.17	0.688 (iii)
TIME TO PEAK	(hrs)=	1.33	1.83	1.33
RUNOFF VOLUME	(mm)=	48.23	7.87	14.33
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.16	0.29

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0210)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.3900	0.0820
	0.0200	0.0000	0.4300	0.1090
	0.0800	0.0020	0.5800	0.2670
	0.2100	0.0160	0.6360	0.3420
	0.3000	0.0330	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0021)	16.900	0.688	1.33	14.33
OUTFLOW: ID= 1 (0210)	16.900	0.303	1.58	14.33

PEAK FLOW REDUCTION [Qout/Qin](%)= 44.07
TIME SHIFT OF PEAK FLOW (min)= 15.00
MAXIMUM STORAGE USED (ha.m.)= 0.0349

DUHYD (0211)				
Inlet Cap.= 0.280				
#of Inlets= 1				
Total(cms)= 0.3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	16.90	0.30	1.58	14.33
MAJOR SYS.(ID= 2):	0.30	0.02	1.58	14.33
MINOR SYS.(ID= 3):	16.60	0.28	1.42	14.33

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
STANDHYD (0023)	Area (ha)= 0.80			
ID= 1 DT= 1.0 min	Total Imp(%)= 90.00	Dir. Conn.(%)= 45.00		
	IMPERVIOUS	PERVIOUS (i)		
Surface Area (ha)=	0.72	0.08		
Dep. Storage (mm)=	0.80	16.50		
Average Slope (%)=	1.00	1.00		
Length (m)=	73.03	40.00		
Mannings n =	0.013	0.250		

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	4.20	1.017	23.22	2.017	8.64	3.02	4.87
0.033	4.20	1.033	23.22	2.033	8.64	3.03	4.87
0.050	4.20	1.050	23.22	2.050	8.64	3.05	4.87
0.067	4.20	1.067	23.22	2.067	8.64	3.07	4.87
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.100	4.20	1.100	23.22	2.100	8.64	3.10	4.87
0.117	4.20	1.117	23.22	2.117	8.64	3.12	4.87
0.133	4.20	1.133	23.22	2.133	8.64	3.13	4.87
0.150	4.20	1.150	23.22	2.150	8.64	3.15	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.183	4.72	1.183	96.03	2.183	7.56	3.18	4.58
0.200	4.72	1.200	96.03	2.200	7.56	3.20	4.58
0.217	4.72	1.217	96.03	2.217	7.56	3.22	4.58
0.233	4.72	1.233	96.03	2.233	7.56	3.23	4.58
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.267	4.72	1.267	96.03	2.267	7.56	3.27	4.58
0.283	4.72	1.283	96.03	2.283	7.56	3.28	4.58
0.300	4.72	1.300	96.03	2.300	7.56	3.30	4.58
0.317	4.72	1.317	96.03	2.317	7.56	3.32	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.350	5.42	1.350	29.33	2.350	6.76	3.35	4.32
0.367	5.42	1.367	29.33	2.367	6.76	3.37	4.32
0.383	5.42	1.383	29.33	2.383	6.76	3.38	4.32
0.400	5.42	1.400	29.33	2.400	6.76	3.40	4.32
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.433	5.42	1.433	29.33	2.433	6.76	3.43	4.32
0.450	5.42	1.450	29.33	2.450	6.76	3.45	4.32
0.467	5.42	1.467	29.33	2.467	6.76	3.47	4.32
0.483	5.42	1.483	29.33	2.483	6.76	3.48	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.517	6.44	1.517	17.13	2.517	6.13	3.52	4.10
0.533	6.44	1.533	17.13	2.533	6.13	3.53	4.10
0.550	6.44	1.550	17.13	2.550	6.13	3.55	4.10
0.567	6.44	1.567	17.13	2.567	6.13	3.57	4.10
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.600	6.44	1.600	17.13	2.600	6.13	3.60	4.10
0.617	6.44	1.617	17.13	2.617	6.13	3.62	4.10
0.633	6.44	1.633	17.13	2.633	6.13	3.63	4.10
0.650	6.44	1.650	17.13	2.650	6.13	3.65	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.683	8.09	1.683	12.62	2.683	5.63	3.68	3.90
0.700	8.09	1.700	12.62	2.700	5.63	3.70	3.90
0.717	8.09	1.717	12.62	2.717	5.63	3.72	3.90
0.733	8.09	1.733	12.62	2.733	5.63	3.73	3.90
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.767	8.09	1.767	12.62	2.767	5.63	3.77	3.90
0.783	8.09	1.783	12.62	2.783	5.63	3.78	3.90
0.800	8.09	1.800	12.62	2.800	5.63	3.80	3.90

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

5-Year Storm Event

0.817	8.09	1.817	12.62	2.817	5.63	3.82	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.850	11.39	1.850	10.19	2.850	5.22	3.85	3.72
0.867	11.39	1.867	10.19	2.867	5.22	3.87	3.72
0.883	11.39	1.883	10.19	2.883	5.22	3.88	3.72
0.900	11.39	1.900	10.19	2.900	5.22	3.90	3.72
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
0.933	11.39	1.933	10.19	2.933	5.22	3.93	3.72
0.950	11.39	1.950	10.19	2.950	5.22	3.95	3.72
0.967	11.39	1.967	10.19	2.967	5.22	3.97	3.72
0.983	11.39	1.983	10.19	2.983	5.22	3.98	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

			TOTALS
Max.Eff.Inten.(mm/hr)=	96.03	275.67	
over (min)	5.00	7.00	
Storage Coeff. (min)=	2.15 (ii)	6.99 (ii)	
Unit Hyd. Tpeak (min)=	5.00	7.00	
Unit Hyd. peak (cms)=	0.36	0.16	
PEAK FLOW (cms)=	0.09	0.05	0.132 (iii)
TIME TO PEAK (hrs)=	1.33	1.40	1.35
RUNOFF VOLUME (mm)=	48.23	26.66	36.36
TOTAL RAINFALL (mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT =	0.98	0.54	0.74

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0230)				
Inlet Cap.= 0.015				
#of Inlets= 1				
Total(cms)= 0.0	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	0.80	0.13	1.35	36.36
MAJOR SYS.(ID= 2):	0.37	0.12	1.35	36.36
MINOR SYS.(ID= 3):	0.43	0.01	1.05	36.36

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
STANDHYD (0024)	Area (ha)=	1.40	
ID= 1 DT= 1.0 min	Total Imp(%)=	90.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.26	0.14
Dep. Storage	(mm)=	0.80	16.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	96.61	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	4.20	1.017	23.22	2.017	8.64	3.02	4.87
0.033	4.20	1.033	23.22	2.033	8.64	3.03	4.87
0.050	4.20	1.050	23.22	2.050	8.64	3.05	4.87
0.067	4.20	1.067	23.22	2.067	8.64	3.07	4.87
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.100	4.20	1.100	23.22	2.100	8.64	3.10	4.87
0.117	4.20	1.117	23.22	2.117	8.64	3.12	4.87
0.133	4.20	1.133	23.22	2.133	8.64	3.13	4.87
0.150	4.20	1.150	23.22	2.150	8.64	3.15	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.183	4.72	1.183	96.03	2.183	7.56	3.18	4.58
0.200	4.72	1.200	96.03	2.200	7.56	3.20	4.58
0.217	4.72	1.217	96.03	2.217	7.56	3.22	4.58
0.233	4.72	1.233	96.03	2.233	7.56	3.23	4.58
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.267	4.72	1.267	96.03	2.267	7.56	3.27	4.58
0.283	4.72	1.283	96.03	2.283	7.56	3.28	4.58
0.300	4.72	1.300	96.03	2.300	7.56	3.30	4.58
0.317	4.72	1.317	96.03	2.317	7.56	3.32	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.350	5.42	1.350	29.33	2.350	6.76	3.35	4.32
0.367	5.42	1.367	29.33	2.367	6.76	3.37	4.32
0.383	5.42	1.383	29.33	2.383	6.76	3.38	4.32
0.400	5.42	1.400	29.33	2.400	6.76	3.40	4.32
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.433	5.42	1.433	29.33	2.433	6.76	3.43	4.32
0.450	5.42	1.450	29.33	2.450	6.76	3.45	4.32
0.467	5.42	1.467	29.33	2.467	6.76	3.47	4.32
0.483	5.42	1.483	29.33	2.483	6.76	3.48	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.517	6.44	1.517	17.13	2.517	6.13	3.52	4.10
0.533	6.44	1.533	17.13	2.533	6.13	3.53	4.10
0.550	6.44	1.550	17.13	2.550	6.13	3.55	4.10
0.567	6.44	1.567	17.13	2.567	6.13	3.57	4.10
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.600	6.44	1.600	17.13	2.600	6.13	3.60	4.10
0.617	6.44	1.617	17.13	2.617	6.13	3.62	4.10
0.633	6.44	1.633	17.13	2.633	6.13	3.63	4.10
0.650	6.44	1.650	17.13	2.650	6.13	3.65	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.683	8.09	1.683	12.62	2.683	5.63	3.68	3.90
0.700	8.09	1.700	12.62	2.700	5.63	3.70	3.90
0.717	8.09	1.717	12.62	2.717	5.63	3.72	3.90
0.733	8.09	1.733	12.62	2.733	5.63	3.73	3.90
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.767	8.09	1.767	12.62	2.767	5.63	3.77	3.90
0.783	8.09	1.783	12.62	2.783	5.63	3.78	3.90
0.800	8.09	1.800	12.62	2.800	5.63	3.80	3.90
0.817	8.09	1.817	12.62	2.817	5.63	3.82	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.850	11.39	1.850	10.19	2.850	5.22	3.85	3.72
0.867	11.39	1.867	10.19	2.867	5.22	3.87	3.72
0.883	11.39	1.883	10.19	2.883	5.22	3.88	3.72
0.900	11.39	1.900	10.19	2.900	5.22	3.90	3.72
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
0.933	11.39	1.933	10.19	2.933	5.22	3.93	3.72
0.950	11.39	1.950	10.19	2.950	5.22	3.95	3.72
0.967	11.39	1.967	10.19	2.967	5.22	3.97	3.72
0.983	11.39	1.983	10.19	2.983	5.22	3.98	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

			TOTALS
Max.Eff.Inten.(mm/hr)=	96.03	275.67	
over (min)	5.00	8.00	
Storage Coeff. (min)=	2.54 (ii)	7.38 (ii)	
Unit Hyd. Tpeak (min)=	5.00	8.00	
Unit Hyd. peak (cms)=	0.33	0.15	
PEAK FLOW (cms)=	0.16	0.08	0.224 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.35
RUNOFF VOLUME (mm)=	48.23	26.66	36.37
TOTAL RAINFALL (mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT =	0.98	0.54	0.74

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0240)				
Inlet Cap.= 0.015				
#of Inlets= 1				
Total(cms)= 0.0	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	1.40	0.22	1.35	36.37
MAJOR SYS.(ID= 2):	0.86	0.21	1.35	36.37
MINOR SYS.(ID= 3):	0.54	0.01	0.87	36.37

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0010):	38.10	0.927	1.28	14.56
+ ID2= 2 (0211):	16.60	0.280	1.42	14.33
ID = 3 (1001):	54.70	1.207	1.43	14.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (1001):	54.70	1.207	1.43	14.49
+ ID2= 2 (0220):	11.82	0.018	4.60	12.32
ID = 1 (1001):	66.52	1.215	1.50	14.11

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1001):	66.52	1.215	1.50	14.11
+ ID2= 2 (0230):	0.43	0.015	1.05	36.36
ID = 3 (1001):	66.95	1.230	1.50	14.25

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (1001):	66.95	1.230	1.50	14.25
+ ID2= 2 (0240):	0.54	0.015	0.87	36.37
ID = 1 (1001):	67.49	1.245	1.50	14.43

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1001):	67.49	1.245	1.50	14.43
+ ID2= 2 (0030):	18.19	1.706	1.27	31.88
ID = 3 (1001):	85.68	2.950	1.45	18.13

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

5-Year Storm Event

```
| ADD HYD  (  1002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
------------------           (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  1001):    85.68   2.950     1.45    18.13
      + ID2= 2 (  0040):     5.93   0.068     1.50    11.99
        ================================================
        ID = 3 (  1002):    91.61   3.005     1.45    17.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  1002)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
------------------           (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  1002):    91.61   3.005     1.45    17.73
      + ID2= 2 (  0050):     2.84   0.017     1.42     6.57
        ================================================
        ID = 1 (  1002):    94.45   3.022     1.45    17.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.2760      0.9276
                          0.0000      0.2312   |    0.2890      0.9828
                          0.0900      0.4109   |    0.3380      1.2097
                          0.1800      0.5998   |    0.3590      1.3270
                          0.2470      0.8192   |    0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1002)     94.450      3.022      1.45      17.40
   OUTFLOW: ID= 1 (  1003)     94.450      0.335      4.22      14.69
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.09
                  TIME SHIFT OF PEAK FLOW         (min)=166.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.1958

     **** WARNING : SELECTED ROUTING TIME STEP DENIED.
--------------------------------------------------------------------------------

 FINISH
================================================================================
```

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

100-Year Storm Event

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================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\Natalie\AppData\Local\Civica\VH5\2b61f5e3-29d9-4c68-
a5ec-7ff64ecb31ab\a733124f-e251-4898-8809-3a302cbb8bf5\scen
  Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\2b61f5e3-29d9-4c68-
a5ec-7ff64ecb31ab\a733124f-e251-4898-8809-3a302cbb8bf5\scen

DATE: 08/20/2024                          TIME: 04:18:40

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 06_100-Year Norfolk           **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 801.041
| Ptotal= 87.09 mm |                          B=   1.501
--------------------                          C=   0.657
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    8.40 |  1.00   38.70 |  2.00   16.17 |  3.00    9.61
                0.17    9.34 |  1.17  160.97 |  2.17   14.33 |  3.17    9.08
                0.33   10.59 |  1.33   47.72 |  2.33   12.95 |  3.33    8.61
                0.50   12.39 |  1.50   29.71 |  2.50   11.86 |  3.50    8.20
                0.67   15.24 |  1.67   22.67 |  2.67   10.97 |  3.67    7.84
                0.83   20.69 |  1.83   18.74 |  2.83   10.24 |  3.83    7.51


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area    (ha)=   4.35   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  13.60   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.30

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    8.40 | 1.083   38.70 | 2.083   16.17 |  3.08    9.61
               0.167    8.40 | 1.167   38.70 | 2.167   16.17 |  3.17    9.61
               0.250    9.34 | 1.250  160.97 | 2.250   14.33 |  3.25    9.08
               0.333    9.34 | 1.333  160.97 | 2.333   14.33 |  3.33    9.08
               0.417   10.59 | 1.417   47.72 | 2.417   12.95 |  3.42    8.61
               0.500   10.59 | 1.500   47.72 | 2.500   12.95 |  3.50    8.61
               0.583   12.39 | 1.583   29.71 | 2.583   11.86 |  3.58    8.20
               0.667   12.39 | 1.667   29.71 | 2.667   11.86 |  3.67    8.20
               0.750   15.24 | 1.750   22.67 | 2.750   10.97 |  3.75    7.84
               0.833   15.24 | 1.833   22.67 | 2.833   10.97 |  3.83    7.84
               0.917   20.69 | 1.917   18.74 | 2.917   10.24 |  3.92    7.51
               1.000   20.69 | 2.000   18.74 | 3.000   10.24 |  4.00    7.51

    Unit Hyd Qpeak  (cms)=   0.554

    PEAK FLOW       (cms)=   0.181 (i)
    TIME TO PEAK    (hrs)=   1.667
    RUNOFF VOLUME    (mm)=  23.557
    TOTAL RAINFALL   (mm)=  87.089
    RUNOFF COEFFICIENT   =   0.270

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0050)|
| Inlet Cap.= 0.017|
| #of Inlets=     1|
| Total(cms)=   0.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)     (mm)
    TOTAL HYD.(ID= 1):   4.35      0.18      1.67   23.56
    ================================================
    MAJOR SYS.(ID= 2):   3.44      0.16      1.67   23.56
    MINOR SYS.(ID= 3):   0.91      0.02      1.33   23.56

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0004)|   Area    (ha)=   7.85   Curve Number   (CN)= 72.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.10   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.46

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    8.40 | 1.083   38.70 | 2.083   16.17 |  3.08    9.61
               0.167    8.40 | 1.167   38.70 | 2.167   16.17 |  3.17    9.61
               0.250    9.34 | 1.250  160.97 | 2.250   14.33 |  3.25    9.08
               0.333    9.34 | 1.333  160.97 | 2.333   14.33 |  3.33    9.08
               0.417   10.59 | 1.417   47.72 | 2.417   12.95 |  3.42    8.61
               0.500   10.59 | 1.500   47.72 | 2.500   12.95 |  3.50    8.61
               0.583   12.39 | 1.583   29.71 | 2.583   11.86 |  3.58    8.20
               0.667   12.39 | 1.667   29.71 | 2.667   11.86 |  3.67    8.20
               0.750   15.24 | 1.750   22.67 | 2.750   10.97 |  3.75    7.84
               0.833   15.24 | 1.833   22.67 | 2.833   10.97 |  3.83    7.84
               0.917   20.69 | 1.917   18.74 | 2.917   10.24 |  3.92    7.51
               1.000   20.69 | 2.000   18.74 | 3.000   10.24 |  4.00    7.51

    Unit Hyd Qpeak  (cms)=   0.652

    PEAK FLOW       (cms)=   0.417 (i)
    TIME TO PEAK    (hrs)=   1.917
    RUNOFF VOLUME    (mm)=  35.095
    TOTAL RAINFALL   (mm)=  87.089
    RUNOFF COEFFICIENT   =   0.403

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0040)|
| Inlet Cap.= 0.068|
| #of Inlets=     1|
| Total(cms)=   0.1|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)     (mm)
    TOTAL HYD.(ID= 1):   7.85      0.42      1.92   35.10
    ================================================
    MAJOR SYS.(ID= 2):   5.28      0.35      1.92   35.10
    MINOR SYS.(ID= 3):   2.57      0.07      1.33   35.10

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  39.40
|ID= 1 DT= 1.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------

                             IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       11.82         27.58
    Dep. Storage     (mm)=        0.80         13.60
    Average Slope     (%)=        2.00          2.00
    Length            (m)=      512.51         40.00
    Mannings n           =       0.013         0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.017    8.40 | 1.017   38.70 | 2.017   16.17 |  3.02    9.61
               0.033    8.40 | 1.033   38.70 | 2.033   16.17 |  3.03    9.61
               0.050    8.40 | 1.050   38.70 | 2.050   16.17 |  3.05    9.61
               0.067    8.40 | 1.067   38.70 | 2.067   16.17 |  3.07    9.61
               0.083    8.40 | 1.083   38.70 | 2.083   16.17 |  3.08    9.61
               0.100    8.40 | 1.100   38.70 | 2.100   16.17 |  3.10    9.61
               0.117    8.40 | 1.117   38.70 | 2.117   16.17 |  3.12    9.61
               0.133    8.40 | 1.133   38.70 | 2.133   16.17 |  3.13    9.61
               0.150    8.40 | 1.150   38.70 | 2.150   16.17 |  3.15    9.61
               0.167    8.40 | 1.167   38.70 | 2.167   16.17 |  3.17    9.61
               0.183    9.34 | 1.183  160.97 | 2.183   14.33 |  3.18    9.08
               0.200    9.34 | 1.200  160.97 | 2.200   14.33 |  3.20    9.08
               0.217    9.34 | 1.217  160.97 | 2.217   14.33 |  3.22    9.08
               0.233    9.34 | 1.233  160.97 | 2.233   14.33 |  3.23    9.08
               0.250    9.34 | 1.250  160.97 | 2.250   14.33 |  3.25    9.08
               0.267    9.34 | 1.267  160.97 | 2.267   14.33 |  3.27    9.08
               0.283    9.34 | 1.283  160.97 | 2.283   14.33 |  3.28    9.08
               0.300    9.34 | 1.300  160.97 | 2.300   14.33 |  3.30    9.08
               0.317    9.34 | 1.317  160.97 | 2.317   14.33 |  3.32    9.08
               0.333    9.34 | 1.333  160.97 | 2.333   14.33 |  3.33    9.08
               0.350   10.59 | 1.350   47.73 | 2.350   12.95 |  3.35    8.61
               0.367   10.59 | 1.367   47.72 | 2.367   12.95 |  3.37    8.61
               0.383   10.59 | 1.383   47.72 | 2.383   12.95 |  3.38    8.61
               0.400   10.59 | 1.400   47.72 | 2.400   12.95 |  3.40    8.61
               0.417   10.59 | 1.417   47.72 | 2.417   12.95 |  3.42    8.61
               0.433   10.59 | 1.433   47.72 | 2.433   12.95 |  3.43    8.61
               0.450   10.59 | 1.450   47.72 | 2.450   12.95 |  3.45    8.61
               0.467   10.59 | 1.467   47.72 | 2.467   12.95 |  3.47    8.61
               0.483   10.59 | 1.483   47.72 | 2.483   12.95 |  3.48    8.61
               0.500   10.59 | 1.500   47.72 | 2.500   12.95 |  3.50    8.61
               0.517   12.39 | 1.517   29.72 | 2.517   11.86 |  3.52    8.20
               0.533   12.39 | 1.533   29.71 | 2.533   11.86 |  3.53    8.20
               0.550   12.39 | 1.550   29.71 | 2.550   11.86 |  3.55    8.20
               0.567   12.39 | 1.567   29.71 | 2.567   11.86 |  3.57    8.20
               0.583   12.39 | 1.583   29.71 | 2.583   11.86 |  3.58    8.20
               0.600   12.39 | 1.600   29.71 | 2.600   11.86 |  3.60    8.20
               0.617   12.39 | 1.617   29.71 | 2.617   11.86 |  3.62    8.20
               0.633   12.39 | 1.633   29.71 | 2.633   11.86 |  3.63    8.20
               0.650   12.39 | 1.650   29.71 | 2.650   11.86 |  3.65    8.20
               0.667   12.39 | 1.667   29.71 | 2.667   11.86 |  3.67    8.20
               0.683   15.24 | 1.683   22.68 | 2.683   10.97 |  3.68    7.84
               0.700   15.24 | 1.700   22.67 | 2.700   10.97 |  3.70    7.84
```

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

100-Year Storm Event

0.717	15.24	1.717	22.67	2.717	10.97	3.72	7.84
0.733	15.24	1.733	22.67	2.733	10.97	3.73	7.84
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.767	15.24	1.767	22.67	2.767	10.97	3.77	7.84
0.783	15.24	1.783	22.67	2.783	10.97	3.78	7.84
0.800	15.24	1.800	22.67	2.800	10.97	3.80	7.84
0.817	15.24	1.817	22.67	2.817	10.97	3.82	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.850	20.69	1.850	18.74	2.850	10.24	3.85	7.51
0.867	20.69	1.867	18.74	2.867	10.24	3.87	7.51
0.883	20.69	1.883	18.74	2.883	10.24	3.88	7.51
0.900	20.69	1.900	18.74	2.900	10.24	3.90	7.51
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
0.933	20.69	1.933	18.74	2.933	10.24	3.93	7.51
0.950	20.69	1.950	18.74	2.950	10.24	3.95	7.51
0.967	20.69	1.967	18.74	2.967	10.24	3.97	7.51
0.983	20.69	1.983	18.74	2.983	10.24	3.98	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	50.83	
over (min)	5.00	14.00	
Storage Coeff. (min)=	4.57 (ii)	13.82 (ii)	
Unit Hyd. Tpeak (min)=	5.00	14.00	
Unit Hyd. peak (cms)=	0.24	0.08	
			TOTALS
PEAK FLOW (cms)=	2.27	2.06	3.280 (iii)
TIME TO PEAK (hrs)=	1.35	1.55	1.38
RUNOFF VOLUME (mm)=	86.29	28.22	36.93
TOTAL RAINFALL (mm)=	87.09	87.09	87.09
RUNOFF COEFFICIENT =	0.99	0.32	0.42

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0010)	
Inlet Cap.= 0.927|	
#of Inlets= 1|	
Total(cms)= 0.9		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):		39.40	3.28	1.38	36.93
MAJOR SYS.(ID= 2):		12.83	2.35	1.38	36.93
MINOR SYS.(ID= 3):		26.57	0.93	1.22	36.93

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	
STANDHYD (0022)|	Area (ha)= 11.82
ID= 1 DT= 1.0 min		Total Imp(%)= 47.00 Dir. Conn.(%)= 22.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.56	6.26
Dep. Storage	(mm)=	0.80	16.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	280.71	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	8.40	1.017	38.70	2.017	16.17	3.02	9.61
0.033	8.40	1.033	38.70	2.033	16.17	3.03	9.61
0.050	8.40	1.050	38.70	2.050	16.17	3.05	9.61
0.067	8.40	1.067	38.70	2.067	16.17	3.07	9.61
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.100	8.40	1.100	38.70	2.100	16.17	3.10	9.61
0.117	8.40	1.117	38.70	2.117	16.17	3.12	9.61
0.133	8.40	1.133	38.70	2.133	16.17	3.13	9.61
0.150	8.40	1.150	38.70	2.150	16.17	3.15	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.183	9.34	1.183	160.97	2.183	14.33	3.18	9.08
0.200	9.34	1.200	160.97	2.200	14.33	3.20	9.08
0.217	9.34	1.217	160.97	2.217	14.33	3.22	9.08
0.233	9.34	1.233	160.97	2.233	14.33	3.23	9.08
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.267	9.34	1.267	160.97	2.267	14.33	3.27	9.08
0.283	9.34	1.283	160.97	2.283	14.33	3.28	9.08
0.300	9.34	1.300	160.97	2.300	14.33	3.30	9.08
0.317	9.34	1.317	160.97	2.317	14.33	3.32	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.350	10.59	1.350	47.73	2.350	12.95	3.35	8.61
0.367	10.59	1.367	47.72	2.367	12.95	3.37	8.61
0.383	10.59	1.383	47.72	2.383	12.95	3.38	8.61
0.400	10.59	1.400	47.72	2.400	12.95	3.40	8.61
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.433	10.59	1.433	47.72	2.433	12.95	3.43	8.61
0.450	10.59	1.450	47.72	2.450	12.95	3.45	8.61
0.467	10.59	1.467	47.72	2.467	12.95	3.47	8.61
0.483	10.59	1.483	47.72	2.483	12.95	3.48	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.517	12.39	1.517	29.72	2.517	11.86	3.52	8.20
0.533	12.39	1.533	29.71	2.533	11.86	3.53	8.20
0.550	12.39	1.550	29.71	2.550	11.86	3.55	8.20
0.567	12.39	1.567	29.71	2.567	11.86	3.57	8.20
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.600	12.39	1.600	29.71	2.600	11.86	3.60	8.20
0.617	12.39	1.617	29.71	2.617	11.86	3.62	8.20
0.633	12.39	1.633	29.71	2.633	11.86	3.63	8.20
0.650	12.39	1.650	29.71	2.650	11.86	3.65	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.683	15.24	1.683	22.68	2.683	10.97	3.68	7.84
0.700	15.24	1.700	22.67	2.700	10.97	3.70	7.84
0.717	15.24	1.717	22.67	2.717	10.97	3.72	7.84
0.733	15.24	1.733	22.67	2.733	10.97	3.73	7.84
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.767	15.24	1.767	22.67	2.767	10.97	3.77	7.84
0.783	15.24	1.783	22.67	2.783	10.97	3.78	7.84
0.800	15.24	1.800	22.67	2.800	10.97	3.80	7.84
0.817	15.24	1.817	22.67	2.817	10.97	3.82	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.850	20.69	1.850	18.74	2.850	10.24	3.85	7.51
0.867	20.69	1.867	18.74	2.867	10.24	3.87	7.51
0.883	20.69	1.883	18.74	2.883	10.24	3.88	7.51
0.900	20.69	1.900	18.74	2.900	10.24	3.90	7.51
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
0.933	20.69	1.933	18.74	2.933	10.24	3.93	7.51
0.950	20.69	1.950	18.74	2.950	10.24	3.95	7.51
0.967	20.69	1.967	18.74	2.967	10.24	3.97	7.51
0.983	20.69	1.983	18.74	2.983	10.24	3.98	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	59.60	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.92 (ii)	14.61 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.26	0.08	
			TOTALS
PEAK FLOW (cms)=	1.03	0.56	1.259 (iii)
TIME TO PEAK (hrs)=	1.35	1.57	1.37
RUNOFF VOLUME (mm)=	86.29	28.66	41.34
TOTAL RAINFALL (mm)=	87.09	87.09	87.09
RUNOFF COEFFICIENT =	0.99	0.33	0.47

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0220)		OVERFLOW IS OFF			
IN= 2---> OUT= 1					
DT= 1.0 min		OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
		0.0000	0.0000	0.0251	0.3540
		0.0066	0.0550	0.0273	0.4180
		0.0127	0.1120	0.0294	0.4840
		0.0167	0.1700	0.0313	0.5510
		0.0199	0.2300	0.0332	0.6200
		0.0226	0.2910	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0022)	11.820	1.259	1.37	41.34
OUTFLOW: ID= 1 (0220)	11.820	0.029	4.50	23.41

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.27
TIME SHIFT OF PEAK FLOW (min)=188.00
MAXIMUM STORAGE USED (ha.m.)= 0.4574

CALIB	
STANDHYD (0003)|	Area (ha)= 19.20
ID= 1 DT= 1.0 min		Total Imp(%)= 80.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	15.36	3.84
Dep. Storage	(mm)=	0.80	16.50
Average Slope	(%)=	2.00	2.00
Length	(m)=	357.77	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	8.40	1.017	38.70	2.017	16.17	3.02	9.61
0.033	8.40	1.033	38.70	2.033	16.17	3.03	9.61
0.050	8.40	1.050	38.70	2.050	16.17	3.05	9.61
0.067	8.40	1.067	38.70	2.067	16.17	3.07	9.61
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.100	8.40	1.100	38.70	2.100	16.17	3.10	9.61
0.117	8.40	1.117	38.70	2.117	16.17	3.12	9.61
0.133	8.40	1.133	38.70	2.133	16.17	3.13	9.61
0.150	8.40	1.150	38.70	2.150	16.17	3.15	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.183	9.34	1.183	160.97	2.183	14.33	3.18	9.08
0.200	9.34	1.200	160.97	2.200	14.33	3.20	9.08
0.217	9.34	1.217	160.97	2.217	14.33	3.22	9.08
0.233	9.34	1.233	160.97	2.233	14.33	3.23	9.08
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.267	9.34	1.267	160.97	2.267	14.33	3.27	9.08
0.283	9.34	1.283	160.97	2.283	14.33	3.28	9.08
0.300	9.34	1.300	160.97	2.300	14.33	3.30	9.08
0.317	9.34	1.317	160.97	2.317	14.33	3.32	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.350	10.59	1.350	47.73	2.350	12.95	3.35	8.61
0.367	10.59	1.367	47.72	2.367	12.95	3.37	8.61
0.383	10.59	1.383	47.72	2.383	12.95	3.38	8.61
0.400	10.59	1.400	47.72	2.400	12.95	3.40	8.61
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.433	10.59	1.433	47.72	2.433	12.95	3.43	8.61
0.450	10.59	1.450	47.72	2.450	12.95	3.45	8.61
0.467	10.59	1.467	47.72	2.467	12.95	3.47	8.61

Revised Waterford Municipal Drain Design
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0.483	10.59	1.483	47.72	2.483	12.95	3.48	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.517	12.39	1.517	29.72	2.517	11.86	3.52	8.20
0.533	12.39	1.533	29.71	2.533	11.86	3.53	8.20
0.550	12.39	1.550	29.71	2.550	11.86	3.55	8.20
0.567	12.39	1.567	29.71	2.567	11.86	3.57	8.20
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.600	12.39	1.600	29.71	2.600	11.86	3.60	8.20
0.617	12.39	1.617	29.71	2.617	11.86	3.62	8.20
0.633	12.39	1.633	29.71	2.633	11.86	3.63	8.20
0.650	12.39	1.650	29.71	2.650	11.86	3.65	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.683	15.24	1.683	22.68	2.683	10.97	3.68	7.84
0.700	15.24	1.700	22.67	2.700	10.97	3.70	7.84
0.717	15.24	1.717	22.67	2.717	10.97	3.72	7.84
0.733	15.24	1.733	22.67	2.733	10.97	3.73	7.84
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.767	15.24	1.767	22.67	2.767	10.97	3.77	7.84
0.783	15.24	1.783	22.67	2.783	10.97	3.78	7.84
0.800	15.24	1.800	22.67	2.800	10.97	3.80	7.84
0.817	15.24	1.817	22.67	2.817	10.97	3.82	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.850	20.69	1.850	18.74	2.850	10.24	3.85	7.51
0.867	20.69	1.867	18.74	2.867	10.24	3.87	7.51
0.883	20.69	1.883	18.74	2.883	10.24	3.88	7.51
0.900	20.69	1.900	18.74	2.900	10.24	3.90	7.51
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
0.933	20.69	1.933	18.74	2.933	10.24	3.93	7.51
0.950	20.69	1.950	18.74	2.950	10.24	3.95	7.51
0.967	20.69	1.967	18.74	2.967	10.24	3.97	7.51
0.983	20.69	1.983	18.74	2.983	10.24	3.98	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	178.84		
over (min)	5.00	8.00		
Storage Coeff. (min)=	3.69 (ii)	7.73 (ii)		
Unit Hyd. Tpeak (min)=	5.00	8.00		
Unit Hyd. peak (cms)=	0.27	0.14		
			TOTALS	
PEAK FLOW (cms)=	3.86	1.35	4.986 (iii)	
TIME TO PEAK (hrs)=	1.35	1.42	1.35	
RUNOFF VOLUME (mm)=	86.29	42.05	64.17	
TOTAL RAINFALL (mm)=	87.09	87.09	87.09	
RUNOFF COEFFICIENT =	0.99	0.48	0.74	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0030)				
Inlet Cap.= 1.706				
#of Inlets= 1				
Total(cms)= 1.7	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	19.20	4.99	1.35	64.17
MAJOR SYS.(ID= 2):	3.78	3.28	1.35	64.17
MINOR SYS.(ID= 3):	15.42	1.71	1.22	64.17

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
STANDHYD (0021)	Area (ha)= 16.90		
ID= 1 DT= 5.0 min	Total Imp(%)= 38.00	Dir. Conn.(%)= 16.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	6.42	10.48	
Dep. Storage (mm)=	0.80	16.50	
Average Slope (%)=	2.00	2.00	
Length (m)=	335.66	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	52.16		
over (min)	5.00	15.00		
Storage Coeff. (min)=	3.55 (ii)	12.70 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.26	0.08		
			TOTALS	
PEAK FLOW (cms)=	1.15	0.85	1.529 (iii)	
TIME TO PEAK (hrs)=	1.33	1.50	1.33	
RUNOFF VOLUME (mm)=	86.29	26.64	36.18	
TOTAL RAINFALL (mm)=	87.09	87.09	87.09	
RUNOFF COEFFICIENT =	0.99	0.31	0.42	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0210)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.3900	0.0820
	0.0200	0.0000	0.4300	0.1090
	0.0800	0.0020	0.5800	0.2670
	0.2100	0.0160	0.6360	0.3420
	0.3000	0.0330	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0021)	16.900	1.529	1.33	36.18
OUTFLOW: ID= 1 (0210)	16.900	0.504	2.17	36.20

PEAK FLOW REDUCTION [Qout/Qin](%)= 32.95
TIME SHIFT OF PEAK FLOW (min)= 50.00
MAXIMUM STORAGE USED (ha.m.)= 0.1870

DUHYD (0211)				
Inlet Cap.= 0.280				
#of Inlets= 1				
Total(cms)= 0.3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	16.90	0.50	2.17	36.20
MAJOR SYS.(ID= 2):	5.48	0.22	2.17	36.20
MINOR SYS.(ID= 3):	11.42	0.28	1.33	36.20

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
STANDHYD (0023)	Area (ha)= 0.80		
ID= 1 DT= 1.0 min	Total Imp(%)= 90.00	Dir. Conn.(%)= 45.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.72	0.08	
Dep. Storage (mm)=	0.80	16.50	
Average Slope (%)=	1.00	1.00	
Length (m)=	73.03	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	8.40	1.017	38.70	2.017	16.17	3.02	9.61
0.033	8.40	1.033	38.70	2.033	16.17	3.03	9.61
0.050	8.40	1.050	38.70	2.050	16.17	3.05	9.61
0.067	8.40	1.067	38.70	2.067	16.17	3.07	9.61
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.100	8.40	1.100	38.70	2.100	16.17	3.10	9.61
0.117	8.40	1.117	38.70	2.117	16.17	3.12	9.61
0.133	8.40	1.133	38.70	2.133	16.17	3.13	9.61
0.150	8.40	1.150	38.70	2.150	16.17	3.15	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.183	9.34	1.183	160.97	2.183	14.33	3.18	9.08
0.200	9.34	1.200	160.97	2.200	14.33	3.20	9.08
0.217	9.34	1.217	160.97	2.217	14.33	3.22	9.08
0.233	9.34	1.233	160.97	2.233	14.33	3.23	9.08
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.267	9.34	1.267	160.97	2.267	14.33	3.27	9.08
0.283	9.34	1.283	160.97	2.283	14.33	3.28	9.08
0.300	9.34	1.300	160.97	2.300	14.33	3.30	9.08
0.317	9.34	1.317	160.97	2.317	14.33	3.32	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.350	10.59	1.350	47.73	2.350	12.95	3.35	8.61
0.367	10.59	1.367	47.72	2.367	12.95	3.37	8.61
0.383	10.59	1.383	47.72	2.383	12.95	3.38	8.61
0.400	10.59	1.400	47.72	2.400	12.95	3.40	8.61
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.433	10.59	1.433	47.72	2.433	12.95	3.43	8.61
0.450	10.59	1.450	47.72	2.450	12.95	3.45	8.61
0.467	10.59	1.467	47.72	2.467	12.95	3.47	8.61
0.483	10.59	1.483	47.72	2.483	12.95	3.48	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.517	12.39	1.517	29.72	2.517	11.86	3.52	8.20
0.533	12.39	1.533	29.71	2.533	11.86	3.53	8.20
0.550	12.39	1.550	29.71	2.550	11.86	3.55	8.20
0.567	12.39	1.567	29.71	2.567	11.86	3.57	8.20
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.600	12.39	1.600	29.71	2.600	11.86	3.60	8.20
0.617	12.39	1.617	29.71	2.617	11.86	3.62	8.20
0.633	12.39	1.633	29.71	2.633	11.86	3.63	8.20
0.650	12.39	1.650	29.71	2.650	11.86	3.65	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.683	15.24	1.683	22.68	2.683	10.97	3.68	7.84
0.700	15.24	1.700	22.67	2.700	10.97	3.70	7.84
0.717	15.24	1.717	22.67	2.717	10.97	3.72	7.84
0.733	15.24	1.733	22.67	2.733	10.97	3.73	7.84
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.767	15.24	1.767	22.67	2.767	10.97	3.77	7.84
0.783	15.24	1.783	22.67	2.783	10.97	3.78	7.84
0.800	15.24	1.800	22.67	2.800	10.97	3.80	7.84

Revised Waterford Municipal Drain Design
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0.817	15.24	1.817	22.67	2.817	10.97	3.82	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.850	20.69	1.850	18.74	2.850	10.24	3.85	7.51
0.867	20.69	1.867	18.74	2.867	10.24	3.87	7.51
0.883	20.69	1.883	18.74	2.883	10.24	3.88	7.51
0.900	20.69	1.900	18.74	2.900	10.24	3.90	7.51
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
0.933	20.69	1.933	18.74	2.933	10.24	3.93	7.51
0.950	20.69	1.950	18.74	2.950	10.24	3.95	7.51
0.967	20.69	1.967	18.74	2.967	10.24	3.97	7.51
0.983	20.69	1.983	18.74	2.983	10.24	3.98	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	624.73	
over (min)	5.00	6.00	
Storage Coeff. (min)=	1.75 (ii)	5.68 (ii)	
Unit Hyd. Tpeak (min)=	5.00	6.00	
Unit Hyd. peak (cms)=	0.40	0.20	
			TOTALS
PEAK FLOW (cms)=	0.16	0.11	0.263 (iii)
TIME TO PEAK (hrs)=	1.33	1.37	1.35
RUNOFF VOLUME (mm)=	86.29	60.16	71.92
TOTAL RAINFALL (mm)=	87.09	87.09	87.09
RUNOFF COEFFICIENT =	0.99	0.69	0.83

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0230)				
Inlet Cap.= 0.015				
#of Inlets= 1				
Total(cms)= 0.0	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	0.80	0.26	1.35	71.92
MAJOR SYS.(ID= 2):	0.51	0.25	1.35	71.92
MINOR SYS.(ID= 3):	0.29	0.01	0.72	71.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
STANDHYD (0024)	Area (ha)=	1.40	
ID= 1 DT= 1.0 min	Total Imp(%)=	90.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.26	0.14
Dep. Storage	(mm)=	0.80	16.50
Average Slope	(%)=	1.00	1.00
Length	(m)=	96.61	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	8.40	1.017	38.70	2.017	16.17	3.02	9.61
0.033	8.40	1.033	38.70	2.033	16.17	3.03	9.61
0.050	8.40	1.050	38.70	2.050	16.17	3.05	9.61
0.067	8.40	1.067	38.70	2.067	16.17	3.07	9.61
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.100	8.40	1.100	38.70	2.100	16.17	3.10	9.61
0.117	8.40	1.117	38.70	2.117	16.17	3.12	9.61
0.133	8.40	1.133	38.70	2.133	16.17	3.13	9.61
0.150	8.40	1.150	38.70	2.150	16.17	3.15	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.183	9.34	1.183	160.97	2.183	14.33	3.18	9.08
0.200	9.34	1.200	160.97	2.200	14.33	3.20	9.08
0.217	9.34	1.217	160.97	2.217	14.33	3.22	9.08
0.233	9.34	1.233	160.97	2.233	14.33	3.23	9.08
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.267	9.34	1.267	160.97	2.267	14.33	3.27	9.08
0.283	9.34	1.283	160.97	2.283	14.33	3.28	9.08
0.300	9.34	1.300	160.97	2.300	14.33	3.30	9.08
0.317	9.34	1.317	160.97	2.317	14.33	3.32	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.350	10.59	1.350	47.73	2.350	12.95	3.35	8.61
0.367	10.59	1.367	47.72	2.367	12.95	3.37	8.61
0.383	10.59	1.383	47.72	2.383	12.95	3.38	8.61
0.400	10.59	1.400	47.72	2.400	12.95	3.40	8.61
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.433	10.59	1.433	47.72	2.433	12.95	3.43	8.61
0.450	10.59	1.450	47.72	2.450	12.95	3.45	8.61
0.467	10.59	1.467	47.72	2.467	12.95	3.47	8.61
0.483	10.59	1.483	47.72	2.483	12.95	3.48	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.517	12.39	1.517	29.72	2.517	11.86	3.52	8.20
0.533	12.39	1.533	29.71	2.533	11.86	3.53	8.20
0.550	12.39	1.550	29.71	2.550	11.86	3.55	8.20
0.567	12.39	1.567	29.71	2.567	11.86	3.57	8.20
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.600	12.39	1.600	29.71	2.600	11.86	3.60	8.20
0.617	12.39	1.617	29.71	2.617	11.86	3.62	8.20
0.633	12.39	1.633	29.71	2.633	11.86	3.63	8.20
0.650	12.39	1.650	29.71	2.650	11.86	3.65	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.683	15.24	1.683	22.68	2.683	10.97	3.68	7.84
0.700	15.24	1.700	22.67	2.700	10.97	3.70	7.84
0.717	15.24	1.717	22.67	2.717	10.97	3.72	7.84
0.733	15.24	1.733	22.67	2.733	10.97	3.73	7.84
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.767	15.24	1.767	22.67	2.767	10.97	3.77	7.84
0.783	15.24	1.783	22.67	2.783	10.97	3.78	7.84
0.800	15.24	1.800	22.67	2.800	10.97	3.80	7.84
0.817	15.24	1.817	22.67	2.817	10.97	3.82	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.850	20.69	1.850	18.74	2.850	10.24	3.85	7.51
0.867	20.69	1.867	18.74	2.867	10.24	3.87	7.51
0.883	20.69	1.883	18.74	2.883	10.24	3.88	7.51
0.900	20.69	1.900	18.74	2.900	10.24	3.90	7.51
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
0.933	20.69	1.933	18.74	2.933	10.24	3.93	7.51
0.950	20.69	1.950	18.74	2.950	10.24	3.95	7.51
0.967	20.69	1.967	18.74	2.967	10.24	3.97	7.51
0.983	20.69	1.983	18.74	2.983	10.24	3.98	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	624.73	
over (min)	5.00	7.00	
Storage Coeff. (min)=	2.07 (ii)	6.00 (ii)	
Unit Hyd. Tpeak (min)=	5.00	7.00	
Unit Hyd. peak (cms)=	0.37	0.18	
			TOTALS
PEAK FLOW (cms)=	0.28	0.19	0.447 (iii)
TIME TO PEAK (hrs)=	1.33	1.38	1.35
RUNOFF VOLUME (mm)=	86.29	60.16	71.92
TOTAL RAINFALL (mm)=	87.09	87.09	87.09
RUNOFF COEFFICIENT =	0.99	0.69	0.83

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0240)				
Inlet Cap.= 0.015				
#of Inlets= 1				
Total(cms)= 0.0	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	1.40	0.45	1.35	71.92
MAJOR SYS.(ID= 2):	1.10	0.43	1.35	71.92
MINOR SYS.(ID= 3):	0.30	0.01	0.25	71.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0010):	26.57	0.927	1.22	36.93
+ ID2= 2 (0211):	11.42	0.280	1.33	36.20
ID = 3 (1001):	37.98	1.207	1.35	36.71

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (1001):	37.98	1.207	1.35	36.71
+ ID2= 2 (0220):	11.82	0.029	4.50	23.41
ID = 1 (1001):	49.80	1.232	2.62	33.55

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1001):	49.80	1.232	2.62	33.55
+ ID2= 2 (0230):	0.29	0.015	0.72	71.92
ID = 3 (1001):	50.09	1.247	2.62	33.77

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (1001):	50.09	1.247	2.62	33.77
+ ID2= 2 (0240):	0.30	0.015	0.25	71.92
ID = 1 (1001):	50.39	1.262	2.62	34.00

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (1001)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1001):	50.39	1.262	2.62	34.00
+ ID2= 2 (0030):	15.42	1.706	1.22	64.17
ID = 3 (1001):	65.80	2.961	1.63	41.07

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Revised Waterford Municipal Drain Design
Visual OTTHYMO MODEL

100-Year Storm Event

```
| ADD HYD  (  1002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)     (cms)    (hrs)      (mm)
        ID1= 1 (  1001):    65.80   2.961     1.63    41.07
      + ID2= 2 (  0040):     2.57   0.068     1.33    35.10
        ================================================
        ID = 3 (  1002):    68.37   3.029     1.63    40.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------


--------------------
| ADD HYD  (  1002)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)     (cms)    (hrs)      (mm)
        ID1= 3 (  1002):    68.37   3.029     1.63    40.84
      + ID2= 2 (  0050):     0.91   0.017     1.33    23.56
        ================================================
        ID = 1 (  1002):    69.28   3.046     1.63    40.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.2760      0.9276
                          0.0000      0.2312   |    0.2890      0.9828
                          0.0900      0.4109   |    0.3380      1.2097
                          0.1800      0.5998   |    0.3590      1.3270
                          0.2470      0.8192   |    0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  1002)     69.280      3.046      1.63      40.62
   OUTFLOW: ID= 1 (  1003)     47.484      0.359      2.43      36.45
   OVERFLOW:ID= 3 (  0003)     21.796      1.619      2.45      36.45

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =   126
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.10
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  6.30

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.79
                  TIME SHIFT OF PEAK FLOW         (min)= 48.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.3270

     **** WARNING : SELECTED ROUTING TIME STEP DENIED.
```

FINISH

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================================================================================
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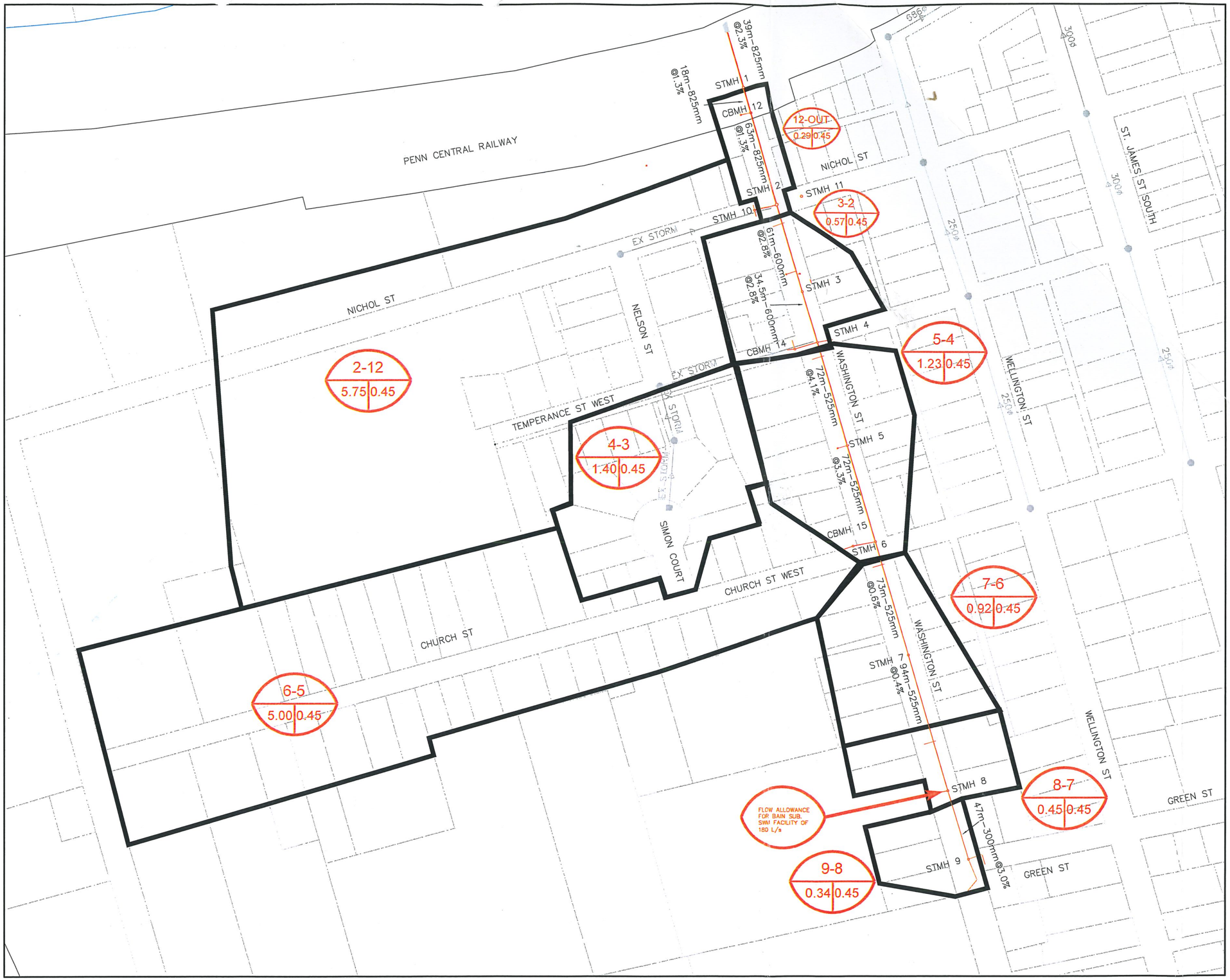
APPENDIX G

Road Reconstruction Record Drawings



DATE	REVISION

Stamp

Stamp

LICENSED PROFESSIONAL ENGINEER
T. G. SMITH
MAY 6/10
PROVINCE OF ONTARIO

vallee
Consulting Engineers, Architects & Planners

G. DOUGLAS VALLEE LIMITED
CONSULTING ENGINEERS AND ARCHITECT
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426–6270

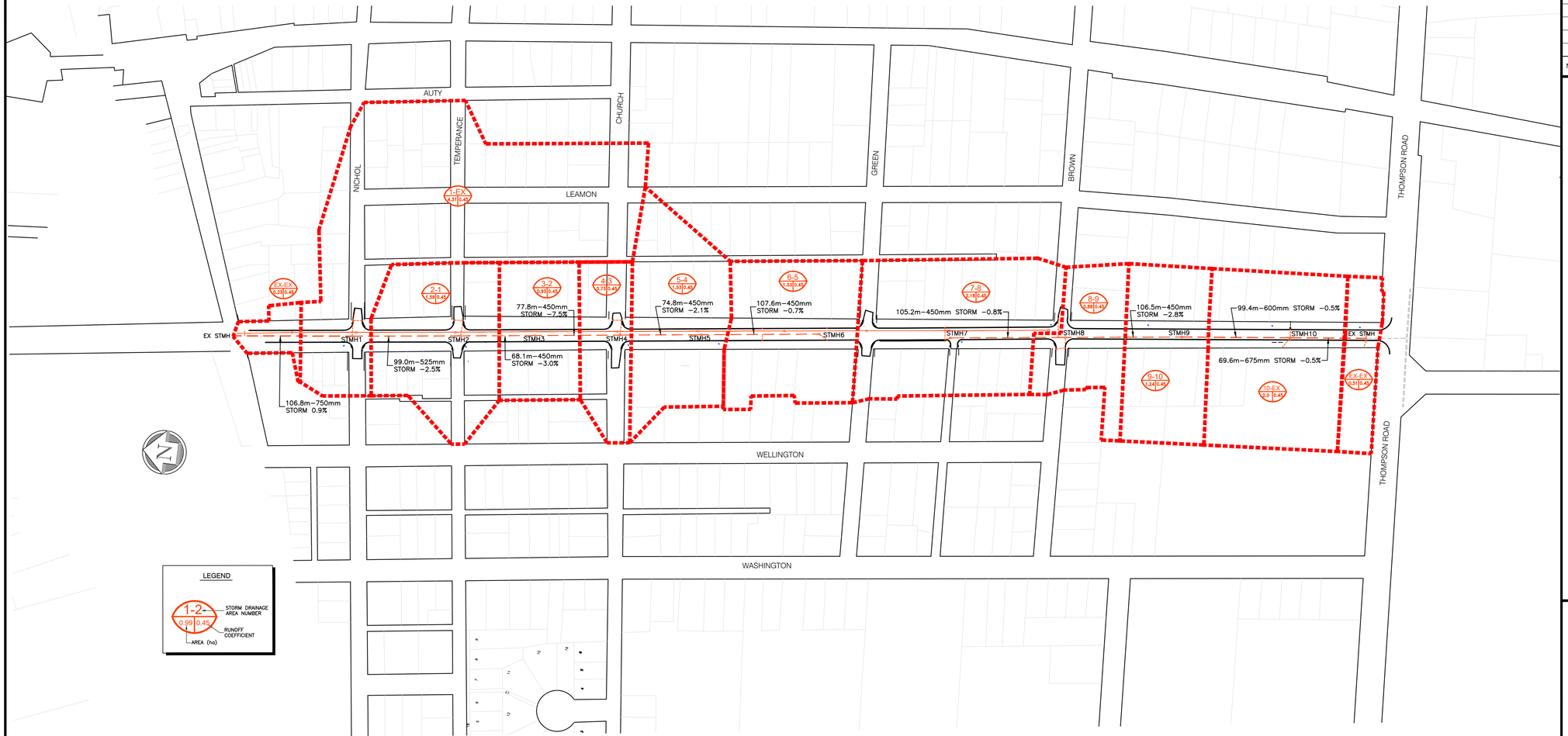
Project Title

WASHINGTON ST.
RECONSTRUCTION

Drawing Title

STORM AREAS

Designed by :	Drawn By :	Checked By :
GAP	GAP	TGS
Scale : 1:2500	Date : FEB 2010	Drawing No. S1
Project No. 10-002		



No.	DATE	ISSUED
0	JAN 11/13	SUBMIT TO COUNTY FOR REVIEW

No.	DATE	REVISION

vallee
Consulting Engineers, Architects & Planners
G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp

Project Title
ST. JAMES STREET
RECONSTRUCTION

WATERFORD - NORFOLK COUNTY

Drawing Title
STORM AREAS

Designed by : TGS	Drawn By : TJC
Checked by : TGS	Date Started : JAN 4, 2013
Drawing Scale : 1:2000	Drawing No. STM
Project No. 11-146	

DATE LAST PLOTTED : Tuesday, February 26, 2013

STORM SEWER DESIGN SHEET

Date: 11/9/2023
Project: 23-003 Brown Street
Town/County: Waterford, Norfolk County

Storm: 2-Year
A= 529.711
B= 4.501
C= 0.745

Pipe Material: PVC<=450, Concrete >450
n 0.013

Designed by: KRA/NLB
Checked by: NLB/TGS

Sheet: 1 of 1

Location				Area			Individual	Cumulative	Time of	Rainfall	Flow	Sewer Design						
Area	Street	From	To	Ha	Ha	Ha	C*A	C*A	Concentration	mm/hr	2.78*I*A*C	Size	Slope	Capacity (Full)	Vel (Full)	Length	Time	Cap
				0.20	0.45	0.75			min		L/s	mm	%	L/s	m/s	m	min	%
A1	BROWN	DCB1	INF. GALLERY		0.44		0.20	0.20	15.00	57.94	31.9	300	0.50%	68.38	0.97	15.0	0.26	✓ 47%
A2	BROWN	DCB2	FUT. STMH		0.37		0.17	0.17	15.00	57.94	26.8	300	0.50%	68.38	0.97	17.8	0.31	✓ 39%
A3	BROWN	DCB3	STMH2		0.43		0.19	0.19	15.00	57.94	31.2	300	0.50%	68.38	0.97	20.9	0.36	✓ 46%
A4	BROWN	DCB5	STMH2		0.54		0.24	0.24	15.00	57.94	39.1	300	0.50%	68.38	0.97	19.1	0.33	✓ 57%
	LEAMON	STMH2	STMH1				0.00	0.44	15.36	57.15	69.4	300	0.50%	68.38	0.97	18.7	0.32	✗ 101%
A5	BROWN	EX STMH	EX STMH			1.13	0.85	0.85	15.00	57.94	136.5	375	0.70%	146.69	1.33	86.6	1.09	✓ 93%
	BROWN	EX STMH	STMH5				0.00	0.85	16.09	55.64	131.1	375	0.70%	146.69	1.33	21.2	0.27	✓ 89%
	BROWN	STMH5	CBMH1				0.00	0.85	16.35	55.11	129.8	375	1.50%	214.73	1.94	14.7	0.13	✓ 60%
A6	BROWN	CBMH1	STMH4			0.97	0.73	1.58	16.48	54.87	240.2	450	1.50%	349.18	2.20	14.7	0.11	✓ 69%
A7	BROWN	STMH4	STMH3		2.40		1.08	2.66	16.59	54.65	403.4	525	1.50%	526.72	2.43	14.7	0.10	✓ 77%
A7	BROWN	STMH3	EX STMH				0.00	2.66	16.69	54.46	401.9	525	1.77%	572.16	2.64			✓ 70%

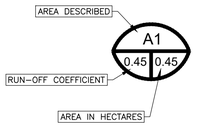
Note: A8 shown as potential catchment for Leamon Street. Accepting this catchment results in a large diameter pipe from STMH2 to STMH1 which is unable to connect to the existing 300mm storm outlet.

Legend:
- Existing Storm Sewer
- Proposed Storm Sewer

DATE LAST PLOTTED : April 10, 2024

REV. No.	DATE	REVISION
0	06/27/23	PRELIMINARY/30% REVIEW
1	11/09/23	60% / 90% DESIGN
2	12/04/23	ISSUED FOR TENDER
3	04/10/24	ISSUED FOR CONSTRUCTION

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL OF THE EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH AREA UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES INCLUDING THOSE NOT INDICATED ON THIS DRAWING. G. DOUGLAS VALLEE LTD. CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY OR MAY NOT BE INDICATED ON THIS DRAWING.



vallee
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G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

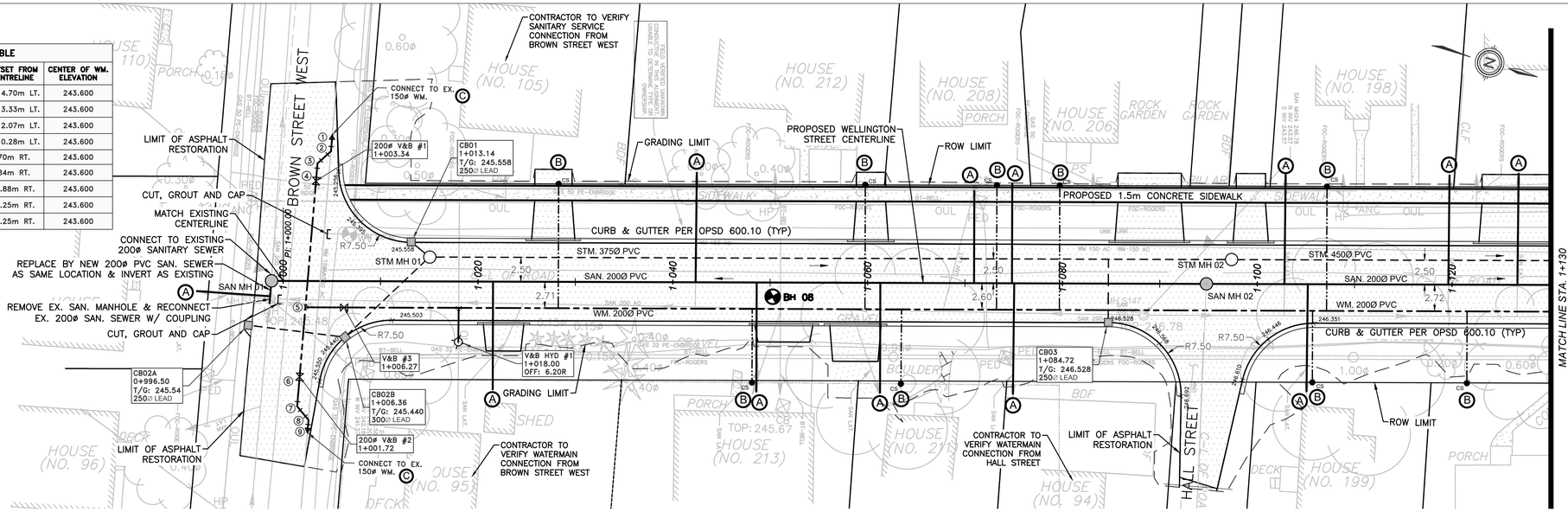
Stamp
LICENSED PROFESSIONAL ENGINEER
T. G. SMITH
2024-04-10
23003
PROVINCE OF ONTARIO

Project Title
EIS-ENG-24-35
BROWN STREET WEST RECONSTRUCTION
WATERFORD, NORFOLK COUNTY

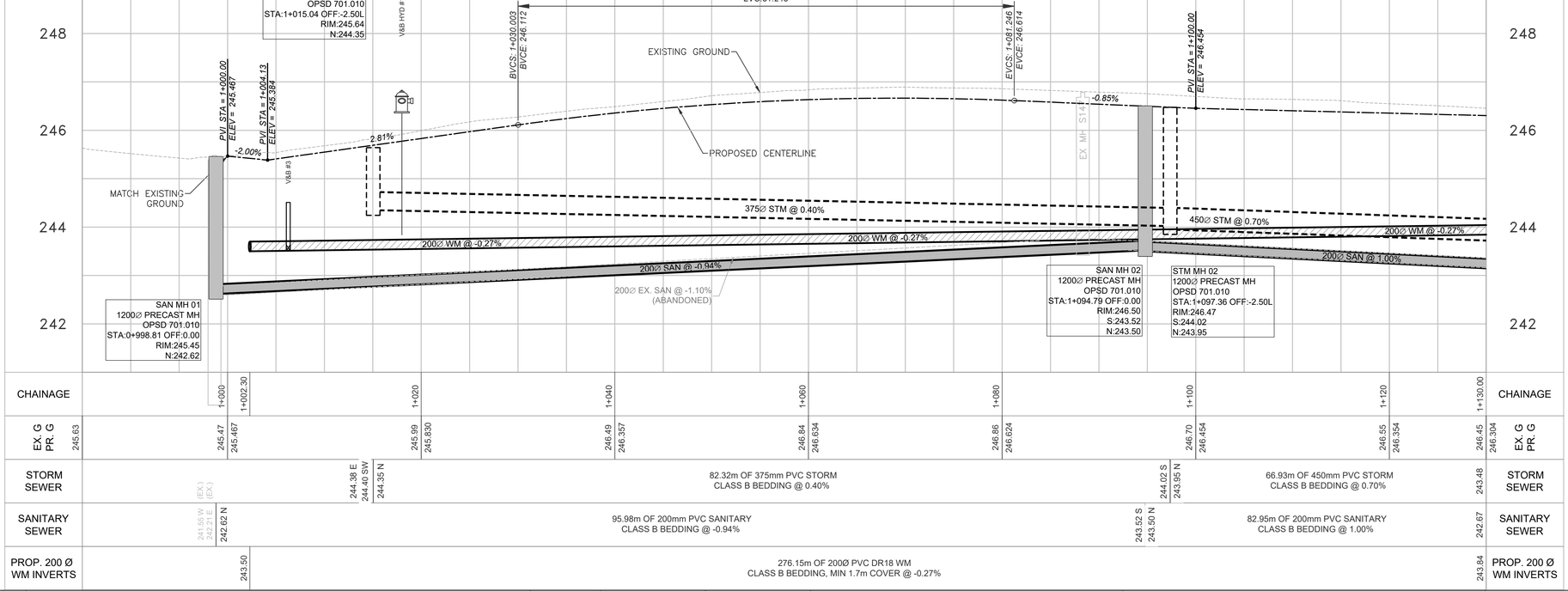
Drawing Title
STORM DRAINAGE AREAS

Designed by : NBN/NLB	Drawn By : NBN
Checked by : NLB/TGS	Date Started : 11/9/23
Drawing Scale : 1:1000	Drawing No. STM
Project No. 23-003	

WATERMAIN LAYOUT TABLE				
WM. ITEM NO.	DECRIPTION	STATION	OFFSET FROM CENTRELINE	CENTER OF WM. ELEVATION
1	200x150ø REDUCER #1	1+004.98	−14.70m LT.	243.600
2	45° HORZ. BEND #1a	1+004.87	−13.33m LT.	243.600
3	45° HORZ. BEND #2a	1+003.49	−12.07m LT.	243.600
4	200ø V&B #1	1+003.34	−10.28m LT.	243.600
5	200ø ANCHOR TEE	1+002.30	2.70m RT.	243.600
6	200ø V&B #2	1+001.72	9.84m RT.	243.600
7	45° HORZ. BEND #3a	1+001.48	12.88m RT.	243.600
8	45° HORZ. BEND #4a	1+002.65	14.25m RT.	243.600
9	200x150ø REDUCER #2	1+002.57	15.25m RT.	243.600



- (A) *CONNECT EX. SANITARY SERVICE @ 1.0m PAST PROPERTY LINE TO NEW SANITARY SEWER AS PER OPSD 1006.010, CONTRACTOR SHOULD CONFIRM THE SERVICE PIPE LOCATION, INVERT AT FIELD PRIOR TO CONSTRUCTION*
- (B) *CONNECT EX. WATER SERVICE TO NEW WATERMAIN WITH NEW 19Ø (MINIMUM) TYPE 'K' COPPER PIPE OR 25Ø (MINIMUM) CROSS-LINKED POLYETHYLENE (PEX) PIPE AS PER OPSD 1104.010 C/W NEW CURB STOP (CS) ON PROPERTY LINE. CONTRACTOR SHOULD CONFIRM THE SERVICE PIPE LOCATION AND INVERT IN FIELD PRIOR TO CONSTRUCTION.*
- (C) *CONNECT EX. WATERMAIN TO NEW WATERMAIN WITH MECHANICAL RESTRAINT JOINT. CONTRACTOR SHOULD CONFIRM THE EX. WATERMAIN LOCATION AND INVERT AT FIELD, IF NEEDED, ADJUST NEW CROSSING WATERMAIN INVERT TO SUIT PRIOR TO CONSTRUCTION*



	1+000	1+002.30	1+020	1+040	1+060	1+080	1+100	1+120	1+130.00	
EX. G / PR. G	245.63 / 245.47 / 245.467		245.99 / 245.830	246.49 / 246.357	246.84 / 246.634	246.86 / 246.624	246.70 / 246.454	246.55 / 246.354	246.45 / 246.304	EX. G / PR. G
STORM SEWER			244.38 E / 244.40 SW / 244.35 N	82.32m OF 375mm PVC STORM CLASS B BEDDING @ 0.40%			244.02 S / 243.95 N	66.93m OF 450mm PVC STORM CLASS B BEDDING @ 0.70%	243.48	STORM SEWER
SANITARY SEWER	(EX.) 241.55 W (EX.) 242.21 E	242.62 N	95.98m OF 200mm PVC SANITARY CLASS B BEDDING @ -0.94%			243.52 S / 243.50 N	82.95m OF 200mm PVC SANITARY CLASS B BEDDING @ 1.00%		242.67	SANITARY SEWER
PROP. 200 Ø WM INVERTS	243.50	276.15m OF 200Ø PVC DR18 WM CLASS B BEDDING, MIN 1.7m COVER @ -0.27%							243.84	PROP. 200 Ø WM INVERTS

NOTES

1 THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

2 PROPERTY LINE WERE PLOTTED USING LEGAL SURVEY PERFORMED BY RASCH AND HYDE, ONTARIO LAND SURVEYORS.

NO.	REVISION	DATE	INIT.
1	ISSUED FOR CONSTRUCTION	2023-03-06	CN

DRAFTING AB/HZ
DESIGN JY/RY
CHECKED BY CN/RY
APPROVED BY AC

Norfolk County
PARSONS

WELLINGTON STREET RECONSTRUCTION

WATERFORD-NORFOLK COUNTY PLAN AND PROFILE STA 1+000 TO STA 1+130

CONSULTANT FILE No. 478324
DATE 2023-03-06
SCALE Hor : 1:250 Ver : 1:50
REF. No.
DWG No. PP01
REV. 0

DRAWING FILE: H:\Projects\2023\23-003 Brown St Norfolk County Waterford\Drawings\Wellington CAD from County\IFC files (Without Electrical)\IFC files (Without Electrical)\Sheets\478324_PP.dwg PLOTTED: Apr 18, 2023 - 9:53am PLOTTED BY: natalie

APPENDIX C

Soil and Pre-Development Parameters
Post-Development Parameters
Rating Curve
Pre to Post Flows & Storage Volumes
Quality Control
Water Balance
Chamber Stage Storage

vallee
Consulting Engineers, Architects & Planners

Subject:	Soil & Pre-Development Parameters		
Date:	Jun-25	By:	NLO
Project #:	25-120	Page	1

SOIL PARAMETERS

Notes:
1) CN and IA soil parameters obtained from the Revised Waterford South Municipal Drain Design Brief (G. Douglas Vallee Engineering Ltd, August 2024)
2) Infiltration rate parameters obtained from Geotechnical Investigation Charles Street & Washington Street, Waterford (G2S Consulting Inc, March 2023)

Soil Group	AB - Sandy & Sandy Silt	
CN (-)	62	
Initial Abstraction (mm)	13.6	mm
Infiltration Rate	30	mm/hr
Safety Correction Factor	2.5	
Design Infiltration Rate (i)	12	mm/hr
Design Infiltration Rate (i)	0.012	m/hr

BMP Sizing
The depth of the soakaway or infiltration trench is dependent on the native soil infiltration rate, porosity (void space ratio) of the gravel storage layer media (i.e, aggregate material used in the stone reservoir) and the targeted time period to achieve complete drainage between storm events. The maximum allowable depth of the stone reservoir for designs without an underdrain can be calculated using the following equation:

$$d_{r\,max} = i * t_s / V_r$$

Where:
$d_{r\,max}$ = Maximum stone reservoir depth (mm)
i = Infiltration rate for native soils (mm/hr)
V_r = Void space ratio for aggregate used (typically 0.4 for 50 mm clear stone)
t_s = Time to drain (design for 48 hour time to drain is recommended)

The value for native soil infiltration rate (i) used in the above equation should be the design infiltration rate that incorporates a safety correction factor based on the ratio of the mean value at the proposed bottom elevation of the practice to the mean value in the least permeable soil horizon within 1.5 metres of the proposed bottom elevation (see Appendix C, Table C2). On highly permeable soils (e.g., infiltration rate of 45 mm/hr or greater), a maximum stone reservoir depth of 2 metres is recommended to prevent soil compaction and loss of permeability from the mass of overlying stone and stored water.

MAX INFILTRATION BASIN DEPTH

Void Ratio (Vr)	0.4	
Drawdown Time (ts)	96	hr
Max allowable stone depth (drmax)	2.88	m
Max recommended stone depth (drmax)	2.00	m

PRE-DEVELOPMENT AREA PARAMETERS:

Notes:
1) Pre-development drainage area parameters for the subject development obtained from the Revised Waterford South Municipal Drain Design Brief (G. Douglas Vallee Engineering Ltd, August 2024)
2) Pre-development drainage area parameters for the external catchment are based on existing conditions.

Drainage Area	Total Area (ha)	Impervious Area (ha)	TIMP (%)	Dir. Conn. Imperv. Area (ha)	XIMP (%)	
PRE	0.484	NA	30%	NA	15%	**See Note 1*
EXT	0.380	0.26	68%	0.17	45%	**See Note 2*

PRE-DEVELOPMENT FLOW RATES FROM AREA PRE

Design Storm	Q (m3/s)	
2	0.049	= Target Release Rate
5	0.068	
10	0.082	
25	0.107	
50	0.124	
100	0.141	

POST-DEVELOPMENT AREA PARAMETERS:

Drainage Area	Control?	Total Area (ha)	Impervious Area (ha)	TIMP (%)	Dir. Conn. Imperv. Area (ha)	XIMP (%)
POST1	Underground SWM Chambers	0.435	0.39	90%	0.39	90%
POST2	Uncontrolled to Leamon Street	0.052	0.01	28%	0.01	28%
EXT	Underground SWM Chambers	0.380	0.26	68%	0.17	45%

vallee
Consulting Engineers, Architects & Planners

Subject:	Rating Curve		
Date:	6/10/2025	By:	NLO
Project #:	25-120	Page	3

CHAMBER PARAMETERS

Model	MC-7200	
Number of Chambers	30	
Number of End Caps	6	
Depth of Stone Above Chamber	305	mm
Depth of Stone Below Chambers	300	mm
Base of Stone Elev.	240.00	m
Base of Chamber Elev.	240.30	m
Height of Chambers	1524	mm
Top of Chamber Elv.	241.82	m
Top of Stone Elev.	242.13	m
Min. Cover (For Vehicles)	0.54	m (min 450mm plus 90mm pavement layer)
Min Surface Elev.	242.36	m
Max. Cover	2.40	m
Max Surface Elev.	244.22	m
System Footprint	211.34	m2
Impermeable liner?	No	

ORIFICE PARAMETERS

Orifice #1	Diameter	0.125	m
	Area	0.0123	m2
	Invert Elev.	240.00	m
	CL Elev.	240.06	m

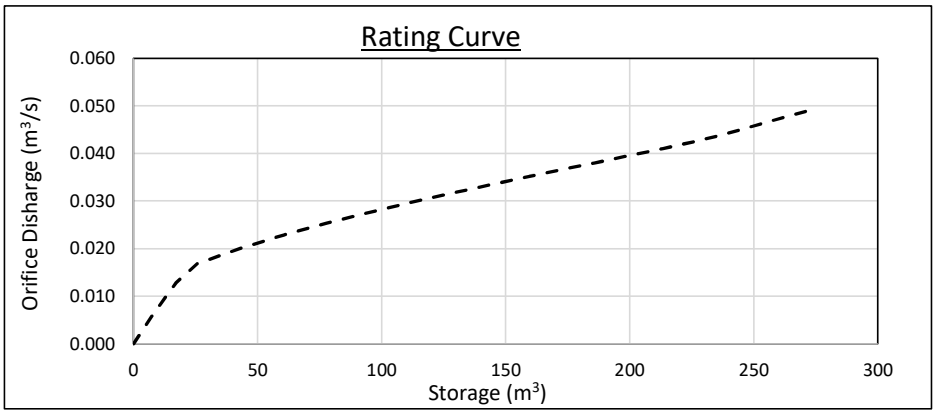
$$Q = CA\sqrt{2gh}$$

C = 0.63

RATING CURVE

Description	Elevation (m)	Stage (mm)	Stage (m)	Volume (m3)	Height Above Invert (m)	Q (m3/s)
Base of Stone	240.00	0	0.000	0	0.000	0.000
	240.10	102	0.102	9	0.102	0.007
	240.20	203	0.203	17	0.203	0.013
Base of Chamber/Orifice	240.30	305	0.305	26	0.305	0.017
	240.41	406	0.406	43	0.406	0.020
	240.51	508	0.508	61	0.508	0.023
	240.61	610	0.610	78	0.610	0.025
	240.71	711	0.711	95	0.711	0.028
	240.81	813	0.813	111	0.813	0.030
	240.91	914	0.914	128	0.914	0.032
	241.02	1016	1.016	144	1.016	0.033
	241.12	1118	1.118	160	1.118	0.035
	241.19	1194	1.194	171	1.194	0.036
	241.30	1295	1.295	186	1.295	0.038
	241.40	1397	1.397	200	1.397	0.040
	241.50	1499	1.499	213	1.499	0.041
	241.60	1600	1.600	226	1.600	0.042
	241.70	1702	1.702	237	1.702	0.044
Top of Chamber	241.80	1803	1.803	246	1.803	0.045
	241.91	1905	1.905	255	1.905	0.046
	242.01	2007	2.007	263	2.007	0.048
Top of Stone	242.13	2134	2.134	274	2.134	0.049

**Storage volumes obtained from OTTHYMO*



PRE TO POST DEVELOPMENT FLOWS

Return Period	Q (m3/s)					Check
	PRE	Allowable Release Rate	FROM CHAMBERS	TOTAL POST	NET	
2	0.049	0.049	0.026	0.028	-0.021	✓
5	0.068		0.031	0.033	-0.016	✓
10	0.082		0.034	0.036	-0.013	✓
25	0.107		0.038	0.040	-0.009	✓
50	0.124		0.041	0.044	-0.005	✓
100	0.141		0.045	0.048	-0.001	✓

RATING CURVE

Description	Elevation (m)	Ponding Depth (m)	Volume (m3)	Q (m3/s)
Base of Stone	240.00	0.00	0.0	0.000
	240.10	0.10	8.6	0.007
	240.20	0.20	17.2	0.013
Base of Chamber/Orifice	240.30	0.30	25.8	0.017
	240.41	0.41	43.2	0.020
	240.51	0.51	60.6	0.023
	240.61	0.61	77.8	0.025
	240.71	0.71	94.7	0.028
	240.81	0.81	111.4	0.030
	240.91	0.91	127.8	0.032
	241.02	1.02	143.9	0.033
	241.12	1.12	159.6	0.035
	241.19	1.19	171.0	0.036
	241.30	1.30	185.8	0.038
	241.40	1.40	199.9	0.040
	241.50	1.50	213.4	0.041
	241.60	1.60	225.8	0.042
	241.70	1.70	236.8	0.044
Top of Chamber	241.80	1.80	246.1	0.045
	241.91	1.91	254.7	0.046
	242.01	2.01	263.3	0.048
Top of Stone	242.13	2.13	274.1	0.049

**Storage volumes obtained from OTTHYMO*

STORAGE & PONDING DEPTHS

Return Period	Flow From Chambers (m3/s)	Maximum Storage (m3)	Ponding Depth (m)	Elev. (m)
2	0.026	83	0.64	240.64
5	0.031	123	0.88	240.88
10	0.034	149	1.05	241.05
25	0.038	186	1.29	241.29
50	0.041	213	1.50	241.50
100	0.045	245	1.79	241.79

WATER QUALITY CONTROL PROVIDED BY STORMTECH ISOLATOR ROW

Inflow to Chambers During 25mm Quality Storm Event	0.079	m^3/s
	79	L/s
Chamber Type	MC-7200	
Treated Flowrate / Isolator Row Chamber	12.74	L/s
Required Number of Isolator Row Chambers	7	
Provided Number of Isolator Row Chambers	10	
Provided Treated Flowrate	127	L/s ✔

StormTech Isolator Row Plus

Chamber Model	Chamber Storage	Chamber Footprint	Treatment Rate
SC-160LP	15.0 cf (0.42 m³)	11.45 sf (1.06 m²)	0.11 cfs (3.11 L/s)
SC-310	31.0 cf (0.88 m³)	17.7 sf (1.64 m²)	0.16 cfs (4.53 L/s)
SC-740	74.9 cf (2.12 m³)	27.8 sf (2.58 m²)	0.26 cfs (7.36 L/s)
DC-780	78.4 cf (2.22 m³)	27.8 sf (2.58 m²)	0.26 cfs (7.36 L/s)
SC-800	81.0 cf (2.29 m³)	27.3 sf (2.54 m²)	0.25 cfs (7.1 L/s)
MC-3500	175.0 cf (4.96 m³)	42.9 sf (3.99 m²)	0.40 cfs (11.32 L/s)
MC-4500	162.6 cf (4.60 m³)	30.1 sf (2.80 m²)	0.28 cfs (7.93 L/s)
MC-7200	267.3 cf (7.57 m³)	50.0 sf (4.65 m²)	0.45 cfs (12.74 L/s)

Notes:

- Results per ETV verified results, independently verifed by VerifiGlobal:
  https://www.verifiglobal.com/media/knubjbej/verifiglobal-verification-statement-for-stormtech-isolator-row-plus-final-2020-10-27-for-posting.pdf
- ETV verified treated flowrate = 4.13 GPM/ft² (2.80 L/s/m²)
- Above rates based on 81.2% removal of ETV/NJDEP particle size distribution.

WATER BALANCE DRAINAGE AREA PARAMETERS

Notes:

1) For the purposes of the water balance analysis, the pre-development drainage area parameters are based on existing conditions.

Drainage Area	Total Area (ha)	Impervious Area (ha)	TIMP (%)	Dir. Conn. Imperv. Area (ha)	XIMP (%)	
PRE	0.484	0.29	60%	0.29	60%	**See Note 1*
POST1	0.435	0.39	90%	0.39	90%	
POST2	0.052	0.01	28%	0.01	28%	

CLIMATE DATA

Station: Brantford Airport
Time Range: 2015 - 2024

AVERAGE ANNUAL PRE TO POST-DEVELOPMENT WATER BALANCE VOLUMES

	Vol. (m3)		Δ Volume (m3)	Δ Volume (%)
	Pre-Development	Post-Development (With SWM Facility)		
Precipatation	3218	3164	-54	-2%
Evapotranspiration	850	494	-356	-42%
Infiltration	409	2209	1800	440%
Runoff	1915	576	-1339	-70%

Project: **25-120 Leamon Street Mid-Rise**

Chamber Model -	MC-7200	
Units -	**Metric**	
Number of Chambers -	30	
Number of End Caps -	6	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	300	mm

Area of System- 211.340 sq.meters Min. Area - 185.88 sq.meters

StormTech MC-7200 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch, EC and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
2134	0.000	0.000	0.00	0.00	2.15	2.15	274.05	2.13
2108	0.000	0.000	0.00	0.00	2.15	2.15	271.91	2.11
2083	0.000	0.000	0.00	0.00	2.15	2.15	269.76	2.08
2057	0.000	0.000	0.00	0.00	2.15	2.15	267.61	2.06
2032	0.000	0.000	0.00	0.00	2.15	2.15	265.47	2.03
2007	0.000	0.000	0.00	0.00	2.15	2.15	263.32	2.01
1981	0.000	0.000	0.00	0.00	2.15	2.15	261.17	1.98
1956	0.000	0.000	0.00	0.00	2.15	2.15	259.02	1.96
1930	0.000	0.000	0.00	0.00	2.15	2.15	256.88	1.93
1905	0.000	0.000	0.00	0.00	2.15	2.15	254.73	1.91
1880	0.000	0.000	0.00	0.00	2.15	2.15	252.58	1.88
1854	0.000	0.000	0.00	0.00	2.15	2.15	250.43	1.85
1829	0.002	0.000	0.05	0.00	2.13	2.18	248.29	1.83
1803	0.005	0.001	0.16	0.01	2.08	2.25	246.11	1.80
1778	0.008	0.001	0.23	0.01	2.05	2.29	243.86	1.78
1753	0.010	0.002	0.30	0.01	2.02	2.34	241.57	1.75
1727	0.013	0.002	0.39	0.01	1.99	2.39	239.23	1.73
1702	0.021	0.003	0.63	0.02	1.89	2.54	236.84	1.70
1676	0.031	0.004	0.93	0.02	1.77	2.72	234.31	1.68
1651	0.037	0.005	1.12	0.03	1.69	2.84	231.59	1.65
1626	0.042	0.005	1.27	0.03	1.63	2.93	228.75	1.63
1600	0.047	0.006	1.41	0.04	1.57	3.01	225.82	1.60
1575	0.051	0.007	1.52	0.04	1.52	3.09	222.81	1.57
1549	0.054	0.008	1.63	0.05	1.48	3.15	219.72	1.55
1524	0.058	0.009	1.73	0.05	1.43	3.22	216.57	1.52
1499	0.061	0.009	1.82	0.06	1.40	3.27	213.35	1.50
1473	0.064	0.010	1.91	0.06	1.36	3.33	210.08	1.47
1448	0.066	0.011	1.99	0.07	1.32	3.38	206.75	1.45
1422	0.069	0.012	2.07	0.07	1.29	3.43	203.37	1.42
1397	0.071	0.012	2.14	0.07	1.26	3.48	199.94	1.40
1372	0.074	0.013	2.21	0.08	1.23	3.52	196.46	1.37
1346	0.076	0.014	2.28	0.08	1.20	3.56	192.94	1.35
1321	0.078	0.015	2.34	0.09	1.18	3.60	189.38	1.32
1295	0.080	0.015	2.40	0.09	1.15	3.64	185.78	1.30
1270	0.082	0.016	2.46	0.10	1.13	3.68	182.13	1.27
1245	0.084	0.017	2.51	0.10	1.10	3.71	178.46	1.24
1219	0.085	0.017	2.56	0.10	1.08	3.75	174.74	1.22
1194	0.087	0.018	2.62	0.11	1.06	3.78	170.99	1.19
1168	0.089	0.018	2.66	0.11	1.04	3.81	167.21	1.17
1143	0.090	0.019	2.71	0.12	1.02	3.84	163.40	1.14
1118	0.092	0.020	2.76	0.12	1.00	3.87	159.56	1.12
1092	0.093	0.020	2.80	0.12	0.98	3.90	155.69	1.09
1067	0.095	0.021	2.84	0.13	0.96	3.93	151.78	1.07
1041	0.096	0.022	2.88	0.13	0.94	3.95	147.86	1.04
1016	0.097	0.022	2.92	0.13	0.93	3.98	143.90	1.02
991	0.099	0.023	2.96	0.14	0.91	4.00	139.92	0.99
965	0.100	0.023	2.99	0.14	0.89	4.03	135.92	0.97
940	0.101	0.024	3.03	0.14	0.88	4.05	131.89	0.94
914	0.102	0.024	3.06	0.14	0.86	4.07	127.84	0.91

889	0.103	0.024	3.10	0.15	0.85	4.09	123.77	0.89
864	0.104	0.025	3.13	0.15	0.84	4.11	119.68	0.86
838	0.105	0.026	3.16	0.15	0.82	4.13	115.56	0.84
813	0.106	0.026	3.18	0.16	0.81	4.15	111.43	0.81
787	0.107	0.026	3.21	0.16	0.80	4.17	107.28	0.79
762	0.108	0.027	3.24	0.16	0.79	4.19	103.11	0.76
737	0.109	0.027	3.26	0.16	0.78	4.20	98.92	0.74
711	0.110	0.027	3.29	0.16	0.77	4.22	94.72	0.71
686	0.110	0.028	3.31	0.17	0.76	4.23	90.50	0.69
660	0.111	0.027	3.33	0.16	0.75	4.25	86.27	0.66
635	0.112	0.028	3.35	0.17	0.74	4.26	82.02	0.64
610	0.112	0.029	3.37	0.17	0.73	4.27	77.76	0.61
584	0.113	0.029	3.39	0.17	0.72	4.29	73.49	0.58
559	0.114	0.029	3.41	0.18	0.71	4.30	69.20	0.56
533	0.114	0.029	3.43	0.18	0.71	4.31	64.90	0.53
508	0.115	0.030	3.45	0.18	0.70	4.32	60.59	0.51
483	0.115	0.030	3.46	0.18	0.69	4.33	56.27	0.48
457	0.116	0.030	3.47	0.18	0.69	4.34	51.94	0.46
432	0.116	0.030	3.49	0.18	0.68	4.35	47.60	0.43
406	0.117	0.030	3.50	0.18	0.67	4.36	43.25	0.41
381	0.117	0.031	3.51	0.18	0.67	4.37	38.89	0.38
356	0.118	0.031	3.53	0.18	0.66	4.37	34.53	0.36
330	0.118	0.031	3.54	0.19	0.65	4.39	30.15	0.33
305	0.000	0.000	0.00	0.00	2.15	2.15	25.77	0.30
279	0.000	0.000	0.00	0.00	2.15	2.15	23.62	0.28
254	0.000	0.000	0.00	0.00	2.15	2.15	21.47	0.25
229	0.000	0.000	0.00	0.00	2.15	2.15	19.32	0.23
203	0.000	0.000	0.00	0.00	2.15	2.15	17.18	0.20
178	0.000	0.000	0.00	0.00	2.15	2.15	15.03	0.18
152	0.000	0.000	0.00	0.00	2.15	2.15	12.88	0.15
127	0.000	0.000	0.00	0.00	2.15	2.15	10.74	0.13
102	0.000	0.000	0.00	0.00	2.15	2.15	8.59	0.10
76	0.000	0.000	0.00	0.00	2.15	2.15	6.44	0.08
51	0.000	0.000	0.00	0.00	2.15	2.15	4.29	0.05
25	0.000	0.000	0.00	0.00	2.15	2.15	2.15	0.03

APPENDIX D

ADS StormTech Chamber Drawings & Specifications

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP

2025.06.24 25120 BUCHAN REV0

WATERFORD, ON, CANADA

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-7200.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.
10. MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE. DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
11. ADS DOES NOT DESIGN OR PROVIDE MEMBRANE LINER SYSTEMS. TO MINIMIZE THE LEAKAGE POTENTIAL OF LINER SYSTEMS, THE MEMBRANE LINER SYSTEM SHOULD BE DESIGNED BY A KNOWLEDGEABLE GEOTEXTILE PROFESSIONAL AND INSTALLED BY A QUALIFIED CONTRACTOR.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1. STORMTECH MC-7200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 230 mm (9") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE; AASHTO M43 #3, 357, 4, 467, 5, 56, OR 57.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 300 mm (12") BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-7200 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-800-821-6710 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

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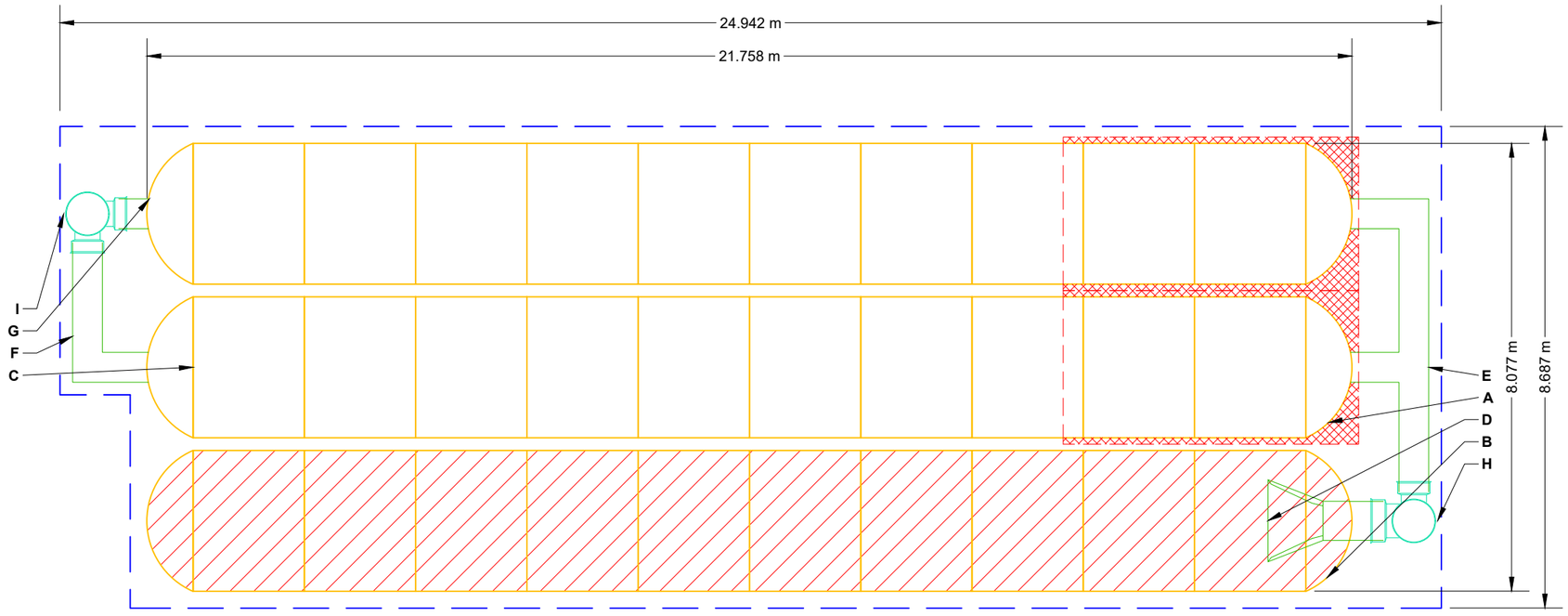
PROPOSED LAYOUT		PROPOSED ELEVATIONS	
30	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	243.958
6	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	242.586
305	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	242.434
300	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	242.434
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	242.434
272.3	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	242.129
		TOP OF MC-7200 CHAMBER:	241.824
		450 mm x 450 mm TOP MANIFOLD INVERT:	241.046
		600 mm ISOLATOR ROW PLUS INVERT:	240.358
211.8	SYSTEM AREA (m^2)	450 mm x 450 mm BOTTOM MANIFOLD INVERT:	240.350
67.3	SYSTEM PERIMETER (m)	450 mm BOTTOM CONNECTION INVERT:	240.350
		BOTTOM OF MC-7200 CHAMBER:	240.300
		BOTTOM OF STONE:	240.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	450 mm TOP PARTIAL CUT END CAP, PART#: MC7200IEPP18T / TYP OF ALL 450 mm TOP CONNECTIONS	746 mm	
PREFABRICATED END CAP	B	600 mm BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	57 mm	
PREFABRICATED END CAP	C	450 mm BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP18B / TYP OF ALL 450 mm BOTTOM CONNECTIONS	50 mm	
FLAMP	D	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	E	450 mm x 450 mm TOP MANIFOLD, ADS N-12	746 mm	
MANIFOLD	F	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	50 mm	
PIPE CONNECTION	G	450 mm BOTTOM CONNECTION	50 mm	
NYLOPLAST (INLET W/ ISO PLUS ROW)	H	750 mm DIAMETER (610 mm SUMP MIN)		311 L/s IN
NYLOPLAST (OUTLET)	I	750 mm DIAMETER (DESIGN BY ENGINEER)		227 L/s OUT



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 5.334 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

2025.06.24 25120 BUCHAN REV0

WATERFORD, ON, CANADA

DATE: 06/24/2025 | DRAWN: NO | CHECKED: N/A

PROJECT #:

DATE	DRW	CHK	DESCRIPTION

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StormTech®
Chamber System

1-800-821-6710 | WWW.STORMTECH.COM

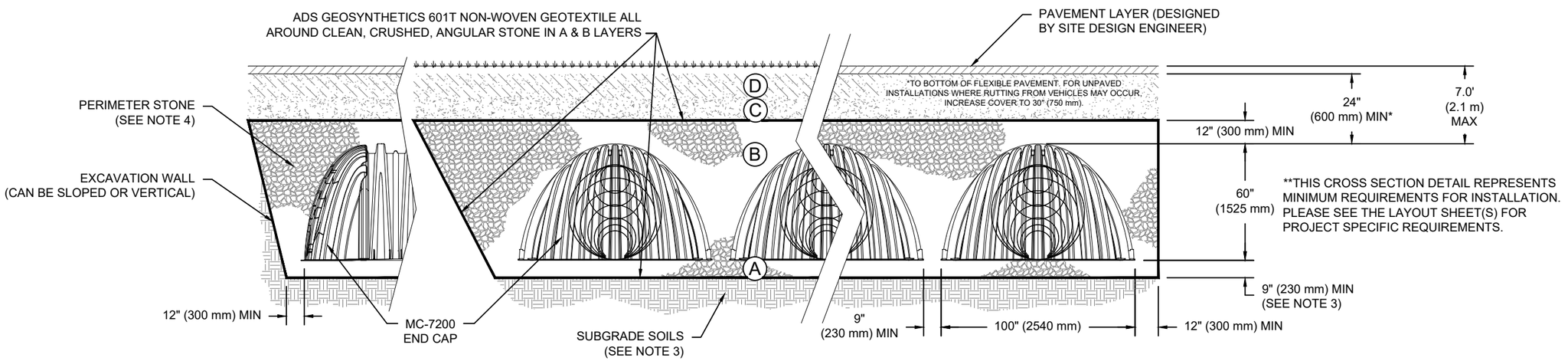
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 100

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

2025.06.24 25120 BUCHAN REV0
WATERFORD, ON, CANADA
DATE: 06/24/2025 | DRAWN: NO | CHECKED: N/A
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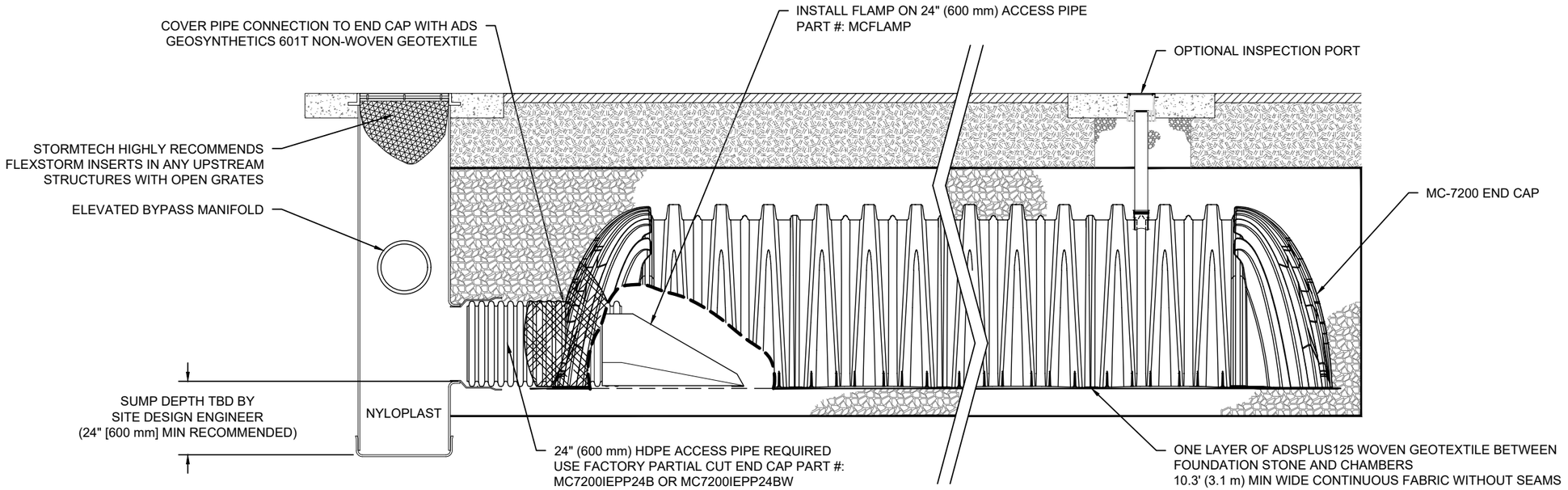

MC-7200 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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DATE: 06/24/2025 | DRAWN: NO | PROJECT #: | CHECKED: N/A

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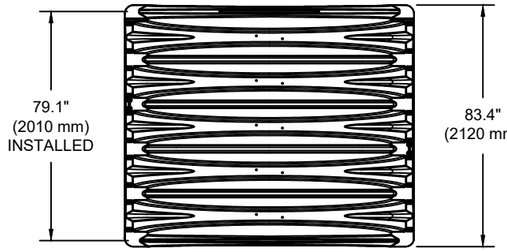
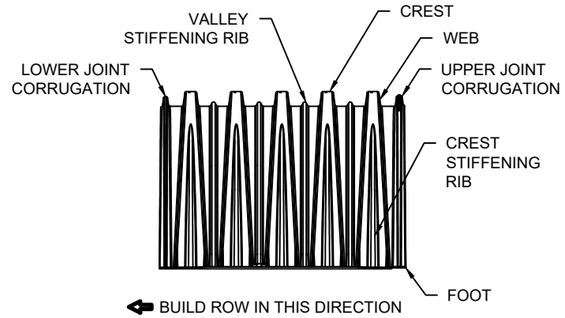
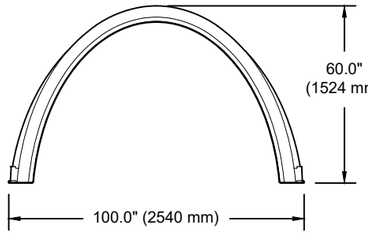
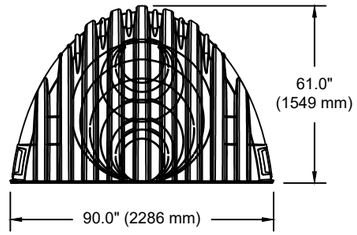
MC-7200 TECHNICAL SPECIFICATION

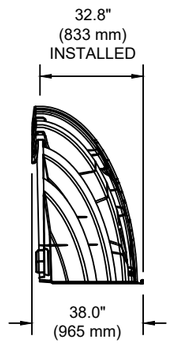
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

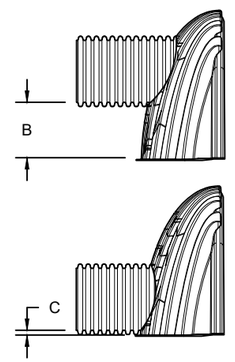
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC7200IEPP18TW			
MC7200IEPP18B		---	1.97" (50 mm)
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW			
MC7200IEPP24B		---	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

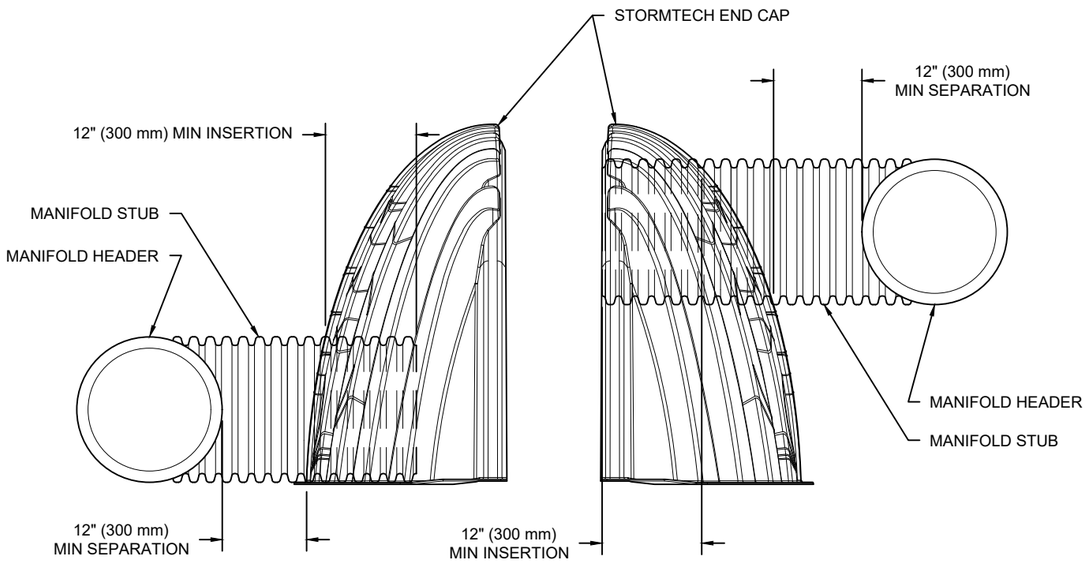
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-7200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

2025.06.24 25120 BUCHAN REV0

WATERFORD, ON, CANADA

DATE: 06/24/2025 | DRAWN: NO | CHECKED: N/A

PROJECT #:

DATE	DRW	CHK	DESCRIPTION

THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE EOR'S PRIOR APPROVAL. EOR SHALL REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS/STORMTECH UNDER THE DIRECTION OF THE PROJECT'S ENGINEER OF RECORD ("EOR") OR OTHER PROJECT REPRESENTATIVE. THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION

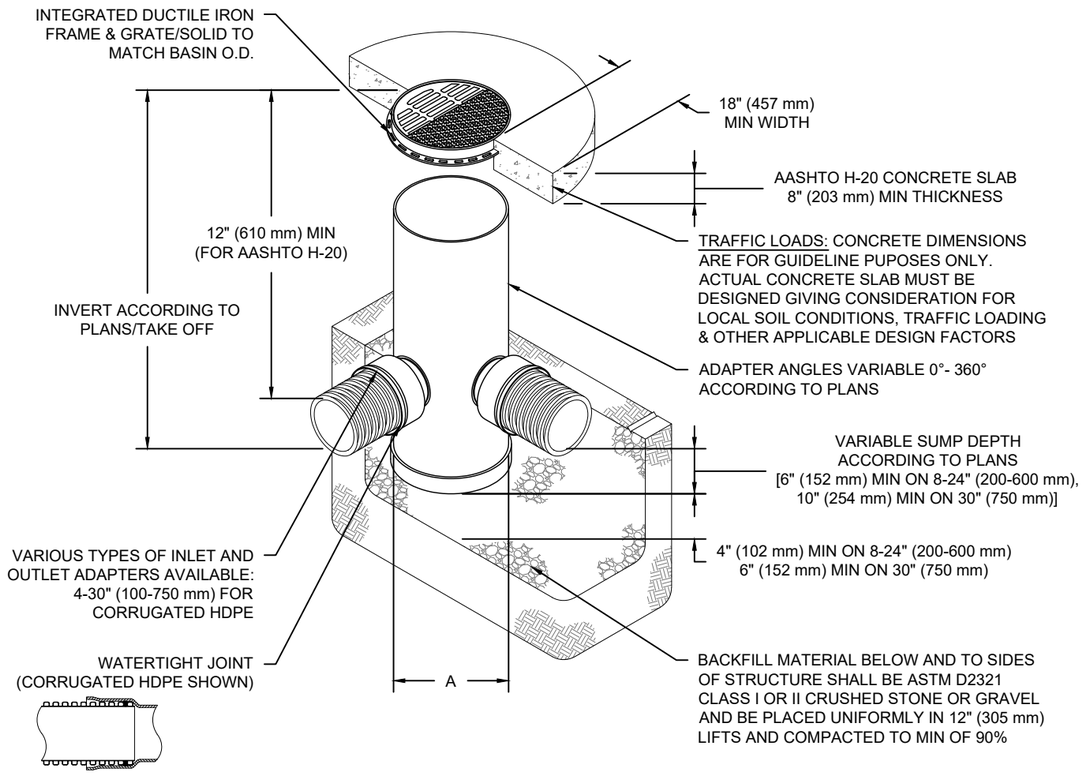
StormTech®
Chamber System

1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

NYLOPLAST DRAIN BASIN

NTS



NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

2025.06.24 25120 BUCHAN REV0

WATERFORD, ON, CANADA

DATE: 06/24/2025 | DRAWN: NO | CHECKED: N/A

PROJECT #:

DATE	DRW	CHK	DESCRIPTION

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADSSTORMTECH UNDER THE DIRECTION OF THE PROJECT'S ENGINEER OF RECORD ("EOR") OR OTHER PROJECT REPRESENTATIVE. THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE EOR'S PRIOR APPROVAL. EOR SHALL REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

Nyloplast®

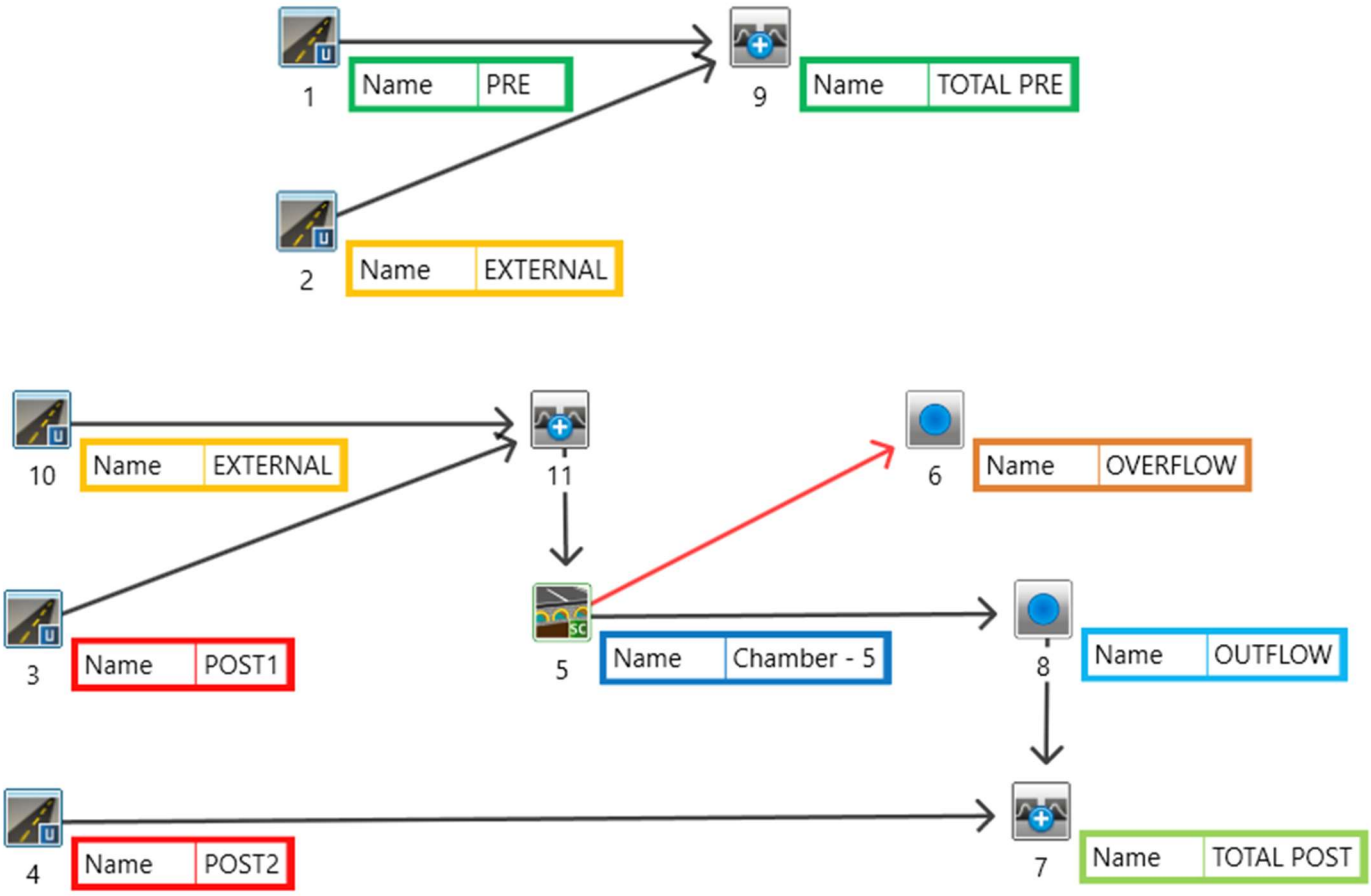
770-932-2443 | WWW.NYLOPLAST-US.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

APPENDIX E

Visual OTTHYMO Summary Outputs

25-120 BUCHAN MIDRISE
VISUAL OTTHYMO MODEL



2-YEAR STORM

```
================================================================================
======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M M M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-
a6fb-fe14aec8eaca\fa70b614-f579-4c05-bb23-0c9849009a2b\scen
  Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-
a6fb-fe14aec8eaca\fa70b614-f579-4c05-bb23-0c9849009a2b\scen


DATE: 09/11/2025                          TIME: 11:08:30

USER:



COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------
--------------------
  ************************************************
  ** SIMULATION : 01_2-Year Norfolk_4hr         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 529.711
| Ptotal= 35.21 mm |                          B=   4.501
--------------------                          C=   0.745
                                 used in:   INTENSITY =  A / (t + B)^C

                                 Duration of storm   =  4.00 hrs
                                 Storm time step     = 10.00 min
                                 Time to peak ratio =  0.33

      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
      0.00    2.68 |  1.00   17.69 |  2.00    5.90 |  3.00    3.14
      0.17    3.04 |  1.17   72.24 |  2.17    5.09 |  3.17    2.94
      0.33    3.53 |  1.33   22.78 |  2.33    4.50 |  3.33    2.76
      0.50    4.26 |  1.50   12.62 |  2.50    4.04 |  3.50    2.60
      0.67    5.49 |  1.67    8.98 |  2.67    3.68 |  3.67    2.47
      0.83    8.02 |  1.83    7.08 |  2.83    3.39 |  3.83    2.35

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area     (ha)=   0.44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  90.00   Dir. Conn.(%)=  90.00
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.39          0.04
     Dep. Storage     (mm)=       1.00         13.60
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      53.85         40.00
     Mannings n           =      0.013         0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                    ---- TRANSFORMED HYETOGRAPH ----
      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
     0.083    2.68 | 1.083   17.69 | 2.083    5.90 |  3.08    3.14
     0.167    2.68 | 1.167   17.69 | 2.167    5.90 |  3.17    3.14
     0.250    3.04 | 1.250   72.24 | 2.250    5.09 |  3.25    2.94
     0.333    3.04 | 1.333   72.24 | 2.333    5.09 |  3.33    2.94
     0.417    3.53 | 1.417   22.78 | 2.417    4.50 |  3.42    2.76
     0.500    3.53 | 1.500   22.78 | 2.500    4.50 |  3.50    2.76
     0.583    4.26 | 1.583   12.62 | 2.583    4.04 |  3.58    2.60
     0.667    4.26 | 1.667   12.62 | 2.667    4.04 |  3.67    2.60
     0.750    5.49 | 1.750    8.98 | 2.750    3.68 |  3.75    2.47
     0.833    5.49 | 1.833    8.98 | 2.833    3.68 |  3.83    2.47
     0.917    8.02 | 1.917    7.08 | 2.917    3.39 |  3.92    2.35
     1.000    8.02 | 2.000    7.08 | 3.000    3.39 |  4.00    2.35

Max.Eff.Inten.(mm/hr)=      72.24         2.23
           over (min)        5.00        10.00
```

Storage Coeff. (min)=	2.01 (ii)	5.34 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.31	0.16	
			TOTALS
PEAK FLOW (cms)=	0.08	0.00	0.078 (iii)
TIME TO PEAK (hrs)=	1.33	1.58	1.33
RUNOFF VOLUME (mm)=	34.21	2.63	31.05
TOTAL RAINFALL (mm)=	35.21	35.21	35.21
RUNOFF COEFFICIENT =	0.97	0.07	0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0010) | Area (ha)= 0.38
ID= 1 DT= 5.0 min | Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

Max.Eff.Inten.(mm/hr)=	72.24	11.50		
over (min)	5.00	20.00		
Storage Coeff. (min)=	1.93 (ii)	18.69 (ii)		
Unit Hyd. Tpeak (min)=	5.00	20.00		
Unit Hyd. peak (cms)=	0.31	0.06		
			TOTALS	
PEAK FLOW (cms)=	0.03	0.00	0.035 (iii)	
TIME TO PEAK (hrs)=	1.33	1.75	1.33	
RUNOFF VOLUME (mm)=	34.21	6.32	18.84	
TOTAL RAINFALL (mm)=	35.21	35.21	35.21	
RUNOFF COEFFICIENT =	0.97	0.18	0.54	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011) | 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0010):	0.38	0.035	1.33	18.84
+ ID2= 2 (0003):	0.44	0.078	1.33	31.05
ID = 3 (0011):	0.81	0.113	1.33	25.36

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
IN= 2--> OUT= 3 | CHAMBER:
DT= 5.0 min | MAX STO VOL (cu.m.)= 274.05 Bottom Area(m2) = 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75
559.00	69.20	1651.00	231.59
584.00	73.49	1676.00	234.31
610.00	77.76	1702.00	236.84
635.00	82.02	1727.00	239.23
660.00	86.27	1753.00	241.57
686.00	90.50	1778.00	243.86
711.00	94.72	1803.00	246.11
737.00	98.92	1829.00	248.29
762.00	103.11	1854.00	250.43
787.00	107.28	1880.00	252.58
813.00	111.43	1905.00	254.73
838.00	115.56	1930.00	256.88
864.00	119.68	1956.00	259.02
889.00	123.77	1981.00	261.17
914.00	127.84	2007.00	263.32
940.00	131.89	2032.00	265.47
965.00	135.92	2057.00	267.61
991.00	139.92	2083.00	269.76
1016.00	143.90	2108.00	271.91
1041.00	147.86	2134.00	274.05
1067.00	151.78	0.00	0.00

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	1.194	0.036
0.102	0.007	1.295	0.038
0.203	0.013	1.397	0.040
0.305	0.017	1.499	0.041
0.406	0.020	1.600	0.042
0.508	0.023	1.702	0.044
0.610	0.025	1.803	0.045
0.813	0.030	1.905	0.046
0.914	0.032	2.007	0.048
1.118	0.035	2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.113	1.33	25.36
OUTFLOW:ID= 1	0.81	0.026	1.50	24.00
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)=		5.36
Time to reach Max storage	(Hr)=	1.50
Volume of water for drawdown in LID	(cu.m.)=	0.00
Volume of maximum water storage	(cu.m.)=	75.76
Calculated Drawdown Time	(Hr)=	0.17

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

Junction Command(0008)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.03	1.50	24.00
OUTFLOW: ID= 2(0008)	0.82	0.03	1.50	24.00

CALIB
STANDHYD (0004) | Area (ha)= 0.05
ID= 1 DT= 5.0 min | Total Imp(%)= 28.00 Dir. Conn.(%)= 28.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.01	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	18.62	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

Max.Eff.Inten.(mm/hr)=	72.24	1.70		
over (min)	5.00	40.00		
Storage Coeff. (min)=	1.06 (ii)	37.04 (ii)		
Unit Hyd. Tpeak (min)=	5.00	40.00		
Unit Hyd. peak (cms)=	0.34	0.03		
			TOTALS	
PEAK FLOW (cms)=	0.00	0.00	0.003 (iii)	
TIME TO PEAK (hrs)=	1.33	2.42	1.33	
RUNOFF VOLUME (mm)=	34.21	2.63	11.06	
TOTAL RAINFALL (mm)=	35.21	35.21	35.21	
RUNOFF COEFFICIENT =	0.97	0.07	0.31	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0007)					
1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):		0.05	0.003	1.33	11.06
+ ID2= 2 (0008):		0.81	0.026	1.50	24.00
ID = 3 (0007):		0.87	0.028	1.33	23.22

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB			
STANDHYD (0001)	Area (ha)=	0.48	
ID= 1 DT= 5.0 min	Total Imp(%)=	30.00	Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.15	0.34
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	56.80	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

					TOTALS
Max.Eff.Inten.(mm/hr)=		72.24	3.69		
over (min)		5.00	30.00		
Storage Coeff. (min)=		2.07 (ii)	28.49 (ii)		
Unit Hyd. Tpeak (min)=		5.00	30.00		
Unit Hyd. peak (cms)=		0.31	0.04		
PEAK FLOW	(cms)=	0.01	0.00		0.015 (iii)
TIME TO PEAK	(hrs)=	1.33	2.00		1.33
RUNOFF VOLUME	(mm)=	34.21	3.79		8.32
TOTAL RAINFALL	(mm)=	35.21	35.21		35.21
RUNOFF COEFFICIENT	=	0.97	0.11		0.24

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
STANDHYD (0002)	Area (ha)=	0.38	
ID= 1 DT= 5.0 min	Total Imp(%)=	68.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.68	1.083	17.69	2.083	5.90	3.08	3.14
0.167	2.68	1.167	17.69	2.167	5.90	3.17	3.14
0.250	3.04	1.250	72.24	2.250	5.09	3.25	2.94
0.333	3.04	1.333	72.24	2.333	5.09	3.33	2.94
0.417	3.53	1.417	22.78	2.417	4.50	3.42	2.76
0.500	3.53	1.500	22.78	2.500	4.50	3.50	2.76
0.583	4.26	1.583	12.62	2.583	4.04	3.58	2.60
0.667	4.26	1.667	12.62	2.667	4.04	3.67	2.60
0.750	5.49	1.750	8.98	2.750	3.68	3.75	2.47
0.833	5.49	1.833	8.98	2.833	3.68	3.83	2.47
0.917	8.02	1.917	7.08	2.917	3.39	3.92	2.35
1.000	8.02	2.000	7.08	3.000	3.39	4.00	2.35

					TOTALS
Max.Eff.Inten.(mm/hr)=		72.24	11.50		
over (min)		5.00	20.00		
Storage Coeff. (min)=		1.93 (ii)	18.69 (ii)		
Unit Hyd. Tpeak (min)=		5.00	20.00		
Unit Hyd. peak (cms)=		0.31	0.06		
PEAK FLOW	(cms)=	0.03	0.00		0.035 (iii)
TIME TO PEAK	(hrs)=	1.33	1.75		1.33
RUNOFF VOLUME	(mm)=	34.21	6.32		18.84
TOTAL RAINFALL	(mm)=	35.21	35.21		35.21
RUNOFF COEFFICIENT	=	0.97	0.18		0.54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0009)					
1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):		0.48	0.015	1.33	8.32
+ ID2= 2 (0002):		0.38	0.035	1.33	18.84
ID = 3 (0009):		0.86	0.049	1.33	12.95

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

5-YEAR STORM

```
V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
 V  V    I       SS  U   U  A   A  L
  VV     I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M   M  O   O
 OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\e9c9265a-f513-4921-a512-3bb1e5ec552c\scen
Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\e9c9265a-f513-4921-a512-3bb1e5ec552c\scen

DATE: 09/11/2025 TIME: 11:08:30

USER:

COMMENTS: _____

** SIMULATION : 02_5-Year Norfolk_4hr **

| CHICAGO STORM | Ptotal= 49.03 mm |

IDF curve parameters: A= 583.017
B= 3.007
C= 0.703
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.20	1.00	23.22	2.00	8.64	3.00	4.87
0.17	4.72	1.17	96.03	2.17	7.56	3.17	4.58
0.33	5.42	1.33	29.33	2.33	6.76	3.33	4.32
0.50	6.44	1.50	17.13	2.50	6.13	3.50	4.10
0.67	8.09	1.67	12.62	2.67	5.63	3.67	3.90
0.83	11.39	1.83	10.19	2.83	5.22	3.83	3.72

CALIB	STANDHYD (0003)	ID= 1 DT= 5.0 min
	Area (ha)= 0.44	Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.39	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	53.85	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	7.42	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.79 (ii)	4.77 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.32	0.22	
				TOTALS
PEAK FLOW	(cms)=	0.10	0.00	0.105 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	48.03	6.57	43.88
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.13	0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0010)	ID= 1 DT= 5.0 min
	Area (ha)= 0.38	Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	26.92	
over (min)		5.00	15.00	
Storage Coeff. (min)=		1.72 (ii)	13.65 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.32	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.05	0.01	0.048 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	48.03	12.84	28.66
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.26	0.58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
		ID1= 1 (0010):	0.38	0.048	1.33	28.66
		+ ID2= 2 (0003):	0.44	0.105	1.33	43.88
		ID = 3 (0011):	0.81	0.153	1.33	36.78

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005)	IN= 2--> OUT= 3	DT= 5.0 min
OUTFLOW: ON,	UNDERDRAIN: OFF,	INFIL: ON
CHAMBER:		
MAX STO VOL (cu.m.)= 274.05	Bottom Area(m2)	= 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75
559.00	69.20	1651.00	231.59
584.00	73.49	1676.00	234.31
610.00	77.76	1702.00	236.84
635.00	82.02	1727.00	239.23
660.00	86.27	1753.00	241.57
686.00	90.50	1778.00	243.86
711.00	94.72	1803.00	246.11
737.00	98.92	1829.00	248.29
762.00	103.11	1854.00	250.43
787.00	107.28	1880.00	252.58
813.00	111.43	1905.00	254.73
838.00	115.56	1930.00	256.88
864.00	119.68	1956.00	259.02
889.00	123.77	1981.00	261.17
914.00	127.84	2007.00	263.32
940.00	131.89	2032.00	265.47

965.00	135.92	|	2057.00	267.61
991.00	139.92	|	2083.00	269.76
1016.00	143.90	|	2108.00	271.91
1041.00	147.86	|	2134.00	274.05
1067.00	151.78	|	0.00	0.00

DEPTH (m)	DISCHARGE (cms)	|	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	|	1.194	0.036
0.102	0.007	|	1.295	0.038
0.203	0.013	|	1.397	0.040
0.305	0.017	|	1.499	0.041
0.406	0.020	|	1.600	0.042
0.508	0.023	|	1.702	0.044
0.610	0.025	|	1.803	0.045
0.813	0.030	|	1.905	0.046
0.914	0.032	|	2.007	0.048
1.118	0.035	|	2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.153	1.33	36.78
OUTFLOW:ID= 1	0.81	0.031	1.67	35.29
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 4.07
Time to reach Max storage (Hr)= 1.67
Volume of water for drawdown in LID (cu.m.)= 0.74
Volume of maximum water storage (cu.m.)= 111.14
Calculated Drawdown Time (Hr)= 0.17

| Junction Command(0006) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

| Junction Command(0008) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.03	1.67	35.29
OUTFLOW: ID= 2(0008)	0.82	0.03	1.67	35.29

| CALIB |
| STANDHYD (0004) \| Area (ha)= 0.05
\|ID= 1 DT= 5.0 min \| Total Imp(%)= 28.00 Dir. Conn.(%)= 28.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.01	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	18.62	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	5.48	
over (min)		5.00	25.00	
Storage Coeff. (min)=		0.95 (ii)	23.51 (ii)	
Unit Hyd. Tpeak (min)=		5.00	25.00	
Unit Hyd. peak (cms)=		0.34	0.05	
				TOTALS
PEAK FLOW	(cms)=	0.00	0.00	0.004 (iii)
TIME TO PEAK	(hrs)=	1.33	1.83	1.33
RUNOFF VOLUME	(mm)=	48.03	6.57	17.94
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.13	0.37

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0007)|		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3					
ID1= 1 (0004):		0.05	0.004	1.33	17.94
+ ID2= 2 (0008):		0.81	0.031	1.67	35.29
==========					
ID = 3 (0007):		0.87	0.033	1.33	34.25

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| CALIB |
| STANDHYD (0001)\| Area (ha)= 0.48
\|ID= 1 DT= 5.0 min \| Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.15	0.34
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	56.80	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	10.08	
over (min)		5.00	20.00	
Storage Coeff. (min)=		1.85 (ii)	19.52 (ii)	
Unit Hyd. Tpeak (min)=		5.00	20.00	
Unit Hyd. peak (cms)=		0.32	0.06	
				TOTALS
PEAK FLOW	(cms)=	0.02	0.01	0.020 (iii)
TIME TO PEAK	(hrs)=	1.33	1.75	1.33
RUNOFF VOLUME	(mm)=	48.03	8.62	14.51
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.18	0.30

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| STANDHYD (0002)\| Area (ha)= 0.38
\|ID= 1 DT= 5.0 min \| Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.20	1.083	23.22	2.083	8.64	3.08	4.87
0.167	4.20	1.167	23.22	2.167	8.64	3.17	4.87
0.250	4.72	1.250	96.03	2.250	7.56	3.25	4.58
0.333	4.72	1.333	96.03	2.333	7.56	3.33	4.58
0.417	5.42	1.417	29.33	2.417	6.76	3.42	4.32
0.500	5.42	1.500	29.33	2.500	6.76	3.50	4.32
0.583	6.44	1.583	17.13	2.583	6.13	3.58	4.10
0.667	6.44	1.667	17.13	2.667	6.13	3.67	4.10
0.750	8.09	1.750	12.62	2.750	5.63	3.75	3.90
0.833	8.09	1.833	12.62	2.833	5.63	3.83	3.90
0.917	11.39	1.917	10.19	2.917	5.22	3.92	3.72
1.000	11.39	2.000	10.19	3.000	5.22	4.00	3.72

Max.Eff.Inten.(mm/hr)=		96.03	26.92	
over (min)		5.00	15.00	
Storage Coeff. (min)=		1.72 (ii)	13.65 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.32	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.05	0.01	0.048 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	48.03	12.84	28.66
TOTAL RAINFALL	(mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT	=	0.98	0.26	0.58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0009)\|

1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	0.48	0.020	1.33	14.51
+ ID2= 2 (0002):	0.38	0.048	1.33	28.66
ID = 3 (0009):	0.86	0.068	1.33	20.73

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

10-YEAR STORM

```
V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
 V  V    I      SS   U   U  A   A  L
  VV     I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M M M  O   O
 OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\37251053-2c19-4117-81e1-7df6bafb76c2\scen
Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\37251053-2c19-4117-81e1-7df6bafb76c2\scen

DATE: 09/11/2025 TIME: 11:08:30

USER:

COMMENTS: _____

** SIMULATION : 03_10-Year Norfolk_4hr **

| CHICAGO STORM | Ptotal= 57.94 mm |

IDF curve parameters: A= 670.324
B= 3.007
C= 0.698
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.04	1.00	27.43	2.00	10.30	3.00	5.84
0.17	5.66	1.17	111.84	2.17	9.03	3.17	5.49
0.33	6.49	1.33	34.58	2.33	8.07	3.33	5.18
0.50	7.70	1.50	20.31	2.50	7.33	3.50	4.92
0.67	9.66	1.67	15.00	2.67	6.74	3.67	4.68
0.83	13.55	1.83	12.13	2.83	6.25	3.83	4.47

CALIB	STANDHYD (0003)	ID= 1 DT= 5.0 min	Area (ha)= 0.44	Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.39	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	53.85	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.04	1.083	27.43	2.083	10.30	3.08	5.84
0.167	5.04	1.167	27.43	2.167	10.30	3.17	5.84
0.250	5.66	1.250	111.84	2.250	9.03	3.25	5.49
0.333	5.66	1.333	111.84	2.333	9.03	3.33	5.49
0.417	6.49	1.417	34.58	2.417	8.07	3.42	5.18
0.500	6.49	1.500	34.58	2.500	8.07	3.50	5.18
0.583	7.70	1.583	20.31	2.583	7.33	3.58	4.92
0.667	7.70	1.667	20.31	2.667	7.33	3.67	4.92
0.750	9.66	1.750	15.00	2.750	6.74	3.75	4.68
0.833	9.66	1.833	15.00	2.833	6.74	3.83	4.68
0.917	13.55	1.917	12.13	2.917	6.25	3.92	4.47
1.000	13.55	2.000	12.13	3.000	6.25	4.00	4.47

				TOTALS
Max.Eff.Inten.(mm/hr)=		111.84	11.80	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.69 (ii)	4.49 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.32	0.23	
PEAK FLOW	(cms)=	0.12	0.00	0.123 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	56.94	9.83	52.23
TOTAL RAINFALL	(mm)=	57.94	57.94	57.94
RUNOFF COEFFICIENT	=	0.98	0.17	0.90

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0010)	ID= 1 DT= 5.0 min	Area (ha)= 0.38	Total Imp(%)= 68.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.04	1.083	27.43	2.083	10.30	3.08	5.84
0.167	5.04	1.167	27.43	2.167	10.30	3.17	5.84
0.250	5.66	1.250	111.84	2.250	9.03	3.25	5.49
0.333	5.66	1.333	111.84	2.333	9.03	3.33	5.49
0.417	6.49	1.417	34.58	2.417	8.07	3.42	5.18
0.500	6.49	1.500	34.58	2.500	8.07	3.50	5.18
0.583	7.70	1.583	20.31	2.583	7.33	3.58	4.92
0.667	7.70	1.667	20.31	2.667	7.33	3.67	4.92
0.750	9.66	1.750	15.00	2.750	6.74	3.75	4.68
0.833	9.66	1.833	15.00	2.833	6.74	3.83	4.68
0.917	13.55	1.917	12.13	2.917	6.25	3.92	4.47
1.000	13.55	2.000	12.13	3.000	6.25	4.00	4.47

				TOTALS
Max.Eff.Inten.(mm/hr)=		111.84	46.85	
over (min)		5.00	15.00	
Storage Coeff. (min)=		1.62 (ii)	11.18 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.32	0.09	
PEAK FLOW	(cms)=	0.05	0.01	0.057 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	56.94	17.80	35.40
TOTAL RAINFALL	(mm)=	57.94	57.94	57.94
RUNOFF COEFFICIENT	=	0.98	0.31	0.61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0010):		0.38	0.057	1.33	35.40
	+ ID2= 2 (0003):		0.44	0.123	1.33	52.23
	ID = 3 (0011):		0.81	0.180	1.33	44.38

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005)	IN= 2--> OUT= 3	DT= 5.0 min	OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON	CHAMBER:	MAX STO VOL (cu.m.)= 274.05 Bottom Area(m2) = 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75
559.00	69.20	1651.00	231.59
584.00	73.49	1676.00	234.31
610.00	77.76	1702.00	236.84
635.00	82.02	1727.00	239.23
660.00	86.27	1753.00	241.57
686.00	90.50	1778.00	243.86
711.00	94.72	1803.00	246.11
737.00	98.92	1829.00	248.29
762.00	103.11	1854.00	250.43
787.00	107.28	1880.00	252.58
813.00	111.43	1905.00	254.73
838.00	115.56	1930.00	256.88
864.00	119.68	1956.00	259.02
889.00	123.77	1981.00	261.17
914.00	127.84	2007.00	263.32
940.00	131.89	2032.00	265.47
965.00	135.92	2057.00	267.61

991.00	139.92	|	2083.00	269.76
1016.00	143.90	|	2108.00	271.91
1041.00	147.86	|	2134.00	274.05
1067.00	151.78	|	0.00	0.00

DEPTH (m)	DISCHARGE (cms)	|	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	|	1.194	0.036
0.102	0.007	|	1.295	0.038
0.203	0.013	|	1.397	0.040
0.305	0.017	|	1.499	0.041
0.406	0.020	|	1.600	0.042
0.508	0.023	|	1.702	0.044
0.610	0.025	|	1.803	0.045
0.813	0.030	|	1.905	0.046
0.914	0.032	|	2.007	0.048
1.118	0.035	|	2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.180	1.33	44.38
OUTFLOW:ID= 1	0.81	0.034	1.67	42.80
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 3.56
Time to reach Max storage (Hr)= 1.67
Volume of water for drawdown in LID (cu.m.)= 3.97
Volume of maximum water storage (cu.m.)= 140.02
Calculated Drawdown Time (Hr)= 0.58

| Junction Command(0006) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

| Junction Command(0008) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.03	1.67	42.80
OUTFLOW: ID= 2(0008)	0.82	0.03	1.67	42.80

| CALIB |
| STANDHYD (0004)\| Area (ha)= 0.05
\|ID= 1 DT= 5.0 min \| Total Imp(%)= 28.00 Dir. Conn.(%)= 28.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.01	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	18.62	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.04	1.083	27.43	2.083	10.30	3.08	5.84
0.167	5.04	1.167	27.43	2.167	10.30	3.17	5.84
0.250	5.66	1.250	111.84	2.250	9.03	3.25	5.49
0.333	5.66	1.333	111.84	2.333	9.03	3.33	5.49
0.417	6.49	1.417	34.58	2.417	8.07	3.42	5.18
0.500	6.49	1.500	34.58	2.500	8.07	3.50	5.18
0.583	7.70	1.583	20.31	2.583	7.33	3.58	4.92
0.667	7.70	1.667	20.31	2.667	7.33	3.67	4.92
0.750	9.66	1.750	15.00	2.750	6.74	3.75	4.68
0.833	9.66	1.833	15.00	2.833	6.74	3.83	4.68
0.917	13.55	1.917	12.13	2.917	6.25	3.92	4.47
1.000	13.55	2.000	12.13	3.000	6.25	4.00	4.47

Max.Eff.Inten.(mm/hr)=	111.84	9.18		
over (min)	5.00	20.00		
Storage Coeff. (min)=	0.89 (ii)	19.24 (ii)		
Unit Hyd. Tpeak (min)=	5.00	20.00		
Unit Hyd. peak (cms)=	0.34	0.06		
			TOTALS	
PEAK FLOW (cms)=	0.00	0.00	0.005 (iii)	
TIME TO PEAK (hrs)=	1.33	1.75	1.33	
RUNOFF VOLUME (mm)=	56.94	9.83	22.81	
TOTAL RAINFALL (mm)=	57.94	57.94	57.94	
RUNOFF COEFFICIENT =	0.98	0.17	0.39	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0007)|
| 1 + 2 = 3 \| AREA QPEAK TPEAK R.V.

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):	0.05	0.005	1.33	22.81
+ ID2= 2 (0008):	0.81	0.034	1.67	42.80
ID = 3 (0007):	0.87	0.036	1.33	41.60

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| CALIB |
| STANDHYD (0001)\| Area (ha)= 0.48
\|ID= 1 DT= 5.0 min \| Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.15	0.34
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	56.80	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.04	1.083	27.43	2.083	10.30	3.08	5.84
0.167	5.04	1.167	27.43	2.167	10.30	3.17	5.84
0.250	5.66	1.250	111.84	2.250	9.03	3.25	5.49
0.333	5.66	1.333	111.84	2.333	9.03	3.33	5.49
0.417	6.49	1.417	34.58	2.417	8.07	3.42	5.18
0.500	6.49	1.500	34.58	2.500	8.07	3.50	5.18
0.583	7.70	1.583	20.31	2.583	7.33	3.58	4.92
0.667	7.70	1.667	20.31	2.667	7.33	3.67	4.92
0.750	9.66	1.750	15.00	2.750	6.74	3.75	4.68
0.833	9.66	1.833	15.00	2.833	6.74	3.83	4.68
0.917	13.55	1.917	12.13	2.917	6.25	3.92	4.47
1.000	13.55	2.000	12.13	3.000	6.25	4.00	4.47

Max.Eff.Inten.(mm/hr)=	111.84	16.97		
over (min)	5.00	20.00		
Storage Coeff. (min)=	1.74 (ii)	16.09 (ii)		
Unit Hyd. Tpeak (min)=	5.00	20.00		
Unit Hyd. peak (cms)=	0.32	0.06		
			TOTALS	
PEAK FLOW (cms)=	0.02	0.01	0.025 (iii)	
TIME TO PEAK (hrs)=	1.33	1.67	1.33	
RUNOFF VOLUME (mm)=	56.94	12.49	19.14	
TOTAL RAINFALL (mm)=	57.94	57.94	57.94	
RUNOFF COEFFICIENT =	0.98	0.22	0.33	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| STANDHYD (0002)\| Area (ha)= 0.38
\|ID= 1 DT= 5.0 min \| Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.04	1.083	27.43	2.083	10.30	3.08	5.84
0.167	5.04	1.167	27.43	2.167	10.30	3.17	5.84
0.250	5.66	1.250	111.84	2.250	9.03	3.25	5.49
0.333	5.66	1.333	111.84	2.333	9.03	3.33	5.49
0.417	6.49	1.417	34.58	2.417	8.07	3.42	5.18
0.500	6.49	1.500	34.58	2.500	8.07	3.50	5.18
0.583	7.70	1.583	20.31	2.583	7.33	3.58	4.92
0.667	7.70	1.667	20.31	2.667	7.33	3.67	4.92
0.750	9.66	1.750	15.00	2.750	6.74	3.75	4.68
0.833	9.66	1.833	15.00	2.833	6.74	3.83	4.68
0.917	13.55	1.917	12.13	2.917	6.25	3.92	4.47
1.000	13.55	2.000	12.13	3.000	6.25	4.00	4.47

Max.Eff.Inten.(mm/hr)=	111.84	46.85		
over (min)	5.00	15.00		
Storage Coeff. (min)=	1.62 (ii)	11.18 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.32	0.09		
			TOTALS	
PEAK FLOW (cms)=	0.05	0.01	0.057 (iii)	
TIME TO PEAK (hrs)=	1.33	1.50	1.33	
RUNOFF VOLUME (mm)=	56.94	17.80	35.40	
TOTAL RAINFALL (mm)=	57.94	57.94	57.94	
RUNOFF COEFFICIENT =	0.98	0.31	0.61	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0009)|
| 1 + 2 = 3 \| AREA QPEAK TPEAK R.V.

```
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0001):     0.48   0.025     1.33    19.14
      + ID2= 2 (  0002):     0.38   0.057     1.33    35.40
        ================================================
        ID = 3 (  0009):     0.86   0.082     1.33    26.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
```

25-YEAR STORM

```
V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
 V  V    I      SS   U   U  A   A  L
  VV     I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M   M  O   O
 OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\4b17e8a3-0f73-4389-a999-39b0088fe589\scen
Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\4b17e8a3-0f73-4389-a999-39b0088fe589\scen

DATE: 09/11/2025 TIME: 11:08:30

USER:

COMMENTS: _____

****
** SIMULATION : 04_25-Year Norfolk_4hr **
****

| CHICAGO STORM | Ptotal= 69.38 mm |

IDF curve parameters: A= 721.533
B= 2.253
C= 0.679
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	6.34	1.00	31.84	2.00	12.58	3.00	7.30
0.17	7.08	1.17	131.63	2.17	11.08	3.17	6.87
0.33	8.07	1.33	39.74	2.33	9.96	3.33	6.50
0.50	9.51	1.50	23.97	2.50	9.08	3.50	6.18
0.67	11.82	1.67	17.98	2.67	8.38	3.67	5.90
0.83	16.33	1.83	14.70	2.83	7.79	3.83	5.64

CALIB	STANDHYD (0003)	Area (ha)= 0.44	ID= 1 DT= 5.0 min	Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.39	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	53.85	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.34	1.083	31.84	2.083	12.58	3.08	7.30
0.167	6.34	1.167	31.84	2.167	12.58	3.17	7.30
0.250	7.08	1.250	131.63	2.250	11.08	3.25	6.87
0.333	7.08	1.333	131.63	2.333	11.08	3.33	6.87
0.417	8.07	1.417	39.74	2.417	9.96	3.42	6.50
0.500	8.07	1.500	39.74	2.500	9.96	3.50	6.50
0.583	9.51	1.583	23.97	2.583	9.08	3.58	6.18
0.667	9.51	1.667	23.97	2.667	9.08	3.67	6.18
0.750	11.82	1.750	17.98	2.750	8.38	3.75	5.90
0.833	11.82	1.833	17.98	2.833	8.38	3.83	5.90
0.917	16.33	1.917	14.70	2.917	7.79	3.92	5.64
1.000	16.33	2.000	14.70	3.000	7.79	4.00	5.64

Max.Eff.Inten.(mm/hr)=		131.63	18.40	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.58 (ii)	4.20 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.33	0.24	
				TOTALS
PEAK FLOW	(cms)=	0.14	0.00	0.145 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	68.38	14.71	63.01
TOTAL RAINFALL	(mm)=	69.38	69.38	69.38
RUNOFF COEFFICIENT	=	0.99	0.21	0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0010)	Area (ha)= 0.38	ID= 1 DT= 5.0 min	Total Imp(%)= 68.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.34	1.083	31.84	2.083	12.58	3.08	7.30
0.167	6.34	1.167	31.84	2.167	12.58	3.17	7.30
0.250	7.08	1.250	131.63	2.250	11.08	3.25	6.87
0.333	7.08	1.333	131.63	2.333	11.08	3.33	6.87
0.417	8.07	1.417	39.74	2.417	9.96	3.42	6.50
0.500	8.07	1.500	39.74	2.500	9.96	3.50	6.50
0.583	9.51	1.583	23.97	2.583	9.08	3.58	6.18
0.667	9.51	1.667	23.97	2.667	9.08	3.67	6.18
0.750	11.82	1.750	17.98	2.750	8.38	3.75	5.90
0.833	11.82	1.833	17.98	2.833	8.38	3.83	5.90
0.917	16.33	1.917	14.70	2.917	7.79	3.92	5.64
1.000	16.33	2.000	14.70	3.000	7.79	4.00	5.64

Max.Eff.Inten.(mm/hr)=		131.63	67.82	
over (min)		5.00	10.00	
Storage Coeff. (min)=		1.52 (ii)	9.76 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.33	0.11	
				TOTALS
PEAK FLOW	(cms)=	0.06	0.02	0.074 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	68.38	24.85	44.42
TOTAL RAINFALL	(mm)=	69.38	69.38	69.38
RUNOFF COEFFICIENT	=	0.99	0.36	0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0010):		0.38	0.074	1.33	44.42
	+ ID2= 2 (0003):		0.44	0.145	1.33	63.01
	ID = 3 (0011):		0.81	0.219	1.33	54.34

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005)	IN= 2--> OUT= 3	DT= 5.0 min	OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON	CHAMBER:	MAX STO VOL (cu.m.)= 274.05 Bottom Area(m2) = 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75

559.00	69.20	|	1651.00	231.59
584.00	73.49	|	1676.00	234.31
610.00	77.76	|	1702.00	236.84
635.00	82.02	|	1727.00	239.23
660.00	86.27	|	1753.00	241.57
686.00	90.50	|	1778.00	243.86
711.00	94.72	|	1803.00	246.11
737.00	98.92	|	1829.00	248.29
762.00	103.11	|	1854.00	250.43
787.00	107.28	|	1880.00	252.58
813.00	111.43	|	1905.00	254.73
838.00	115.56	|	1930.00	256.88
864.00	119.68	|	1956.00	259.02
889.00	123.77	|	1981.00	261.17
914.00	127.84	|	2007.00	263.32
940.00	131.89	|	2032.00	265.47
965.00	135.92	|	2057.00	267.61
991.00	139.92	|	2083.00	269.76
1016.00	143.90	|	2108.00	271.91
1041.00	147.86	|	2134.00	274.05
1067.00	151.78	|	0.00	0.00

DEPTH (m)	DISCHARGE (cms)	|	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	|	1.194	0.036
0.102	0.007	|	1.295	0.038
0.203	0.013	|	1.397	0.040
0.305	0.017	|	1.499	0.041
0.406	0.020	|	1.600	0.042
0.508	0.023	|	1.702	0.044
0.610	0.025	|	1.803	0.045
0.813	0.030	|	1.905	0.046
0.914	0.032	|	2.007	0.048
1.118	0.035	|	2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.219	1.33	54.34
OUTFLOW:ID= 1	0.81	0.038	1.67	52.62
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 3.17
Time to reach Max storage (Hr)= 1.67
Volume of water for drawdown in LID (cu.m.)= 19.31
Volume of maximum water storage (cu.m.)= 177.11
Calculated Drawdown Time (Hr)= 1.00

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

Junction Command(0008)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.04	1.67	52.62
OUTFLOW: ID= 2(0008)	0.82	0.04	1.67	52.62

CALIB
STANDHYD (0004) | Area (ha)= 0.05
ID= 1 DT= 5.0 min | Total Imp(%)= 28.00 Dir. Conn.(%)= 28.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.01	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	18.62	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.34	1.083	31.84	2.083	12.58	3.08	7.30
0.167	6.34	1.167	31.84	2.167	12.58	3.17	7.30
0.250	7.08	1.250	131.63	2.250	11.08	3.25	6.87
0.333	7.08	1.333	131.63	2.333	11.08	3.33	6.87
0.417	8.07	1.417	39.74	2.417	9.96	3.42	6.50
0.500	8.07	1.500	39.74	2.500	9.96	3.50	6.50
0.583	9.51	1.583	23.97	2.583	9.08	3.58	6.18
0.667	9.51	1.667	23.97	2.667	9.08	3.67	6.18
0.750	11.82	1.750	17.98	2.750	8.38	3.75	5.90
0.833	11.82	1.833	17.98	2.833	8.38	3.83	5.90
0.917	16.33	1.917	14.70	2.917	7.79	3.92	5.64
1.000	16.33	2.000	14.70	3.000	7.79	4.00	5.64

Max.Eff.Inten.(mm/hr)=		131.63	15.80	
over (min)		5.00	20.00	
Storage Coeff. (min)=		0.83 (ii)	15.60 (ii)	
Unit Hyd. Tpeak (min)=		5.00	20.00	
Unit Hyd. peak (cms)=		0.34	0.07	
				TOTALS
PEAK FLOW	(cms)=	0.01	0.00	0.006 (iii)
TIME TO PEAK	(hrs)=	1.33	1.58	1.33
RUNOFF VOLUME	(mm)=	68.38	14.71	29.58
TOTAL RAINFALL	(mm)=	69.38	69.38	69.38
RUNOFF COEFFICIENT	=	0.99	0.21	0.43

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0007)|
1 + 2 = 3 |

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):		0.05	0.006	1.33	29.58
+ ID2= 2 (0008):		0.81	0.038	1.67	52.62
ID = 3 (0007):		0.87	0.040	1.67	51.24

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB
STANDHYD (0001) | Area (ha)= 0.48
ID= 1 DT= 5.0 min | Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.15	0.34
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	56.80	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.34	1.083	31.84	2.083	12.58	3.08	7.30
0.167	6.34	1.167	31.84	2.167	12.58	3.17	7.30
0.250	7.08	1.250	131.63	2.250	11.08	3.25	6.87
0.333	7.08	1.333	131.63	2.333	11.08	3.33	6.87
0.417	8.07	1.417	39.74	2.417	9.96	3.42	6.50
0.500	8.07	1.500	39.74	2.500	9.96	3.50	6.50
0.583	9.51	1.583	23.97	2.583	9.08	3.58	6.18
0.667	9.51	1.667	23.97	2.667	9.08	3.67	6.18
0.750	11.82	1.750	17.98	2.750	8.38	3.75	5.90
0.833	11.82	1.833	17.98	2.833	8.38	3.83	5.90
0.917	16.33	1.917	14.70	2.917	7.79	3.92	5.64
1.000	16.33	2.000	14.70	3.000	7.79	4.00	5.64

Max.Eff.Inten.(mm/hr)=		131.63	25.76	
over (min)		5.00	15.00	
Storage Coeff. (min)=		1.63 (ii)	13.77 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.32	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.03	0.02	0.033 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	68.38	18.16	25.68
TOTAL RAINFALL	(mm)=	69.38	69.38	69.38
RUNOFF COEFFICIENT	=	0.99	0.26	0.37

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0002) | Area (ha)= 0.38
ID= 1 DT= 5.0 min | Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.34	1.083	31.84	2.083	12.58	3.08	7.30
0.167	6.34	1.167	31.84	2.167	12.58	3.17	7.30
0.250	7.08	1.250	131.63	2.250	11.08	3.25	6.87

0.333	7.08	1.333	131.63	2.333	11.08	3.33	6.87
0.417	8.07	1.417	39.74	2.417	9.96	3.42	6.50
0.500	8.07	1.500	39.74	2.500	9.96	3.50	6.50
0.583	9.51	1.583	23.97	2.583	9.08	3.58	6.18
0.667	9.51	1.667	23.97	2.667	9.08	3.67	6.18
0.750	11.82	1.750	17.98	2.750	8.38	3.75	5.90
0.833	11.82	1.833	17.98	2.833	8.38	3.83	5.90
0.917	16.33	1.917	14.70	2.917	7.79	3.92	5.64
1.000	16.33	2.000	14.70	3.000	7.79	4.00	5.64

Max.Eff.Inten.(mm/hr)=	131.63	67.82	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.52 (ii)	9.76 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.33	0.11	
			TOTALS
PEAK FLOW (cms)=	0.06	0.02	0.074 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	68.38	24.85	44.42
TOTAL RAINFALL (mm)=	69.38	69.38	69.38
RUNOFF COEFFICIENT =	0.99	0.36	0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0009)					
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.	
	(ha)	(cms)	(hrs)	(mm)	
ID1= 1 (0001):	0.48	0.033	1.33	25.68	
+ ID2= 2 (0002):	0.38	0.074	1.33	44.42	
ID = 3 (0009):	0.86	0.107	1.33	33.92	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

50-YEAR STORM

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M M M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\67f8b920-a4f8-4a8b-a6ce-141783e1fac6\scen
Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\67f8b920-a4f8-4a8b-a6ce-141783e1fac6\scen

DATE: 09/11/2025 TIME: 11:08:30

USER:

COMMENTS: _____

** SIMULATION : 05_50-Year Norfolk_4hr **

| CHICAGO STORM | IDF curve parameters: A= 766.038
| Ptotal= 78.32 mm | B= 1.898
C= 0.668

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	7.35	1.00	35.40	2.00	14.38	3.00	8.44
0.17	8.19	1.17	146.50	2.17	12.71	3.17	7.96
0.33	9.32	1.33	43.93	2.33	11.45	3.33	7.55
0.50	10.95	1.50	26.91	2.50	10.46	3.50	7.18
0.67	13.53	1.67	20.36	2.67	9.66	3.67	6.85
0.83	18.53	1.83	16.73	2.83	9.00	3.83	6.56

| CALIB | STANDHYD (0003) | Area (ha)= 0.44
|ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.39	0.04
Dep. Storage (mm)=	1.00	13.60
Average Slope (%)=	1.00	2.00
Length (m)=	53.85	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	7.35	1.083	35.40	2.083	14.38	3.08	8.44
0.167	7.35	1.167	35.40	2.167	14.38	3.17	8.44
0.250	8.19	1.250	146.50	2.250	12.71	3.25	7.96
0.333	8.19	1.333	146.50	2.333	12.71	3.33	7.96
0.417	9.32	1.417	43.93	2.417	11.45	3.42	7.55
0.500	9.32	1.500	43.93	2.500	11.45	3.50	7.55
0.583	10.95	1.583	26.91	2.583	10.46	3.58	7.18
0.667	10.95	1.667	26.91	2.667	10.46	3.67	7.18
0.750	13.53	1.750	20.36	2.750	9.66	3.75	6.85
0.833	13.53	1.833	20.36	2.833	9.66	3.83	6.85
0.917	18.53	1.917	16.73	2.917	9.00	3.92	6.56
1.000	18.53	2.000	16.73	3.000	9.00	4.00	6.56

Max.Eff.Inten.(mm/hr)=	146.50	25.17	
over (min)	5.00	5.00	
Storage Coeff. (min)=	1.51 (ii)	4.03 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.33	0.24	
			TOTALS
PEAK FLOW (cms)=	0.16	0.00	0.162 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	77.32	19.00	71.48
TOTAL RAINFALL (mm)=	78.32	78.32	78.32
RUNOFF COEFFICIENT =	0.99	0.24	0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB | STANDHYD (0010) | Area (ha)= 0.38
|ID= 1 DT= 5.0 min | Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.26	0.12
Dep. Storage (mm)=	1.00	13.60
Average Slope (%)=	1.00	2.00
Length (m)=	50.33	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	7.35	1.083	35.40	2.083	14.38	3.08	8.44
0.167	7.35	1.167	35.40	2.167	14.38	3.17	8.44
0.250	8.19	1.250	146.50	2.250	12.71	3.25	7.96
0.333	8.19	1.333	146.50	2.333	12.71	3.33	7.96
0.417	9.32	1.417	43.93	2.417	11.45	3.42	7.55
0.500	9.32	1.500	43.93	2.500	11.45	3.50	7.55
0.583	10.95	1.583	26.91	2.583	10.46	3.58	7.18
0.667	10.95	1.667	26.91	2.667	10.46	3.67	7.18
0.750	13.53	1.750	20.36	2.750	9.66	3.75	6.85
0.833	13.53	1.833	20.36	2.833	9.66	3.83	6.85
0.917	18.53	1.917	16.73	2.917	9.00	3.92	6.56
1.000	18.53	2.000	16.73	3.000	9.00	4.00	6.56

Max.Eff.Inten.(mm/hr)=	146.50	85.39	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.45 (ii)	8.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.33	0.12	
			TOTALS
PEAK FLOW (cms)=	0.07	0.02	0.085 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	77.32	30.79	51.72
TOTAL RAINFALL (mm)=	78.32	78.32	78.32
RUNOFF COEFFICIENT =	0.99	0.39	0.66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0010):		0.38	0.085	1.33	51.72
	+ ID2= 2 (0003):		0.44	0.162	1.33	71.48
	ID = 3 (0011):		0.81	0.247	1.33	62.27

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| CHAMBER(0005) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
|IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 274.05 Bottom Area(m2) = 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75
559.00	69.20	1651.00	231.59
584.00	73.49	1676.00	234.31
610.00	77.76	1702.00	236.84
635.00	82.02	1727.00	239.23
660.00	86.27	1753.00	241.57
686.00	90.50	1778.00	243.86
711.00	94.72	1803.00	246.11
737.00	98.92	1829.00	248.29
762.00	103.11	1854.00	250.43
787.00	107.28	1880.00	252.58
813.00	111.43	1905.00	254.73
838.00	115.56	1930.00	256.88
864.00	119.68	1956.00	259.02
889.00	123.77	1981.00	261.17
914.00	127.84	2007.00	263.32
940.00	131.89	2032.00	265.47
965.00	135.92	2057.00	267.61

991.00	139.92	2083.00	269.76
1016.00	143.90	2108.00	271.91
1041.00	147.86	2134.00	274.05
1067.00	151.78	0.00	0.00

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	1.194	0.036
0.102	0.007	1.295	0.038
0.203	0.013	1.397	0.040
0.305	0.017	1.499	0.041
0.406	0.020	1.600	0.042
0.508	0.023	1.702	0.044
0.610	0.025	1.803	0.045
0.813	0.030	1.905	0.046
0.914	0.032	2.007	0.048
1.118	0.035	2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.247	1.33	62.27
OUTFLOW:ID= 1	0.81	0.041	1.75	60.46
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 2.90
Time to reach Max storage (Hr)= 1.75
Volume of water for drawdown in LID (cu.m.)= 36.85
Volume of maximum water storage (cu.m.)= 206.01
Calculated Drawdown Time (Hr)= 1.25

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

Junction Command(0008)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.04	1.75	60.46
OUTFLOW: ID= 2(0008)	0.82	0.04	1.75	60.46

CALIB	STANDHYD (0004)	Area (ha)= 0.05	Total Imp(%)= 28.00	Dir. Conn.(%)= 28.00
ID= 1 DT= 5.0 min				

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.01	0.04
Dep. Storage (mm)=	1.00	13.60
Average Slope (%)=	1.00	2.00
Length (m)=	18.62	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	7.35	1.083	35.40	2.083	14.38	3.08	8.44
0.167	7.35	1.167	35.40	2.167	14.38	3.17	8.44
0.250	8.19	1.250	146.50	2.250	12.71	3.25	7.96
0.333	8.19	1.333	146.50	2.333	12.71	3.33	7.96
0.417	9.32	1.417	43.93	2.417	11.45	3.42	7.55
0.500	9.32	1.500	43.93	2.500	11.45	3.50	7.55
0.583	10.95	1.583	26.91	2.583	10.46	3.58	7.18
0.667	10.95	1.667	26.91	2.667	10.46	3.67	7.18
0.750	13.53	1.750	20.36	2.750	9.66	3.75	6.85
0.833	13.53	1.833	20.36	2.833	9.66	3.83	6.85
0.917	18.53	1.917	16.73	2.917	9.00	3.92	6.56
1.000	18.53	2.000	16.73	3.000	9.00	4.00	6.56

			TOTALS
Max.Eff.Inten.(mm/hr)=	146.50	21.11	
over (min)	5.00	15.00	
Storage Coeff. (min)=	0.80 (ii)	13.95 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.34	0.08	
PEAK FLOW (cms)=	0.01	0.00	0.006 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.33
RUNOFF VOLUME (mm)=	77.32	19.00	35.16
TOTAL RAINFALL (mm)=	78.32	78.32	78.32
RUNOFF COEFFICIENT =	0.99	0.24	0.45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0007)					
1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):		0.05	0.006	1.33	35.16
+ ID2= 2 (0008):		0.81	0.041	1.75	60.46
ID = 3 (0007):		0.87	0.044	1.50	58.94

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	STANDHYD (0001)	Area (ha)= 0.48	Total Imp(%)= 30.00	Dir. Conn.(%)= 15.00
ID= 1 DT= 5.0 min				

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.15	0.34
Dep. Storage (mm)=	1.00	13.60
Average Slope (%)=	1.00	2.00
Length (m)=	56.80	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	7.35	1.083	35.40	2.083	14.38	3.08	8.44
0.167	7.35	1.167	35.40	2.167	14.38	3.17	8.44
0.250	8.19	1.250	146.50	2.250	12.71	3.25	7.96
0.333	8.19	1.333	146.50	2.333	12.71	3.33	7.96
0.417	9.32	1.417	43.93	2.417	11.45	3.42	7.55
0.500	9.32	1.500	43.93	2.500	11.45	3.50	7.55
0.583	10.95	1.583	26.91	2.583	10.46	3.58	7.18
0.667	10.95	1.667	26.91	2.667	10.46	3.67	7.18
0.750	13.53	1.750	20.36	2.750	9.66	3.75	6.85
0.833	13.53	1.833	20.36	2.833	9.66	3.83	6.85
0.917	18.53	1.917	16.73	2.917	9.00	3.92	6.56
1.000	18.53	2.000	16.73	3.000	9.00	4.00	6.56

			TOTALS
Max.Eff.Inten.(mm/hr)=	146.50	33.47	
over (min)	5.00	15.00	
Storage Coeff. (min)=	1.56 (ii)	12.50 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.33	0.08	
PEAK FLOW (cms)=	0.03	0.02	0.039 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.33
RUNOFF VOLUME (mm)=	77.32	23.06	31.19
TOTAL RAINFALL (mm)=	78.32	78.32	78.32
RUNOFF COEFFICIENT =	0.99	0.29	0.40

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0002)	Area (ha)= 0.38	Total Imp(%)= 68.00	Dir. Conn.(%)= 45.00
ID= 1 DT= 5.0 min				

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.26	0.12
Dep. Storage (mm)=	1.00	13.60
Average Slope (%)=	1.00	2.00
Length (m)=	50.33	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	7.35	1.083	35.40	2.083	14.38	3.08	8.44
0.167	7.35	1.167	35.40	2.167	14.38	3.17	8.44
0.250	8.19	1.250	146.50	2.250	12.71	3.25	7.96
0.333	8.19	1.333	146.50	2.333	12.71	3.33	7.96
0.417	9.32	1.417	43.93	2.417	11.45	3.42	7.55
0.500	9.32	1.500	43.93	2.500	11.45	3.50	7.55
0.583	10.95	1.583	26.91	2.583	10.46	3.58	7.18
0.667	10.95	1.667	26.91	2.667	10.46	3.67	7.18
0.750	13.53	1.750	20.36	2.750	9.66	3.75	6.85
0.833	13.53	1.833	20.36	2.833	9.66	3.83	6.85
0.917	18.53	1.917	16.73	2.917	9.00	3.92	6.56
1.000	18.53	2.000	16.73	3.000	9.00	4.00	6.56

			TOTALS
Max.Eff.Inten.(mm/hr)=	146.50	85.39	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.45 (ii)	8.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.33	0.12	
PEAK FLOW (cms)=	0.07	0.02	0.085 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	77.32	30.79	51.72
TOTAL RAINFALL (mm)=	78.32	78.32	78.32
RUNOFF COEFFICIENT =	0.99	0.39	0.66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0009)				
1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.

```
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0001):     0.48   0.039     1.33    31.19
      + ID2= 2 (  0002):     0.38   0.085     1.33    51.72
        ================================================
        ID = 3 (  0009):     0.86   0.124     1.33    40.22

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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100-YEAR STORM

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M M M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\5200ab59-0558-4412-8357-35e91b00609a\scen
Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\5200ab59-0558-4412-8357-35e91b00609a\scen

DATE: 09/11/2025 TIME: 11:08:30

USER:

COMMENTS: _____

** SIMULATION : 06_100-Year Norfolk_4hr **

CHICAGO STORM	Ptotal= 87.09 mm

IDF curve parameters: A= 801.041
B= 1.501
C= 0.657
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	8.40	1.00	38.70	2.00	16.17	3.00	9.61
0.17	9.34	1.17	160.97	2.17	14.33	3.17	9.08
0.33	10.59	1.33	47.72	2.33	12.95	3.33	8.61
0.50	12.39	1.50	29.71	2.50	11.86	3.50	8.20
0.67	15.24	1.67	22.67	2.67	10.97	3.67	7.84
0.83	20.69	1.83	18.74	2.83	10.24	3.83	7.51

CALIB	STANDHYD (0003)	ID= 1 DT= 5.0 min	Area (ha)= 0.44	Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.39	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	53.85	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.	(mm/hr)=	160.97	32.41	
	over (min)	5.00	5.00	
Storage Coeff.	(min)=	1.46 (ii)	3.88 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	5.00	
Unit Hyd. peak	(cms)=	0.33	0.25	
				TOTALS
PEAK FLOW	(cms)=	0.17	0.00	0.179 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	86.09	23.57	79.83
TOTAL RAINFALL	(mm)=	87.09	87.09	87.09
RUNOFF COEFFICIENT	=	0.99	0.27	0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0010)	ID= 1 DT= 5.0 min	Area (ha)= 0.38	Total Imp(%)= 68.00	Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.	(mm/hr)=	160.97	103.60	
	over (min)	5.00	10.00	
Storage Coeff.	(min)=	1.40 (ii)	8.36 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.33	0.12	
				TOTALS
PEAK FLOW	(cms)=	0.08	0.02	0.096 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	86.09	36.93	59.04
TOTAL RAINFALL	(mm)=	87.09	87.09	87.09
RUNOFF COEFFICIENT	=	0.99	0.42	0.68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
		ID1= 1 (0010):	0.38	0.096	1.33	59.04
		+ ID2= 2 (0003):	0.44	0.179	1.33	79.83
		ID = 3 (0011):	0.81	0.275	1.33	70.14

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005)	IN= 2--> OUT= 3	DT= 5.0 min	OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON	CHAMBER:	MAX STO VOL (cu.m.)= 274.05 Bottom Area(m2) = 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75
559.00	69.20	1651.00	231.59
584.00	73.49	1676.00	234.31
610.00	77.76	1702.00	236.84
635.00	82.02	1727.00	239.23
660.00	86.27	1753.00	241.57
686.00	90.50	1778.00	243.86
711.00	94.72	1803.00	246.11
737.00	98.92	1829.00	248.29
762.00	103.11	1854.00	250.43
787.00	107.28	1880.00	252.58
813.00	111.43	1905.00	254.73
838.00	115.56	1930.00	256.88
864.00	119.68	1956.00	259.02
889.00	123.77	1981.00	261.17
914.00	127.84	2007.00	263.32
940.00	131.89	2032.00	265.47
965.00	135.92	2057.00	267.61

991.00	139.92	|	2083.00	269.76
1016.00	143.90	|	2108.00	271.91
1041.00	147.86	|	2134.00	274.05
1067.00	151.78	|	0.00	0.00

DEPTH (m)	DISCHARGE (cms)	|	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	|	1.194	0.036
0.102	0.007	|	1.295	0.038
0.203	0.013	|	1.397	0.040
0.305	0.017	|	1.499	0.041
0.406	0.020	|	1.600	0.042
0.508	0.023	|	1.702	0.044
0.610	0.025	|	1.803	0.045
0.813	0.030	|	1.905	0.046
0.914	0.032	|	2.007	0.048
1.118	0.035	|	2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.275	1.33	70.14
OUTFLOW:ID= 1	0.81	0.045	1.83	68.26
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 2.68
Time to reach Max storage (Hr)= 1.83
Volume of water for drawdown in LID (cu.m.)= 55.97
Volume of maximum water storage (cu.m.)= 234.70
Calculated Drawdown Time (Hr)= 1.50

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

Junction Command(0008)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.05	1.83	68.26
OUTFLOW: ID= 2(0008)	0.82	0.05	1.83	68.26

CALIB	STANDHYD (0004) | ID= 1 DT= 5.0 min	Area (ha)= 0.05 Total Imp(%)= 28.00 Dir. Conn.(%)= 28.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.01	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	18.62	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	26.85		
over (min)	5.00	15.00		
Storage Coeff. (min)=	0.77 (ii)	12.71 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.34	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.01	0.00	0.007 (iii)	
TIME TO PEAK (hrs)=	1.33	1.50	1.33	
RUNOFF VOLUME (mm)=	86.09	23.57	40.95	
TOTAL RAINFALL (mm)=	87.09	87.09	87.09	
RUNOFF COEFFICIENT =	0.99	0.27	0.47	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0007) | 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):	0.05	0.007	1.33	40.95
+ ID2= 2 (0008):	0.81	0.045	1.83	68.26
ID = 3 (0007):	0.87	0.048	1.67	66.62

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	STANDHYD (0001) | ID= 1 DT= 5.0 min	Area (ha)= 0.48 Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.15	0.34
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	56.80	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	50.83		
over (min)	5.00	15.00		
Storage Coeff. (min)=	1.50 (ii)	10.76 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.33	0.09		
			TOTALS	
PEAK FLOW (cms)=	0.03	0.03	0.046 (iii)	
TIME TO PEAK (hrs)=	1.33	1.50	1.33	
RUNOFF VOLUME (mm)=	86.09	28.22	36.88	
TOTAL RAINFALL (mm)=	87.09	87.09	87.09	
RUNOFF COEFFICIENT =	0.99	0.32	0.42	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0002) | ID= 1 DT= 5.0 min	Area (ha)= 0.38 Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	8.40	1.083	38.70	2.083	16.17	3.08	9.61
0.167	8.40	1.167	38.70	2.167	16.17	3.17	9.61
0.250	9.34	1.250	160.97	2.250	14.33	3.25	9.08
0.333	9.34	1.333	160.97	2.333	14.33	3.33	9.08
0.417	10.59	1.417	47.72	2.417	12.95	3.42	8.61
0.500	10.59	1.500	47.72	2.500	12.95	3.50	8.61
0.583	12.39	1.583	29.71	2.583	11.86	3.58	8.20
0.667	12.39	1.667	29.71	2.667	11.86	3.67	8.20
0.750	15.24	1.750	22.67	2.750	10.97	3.75	7.84
0.833	15.24	1.833	22.67	2.833	10.97	3.83	7.84
0.917	20.69	1.917	18.74	2.917	10.24	3.92	7.51
1.000	20.69	2.000	18.74	3.000	10.24	4.00	7.51

Max.Eff.Inten.(mm/hr)=	160.97	103.60		
over (min)	5.00	10.00		
Storage Coeff. (min)=	1.40 (ii)	8.36 (ii)		
Unit Hyd. Tpeak (min)=	5.00	10.00		
Unit Hyd. peak (cms)=	0.33	0.12		
			TOTALS	
PEAK FLOW (cms)=	0.08	0.02	0.096 (iii)	
TIME TO PEAK (hrs)=	1.33	1.42	1.33	
RUNOFF VOLUME (mm)=	86.09	36.93	59.04	
TOTAL RAINFALL (mm)=	87.09	87.09	87.09	
RUNOFF COEFFICIENT =	0.99	0.42	0.68	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0009) | 1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.

	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):	0.48	0.046	1.33	36.88
+ ID2= 2 (0002):	0.38	0.096	1.33	59.04
ID = 3 (0009):	0.86	0.141	1.33	46.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

25mm QUALITY STORM

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2020)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M M M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\44787535-ca02-481a-a27c-d2b43f116b74\scen
Summary filename: C:\Users\Natalie\AppData\Local\Civica\VH5\50dad99d-71ce-4046-a6fb-fe14aec8eaca\44787535-ca02-481a-a27c-d2b43f116b74\scen

DATE: 09/11/2025 TIME: 11:08:30

USER:

COMMENTS: _____

** SIMULATION : 25mm Norfolk_4hr **

READ STORM | Filename: C:\Users\Natalie\AppData\Local\Temp\73d936e7-d069-4b15-afb7-7dafa5f56846\a90d8952
Ptotal= 25.00 mm | Comments: 25mm Norfolk_4hr

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	1.17	12.56	2.33	3.61	3.50	1.96
0.17	1.90	1.33	51.29	2.50	3.19	3.67	1.85
0.33	2.16	1.50	16.17	2.67	2.87	3.83	1.75
0.50	2.51	1.67	8.96	2.83	2.61	4.00	1.67
0.67	3.03	1.83	6.38	3.00	2.41		
0.83	3.90	2.00	5.03	3.17	2.23		
1.00	5.69	2.17	4.19	3.33	2.09		

CALIB | STANDHYD (0003) | ID= 1 DT= 5.0 min | Area (ha)= 0.44 | Total Imp(%)= 90.00 | Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.39	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	53.85	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	5.69	2.250	4.19	3.33	2.23
0.167	0.00	1.250	12.56	2.333	4.19	3.42	2.09
0.250	1.90	1.333	12.56	2.417	3.61	3.50	2.09
0.333	1.90	1.417	51.29	2.500	3.61	3.58	1.96
0.417	2.16	1.500	51.29	2.583	3.19	3.67	1.96
0.500	2.16	1.583	16.17	2.667	3.19	3.75	1.85
0.583	2.51	1.667	16.17	2.750	2.87	3.83	1.85
0.667	2.51	1.750	8.96	2.833	2.87	3.92	1.75
0.750	3.03	1.833	8.96	2.917	2.61	4.00	1.75
0.833	3.03	1.917	6.38	3.000	2.61	4.08	1.67
0.917	3.89	2.000	6.38	3.083	2.41	4.17	1.67
1.000	3.90	2.083	5.03	3.167	2.41		
1.083	5.69	2.167	5.03	3.250	2.23		

				TOTALS
Max.Eff.Inten.	(mm/hr)=	51.29	0.41	
over	(min)	5.00	10.00	
Storage Coeff.	(min)=	2.30 (ii)	6.13 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.30	0.15	
PEAK FLOW	(cms)=	0.06	0.00	0.055 (iii)
TIME TO PEAK	(hrs)=	1.50	1.92	1.50
RUNOFF VOLUME	(mm)=	24.00	0.78	21.67
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.03	0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB | STANDHYD (0010) | ID= 1 DT= 5.0 min | Area (ha)= 0.38 | Total Imp(%)= 68.00 | Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	5.69	2.250	4.19	3.33	2.23
0.167	0.00	1.250	12.56	2.333	4.19	3.42	2.09
0.250	1.90	1.333	12.56	2.417	3.61	3.50	2.09
0.333	1.90	1.417	51.29	2.500	3.61	3.58	1.96
0.417	2.16	1.500	51.29	2.583	3.19	3.67	1.96
0.500	2.16	1.583	16.17	2.667	3.19	3.75	1.85
0.583	2.51	1.667	16.17	2.750	2.87	3.83	1.85
0.667	2.51	1.750	8.96	2.833	2.87	3.92	1.75
0.750	3.03	1.833	8.96	2.917	2.61	4.00	1.75
0.833	3.03	1.917	6.38	3.000	2.61	4.08	1.67
0.917	3.89	2.000	6.38	3.083	2.41	4.17	1.67
1.000	3.90	2.083	5.03	3.167	2.41		
1.083	5.69	2.167	5.03	3.250	2.23		

				TOTALS
Max.Eff.Inten.	(mm/hr)=	51.29	3.75	
over	(min)	5.00	30.00	
Storage Coeff.	(min)=	2.21 (ii)	28.46 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	30.00	
Unit Hyd. peak	(cms)=	0.30	0.04	
PEAK FLOW	(cms)=	0.02	0.00	0.024 (iii)
TIME TO PEAK	(hrs)=	1.50	2.17	1.50
RUNOFF VOLUME	(mm)=	24.00	2.71	12.25
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.11	0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0011) | 1 + 2 = 3

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1	(0010):	0.38	0.024	1.50	12.25
+ ID2= 2	(0003):	0.44	0.055	1.50	21.67
ID = 3	(0011):	0.81	0.079	1.50	17.28

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005) | IN= 2--> OUT= 3 | DT= 5.0 min | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON | CHAMBER: | MAX STO VOL (cu.m.)= 274.05 Bottom Area(m2) = 211.34

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1092.00	155.69
25.00	2.15	1118.00	159.56
51.00	4.29	1143.00	163.40
76.00	6.44	1168.00	167.21
102.00	8.59	1194.00	170.99
127.00	10.74	1219.00	174.74
152.00	12.88	1245.00	178.46
178.00	15.03	1270.00	182.13
203.00	17.18	1295.00	185.78
229.00	19.32	1321.00	189.38
254.00	21.47	1346.00	192.94
279.00	23.62	1372.00	196.46
305.00	25.77	1397.00	199.94
330.00	30.15	1422.00	203.37
356.00	34.53	1448.00	206.75
381.00	38.89	1473.00	210.08
406.00	43.25	1499.00	213.35
432.00	47.60	1524.00	216.57
457.00	51.94	1549.00	219.72
483.00	56.27	1575.00	222.81
508.00	60.59	1600.00	225.82
533.00	64.90	1626.00	228.75
559.00	69.20	1651.00	231.59
584.00	73.49	1676.00	234.31
610.00	77.76	1702.00	236.84
635.00	82.02	1727.00	239.23
660.00	86.27	1753.00	241.57
686.00	90.50	1778.00	243.86
711.00	94.72	1803.00	246.11
737.00	98.92	1829.00	248.29
762.00	103.11	1854.00	250.43
787.00	107.28	1880.00	252.58
813.00	111.43	1905.00	254.73
838.00	115.56	1930.00	256.88
864.00	119.68	1956.00	259.02
889.00	123.77	1981.00	261.17
914.00	127.84	2007.00	263.32
940.00	131.89	2032.00	265.47
965.00	135.92	2057.00	267.61

991.00	139.92		2083.00	269.76
1016.00	143.90		2108.00	271.91
1041.00	147.86		2134.00	274.05
1067.00	151.78		0.00	0.00

DEPTH (m)	DISCHARGE (cms)		DEPTH (m)	DISCHARGE (cms)
0.000	0.000		1.194	0.036
0.102	0.007		1.295	0.038
0.203	0.013		1.397	0.040
0.305	0.017		1.499	0.041
0.406	0.020		1.600	0.042
0.508	0.023		1.702	0.044
0.610	0.025		1.803	0.045
0.813	0.030		1.905	0.046
0.914	0.032		2.007	0.048
1.118	0.035		2.134	0.049

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0120

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.81	0.079	1.50	17.28
OUTFLOW:ID= 1	0.81	0.022	1.67	15.98
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 7.53
Time to reach Max storage (Hr)= 1.67
Volume of water for drawdown in LID (cu.m.)= 0.00
Volume of maximum water storage (cu.m.)= 47.75
Calculated Drawdown Time (Hr)= 0.00

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

Junction Command(0008)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	0.82	0.02	1.67	15.98
OUTFLOW: ID= 2(0008)	0.82	0.02	1.67	15.98

CALIB	
STANDHYD (0004)	Area (ha)= 0.05
ID= 1 DT= 5.0 min	Total Imp(%)= 28.00 Dir. Conn.(%)= 28.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.01	0.04
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	18.62	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	5.69	2.250	4.19	3.33	2.23
0.167	0.00	1.250	12.56	2.333	4.19	3.42	2.09
0.250	1.90	1.333	12.56	2.417	3.61	3.50	2.09
0.333	1.90	1.417	51.29	2.500	3.61	3.58	1.96
0.417	2.16	1.500	51.29	2.583	3.19	3.67	1.96
0.500	2.16	1.583	16.17	2.667	3.19	3.75	1.85
0.583	2.51	1.667	16.17	2.750	2.87	3.83	1.85
0.667	2.51	1.750	8.96	2.833	2.87	3.92	1.75
0.750	3.03	1.833	8.96	2.917	2.61	4.00	1.75
0.833	3.03	1.917	6.38	3.000	2.61	4.08	1.67
0.917	3.89	2.000	6.38	3.083	2.41	4.17	1.67
1.000	3.90	2.083	5.03	3.167	2.41		
1.083	5.69	2.167	5.03	3.250	2.23		

				TOTALS
Max.Eff.Inten.(mm/hr)=		51.29	0.36	
over (min)		5.00	70.00	
Storage Coeff. (min)=		1.22 (ii)	67.86 (ii)	
Unit Hyd. Tpeak (min)=		5.00	70.00	
Unit Hyd. peak (cms)=		0.33	0.02	
PEAK FLOW	(cms)=	0.00	0.00	0.002 (iii)
TIME TO PEAK	(hrs)=	1.50	4.17	1.50
RUNOFF VOLUME	(mm)=	24.00	0.78	6.66
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.03	0.27

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0007)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0004):	0.05	0.002	1.50	6.66
+ ID2= 2 (0008):	0.81	0.022	1.67	15.98
ID = 3 (0007):	0.87	0.023	1.50	15.42

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	
STANDHYD (0001)	Area (ha)= 0.48
ID= 1 DT= 5.0 min	Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.15	0.34
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	56.80	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	5.69	2.250	4.19	3.33	2.23
0.167	0.00	1.250	12.56	2.333	4.19	3.42	2.09
0.250	1.90	1.333	12.56	2.417	3.61	3.50	2.09
0.333	1.90	1.417	51.29	2.500	3.61	3.58	1.96
0.417	2.16	1.500	51.29	2.583	3.19	3.67	1.96
0.500	2.16	1.583	16.17	2.667	3.19	3.75	1.85
0.583	2.51	1.667	16.17	2.750	2.87	3.83	1.85
0.667	2.51	1.750	8.96	2.833	2.87	3.92	1.75
0.750	3.03	1.833	8.96	2.917	2.61	4.00	1.75
0.833	3.03	1.917	6.38	3.000	2.61	4.08	1.67
0.917	3.89	2.000	6.38	3.083	2.41	4.17	1.67
1.000	3.90	2.083	5.03	3.167	2.41		
1.083	5.69	2.167	5.03	3.250	2.23		

				TOTALS
Max.Eff.Inten.(mm/hr)=		51.29	0.87	
over (min)		5.00	50.00	
Storage Coeff. (min)=		2.38 (ii)	49.36 (ii)	
Unit Hyd. Tpeak (min)=		5.00	50.00	
Unit Hyd. peak (cms)=		0.30	0.02	
PEAK FLOW	(cms)=	0.01	0.00	0.010 (iii)
TIME TO PEAK	(hrs)=	1.50	3.08	1.50
RUNOFF VOLUME	(mm)=	24.00	1.34	4.68
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.05	0.19

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0002)	Area (ha)= 0.38
ID= 1 DT= 5.0 min	Total Imp(%)= 68.00 Dir. Conn.(%)= 45.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.12
Dep. Storage	(mm)=	1.00	13.60
Average Slope	(%)=	1.00	2.00
Length	(m)=	50.33	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	1.167	5.69	2.250	4.19	3.33	2.23
0.167	0.00	1.250	12.56	2.333	4.19	3.42	2.09
0.250	1.90	1.333	12.56	2.417	3.61	3.50	2.09
0.333	1.90	1.417	51.29	2.500	3.61	3.58	1.96
0.417	2.16	1.500	51.29	2.583	3.19	3.67	1.96
0.500	2.16	1.583	16.17	2.667	3.19	3.75	1.85
0.583	2.51	1.667	16.17	2.750	2.87	3.83	1.85
0.667	2.51	1.750	8.96	2.833	2.87	3.92	1.75
0.750	3.03	1.833	8.96	2.917	2.61	4.00	1.75
0.833	3.03	1.917	6.38	3.000	2.61	4.08	1.67
0.917	3.89	2.000	6.38	3.083	2.41	4.17	1.67
1.000	3.90	2.083	5.03	3.167	2.41		
1.083	5.69	2.167	5.03	3.250	2.23		

				TOTALS
Max.Eff.Inten.(mm/hr)=		51.29	3.75	
over (min)		5.00	30.00	
Storage Coeff. (min)=		2.21 (ii)	28.46 (ii)	
Unit Hyd. Tpeak (min)=		5.00	30.00	
Unit Hyd. peak (cms)=		0.30	0.04	
PEAK FLOW	(cms)=	0.02	0.00	0.024 (iii)
TIME TO PEAK	(hrs)=	1.50	2.17	1.50
RUNOFF VOLUME	(mm)=	24.00	2.71	12.25
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.11	0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK      R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0001):     0.48   0.010     1.50      4.68
      + ID2= 2 (  0002):     0.38   0.024     1.50     12.25
        ==========================================================
        ID = 3 (  0009):     0.86   0.034     1.50      8.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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 FINISH
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APPENDIX F

Geotechnical Investigation

(GEMTEC Consulting Engineers and Scientists Limited, September 4, 2025)

RC SPENCER ASSOCIATES INC.
Consulting Engineers

RC SPENCER ASSOCIATES INC.
Consulting Engineers
EST. 1989
35 YEARS STRONG!

16 May 2025
File No.: 25-Pro-98

B&B Landco Inc.
245 King George Road, Suite 222
Brantford ON N3R 7N7

Via email: **natalieongena@gdvallee.ca**

Attention: **Jesse Buchan**

Re: **289 Leamon Street, Waterford, Ontario**
Traffic Impact Brief

Dear Mr. Buchan:

The following provides our outline of engineering services deemed to be required for the proposed mixed-use development, located at 289 Leamon Street, in Waterford, Ontario.

General

We are basing our scope of work on the 16 May 2025 email correspondence between Ms. Natalie Ongena and our Mr. Aaron Blata, as well as the site plan package provided to our office. We understand that the development will include a 5-storey, 44-unit apartment building with approximately 2,476 sq. ft. of first-floor commercial space. A scaled-down traffic impact brief should suffice in satisfying the road authority; however, upon meeting with the respective road authorities, the scope of work (and our corresponding agreement) are subject to change.

Scope of Services

- Correspondence with Officials;
- Weekday and weekend turning movement counts at one area intersection;
- Trip generation for the proposed site using ITE trip generation reference data;
- Traffic distribution and assignment of site generated traffic onto the road network;
- High-level capacity and level of service analysis using the Synchro 12 analysis program;
- Geometric and sight line analyses for the proposed development site accesses;
- Identification of applicable improvements for future consideration;
- Preparation of a final report (to include engineers' comments and supporting figures).

Note: *This scope of services assumes that no other area developments are to be considered within the context of this report.*

Fees

Our lump sum fee to prepare this traffic impact brief as described will be **$6,400.00** plus HST. Please note that this quotation is for the defined scope of work (up to the completion of the final report). Any work that may be required beyond the completion of the report and attendance at any meetings will be considered an extra to be billed on a per diem basis. Likewise, should the proposed site plan be amended, it is requested that RC Spencer Associates Inc. be notified immediately so that the scope of services can be revisited.

Payment

RC Spencer Associates Inc. has a corporate policy requiring payment in full, **$7.232.00** ($6,400.00 + $832.00 HST), prior to undertaking the aforementioned scope of services. All payment should be addressed to RC Spencer Associates Inc., located at 800 University Avenue West, Windsor, ON, N9A 5R9.

Closure

Thank you for providing us with an opportunity to submit this outline of engineering services. If you are in agreement, please sign the affidavit below and return one copy to our Windsor Office. If you have any questions, please call Mr. Aaron Blata at our Leamington Office at 519-324-0606

Yours Truly,
RC Spencer Associates Inc.

Randa Hill
Executive Assistant to

Richard C. Spencer, M.A.Sc., P.Eng.
Consulting Engineer
President

cc: **Aaron Blata**
Cheryl Morden

AFFIDAVIT

I am in agreement with the outline of engineering services re: Traffic Impact Brief for the proposed Leamon Street Mixed-Use development, located in Waterford, Ontario, and authorize RC Spencer Associates Inc. to proceed immediately as noted. I, the undersigned, have read and agree to the payment conditions outlined under "Fees" and "Payment".

_____

WITNESS

_____ _____

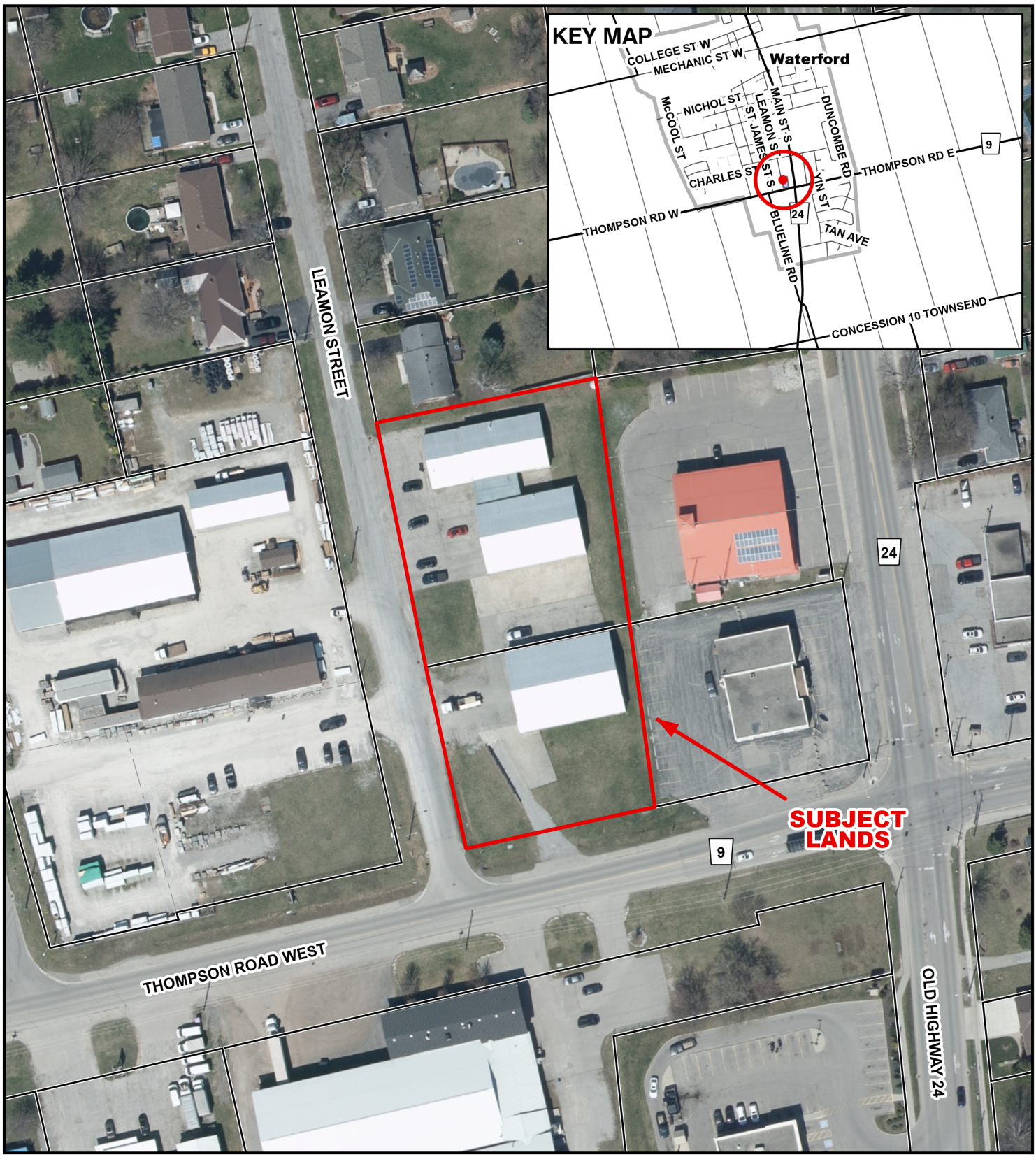
DATE **B&B Landco Inc.**

MAP A

ZNPL2025313

CONTEXT MAP

Urban Area of WATERFORD



Legend

Subject Lands

2020 Air Photo

12/2/2025

N

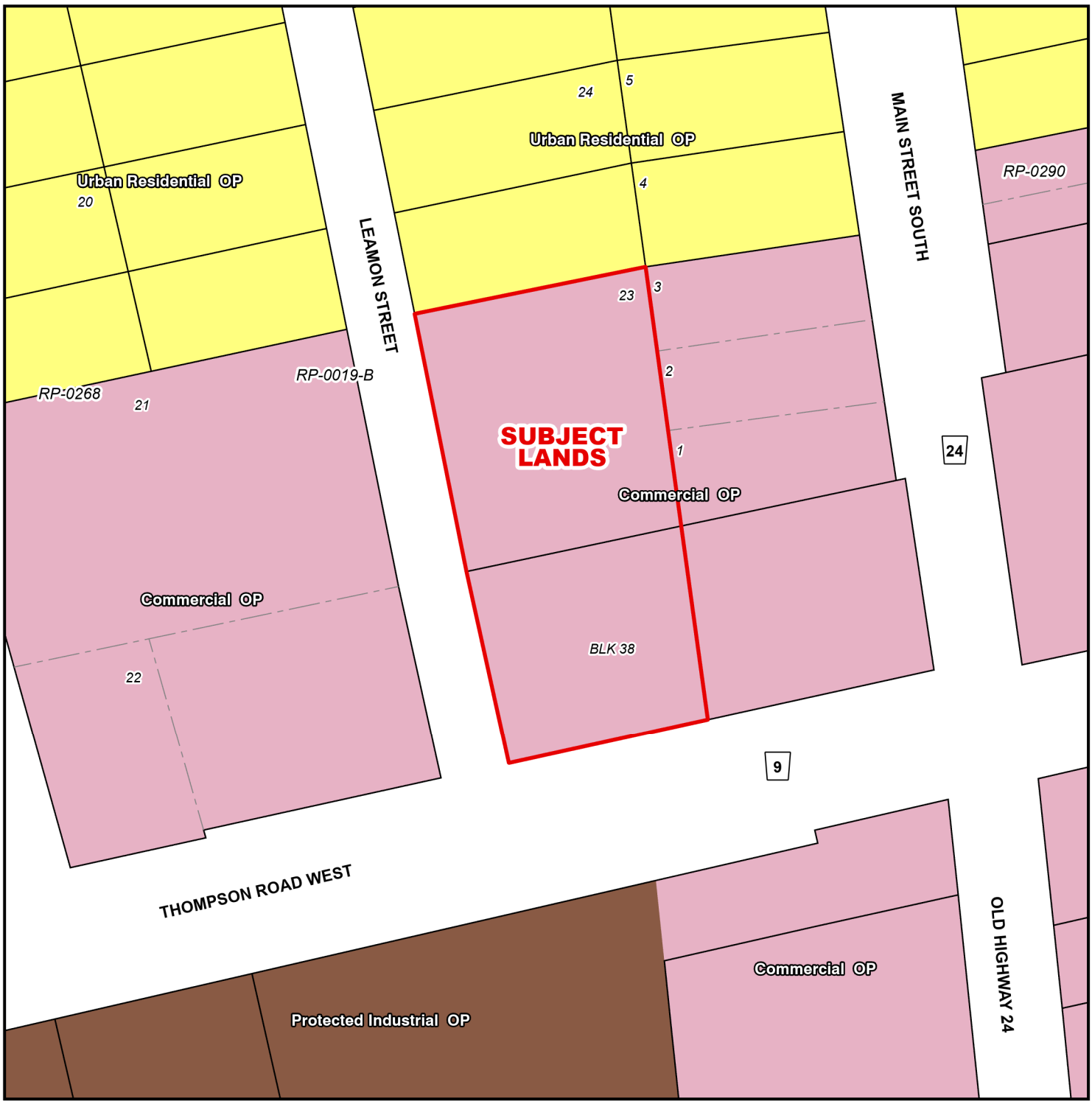
9.54.75 0 9.5 19 28.5 38 Meters

MAP B

ZNPL2025313

OFFICIAL PLAN MAP

Urban Area of WATERFORD



Legend

- Subject Lands

Official Plan Designations

- Urban Residential
- Commercial
- Protected Industrial
- Urban Area Boundary

12/2/2025

N

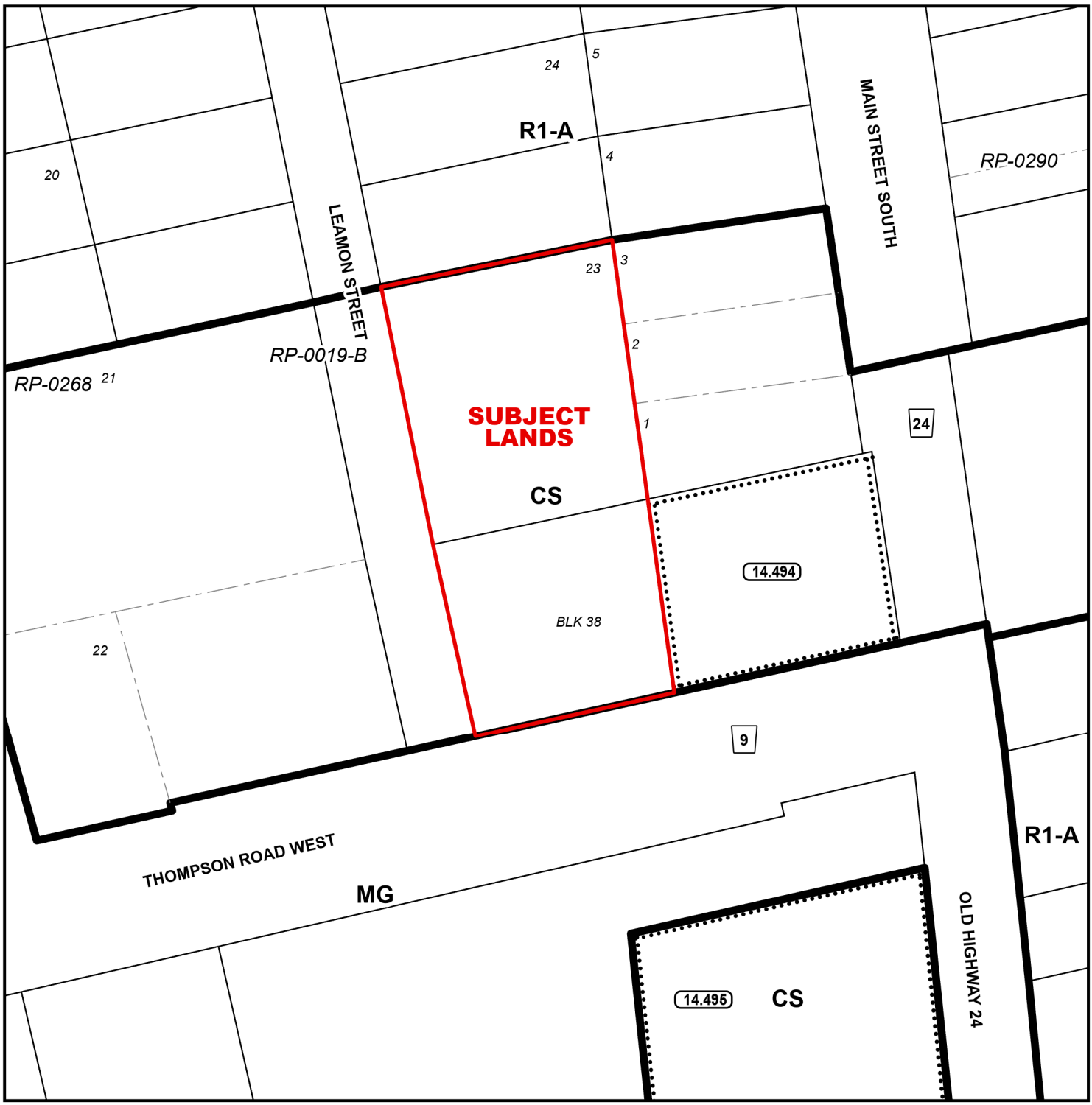
9.54.75 0 9.5 19 28.5 38 Meters

MAP C

ZNPL2025313

PROPOSED ZONING BY-LAW AMENDMENT MAP

Urban Area of WATERFORD



ZONING BY-LAW 1-Z-2014

12/2/2025

LEGEND

Subject Lands

(H) - Holding

CS - Service Commercial Zone

MG - General Industrial Zone

R1-A - Residential R1-A Zone

N

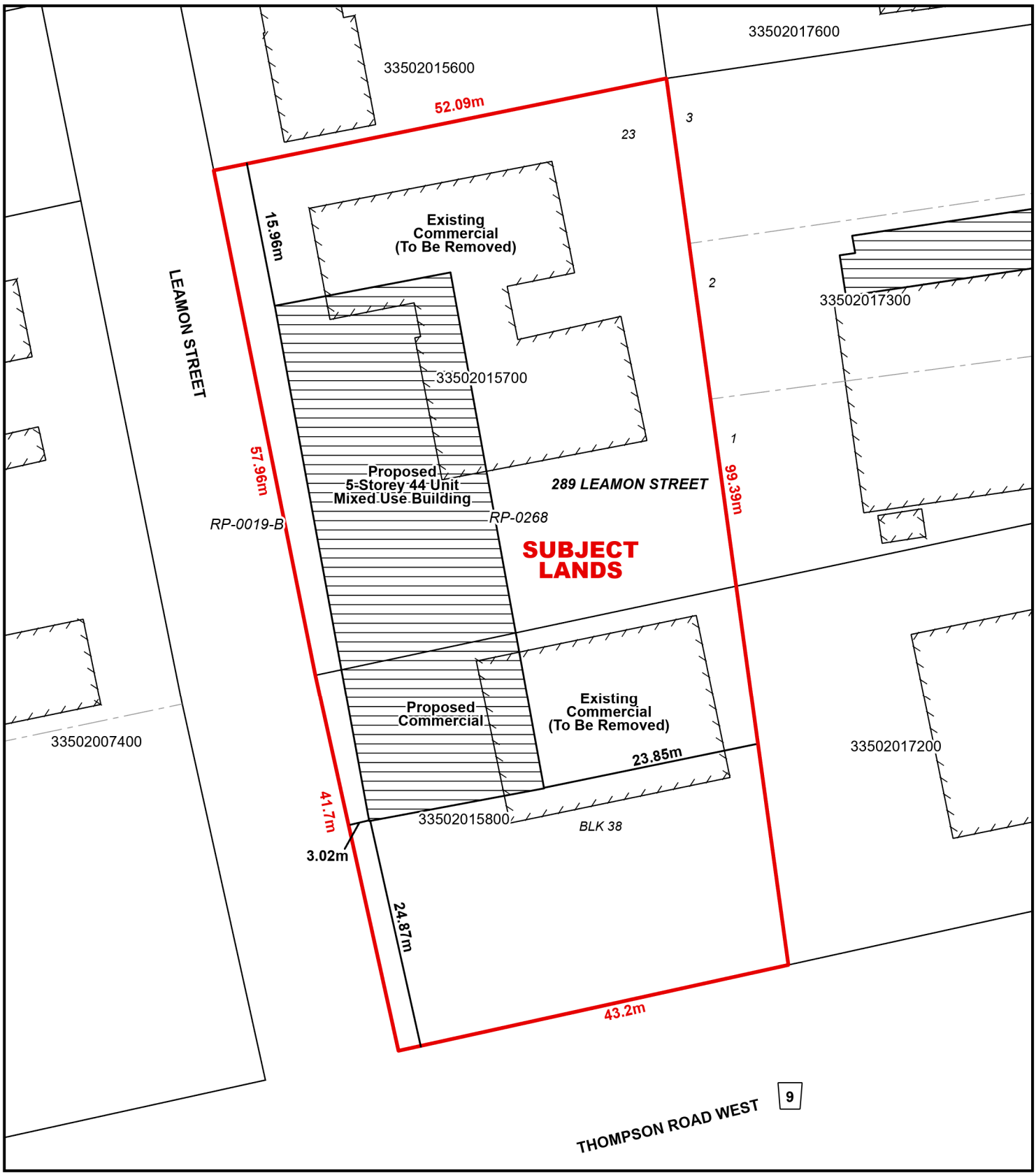
9.54.75 0 9.5 19 28.5 38 Meters

MAP D

ZNPL2025313

CONCEPTUAL PLAN

Urban Area of WATERFORD



Legend

Subject Lands

12/2/2025

N

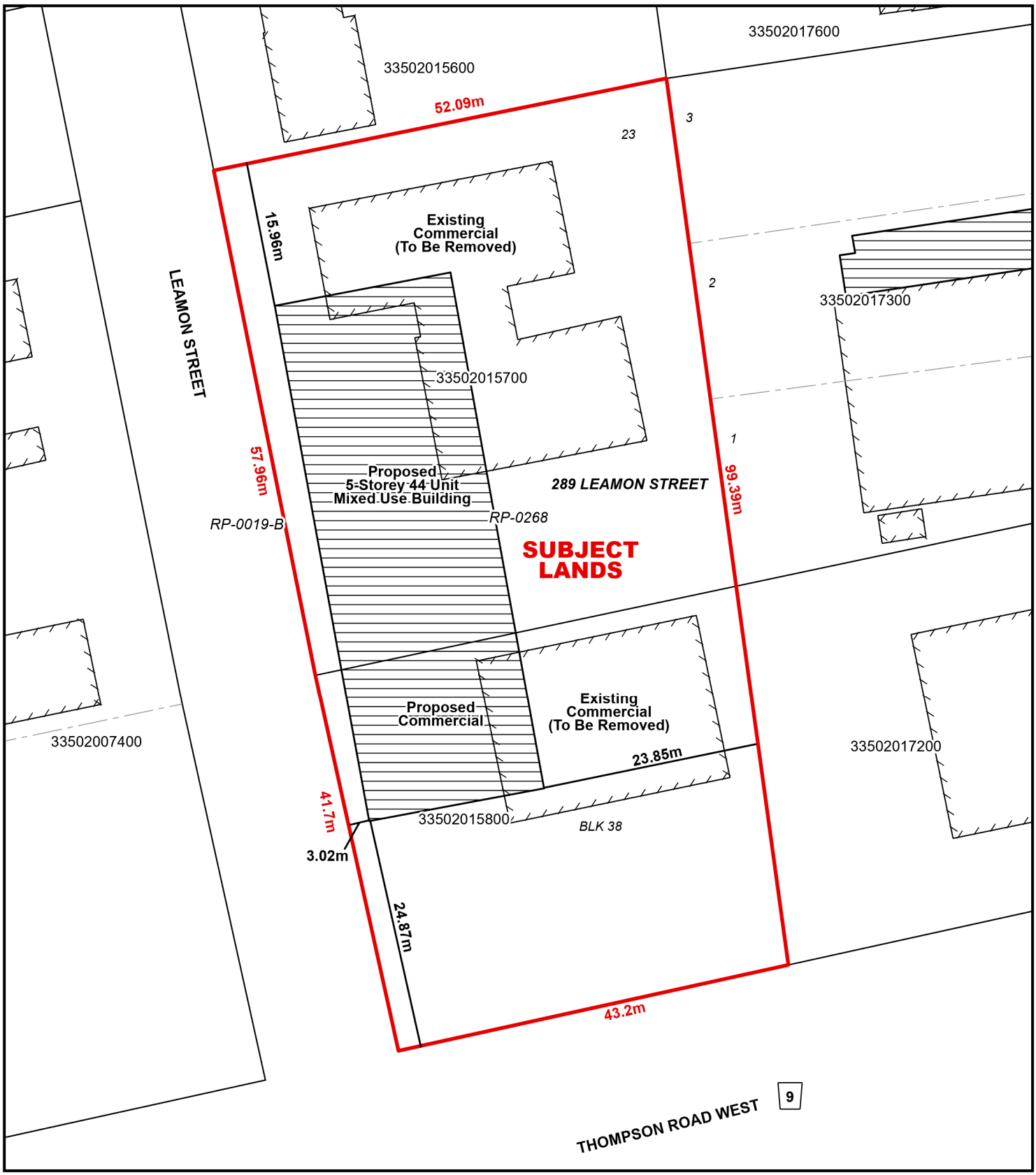
4.5 2.25 0 4.5 9 13.5 18 Meters

LOCATION OF LANDS AFFECTED

ZNPL2025313

CONCEPTUAL PLAN

Urban Area of WATERFORD



Legend

Subject Lands

12/2/2025

N

4.5 2.25 0 4.5 9 13.5 18 Meters